



Assessment of future mobile competition and award of 800 MHz and 2.6 GHz

Annexes1 - 6

Statement

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Contents

Annex		Page
1	Summary of impact assessment	3
2	Competition assessment – supporting material	6
3	Summary of responses to our January 2012 competition assessment and Ofcom’s comments	68
4	Auction design – issues raised in responses to our January 2012 consultation	215
5	Auction rules	226
6	DTT Coexistence	257

Annex 1

Summary of impact assessment

- A1.1 Ofcom has considered and assessed the likely impact of implementing its decisions throughout this Statement, and therefore the document as a whole constitutes our impact assessment.
- A1.2 For ease of reference, we have set out in the table below a summary of the main decisions made in this Statement and details of where the impacts of those proposals are primarily considered.

Policy Decisions	Impacts considered in
Promotion of competition	
Seek to ensure at least four national wholesalers after the Auction	Section 4; Annex 2; and Annex 3
Reserve spectrum for a fourth national wholesaler	Section 4; Annex 2; and Annex 3
Impose constraints in the Auction on the total amount of sub 1 GHz mobile spectrum that any one licensee can hold immediately after the Auction	Section 4 and Annex 3
Impose constraints in the Auction on the total amount of mobile spectrum that any one licensee can hold immediately after the Auction	Section 4 and Annex 3
Do not reserve 2.6 GHz spectrum for shared low power use but allow competition between standard power and concurrent low power use for 2 x 10 MHz and 2 x 20 MHz	Section 4; and Annex 3
Promotion of mobile coverage	
Impose a coverage obligation on one 800 MHz licence	Section 5 and Annex 9
Spectrum packaging	
2.6 GHz band: 2 x 5 MHz lots for paired spectrum for individual use at standard powers	Section 6
2.6 GHz band: 1 x 5 MHz lots for unpaired spectrum	Section 6
2.6 GHz band: two types of lots available for concurrent low power use, with a single block of 2 x 10 MHz and a single block of 2 x 20 MHz (in each case there are up to 10 lots available in each block).	Section 6
800 MHz band: to package the spectrum in two categories: A1 comprising four 2 x 5 MHz lots; and A2 comprising one 2 x 10 MHz lot which is subject to the coverage obligation	Section 6

Auction design	
Eligibility points per lot	Section 7
Use of a combinatorial clock auction design for the Auction with particular features to implement our policy decisions on competition and coverage	Section 7, Annex 4 and Annex 5
Reserve prices	
The reserve prices that we propose should apply for each lot in the auction.	Section 8
Licence conditions (other than coverage obligation)	
The technical and other licence conditions subject to which the 800 MHz, 2.6 GHz and possibly 1800 MHz spectrum will be awarded in the auction	Sections 9, 10 and Annex 11
DTT Co-existence	
The interference mitigation that licensees of the 800 MHz licences will be required to undertake to mitigate interference to use of digital terrestrial television	Section 11 and Annex 6

Annex 2

Competition assessment – supporting material

Contents

Is sub-1 GHz spectrum necessary for a national wholesaler to be credible?	6
Update on when different bands are likely to be used for LTE	19
Unpaired spectrum and other spectrum releases	21
Assessment of credibility of H3G with various spectrum portfolios	24
Treatment of a new entrant	36
Alternative portfolios reserved for fourth national wholesaler if the 2x15 of 1800 MHz divestment is sold before the auction	41
Evidence on spectrum holdings and auction outcomes in Europe	47

Annex 2

Competition assessment – supporting material

A2.1 This Annex contains supporting material for some parts of the competition assessment set out in Section 4. It does not repeat the material in Section 4, and so does not provide a full explanation of our competition assessment. It therefore needs to be read in conjunction with Section 4.

A2.2 This Annex does not summarise responses to the competition assessment and our views on those responses, which are set out in Annex 3.

Is sub-1 GHz spectrum necessary for a national wholesaler to be credible?

A2.3 In paragraphs 3.71 to 3.140 of Annex 6 of the January 2012 consultation we set out our provisional views on quality of coverage. In light of responses, we have reviewed our assessment on coverage. In particular, we have reviewed our conclusion on whether sub-1 GHz spectrum is necessary for a national wholesaler to be credible. In doing this we have focussed on depth of coverage, that is, the ability to deliver a service to harder to serve locations, e.g. within buildings, as this was the focus in responses.¹

A2.4 As described in Annexes 7 and 8, we have revised our technical modelling, and below we summarise the implications of the revised results for the question of whether sub-1 GHz is necessary.

A2.5 The technical modelling results were only one input into our assessment of quality of coverage in the January 2012 consultation. We also considered:

- The ability of other technologies (including Wi-Fi, femtocells and in-building repeaters) to provide good quality coverage;
- The value consumers place on good coverage;
- International evidence on the importance of holding lower frequency spectrum; and
- Analysts' views on the importance of holding low frequency spectrum.

A2.6 We consider that our assessment of these other considerations, as set out in paragraphs 3.93 to 3.135 of Annex 6 of the January 2012 consultation, remains valid. However, in the following sections, we supplement the evidence in the January 2012 consultation by considering:

- Revised technical modelling results;
- Alternative technologies (such as Wi-Fi and femtocells); and

¹ In paragraphs 3.72 to 3.76 of Annex 6 of the January 2012 consultation we distinguished between two aspects of coverage, namely, breadth of coverage and depth of coverage. We described why it was likely to be possible to deliver sufficient breadth of coverage to be credible with spectrum at 2100 MHz and below, but this was likely to be more challenging with 2.6 GHz spectrum.

- The relative value of sub-1 GHz spectrum compared to higher frequencies in other auctions.

A2.7 We conclude in Section 4 that sub-1 GHz spectrum is unlikely to be necessary for a national wholesaler to be credible, but is likely to give some advantage and so is an important capability strength (see Figure 4.2). From paragraph 4.78 we make clear the evidence we have relied on in reaching this conclusion.

Revised technical modelling results

A2.8 In our assessment we are particularly concerned with comparing the performance achieved by networks using different portfolios of spectrum with a range of frequency bands and bandwidths, and how this affects the ability of a national wholesaler to be credible. As such our technical model has been developed and parameters selected with this aim in mind.

A2.9 Our revised technical modelling results are presented in Annex 7. We recognise that whilst our technical modelling was developed for the above purpose, the results are nevertheless illustrative and are affected by various uncertainties. The key uncertainties in our model are discussed in detail in Annex 7. While recognising these limitations, the key results of the technical modelling are set out below.

A2.10 In our assessment, we have given more weight to the technical results associated with the 'Maxvar' case. This is partly for the reason (as set out in paragraph A7.39) that we believe that the BPL parameters encapsulated in the 'Maxvar' case are more aligned with the evidence available to us. Also, given the importance of the performance of different frequency spectrum holdings in the coverage and capacity dimensions we consider it appropriate to concentrate on the 'Maxvar' case which illustrates results that emphasise the differences between different frequencies while still being credible assumptions. We illustrate in Annex 7 the sensitivity between the 'Maxvar' and 'Minvar' cases and the extent to which 'Minvar' would reduce the performance differential that macrocell networks using these spectrum portfolios might make in these dimensions.

A2.11 Our technical modelling focuses on the macrocellular layer downlink capability of networks to offer illustrations and insight into particularly coverage and capacity. In reality the performance seen by users in a mobile network is influenced by a large number of interlinked factors that interact with each other in a highly dynamic fashion. For instance, the performance a user will achieve will depend on: their location within a cell; the location of other users relative to them and relative to the network; the local topology of the network; and the type of service being demanded. It is not realistic to develop a technical model that could capture every possible dynamic variation with enough certainty on which we could base our policy. Our relatively simple model enables the capture of key metrics, in particular coverage, throughput and capacity that allow a comparison between networks operating at different frequencies and bandwidths. The downlink SINR based Monte Carlo approach is an approach consistent with those used for establishing network performance by regulators and some mobile operators.

A2.12 Our analysis does not make detailed predictions of uplink performance; such performance will be highly dependent on the nature of the services being demanded by users (e.g. data-rates required, the degree of uplink/downlink asymmetry etc) and is also to a certain extent within the control of the operator, through traffic shaping and charging models. We note that LTE has not been specified with provision of

perfectly symmetric services and the original requirements² suggest a difference in uplink to downlink data rates of a factor of 2. The practical implementation of LTE actually suggests that for a given link the uplink is likely to be a much smaller percentage of the downlink; for example Holma and Toskala³ demonstrate uplink and downlink budgets that are balanced for data-rates of 64kbps and 1024kbps respectively. Thus high uplink data-rate traffic is inevitably going to be more difficult to support over wide coverage areas. As a result of some responses to our January 2012 consultation, we have also examined how uplink limitations associated with the requirements of TCP⁴ traffic can influence downlink performance.

- A2.13 Our model does not include alternative methods of dealing with capacity (for example in dense traffic ‘hot-spots’) or coverage (for example in particularly hard to serve locations) by techniques such as microcells, Wi-Fi off-load or deploying femtocells, which are considered elsewhere in our analysis. Differences in frequency are likely to have most influence on the macrocell component of the access network.

Differences in macrocell coverage between frequencies when considered on a like-for-like basis

- A2.14 Our technical modelling predicts a difference in macrocell coverage between 800 MHz, 1800 MHz and 2.6 GHz spectrum, when considered on a like-for-like basis (in the sense of equal bandwidths, equal number of sites and equal loading).
- A2.15 This is illustrated in the figures below where we show our results for single user throughput for 2x10 MHz of each of the three bands in two different situations. Single-user throughput represents the maximum downlink data-rate that a single user could receive if they were the only user in a cell at any instant in time and the maximum available resources of the cell were dedicated to them.
- A2.16 As explained in more detail in paragraph A7.57, these graphs can also be used as a proxy for comparing the capacity of one frequency/bandwidth combination with another but only when dealing with equal site counts and equal network loadings.
- A2.17 Figure A2.1 below shows the results for macrocell coverage to shallow indoor locations, the 0-50% population area and 18,000 sites.⁵

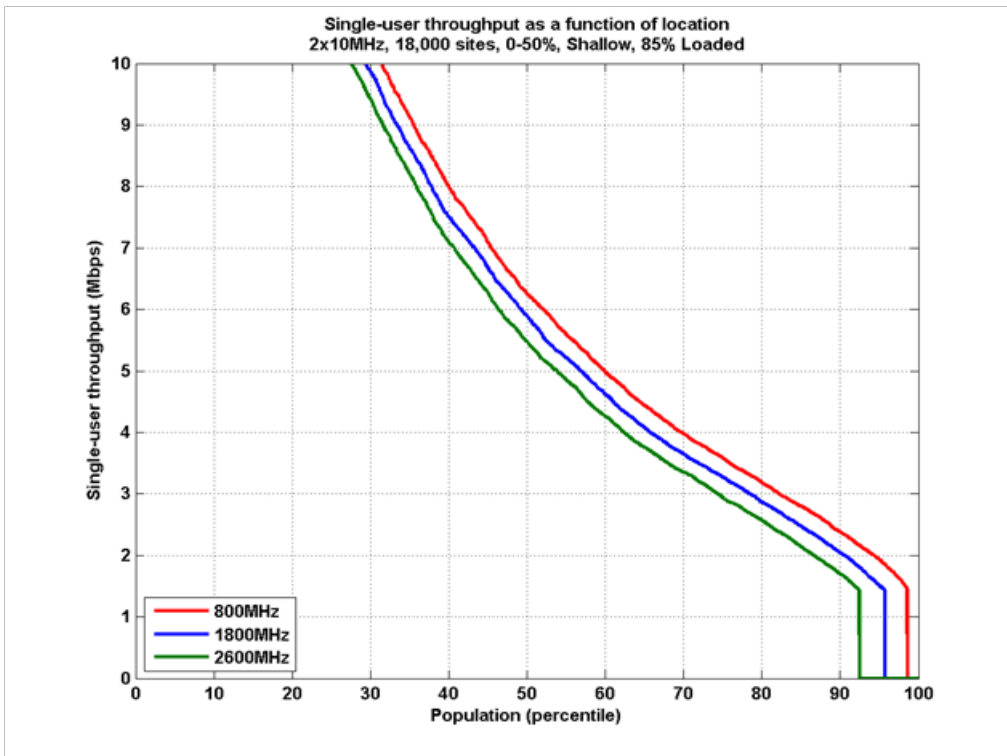
² TR 25.913 targets a peak downlink rate of 100Mbps and an uplink of 50Mbps.

³ H. Holma and A. Toskala, “LTE for UMTS – OFDMA and SC-FDMA Based Radio Access” 2nd Ed. Published Wiley.

⁴ TCP stands for transmission control protocol. TCP is commonly used for internet traffic and it provides a reliable means of delivering an ordered stream of data. It is used by many internet applications such as web browsing, email, video streaming and file transfer.

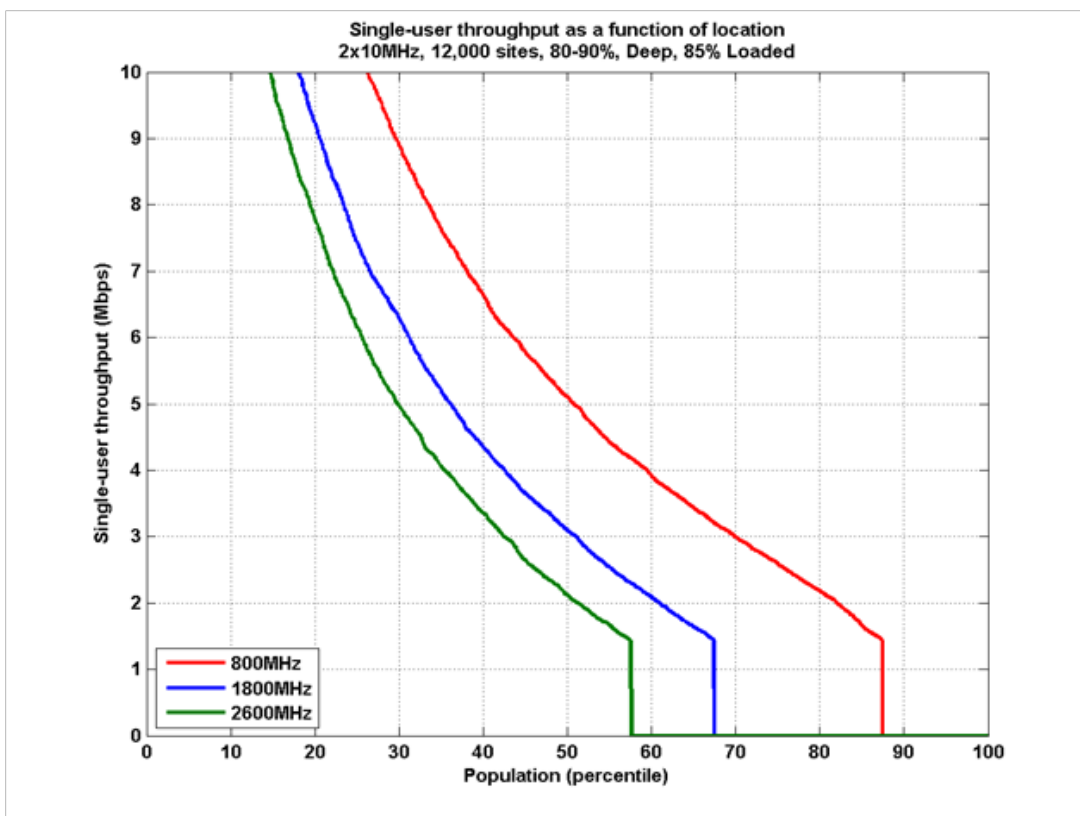
⁵ We now consider two depths, ‘deep’ and ‘shallow’, as described in paragraph A7.34. The construction of the population areas are described from paragraph A7.18.

Figure A2.1: Single-user throughput, 18,000 sites, 0-50% area, shallow



A2.18 Figure A2.2 below shows 2x10 MHz of the same three frequencies for coverage to deep indoor locations, the 80-90% population area and 12,000 sites.

Figure A2.2: Single-user throughput, 12,000 sites, 80-90% area, deep



- A2.19 The x-axis on these Figures represents the percentage of the residential population (i.e. when users are indoors at home) that our model predicts could receive a single-user throughput of at least the corresponding value indicated on the y-axis at the specified depth inside their home.
- A2.20 As we would expect, in both these graphs the 800 MHz spectrum is predicted to have better macrocell coverage than the 1800 MHz spectrum, which in turn is predicted to have better coverage than 2.6 GHz spectrum. But the magnitude of the differences between the frequencies is very different in the two graphs. These graphs are for two extremes, with one showing the case with the least variation and the other showing the case with the greatest variation. In Figures A7.11 to A7.16 and A7.21 to A7.26 in Annex 7 we show results for other situations we have modelled between these two extremes (that is, for different combination for depths, population areas and sites).
- A2.21 The wider set of results show that the differences in macrocell coverage between frequencies are predicted to be greater when:
- The location of the user is 'deep' inside a building as compared with when the user is in a 'shallow' indoor location;
 - Less densely populated areas are considered; and
 - Smaller site numbers are considered.
- A2.22 In terms of the population areas, we give more weight to some results than others. We attach most weight to the 0-50% and 50-80% population areas, partly because these together account for the majority of the total population and partly because we consider the quality of service in more densely populated areas to be more important for determining whether a national wholesaler is able to be credible.
- A2.23 We attach weight to both the shallow and deep results.
- A2.24 While in the January 2012 consultation we focused on 12,000 sites, we now attach more weight to the results with 18,000 sites. This is because we consider this a reasonable expectation for site numbers for a national wholesaler in the medium term, especially if that national wholesaler did not have sub-1 GHz spectrum. This view is informed by the following:
- a) H3G is adding an additional 3,000 sites to its network, taking it to 16,000 sites in total within the next two years^{6, 7}
 - b) With the combination of the T-Mobile and Orange networks, Everything Everywhere had around 27,000 sites⁸, but it is planning to decommission 9,000 sites, so as to have around 18,000 sites by 2014^{9, 10}

⁶ http://www.three.co.uk/Discover/Network/The_future_of_our_network

⁷ Vodafone also noted this in its technical analysis, and argued that since Ofcom assumes that operators can add 1,500 sites per annum, it is reasonable to assume that H3G could have a network of 18,000 sites by around 2015, or even sooner if it is able to share sites with others.

⁸ <http://www.t-mobile.co.uk/our-network/>

⁹ <http://www.mbnl.co.uk/diamond.htm>

¹⁰ This is also in line with a statement in September 2010 where Everything Everywhere announced plans to increase the number of network sites from 16,000+ to 18,000+.
<http://everythingeverywhere.com/2010/09/28/everything-everywhere-unveils-plans-for-growth-through-network-leadership-2/>

- c) Telefónica and Vodafone have announced plans to pool their basic network infrastructure to create one national grid of 18,500 sites (which, if this co-operation goes ahead, represents an increase in sites of more than 40% for each operator from their respective existing networks).¹¹

A2.25 Our modelling focuses on the number of sites required to provide household coverage using macrocells, but we recognise that some operators' sites will be used for other purposes (for example, on roads).

A2.26 In Figure A2.3 below, we summarise the predicted macrocell coverage results.¹² These coverage percentages are for the intercept of each single user throughput curve with the x-axis for each frequency. This simulates the limit of coverage at which basic connectivity is possible, but higher data-rates will not be available to all users within this percentage. The different rows show the results for different population areas, and the columns show the three frequencies separately for shallow and deep indoors.

Figure A2.3: Macrocell coverage, 18,000 sites

Area	Popn	Shallow			Deep		
		800	1800	2600	800	1800	2600
0-50%	50%	99%	96%	93%	98%	91%	84%
50-80%	30%	97%	90%	83%	95%	80%	71%
80-90%	10%	97%	85%	78%	92%	75%	66%
0-80%	80%	98%	93%	89%	97%	87%	80%
0-90%	90%	98%	92%	88%	96%	86%	78%

A2.27 The 0-80% row summarises results for the combination of the 0-50% population area and the 50-80% population areas, and so shows indoor coverage for an area where 80% of the population live. Similarly, the 0-90% row shows indoor coverage for an area where 90% of the population live. It can be seen that average coverage for the 0-80% and 0-90% population areas are predicted to be very similar.

A2.28 If we consider the 0-80% and 0-90% population areas, then our model predicts macrocell coverage with 800 MHz spectrum (and 18,000 sites) is 98% for shallow indoors whereas it is predicted to be around 5 percentage points worse for 1800 MHz spectrum. For deep indoors, the gap is wider. Macrocell coverage with 1800 MHz spectrum is predicted to be around 10 percentage points worse than with 800 MHz spectrum. Macrocell coverage with 2.6 GHz is predicted to be worse again, being around 10 percentage points worse than 800 MHz spectrum for shallow indoors, and approaching 20 percentage points worse for deep indoors.

A2.29 While macrocell coverage is clearly worse with 1800 MHz spectrum than with 800 MHz spectrum, an 1800 MHz network is still predicted to achieve a relatively high absolute level of coverage, especially for shallow indoor locations. This is particularly true for the more densely populated areas (i.e. 0-50% and 50-80%), which we believe are more important for assessing credibility.

¹¹ <http://news.o2.co.uk/Press-Releases/Telef%C3%B3nica-UK-and-Vodafone-UK-to-strengthen-their-network-collaboration-385.aspx>

¹² See Annex 7 for more details on the assumptions underlying these results. We have only shown results here for 18,000 sites. Table A7.4 in Annex 7 shows results for 12,000 sites, which tend to show lower coverage for all frequencies and greater differences in coverage between frequencies.

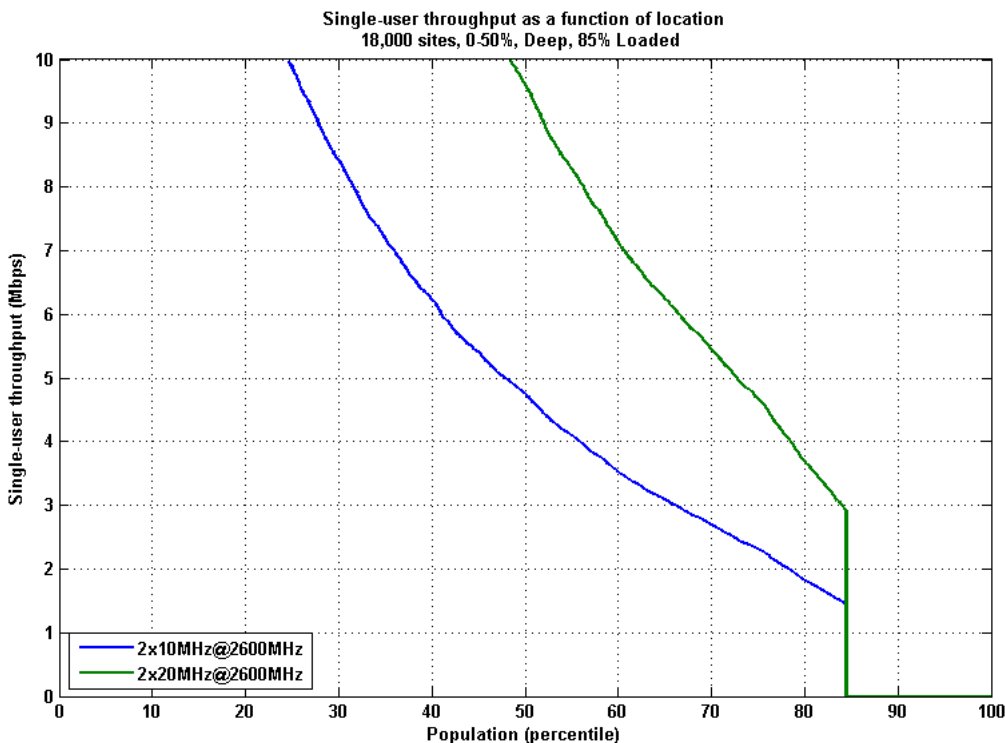
A2.30 1800 MHz is still predicted to achieve a relatively high absolute level of coverage even if we were to account for some of the sensitivity issues included in Annex 7. For instance adopting a higher RSRP threshold (-124 dBm) or if we were to model a network with slightly fewer sites (say 15,000 – which would lead to results that lay between our 12,000 and 18,000 site results).¹³

Macrocell coverage for higher data rates and different bandwidths

A2.31 If we focus on coverage for higher data rates, then the bandwidth of the carrier becomes significant. The extremes of coverage where only basic services may be possible tend to be limited by signal detectability, whether noise or interference limited. However the distance over which high throughputs can be achieved is significantly affected by bandwidth.

A2.32 For example, if we consider a single user throughput of 5 Mbps, then 2x20 MHz of any particular frequency gives significantly better macrocell coverage than 2x10 MHz of that frequency. This is illustrated in Figure A2.4 below. The two lines are for different amounts of 2.6 GHz spectrum. It can be seen that for 5 Mbps with 2x10 MHz of 2.6 GHz spectrum the predicted macrocell coverage is below 50% in this particular scenario, whereas for 2x20 MHz of 2.6 GHz spectrum and the same scenario, it is predicted to be over 70%.

Figure A2.4: Single-user throughput, 18,000 sites, 0-50% area, deep



A2.33 Similar results can be seen in Figures A7.48 to A7.51 in Annex 7. The basic result that for higher data rates bandwidth is predicted to matter is also true for other frequencies.

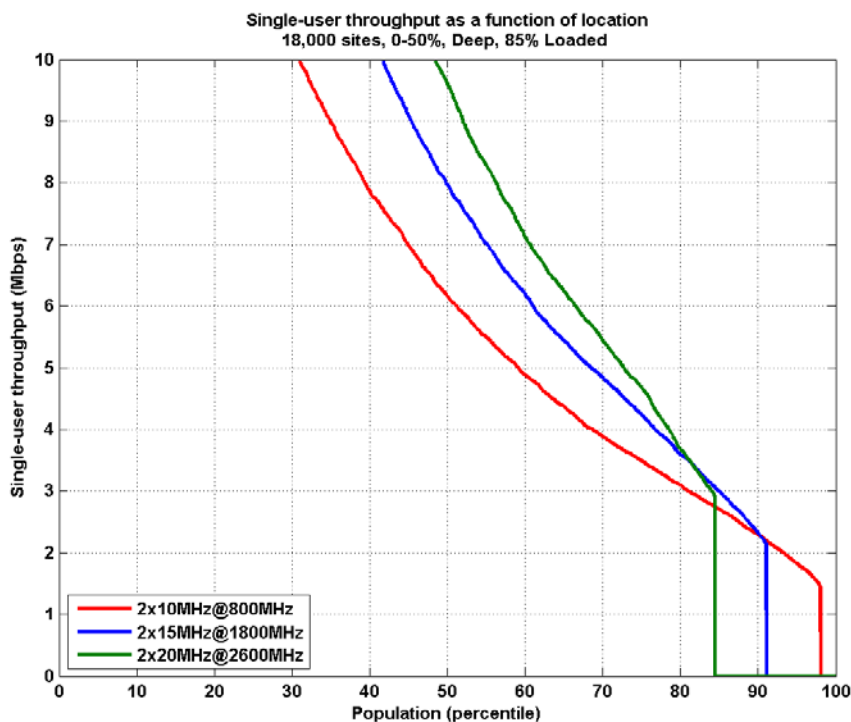
¹³ See Table A7.4 for results for 12,000 sites and Table A7.8 for results for an RSRP threshold of -124 dBm.

A2.34 Another way of looking at this is that for any location, greater bandwidth gives higher data rates, up until the limit of coverage (shown graphically by the cut-off point on Figure A2.4 above). So considering Figure A2.4 above, if we consider what is possible at 60% of locations, it can be seen that 2x20 MHz of 2.6 GHz gives predicted single user data rates of up to around 7 Mbps, whereas only up to around 3.5 Mbps is predicted to be possible with 2x10 MHz bandwidth. This general pattern is the same for other scenarios and frequencies, up until the limit of coverage in that scenario.

2x10 MHz of 800 MHz compared to larger amounts of higher frequencies

A2.35 This means for higher data rate services it may not necessarily be the case that lower frequencies give better macrocell coverage, if the higher frequencies are available in greater bandwidths. This is pertinent because there are larger amounts of higher frequency spectrum available. Figure A2.5 below shows 2x10 MHz of 800 MHz, 2x15 MHz of 1800 MHz and 2x20 MHz of 2.6 GHz, for 18,000 sites, 0-50% population area and deep indoors. It can be seen that the single user throughput line for 800 MHz spectrum is predicted to cross the lines for larger amounts of higher frequencies. This means that for some easier to serve locations, the larger amounts of higher frequencies deliver higher data rates, and for some harder to serve locations the higher frequencies cannot deliver any service at all or deliver lower data rates than the lower frequency spectrum.

Figure A2.5: Single-user throughput, 18,000 sites, 0-50% area, deep



A2.36 The same pattern can be seen in Figures A7.27 to A7.30 in Annex 7.

A2.37 We conclude from this that the more weight that consumers place on coverage for basic connectivity from macrocell networks even at comparatively low data rates, the more important will be the macrocell coverage advantage from the small amounts available of sub-1 GHz spectrum. On the other hand, the more weight that consumers place on higher data rate services, the less important will be small

amounts of sub-1 GHz spectrum, and the bandwidth and quantity of available spectrum will be more important. This is provided coverage is sufficiently good with the higher frequencies in locations consumers use most frequently, which could be provided in part by small cells (as discussed below). There is uncertainty over the relative weight consumers will put on basic connectivity compared to higher average data rates in the future, and also over how well small cell solutions can provide sufficient coverage.

Alternative technologies (including Wi-Fi)

A2.38 The relative macrocell coverage advantage of sub-1 GHz spectrum is greatest for serving consumers indoors, especially deep indoors. But there are other technologies besides macrocells that can provide good quality indoor coverage, which include:

- Offloading onto unlicensed spectrum solutions, most obviously Wi-Fi, but potentially other unlicensed spectrum in the future such as White Spaces;
- Indoor femtocells (using licensed spectrum, but managed separately from the wide area network) and 'hetnets' (heterogeneous networks); and
- In-building repeaters.

A2.39 We considered alternative technologies in paragraphs 3.93 to 3.119 of Annex 6 of the January 2012 consultation and have discussed responses to them from paragraph A3.128 of Annex 3 below.

A2.40 Here we discuss these further by supplementing the evidence we previously drew on, and summarising our main conclusions.

Offload onto unlicensed solutions

A2.41 Wi-Fi currently plays a major role in providing services to mobile devices, especially smartphones and tablets, and especially indoors. We expect Wi-Fi (and small cells in general) to continue to be important in the future. As well as relying on others to provide Wi-Fi, national wholesalers can themselves take measures to increase their use. They can integrate Wi-Fi coverage (either purchased from others or through their own Wi-Fi networks) into their retail products.

A2.42 In addition to the evidence in the January 2012 consultation on Wi-Fi¹⁴, we also consider that the following evidence supports the conclusion that Wi-Fi is an important alternative to more spectrum to provide capacity:

- A study by Informa Telecoms & Media found that on a sample of smartphones in the UK in January 2012, 81% of traffic on smartphones was carried over Wi-Fi rather than the mobile network.¹⁵ Another study by Analysys Mason of a sample of

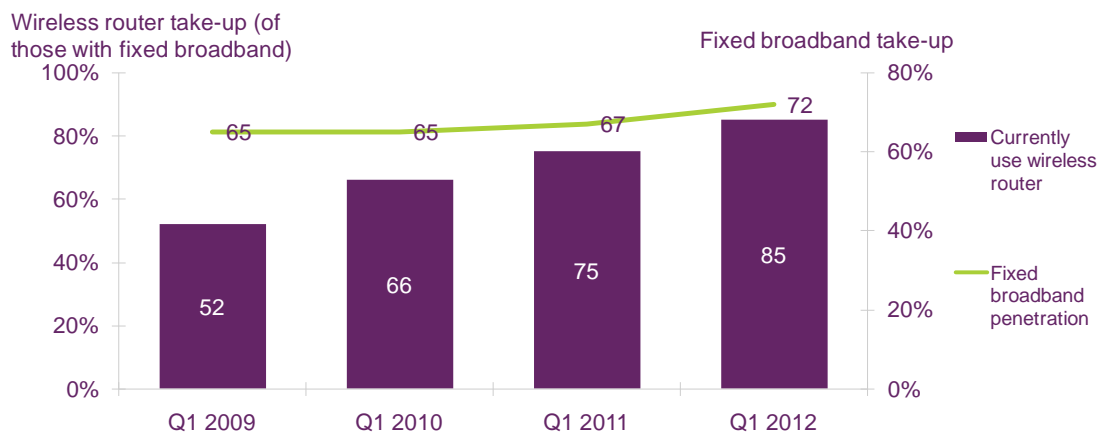
¹⁴ Set out in paragraph 3.98 to 3.105 of Annex 6 of the January 2012 consultation

¹⁵ This was measured by a third-party application called Mobidia MyData Manager, and relates to a sample of 2,300 UK smartphones, on the Android platform only. The paper also shows the proportion of data on the mobile network compared to Wi-Fi for each operator in the UK. See Figure 4 in the paper, which is available at http://www.informatandm.com/wp-content/uploads/2012/02/Mobidia_final.pdf

smartphones in the EU and US found 59% of data was off-loaded to Wi-Fi rather than the mobile network.¹⁶

- 61% of households had a Wi-Fi router in Q1 2012. This is composed of 72% of households that had fixed broadband of which 85% had a Wi-Fi router. Both these two underlying percentages have been growing steadily, as illustrated below.

Figure A2.6: Take up of fixed broadband and wireless routers



Source: Ofcom research, Quarter 1 2012
 Base: Adults aged 16+ with a fixed broadband connection at home
 Note: Fixed broadband penetration based on all adults aged 16+

- In Real Wireless's recent study for Ofcom on device availability, Real Wireless says that off load to Wi-Fi remains an important factor and while it has not examined it in detail in its report for us it believes that virtually all smartphones and tablets will in future contain dual band Wi-Fi and Bluetooth along with cellular frequencies.¹⁷
- We discuss the use of Wi-Fi by smartphone users further in our 2012 Communications Market Report.¹⁸ We include survey results showing that Wi-Fi is the most common tool that subscribers employ to manage their data use, and its use appears to be rising with nineteen per cent of smartphone data users using Wi-Fi to help them stay within their tariff's data limits. Of those that use Wi-Fi, 43% say they use it (as opposed to the cellular connection) all or most of the time when they consume data, with a further 28% saying they use Wi-Fi and cellular networks in equal proportion for data. We also set out survey results showing that by far the most popular location for smartphone Wi-Fi usage is at home.¹⁹ Access with Wi-Fi

¹⁶ Analysys Mason's study was in partnership with Arbitron Mobile. It was based on data gathered by a passive on-device monitoring app installed on over 1,000 smartphones across France, Germany, Spain, the UK and the USA during August and September 2011.

<http://www.analysismason.com/Research/Content/Reports/consumer-smartphone-usage-May2012-RDMM0-RDMY0/>

¹⁷ Real Wireless, *LTE and HSPA device availability in UK-relevant frequency bands: current availability and future evolution*, May 2012, published alongside this Statement.

¹⁸ See page 293 of the 2012 Communications Market Report for the section on 'Smartphone users adopted Wi-Fi to save on mobile data and to increase speed':

http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/CMR_UK_2012.pdf

¹⁹ That Wi-Fi use is particularly valuable in the home is consistent with Informa Telecoms & Media's finding that compared to Wi-Fi, a higher proportion of the mobile network traffic is carried during the period 7am to 7pm, for a weekday. See Figure 9 in Informa Telecoms & Media's paper:

http://www.informatandm.com/wp-content/uploads/2012/02/Mobidia_final.pdf.

in the workplace and 'on the move' is much less frequent, with access in public places or 'out and about' in between.

- A2.43 Today Wi-Fi has some technology limitations that mean that seamless roaming between different providers is not always easy and consistent, and there may be complexity from a user perspective involving logging on and security. This is consistent with the survey evidence in the 2012 Communications Market Report mentioned above that found that the home was by far the most popular location for smartphone Wi-Fi usage, with it being much less common in the workplace and 'on the move'.
- A2.44 Developments are likely to change this picture in the future. For example the Wi-Fi Alliance "Passpoint" programme seeks to enable phones and other mobile devices to seamlessly discover and connect to compatible networks, enabling greater Wi-Fi offload and an expansion of roaming agreements. This programme appears to be gaining significant industry support.²⁰

Indoor femtocells and hetnets

- A2.45 As well as Wi-Fi, femtocells may also have a role in providing services to mobile devices. We expect them to be increasingly relevant for providing good coverage in specific harder to serve areas. In addition to the evidence in the January 2012 consultation on femtocells²¹, we also consider that the following provides further support for the conclusion that they present a useful potential way to provide coverage (as well as capacity) in the future:
- There are now several worldwide deployments of femtocells that reach well into hundreds of thousand units, including Vodafone, Sprint, AT&T, Softbank and SFR. Informa Telecoms and Media's Small Cell Market Status of June 2012 reported 41 commercial services (up from 36 in October 2011) and a total of 57 deployment commitments (compared with 53 in February 2012).²²
 - Informa Telecoms and Media's Small Cell Market Status of June 2012 also reported that nine of the top ten mobile operator groups (by revenue) now offer femtocell services, including AT&T, China Mobile, France Telecom/Orange, Telefónica, T-Mobile/Deutsche Telecom and Vodafone.
- A2.46 Heterogeneous networks (hetnets) make use of a range of different cell types (eg. macro, pico, femto) managed as a single network to optimise performance. They use LTE Advanced techniques such as enhanced inter-cell resource and interference coordination (eICIC) in the network and advanced terminal receivers with interference cancellation (IC), allowing small cells to operate efficiently on the same frequency as macrocells in an way that maximises spectral efficiency. Deploying hetnets may be another way of extending coverage compared to a pure macrocell network, though their greatest benefit is in increasing capacity and service quality.

²⁰ A recent press release from the WiFi Alliance cites widespread industry support, eg. Broadcom, Cisco, Huawei, BT, Ericsson. See <http://www.wi-fi.org/media/press-releases/launch-wi-fi-certified-passpoint%E2%84%A2-enables-new-era-service-provider-wi-fi%C2%AE>

²¹ See the discussion in paragraph 3.106 to 3.110 of Annex 6 of the January 2012 consultation.

²² Informa Telecoms and Media, Small Cell Market Status June 2012:

<http://www.smallcellforum.org/resources-white-papers>

Repeaters

A2.47 We remain of the view that in-building repeaters are not appropriate for delivering coverage in hard to serve outdoor areas, but they may address some of the difficulties of providing good indoor coverage in areas where there is at least good outside coverage. As we set out in paragraph 3.114 of the January 2012 consultation, in-building repeaters only require the covering macrocell to have good outdoor coverage and are not limited by the coverage of the fixed network. However, this implies they are limited by the capabilities of the macrocell network and they need at least good outside coverage on the macrocell. Consequently they are not appropriate for delivering coverage in hard to serve outdoor areas.

Challenges of providing coverage with small cells

A2.48 There are likely to be challenges in relying on alternative technologies to deliver consistently good quality indoor coverage outside the home or office to a large proportion of consumers. It is likely that there will always be some locations or situations where a macrocell network with sub-1 GHz spectrum provides coverage where alternative technologies do not (at least not for all consumers).

A2.49 For example, femtocells may be ‘closed’, that is accessible only to devices of the household or business owning the broadband connection. Technically, this can be overcome as it is relatively easy to set up femtocells in ‘open-access’ mode. However, femtocell owners may not have an incentive to allow all devices to connect to their femtocells as this would involve sharing their broadband connections with others. Similarly, access to Wi-Fi can be restricted only to authorised users.²³

A2.50 There are potentially some more general challenges with Wi-Fi, such as the potential for network congestion, the current limited proliferation of the ability to support seamless services (for example voice and text messaging are not routinely supported through Wi-Fi, though technologies such as Unlicensed Mobile Access are deployed in some handsets), and the current need to manually register to use Wi-Fi.²⁴ Similarly, there are other limitations with femtocells, such as the potential 3G/HSPA interference with the macrocell network, and the current high cost.²⁵

A2.51 However, future developments (such as the Wi-Fi Alliance “Passpoint” programme described earlier) may remove some of these challenges.

Relative value of sub-1 GHz spectrum compared to higher frequencies

A2.52 It is in our view clear that sub-1 GHz spectrum is more valuable than higher frequency spectrum.²⁶ This is shown by the results in recent European auctions, where the price per MHz of sub-1 GHz spectrum is typically many times higher than for higher frequency spectrum.²⁷

²³ See also paragraph 3.115 of Annex 6 of the January 2012 consultation.

²⁴ These issues were discussed in paragraph 3.104 of Annex 6 of the January 2012 consultation.

²⁵ These issues were discussed in paragraph 3.111 of Annex 6 of the January 2012 consultation.

²⁶ For example, in its response to the January 2012 consultation, H3G includes statements from national regulatory authorities (NRAs), mobile operators, academic institutions, industry bodies and other industry stakeholders on the value or importance of sub-1 GHz spectrum compared to higher frequencies. See Annex C of H3G’s response:

[http://stakeholders.ofcom.org.uk/binaries/consultations/award-800 MHz/responses/Three.pdf](http://stakeholders.ofcom.org.uk/binaries/consultations/award-800%20MHz/responses/Three.pdf)

²⁷ See Section 8 on reserve prices, especially Table 8.4 for the ratios in prices for different frequencies in some recent auctions.

- A2.53 There could be a number of reasons for the much higher prices of sub-1 GHz spectrum:
- Sub-1 GHz spectrum could give commercial advantages in terms of providing consumers with more attractive services because of better indoor coverage than higher frequencies (or the value of a lower risk that such coverage will be achieved);
 - Sub-1 GHz spectrum allows a particular level of coverage to be delivered with fewer sites and hence at lower cost; and
 - Sub-1 GHz spectrum could allow the provision of a national LTE service more quickly than with higher frequencies because coverage can be provided with fewer sites.
- A2.54 The relative importance of these different reasons is relevant to our competition assessment. The more the difference is due to a commercial advantage from delivering more attractive services to consumers, the greater would be the concern about the impact on competition. But to the extent the difference is due to network cost savings, with broadly the same service being delivered to consumers, the less concern we have about the impact on competition.
- A2.55 In reality it may be a mix of these reasons, and we do not have robust information to assess the relative importance of the possible reasons. However, illustrative calculations suggest that avoided network cost could be a significant part of the difference in price.
- A2.56 The avoided network cost could be due to fewer macrocells and fewer small cells. We have not tried to quantify the likely difference in cost, as it would depend on the extent to which a national wholesaler without sub-1 GHz spectrum wanted to close the gap in coverage, and the relative cost and balance in terms of building macro and small cells.
- A2.57 To give some sense of possible scale, we have calculated approximate costs for 1,000 macrocells. The cost per 1,000 new sites (including building and operating the sites for 5-10 years) is of the order of £250m, while the savings per 1,000 sites from decommissioning is somewhat less than £100m.²⁸
- A2.58 This is not to imply that the difference in coverage could be completely removed with only 1,000 macrocells. We consider that unlikely. If only considering macrocells, it might take significantly higher site numbers with 1800 MHz spectrum to match the coverage of sub-1 GHz spectrum, meaning the site differences could be in multiple thousands of sites. This could mean the cost to reduce the coverage difference would be much higher than the illustrative cost figures in the previous paragraph. The use of an efficient combination of macrocells and small cells may reduce the cost compared to using macrocells alone.

²⁸ We calculated these approximate figures based on site cost data from the 2011 Ofcom Mobile Call Termination model (Release Version 4). This model assumes passive RAN sharing and includes a general uplift to prices to capture wrap around costs. If we assumed no RAN sharing, the costs would be materially higher. We have rounded the cost numbers as this calculation is for illustrative purposes only. We assumed the capital cost of deploying a new site was £180,000, with annual operating costs of £15,000. For decommissioning, we assumed a one-off cost of £30,000, with operating cost savings of £15,000 per year.

Update on when different bands are likely to be used for LTE

- A2.59 In paragraphs 3.201 to 3.208 of Annex 6 of the January 2012 consultation, we considered when different bands were likely to be used for LTE and the availability of user devices. We considered that the 800 MHz, 1800 MHz or 2.6 GHz bands would all be suitable for an early route to LTE, but that for the 900 MHz band the move to LTE was longer term, with considerable uncertainty over when it might occur. We considered it less likely that the 2100 MHz band would be used for LTE services in Europe than other bands within the timescale of this assessment (the five to ten years from the conclusion of the Auction).
- A2.60 We saw the availability of user equipment as a key factor in determining whether a band was likely to be used for LTE. We drew on a study we commissioned from Real Wireless to explore evidence on the relative opportunities to support future mobile broadband services between frequency bands of relevance to the consultation.²⁹
- A2.61 We have subsequently asked Real Wireless to update this in respect of the main areas that may have changed, namely current device availability and future evolution of device availability. We are publishing the resulting study alongside this statement.³⁰ We also asked Real Wireless to expand the frequencies considered to include 2.3 GHz and 3.5 GHz spectrum which might be released by the public sector in the future.
- A2.62 Both the updated Real Wireless study and responses supported our view that the 800 MHz, 1800 MHz and 2.6 GHz bands will all be used for LTE soon after the Auction (if not before in the case of 1800 MHz) and that there will be a reasonable selection of user devices, including smartphones and tablets, within a couple of years. Real Wireless's research suggests two tiers of LTE frequencies in device procurement terms. The 'first tier' will consist of 3-4 bands per region which will be nearly universally supported, with the second tier being outside this. Real Wireless conclude that the 800 MHz, 1800 MHz and 2.6 GHz bands will all be first tier bands for LTE in Europe. There is already at least one high quality smartphone commercially available that can use LTE with all three frequencies (the Samsung Galaxy SII LTE).
- A2.63 For the 900 MHz band, the situation is less clear. It is difficult to infer much based on current device availability, as the availability of the 900 MHz band for LTE is a recent development. However, while the number of LTE900 capable devices currently available remains very low (at just 5 devices at May 2012), Real Wireless found that support for LTE900 is gaining momentum. Additionally, we note that 900 MHz is currently in use for mobile all around the world and many of those operators with this spectrum face some incentive to refarm, so there is potentially a global market for manufacturers of handsets for those compatible with 900 MHz LTE.
- A2.64 There are also some characteristics of LTE that make it easier to refarm spectrum for LTE than (say) for 3G. Specifically, these characteristics include the ability of LTE to cope with narrow channels, and the ability for LTE-Advanced to bond 900 MHz with higher frequencies (so, for example, 2x5 MHz of 900 MHz could be bonded with unpaired spectrum at a higher frequency to provide basic connectivity plus additional downlink capacity). Real Wireless also found considerable interest from operators in

²⁹ "The timing of the consumer and operator features available from HSPA and LTE", Real Wireless, January 2012: http://stakeholders.ofcom.org.uk/binaries/consultations/award-800MHz/annexes/HSPA_vs_LTE.pdf

³⁰ Real Wireless, LTE and HSPA device availability in UK-relevant frequency bands: current availability and future evolution, May 2012.

refarming 900 MHz spectrum in 2014 or later as a way to move directly to LTE-Advanced, and this was even among those who were confident of securing 800 MHz licences.

- A2.65 Real Wireless considered that while the 900 MHz band will probably fall into the second tier of LTE bands in Europe initially, it is likely to become a first tier LTE band in the future, probably around 2015/16 (although we note it could be earlier, for example Telstra is already considering using 900 MHz for LTE³¹).
- A2.66 Even if the 900 MHz band were not in the first tier of LTE bands in Europe, national wholesalers with 900 MHz will still have access to LTE user devices, including smartphones and tablets. The Real Wireless states that because of more flexible architectures used in user devices, it is now less technically challenging, quicker and lower cost to add bands or change bands. This is especially the case if the bands are relatively close in frequency, such as between 800 MHz and 900 MHz. But the Real Wireless study makes clear that there are still some disadvantages with being outside the first tier, including a delay in obtaining user devices, somewhat higher costs, less choice and potentially lower performance. Also, some original equipment manufacturers may only support large volume bands. In particular, Real Wireless noted that in the past Apple has tended to be conservative about supporting non-mainstream frequencies.
- A2.67 Based on Real Wireless's findings, we remain of the view that the use of 900 MHz spectrum for LTE is likely to be somewhat later than 800 MHz, 1800 MHz and 2.6 GHz, but that if national wholesalers with 900 MHz spectrum wanted to use it for LTE there would be a reasonable selection of user devices available.
- A2.68 Also, as we said in paragraph 3.208 of Annex 6 of the January 2012 consultation, it is quite possible that, for some period of time, there will be advantages to holding the 900 MHz band rather than the initial first tier LTE bands (800 MHz, 1800 MHz and 2.6 GHz). This is because HSPA900 will have a larger range and stock of compatible devices. The latest Real Wireless study confirms that the number of HSPA900 devices currently remains very high and the number supporting higher speed dual carrier operation (DC-HSPA) at 900 MHz is also set to rise rapidly over the coming months.
- A2.69 We said in paragraph 3.205 of Annex 6 of the January 2012 consultation that 2.1 GHz spectrum is less likely to be used for LTE in Europe in the timescales we are considering. However, we also said that if LTE did give a significant commercial advantage over HSPA this would tend to make it more likely that equipment would be available and national wholesalers would start to move spectrum to LTE more rapidly, even at 2.1 GHz. We do not consider that there was strong evidence in responses to the January 2012 consultation questioning this view. We note that the possibility of user devices being available for LTE at 2.1 GHz if there were demand from national wholesalers is consistent with the more flexible RF architectures that Real Wireless describes, which make it less technically challenging, quicker and lower cost to add bands or change bands.
- A2.70 In Figure A2.7 below, we reproduce the indicative timescales for deployment of LTE in different bands from our January 2012 consultation. We consider this is still broadly appropriate, though it is possible that use of LTE in 900 MHz may now be earlier than indicated. (We also note that the timing of deployment of LTE in the 1800 MHz band

³¹ See for example, <http://www.telecomasia.net/content/telstra-leading-charge-900-mhz-lte?page=0%2C0>

in the UK in part depends on the outcome of Ofcom's current consultation on the Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences).

Figure A2.7: Indicative timescales for deployment of LTE in different bands



A2.71 In summary, we consider that national wholesalers can influence the availability of user devices to some extent, but that there are some limits to this. In terms of when different bands might be used for LTE, we consider that:

- The 800 MHz, 1800 MHz and 2.6 GHz bands will all be used for LTE soon after the Auction (if not before in the case of 1800 MHz).
- The use of 900 MHz spectrum for LTE is likely to be somewhat later, but if national wholesalers with 900 MHz spectrum wanted to use it for LTE there would be a reasonable selection of user devices available for this.
- 2.1 GHz spectrum is less likely to be used for LTE in Europe in the timescales we are considering. However, if LTE did give a significant commercial advantage over HSPA this would tend to make it more likely that equipment would be available and national wholesalers would start to move spectrum to LTE more rapidly, even at 2.1 GHz.

Unpaired spectrum and other spectrum releases

A2.72 Below we consider the following spectrum and whether we can rely on it to enable a national wholesaler to be credible:

- Existing spectrum holdings already in the market comprising unpaired 2.1 GHz holdings held by current national wholesalers, UK Broadband's holdings at 3.4-3.8 GHz, and Qualcomm's holdings at 1452-1492 MHz.
- The unpaired 2.6 GHz spectrum which is part of this Auction; and

- Spectrum that may be released in the future, comprising 700 MHz, 2.3 GHz and 3.4-3.6 GHz.

Existing spectrum holdings

- A2.73 Three of the national wholesalers already hold unpaired 2.1 GHz spectrum. To date, these have not been used by national wholesalers, either in the UK or that we are aware of elsewhere. Responses did not argue that this spectrum should be included in our assessment of what spectrum might contribute to the credibility of a national wholesaler. It is not clear that mainstream devices will become widely available to support this band, although we note that this is to a degree within the national wholesalers' control.
- A2.74 UK Broadband holds a large amount of spectrum (124 MHz) in the 3.4 to 3.8 GHz range. We set out in the January 2012 consultation that while UK Broadband planned to launch an unpaired LTE network covering major UK cities, we did not anticipate that it could act as a significant competitive influence on the national wholesale market in its own right with its existing spectrum.³² This was because, firstly, its spectrum is high frequency (higher than 2.6 GHz), and secondly, although this spectrum now benefits from European harmonisation, there is not yet an international 'ecosystem' for user devices or network equipment to the extent of the mainstream mobile spectrum frequencies.
- A2.75 As expected, in February 2012 UK Broadband announced it had launched an LTE service in parts of London.³³ Real Wireless's report says that the first devices will be Customer Premises Equipment (CPE) from Huawei available for indoor and outdoor use at homes and businesses, and that UK Broadband plans to have 'Mi-Fi' devices in the future that support both FDD and TDD LTE and 3G.³⁴ Responses did not argue that this spectrum should be included in our assessment of what spectrum might contribute to the credibility of a national wholesaler. We consider it is still uncertain that there will be a reasonable selection of user devices in this frequency band, especially smartphones and tablets.
- A2.76 Qualcomm hold 40 MHz of spectrum in the 1452-1492 MHz band. This has been awarded on a technology neutral basis and the spectrum is subject to ongoing harmonisation work in Europe. It is not clear that mainstream devices will become widely available to support this band.

Unpaired 2.6 GHz spectrum

- A2.77 We consider the case for including the unpaired 2.6 GHz spectrum is uncertain. Real Wireless found that momentum had increased for 2.6 TD-LTE globally (and for the 2.3 GHz band) with significantly more devices becoming available though mostly simpler devices such as dongles. This was driven by parts of Asia (such as China and India), as a migration path from their current 3G technology (TD-SCDMA), rather than Europe. Real Wireless also found there had also been an increase in the interest in 2.6 TD-LTE within Europe, for example noting one commercial deployment in Poland.

³² See paragraph 3.45 and footnote 66 in Annex 6 of the January 2012 consultation.

³³ <http://www.ukbroadband.com/about-us/press-releases/press-release-1>

³⁴ Real Wireless, *LTE and HSPA device availability in UK-relevant frequency bands: current availability and future evolution*, May 2012, published alongside this Statement.

- A2.78 We have reviewed the difference in prices between the paired and unpaired 2.6 GHz spectrum in countries where they have been auctioned together. In some recent auctions, the paired 2.6 GHz spectrum has sold for substantially more than the unpaired 2.6 GHz spectrum, when considered on a per MHz basis. For example, in Portugal in 2011 the ratio of the price of paired spectrum to unpaired spectrum per MHz was 2.4:1. In Italy in 2011 it was 1.5:1 and in Spain in 2011 it was 4.2:1. While in the recent auctions in Germany and Belgium there was no difference between the price of the paired and unpaired 2.6 GHz spectrum on a per MHz basis, there may have been particular reasons for this that do not reflect the underlying value of the two.³⁵ The greater interest in paired spectrum (especially among incumbent operators) is also supported by auction results showing that, if there is unsold spectrum, more often than not it is unpaired spectrum that remains unsold, as was the case in the Dutch auction in 2010 and the Spanish and Portuguese auctions in 2011. In general, we consider that it is reasonable to conclude from recent auctions that the paired 2.6 GHz spectrum is more valuable than the unpaired 2.6 GHz spectrum.
- A2.79 There are already some simpler user devices such as dongles available, and it is likely that more will become available. But, while it is possible, we consider it remains uncertain that there will be a reasonable selection of user devices, including smartphones and tablets, for the European market that will use the unpaired 2.6 GHz. This uncertainty may be reflected in the differences in prices between paired and unpaired 2.6 GHz spectrum.

Spectrum that may be released in the future

- A2.80 It is possible that additional spectrum may be released during the timeframe we are considering (i.e. the 5-10 years from the Auction), which could be used for the provision of mobile services. In particular:
- The Government is planning major future releases of spectrum below 5 GHz, including from bands which are or could become harmonised for mobile broadband use in Europe or even more widely. In particular the Ministry of Defence (MoD) has identified two bands (2310-2390 MHz and 3400-3600 MHz) from which they expect to release 160 MHz by the end of 2016.³⁶
 - In Europe, Africa and the Middle East a resolution was passed at the 2012 World Radio Conference (WRC 12) paving the way to a decision to enable the 700 MHz band to be used for mobile broadband after the next World Radio Conference in 2015.³⁷ There is no quantity identified yet for Europe, but a potential future

³⁵ In its report for us, DotEcon and Aetha considered that the values of 2.6 GHz spectrum in Germany were determined by 'parking strategies' rather than genuine demand for incremental spectrum, whereby bidders place bids on the cheapest lots to park eligibility, regardless of whether it is paired or unpaired spectrum and thus drive up prices uniformly (paragraphs 113 and 114). In Belgium, there was excess supply of paired spectrum in the auction because of the lot structure, spectrum caps and the presence of only three incumbent bidders interested in paired spectrum: one lot of paired spectrum remained unsold and all other lots sold essentially at reserve price, while the unpaired spectrum was acquired by a new entrant at reserve price (paragraphs 121 and 122).

See DotEcon and Aetha, *Spectrum value of 800 MHz, 1800 MHz and 2.6 GHz*, July 2012, published alongside this Statement.

³⁶ <http://www.culture.gov.uk/images/publications/Spectrum-Public-Update-December-2011.pdf>
http://www.culture.gov.uk/images/publications/Spectrum_Release.pdf

³⁷ Ofcom, Consultation document of 29 March 2012, Securing long term benefits from scarce spectrum resources, paragraph 1.18, available at: "http://stakeholders.ofcom.org.uk/consultations/uhf-strategy/"

clearance of the 700 MHz band could create 2 x 40 MHz of total usable spectrum for mobile broadband.³⁸

- We are currently progressing proposals to make the interleaved spectrum between 470 MHz and 790 MHz (so called TV white spaces) available on a licence exempt basis for wireless devices, provided interference is not caused to existing services (including digital terrestrial television services, PMSE users or other future licensed users). The amount of spectrum available will differ by location and time, based on the need to protect existing services.³⁹

A2.81 These potential future releases could possibly increase the availability of spectrum for mobile services by more than half, including up to around 60% increase in sub-1 GHz paired spectrum.

A2.82 Ofcom is currently consulting on its strategy for ensuring the best usage of UHF spectrum band IV and V, encompassing the 700 MHz band, and any final decision on 700 MHz release will be informed by consultation responses and by future developments, including those related to the international process.⁴⁰ The time required to reach the necessary international agreements makes it unlikely that any clearance of the 700MHz band to enable a harmonised and coordinated release for mobile broadband use could start before 2018. The actual date of any release from 2018 onwards is subject to a high degree of uncertainty, because that will be dependent on an assessment, nearer the time, of a number of factors including the requirements of DTT and other uses, and potential impacts on consumers. Many European countries, including the UK, currently use the 700 MHz band for DTT broadcasting, whereas in a number of countries it is already used for mobile broadband.⁴¹

A2.83 Some of the other potential releases are more certain. However, we cannot be as certain at this point that there will be widespread availability of mainstream user devices, including smartphones and tablets, for some of the bands.

A2.84 Clearly these bands have the potential in the future to play an important role in the delivery of some mobile services. But because of the uncertainties identified above about timing and user equipment availability in these bands, we have concluded that we should not rely on these potential spectrum releases for enabling a national wholesaler to be credible.

Assessment of credibility of H3G with various spectrum portfolios

A2.85 Below we consider what portfolios H3G might obtain in the Auction that would enable it to be credible. From paragraph A2.134 below we consider how the position of a new entrant compares to this.

A2.86 Our conclusions on the potential credibility of H3G with its existing spectrum holdings (assessed in Section 4) plus a range of possible additional spectrum portfolios are shown in Figure A2.8 below. The four portfolios in bold at the bottom are those we

³⁸ This is the assumption used by Real Wireless, *Techniques for increasing the capacity of wireless broadband networks: UK, 2012-2030, Annex 6*, March 2012, p.63, available here:

<http://www.ofcom.org.uk/static/uhf/real-wireless-annex1.pdf>

³⁹ Ofcom, Consultation document of 1 September 2011, Implementing Geolocation, Summary of consultation responses and next steps, paragraphs 1.1 to 1.7 available at "http://stakeholders.ofcom.org.uk/binaries/consultations/geolocation/statement/statement.pdf"

⁴⁰ Ibid, paragraph 2.28 and 8.18

⁴¹ Ibid, paragraphs 3.54–3.56

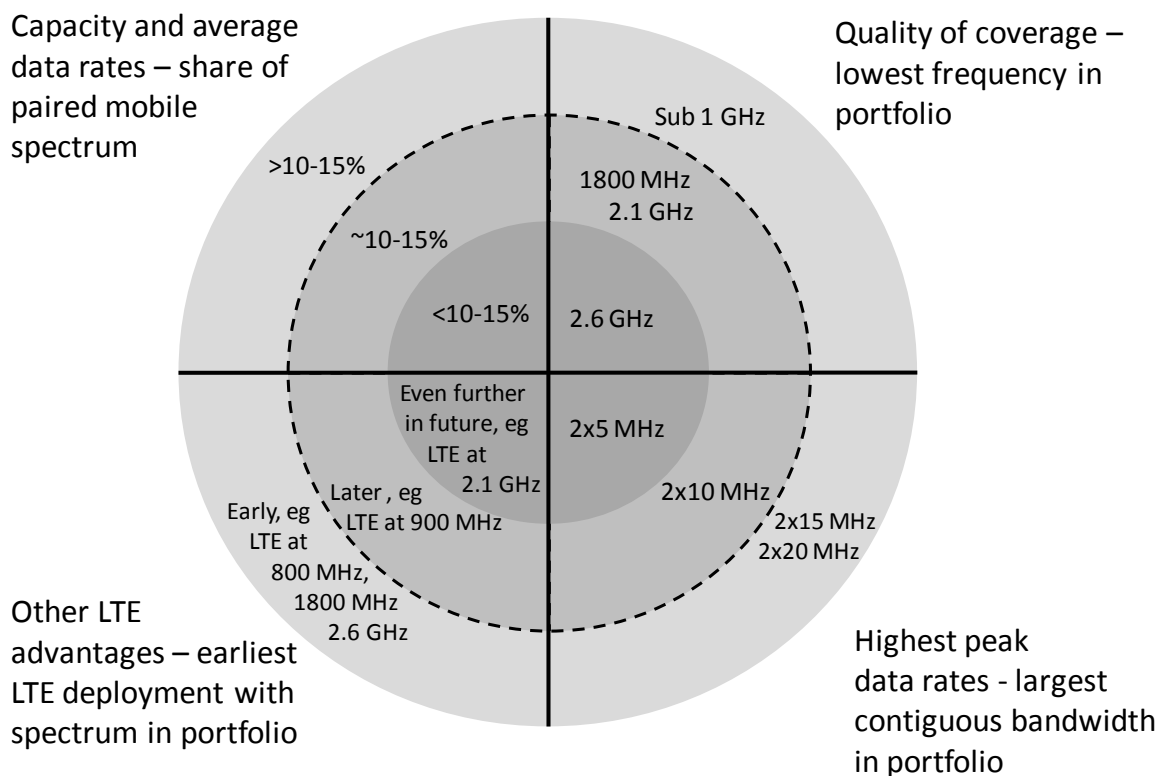
consider are likely to be sufficient to enable H3G to be credible. Larger portfolios than these would further reduce what we regard as the low residual risk that H3G would not be credible with these four portfolios.

Figure A2.8: Alternative portfolios considered that could enable H3G to be credible

	Additional spectrum			Existing spectrum	Summary of assessment
	800 MHz	1800 MHz	2.6 GHz	2.1 GHz	
	2 x 10 MHz	-	-	2 x 15 MHz	Low level of confidence that H3G would be credible
	-	2 x 15 MHz	-	2 x 15 MHz	
	-	2 x 15 MHz	2 x 10 MHz	2 x 15 MHz	
Portfolio 1	2 x 15 MHz	-	-	2 x 15 MHz	Likely to be sufficient spectrum for credibility
Portfolio 2	2 x 10 MHz	-	2 x 10 MHz	2 x 15 MHz	
Portfolio 3	2 x 5 MHz	2 x 15 MHz	-	2 x 15 MHz	
Portfolio 4	-	2 x 15 MHz	2 x 20 MHz	2 x 15 MHz	

A2.87 Below we assess these portfolios in the order they appear in the table above. We assess them using the framework we established in Section 4. This involves considering each portfolio in the round against the four dimensions of capability we have identified. We reproduce Figure 4.3 from Section 4 below. This shows a simplified version of our conclusions on how the dimensions of capability affect credibility. The darker inner circles (bounded by the dotted line) represent the spectrum we consider is likely to be the necessary minimum for a national wholesaler to be credible. The outer circle shows the other or further spectrum that may contribute to a national wholesaler having sufficient capability to be credible. While Figure 4.3 is simplified, our conclusions are set out more precisely in Figure 4.2 in Section 4.

Figure A2.9: Illustration of our judgements on how dimensions of capability and spectrum affect ability to be credible



A2.88 As well as considering each dimension separately, we also consider the interaction between the dimensions, especially between coverage and capacity. This assessment does not lead to a mechanical answer. Using this framework, we have exercised our judgement in deciding which portfolios are likely to enable H3G to be credible and which are not.

A2.89 We believe we have improved the presentation of our ‘in the round’ assessment, as a result of responses to the January 2012 consultation. Some responses criticised our assessment as lacking transparency and rigour.⁴² We do not agree that there were any deficiencies in the substance of our assessment, but we have improved the presentation in two ways to make it clearer:

- We no longer present the ‘traffic light tables’ we used in the January 2012 consultation. These tables were intended to show where specified spectrum portfolios for national wholesalers were strong and where they were weak. The colour coding was intended to show the strengths and weaknesses *before* taking account of the importance of those strengths and weaknesses. This appears to have been confusing to some respondents. We now therefore use a simpler table without colour coding that assesses the spectrum holdings against each of the four dimensions of quality we have considered.
- We have been more explicit about what we consider the minimum necessary requirements for each dimension of capability, and to what extent a strength in capability in the dimension can contribute to making a national wholesaler credible.

⁴² See from paragraph A3.279 below for more discussion of responses on this.

This is summarised in the Figure above, and set out more precisely in Figure 4.2 in Section 4.

Assessment of H3G’s credibility with 2x10 MHz of 800 MHz spectrum

Figure A2.10: H3G’s existing holdings plus 2x10 MHz of 800 MHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x25 MHz	2x25 MHz	2x10 MHz
Spectrum holdings for data services – longer term	2x25 MHz (9%)	2x25 MHz (13%)	2x10 MHz (15%)

	Assessment
Capacity and average data rates	With only 9% of spectrum overall, there is some risk that H3G would not have the necessary minimum to be credible, although the 9% share may tend to understate its capacity, as part of it is low frequency spectrum.
Quality of coverage	With 800 MHz spectrum, H3G would not only meet the likely necessary requirement in the inner circle of Figure A2.9 in the quadrant for coverage, but would also have an important strength in terms of the outer circle in that quadrant.
Highest peak data rates	With 2x10 MHz of 800 MHz spectrum, H3G would not be able to deliver the highest peak data rates. But the importance of this is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.90 With 2x10 MHz of sub-1 GHz spectrum this portfolio has an advantage. That is, it not only has the necessary requirements in the inner circles of Figure A2.9 in the quadrant for coverage, but also has an important strength in terms of the outer circle in this quadrant. While the importance of other LTE advantages is unclear in the near term, this portfolio does have such capability, as do all the portfolios we consider below.

A2.91 However, the share of spectrum is limited. There is some risk that this portfolio does not meet the necessary minimum requirement for capacity. We explained in Section 4 that we considered there would be a risk to credibility if a national wholesaler has a portfolio with spectrum towards the weak end of the range for the necessary minimum for capacity or coverage. This portfolio is near the lower end of our range for the necessary minimum for capacity.

A2.92 Responses were split on whether this portfolio was sufficient. For example, H3G argued that this portfolio was inadequate to ensure credibility, whereas Vodafone, Telefónica and Everything Everywhere argued that it was sufficient.

A2.93 On balance, despite the sub-1 GHz spectrum in this portfolio, we consider that the lack of strength in capacity from the limited share of spectrum means that it presents a material risk for credibility.

A2.94 In paragraph A2.114 below we describe our technical modelling results for this portfolio compared to 2x15 MHz of 800 MHz spectrum, which we conclude below is likely to be sufficient for H3G to be credible.

Assessment of H3G’s credibility with 2x15 MHz of 1800 MHz spectrum

Figure A2.11: H3G’s existing holdings plus 2x15 MHz of 1800 MHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x25-30 MHz ⁴³	2x25-30 MHz	-
Spectrum holdings for data services – longer term	2x30 MHz (11%)	2x30 MHz (15%)	- (0%)

	Assessment
Capacity and average data rates	With 11% of spectrum overall, H3G may meet the necessary minimum requirement for share of spectrum to be credible, but is towards the lower end of our range of 10-15%.
Quality of coverage	With 2x15 MHz of 1800 MHz as well as its 2.1 GHz spectrum, H3G would have the likely necessary requirement for quality of coverage to be a credible national wholesaler given the range of ways of providing coverage. However, without sub-1 GHz spectrum it would be more challenging for H3G to deliver a service in locations that are harder to serve. We consider this a disadvantage compared to national wholesalers with sub-1 GHz spectrum.
Highest peak data rates	With 2x15 MHz of 1800 MHz spectrum, H3G would be able to offer high peak data rates with early LTE, but the full 2x15 MHz may not be available until September 2015. Until then H3G would only have 2x10 MHz and would not be able to offer high peak data rates. The importance of high peak speeds is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.95 Responses were split on whether this portfolio was sufficient. For example, H3G argued that this portfolio was inadequate to ensure credibility, whereas Vodafone, Telefónica and Everything Everywhere argued that it was sufficient.

A2.96 This portfolio falls within our ranges for the necessary minimum requirements in the inner circles in Figure A2.9 above. However, the share of spectrum is towards the weak end of our range for the necessary minimum requirement for capacity. This presents a risk to credibility.

A2.97 The portfolio includes spectrum in the outer circle in the quadrants (on which we place less weight) for highest peak data rates and other LTE advantages. However, it does not have more than the necessary minimum for either coverage or capacity:

- It has the disadvantage of no sub-1 GHz spectrum, i.e. it does not have the spectrum in the outer circle in the quadrant for coverage in Figure A2.9 above. It might therefore require greater network investment (perhaps particularly in small cells) in order to provide sufficient coverage than a portfolio that contained sub-1 GHz spectrum. This difference in network cost is likely to be reflected in the relative

⁴³ Unlike in the January 2012 consultation, we have shown the amount of spectrum in the near term in this portfolio as a range. This is because the purchaser of the divested 1800 MHz spectrum may only have access to the full 2x15 MHz of this in September 2015. This is common to all portfolios where we consider the divested 1800 MHz spectrum.

cost of spectrum in different portfolios. But there is a risk of a residual gap in coverage relative to competitors.

- With only 11% of spectrum overall, it does not have a large share of spectrum and does not provide a strength in the outer circle in the quadrant for capacity.

A2.98 We consider this portfolio is risky for credibility because the share of spectrum is towards the low end of our range for the necessary minimum for capacity and because of the dependence on alternative ways to spectrum to provide both good quality coverage and capacity. Therefore we would have a low level of confidence that this portfolio has sufficient spectrum for H3G to be credible.

A2.99 In paragraph A2.114 below we describe our technical modelling results for this portfolio compared to 2x15 MHz of 800 MHz spectrum, which we consider is likely to be sufficient for H3G to be credible.

Assessment of H3G’s credibility with 2x15 MHz of 1800 MHz and 2x10 MHz of 2.6 GHz spectrum

Figure A2.12: H3G’s existing holdings plus 2x15 MHz of 1800 MHz spectrum and 2x10 MHz of 2.6 GHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x35-40 MHz	2x25-30 MHz	-
Spectrum holdings for data services – longer term	2x40 MHz (15%)	2x30 MHz (15%)	-

	Assessment
Capacity and average data rates	With 15% of spectrum overall, this is likely to meet the necessary minimum requirement in share of spectrum to allow H3G to be credible, though this spectrum is all at higher frequencies which deliver less capacity.
Quality of coverage	With 2x15 MHz of 1800 MHz as well as its 2.1 GHz spectrum, H3G would have the likely necessary requirement for quality of coverage to be a credible national wholesaler given the range of ways of providing coverage. However, without sub-1 GHz spectrum it would be more challenging for H3G to deliver a service in locations that are harder to serve. We consider this a disadvantage compared to national wholesalers with sub-1 GHz spectrum.
Highest peak data rates	With 2x15 MHz of 1800 MHz spectrum, H3G would be able to offer high peak data rates with early LTE, but the full 2x15 MHz may not be available until September 2015. Until then H3G would only have 2x10 MHz. The importance of high peak speeds is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.100 We proposed in the January 2012 consultation that this portfolio would probably be sufficient for H3G to be credible. But we noted (in paragraph 4.71 of Annex 6) that it could present a particular risk depending on the technical and market conditions, i.e. if quality of coverage in harder to serve locations were important and it was not possible to provide this with the amount of higher frequency spectrum in this portfolio.

- A2.101 Vodafone, Telefónica and Everything Everywhere considered that the smaller portfolio of 2x15 MHz of 1800 MHz on its own would be sufficient. H3G considered that this larger portfolio would still be insufficient.
- A2.102 This portfolio has the disadvantage of not having sub-1 GHz spectrum. It might therefore require greater network investment (perhaps particularly in small cells) in order to provide sufficient coverage than a portfolio that contained sub-1 GHz spectrum. This difference in network cost is likely to be reflected in the relative cost of spectrum in different portfolios. But there is a risk of a residual gap in coverage relative to competitors.
- A2.103 With 15% of spectrum overall, this portfolio is likely to meet the necessary minimum requirement for capacity but does not provide a strength in terms of share of spectrum (i.e. it has no clear strength in the outer circle in the quadrant for capacity in Figure A2.9 above).
- A2.104 While it does provide a route to LTE and so allows services that offer LTE advantages, it is unclear how important these are for credibility in the near term, though the importance is likely to grow over time. In terms of peak data rates, this portfolio may only have a maximum bandwidth for LTE of 2x10 MHz until September 2015, when it would increase to 2x15 MHz.
- A2.105 An argument against this portfolio being sufficient to allow a national wholesaler to be credible is that while it may have the necessary minimum requirements, it does not have any clear strengths. In particular, it does not clearly have more than the necessary minimum for either coverage or capacity. Therefore, despite the additional 2x10 MHz of 2.6 GHz spectrum compared to the previous portfolio, it is still dependent on alternative ways to spectrum to provide both good quality coverage and capacity.
- A2.106 On balance, we now consider that this portfolio does not give a high level of confidence that H3G would be credible, though it is higher than just with 2x15 MHz of 1800 MHz spectrum.
- A2.107 In our technical modelling, we have compared the predicted macrocell performance of 2x15 MHz of 1800 MHz, 2x10 MHz of 2.6 GHz and 2x20 MHz of 2.6 GHz. We compare these frequencies and bandwidths because, as we discuss from paragraph A2.127 below, we consider that 2x15 MHz of 1800 MHz plus 2x20 MHz of 2.6 GHz would be likely to allow H3G to be credible.
- A2.108 In Figures A7.48 to A7.51 of Annex 7, we compare the single user throughputs for these frequencies. It can be seen from the single user throughput graphs that there is no difference in terms of coverage for low data rates between these two portfolios. However, the two sets of graphs show that the larger amount of 2.6 GHz provides more capacity and higher single user throughput than the smaller portfolio.
- A2.109 We have not explicitly set out an assessment of 2x15 MHz of 1800 MHz and 2x15 MHz of 2.6 GHz spectrum, but we consider that this would only give a moderately higher level of confidence than this portfolio, as it only involves an extra 2x5 MHz of 2.6 GHz spectrum.

Assessment of H3G’s credibility with 2x15 MHz of 800 MHz spectrum

Figure A2.13: H3G’s existing holdings plus 2x15 MHz of 800 MHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x30 MHz	2x30 MHz	2x15 MHz
Spectrum holdings for data services – longer term	2x30 MHz (11%)	2x30 MHz (15%)	2x15 MHz (23%)

	Assessment
Capacity and average data rates	With 11% of spectrum overall H3G may meet the necessary minimum requirement for share of spectrum to be credible. There is also the benefit of half of it being sub-1 GHz spectrum which can deliver more capacity.
Quality of coverage	With 2x15 MHz of 800 MHz spectrum, H3G would not only meet the likely necessary requirement in the inner circle of Figure A2.9 in the quadrant for coverage, but would also have an important strength in terms of the outer circle in that quadrant.
Highest peak data rates	With 2x15 MHz of 800 MHz spectrum, H3G would be able to offer high peak data rates with early LTE. There could only be at most one other party that had such large bandwidth of LTE spectrum at sub-1 GHz for early LTE. But the importance of this is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.110 In the January 2012 consultation, we considered that this portfolio would give a reasonable level of confidence that H3G would be credible. In responses, H3G considered that it would be sufficient, and Vodafone, Telefónica and Everything Everywhere considered it was more than necessary.

A2.111 With 11% of spectrum overall, this portfolio does not have a large share of spectrum. But it does have the advantage of a large amount of sub-1 GHz spectrum, which we consider makes this portfolio stronger in terms of capacity than the portfolio considered in Figure A2.11 above (i.e. 2x15 MHz of 1800 MHz). The large amount of sub-1 GHz spectrum also means that it is significantly stronger in terms of coverage. It has the advantage of allowing reasonable capacity to be provided even in the most difficult to serve areas.

A2.112 It provides the capability for high peak data rates though the importance of this is unclear. It can also offer services which have LTE advantages - although the importance is unclear in the near term, its importance is likely to grow over time.

A2.113 Given the large amount of sub-1 GHz spectrum, we consider that this portfolio is likely to provide sufficient spectrum for credibility.

A2.114 In our technical modelling, we have compared the predicted macrocell performance of this portfolio with (a) 2x10 MHz of 800 MHz and (b) 2x15 MHz of 1800 MHz spectrum, both of which we consider give a low level of confidence that H3G would be capable of being credible. In terms of single user throughput, this comparison is shown in Figures A7.44 to A7.47 of Annex 7. 2x15 MHz of 800 MHz is obviously superior to (a) and (b) in these graphs. Compared to 2x10 MHz of 800 MHz it gives greater capacity, and compared to 2x15 MHz of 1800 MHz it gives greater coverage.

We consider that 2x15 MHz of 800 MHz is materially more likely to be sufficient to enable H3G to be credible than either of the other two portfolios.

Assessment of H3G’s credibility with 2x10 MHz of 800 MHz and 2x10 MHz of 2.6 GHz spectrum

Figure A2.14: H3G’s existing holdings plus 2x10 MHz of 800 MHz and 2x10 MHz of 2.6 GHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x35 MHz	2x25 MHz	2x10 MHz
Spectrum holdings for data services – longer term	2x35 MHz (13%)	2x25 MHz (13%)	2x10 MHz (15%)

	Assessment
Capacity and average data rates	With 13% of spectrum overall this portfolio is likely to meet the necessary minimum requirement for capacity. But it does not give any particular strength beyond that necessary minimum.
Quality of coverage	With 800 MHz spectrum, H3G would not only meet the likely necessary requirement in the inner circle of Figure A2.9 in the quadrant for coverage, but would also have an important strength in terms of the outer circle in that quadrant.
Highest peak data rates	With 2x10 MHz of 800 MHz and 2.6 GHz spectrum, this portfolio would not allow the fastest peak data rates possible with early LTE. But the importance of this capability is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.115 In the January 2012 consultation, we considered that this portfolio would give a reasonable level of confidence that H3G would be credible. In responses, H3G considered that it would be sufficient, and Vodafone, Telefónica and Everything Everywhere considered it was more than necessary.

A2.116 This portfolio has what we consider are likely to be the minimum necessary requirements and also has the advantage of sub-1 GHz spectrum. We consider this portfolio is likely to be sufficient spectrum for credibility.

Assessment of H3G’s credibility with 2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz spectrum

Figure A2.15: H3G’s existing holdings plus 2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x30-35 MHz	2x30-35 MHz	2x5 MHz
Spectrum holdings for data services – longer term	2x35 MHz (13%)	2x35 MHz (18%)	2x5 MHz (8%)

Assessment

Capacity and average data rates	With 13% of spectrum overall this portfolio is likely to meet the necessary minimum requirement for capacity and all at 2.1 GHz and below (and lower frequencies give better capacity). It does not give any particular strength beyond the minimum necessary for credibility.
Quality of coverage	With 800 MHz spectrum, H3G would not only have the likely necessary requirement in the inner circle of Figure A2.9 in the quadrant for coverage, but also a strength in terms of the outer circle. But it would only have 2x5 MHz of sub-1 GHz spectrum. We discuss this further below.
Highest peak data rates	With 2x15 MHz of 1800 MHz spectrum, H3G would be able to offer high peak data rates with early LTE, but the full 2x15 MHz may not be available until September 2015. Until then H3G would only have 2x10 MHz and would not be able to offer high peak data rates. The importance of high peak speeds is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.117 In the January 2012 consultation, we considered that there may be concerns with a portfolio of 2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz spectrum about coverage (especially at higher speeds) and capacity. We considered that 2x5 MHz of 800 MHz spectrum is likely to struggle to provide adequate coverage for higher data speeds, such as 5 Mbps.⁴⁴

A2.118 In its response, H3G has argued that it would be sufficient for it to be credible if it had 2x5 MHz of 800 MHz spectrum combined with 2x15 MHz of 1800 MHz and 2x5 MHz of 2.6 GHz spectrum. Vodafone, Telefónica and Everything Everywhere considered that the smaller portfolio of 2x15 MHz of 1800 MHz on its own would be sufficient. We have therefore reviewed the value of 2x5 MHz of 800 MHz spectrum when combined with 2x15 MHz of 1800 MHz spectrum.

A2.119 A small amount of 800 MHz spectrum would allow better indoor coverage. When combined with 2x15 MHz of 1800 MHz spectrum (and also 2x15 MHz of 2.1 GHz spectrum), it is possible that an operator might be able to manage traffic in a way that assigns users in relatively good signal conditions to the 1800 MHz band and users in relatively poor signal conditions (e.g. deep inside buildings) to the 800 MHz band. LTE advanced, in particular, should have the ability to manage resource blocks in different bands in a manner which is optimised overall. This could maximise the coverage benefits of 800 MHz although the typical data rates that could be delivered to users in this band may be relatively restricted. The limited capacity means that the indoor coverage is only better when considering services with relatively low data rates. For higher data rate services, coverage will be dominated by the larger bandwidths available in the 1800 MHz or even 2.6 GHz spectrum with the small amount of 800 MHz making no significant contribution.

A2.120 This can be seen in our technical modelling results. For example, in Figures A7.52 to A7.55, while for low single user throughputs the 2x5 MHz of 800 MHz is predicted to have greater coverage, at higher single user throughputs, the larger bandwidth of 1800 MHz and 2.6 GHz are predicted to have greater coverage.

A2.121 The 2x5 MHz of 800 MHz would therefore be particularly valuable for those consumers that place a high value on having some basic connectivity in a wide range of locations, even if that is only at a relatively low average data rate. 800 MHz spectrum may also give an advantage in the sense that it would allow an operator to

⁴⁴ See for example paragraphs 3.92 and 4.72 of Annex 6 of the January 2012 consultation.

obtain national coverage with a relatively small number of sites. This could give a timing advantage in terms of being able to offer a national service quickly.

- A2.122 In terms of the total share of paired spectrum, this portfolio has 13%. But it has a higher share of 18% of spectrum at 2.1 GHz and below, which gives some capacity and coverage advantages over 2.6 GHz spectrum.
- A2.123 We also note that several national wholesalers in Europe only have 2x5 MHz of sub-1 GHz spectrum, though this is at 900 MHz rather than 800 MHz. If we knew that those smaller national wholesalers were credible, this would give us greater confidence that this portfolio was sufficient. However, we do not know for certain that these other smaller national wholesalers are credible, so we do not put a lot of weight on the holdings being similar to those in other European countries.⁴⁵
- A2.124 Our revised view is that a portfolio of 2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz spectrum would be likely to be sufficient to make H3G credible.
- A2.125 We acknowledge this portfolio is smaller than the portfolio that H3G proposed (which also included 2x5 MHz of 2.6 GHz spectrum). But we do not consider that there would be much value in only 2x5 MHz of 2.6 GHz spectrum. We therefore consider this portfolio close to a portfolio that H3G considered was sufficient to allow the fourth national wholesaler to be credible. We also recognise that other existing national wholesalers are likely to regard this portfolio as more than sufficient, as they consider 2x15 MHz of 1800 MHz spectrum on its own to be sufficient.
- A2.126 We have also considered portfolios with 2x5 MHz of 800 MHz spectrum and a large amount of 2.6 GHz spectrum. Such portfolios might allow basic connectivity to be provided with good coverage but very limited capacity, coupled with a layer providing much higher capacity but materially poorer coverage. We are concerned however that the users of such a network would experience a particularly inconsistent service, with high speeds available in some locations but only very basic connectivity in many others. We are also not aware of any practical examples of networks with spectrum combinations of this nature. Furthermore, responses did not argue for including such a portfolio. For these reasons we do not consider such portfolios would give a high level of confidence that they would enable H3G to be credible.

Assessment of H3G’s credibility with 2x15 MHz of 1800 MHz and 2x20 MHz of 2.6 GHz spectrum

Figure A2.16: H3G’s existing holdings plus 2x15 MHz of 1800 MHz spectrum and 2x20 MHz of 2.6 GHz spectrum

	A: 2.6 GHz & below	B: 2.1 GHz & below	C: Sub-1 GHz
Spectrum holdings for data services – near term	2x45-50 MHz	2x25-30 MHz	-
Spectrum holdings for data services – longer term	2x50 MHz (19%)	2x30 MHz (15%)	-

Assessment	
Capacity and	With 19% of spectrum overall, this would provide more than the minimum share

⁴⁵ See from paragraph A2.187 below.

average data rates	of spectrum to be credible and as such a strength in the outer circle in Figure A2.9, though this spectrum is all at higher frequencies which deliver less capacity.
Quality of coverage	With 2x15 MHz of 1800 MHz as well as its 2.1 GHz spectrum, H3G would have the likely necessary requirement for quality of coverage to be a credible national wholesaler given the range of ways of providing coverage. However, without sub-1 GHz spectrum it would be more challenging for H3G to deliver a service in locations that are harder to serve. We consider this a disadvantage compared to national wholesalers with sub-1 GHz spectrum.
Highest peak data rates	With 2x20 MHz of 2.6 GHz spectrum, H3G would be able to offer the highest peak data rates with early LTE. But the importance of this is unclear for credibility.
Other LTE advantages (e.g. better latency)	This portfolio would provide an early route to LTE and allow services that offer other LTE advantages, which may provide a strength in capability, but it is unclear how important this is for credibility in the near term. In the longer term it is more likely to be necessary.

A2.127 This portfolio has the disadvantage of not having sub-1 GHz spectrum. It might therefore require greater network investment in alternative ways to provide good quality coverage (perhaps particularly in small cells). This difference in network cost is likely to be reflected in the relative cost of spectrum in different portfolios. But there is a risk of a residual gap in coverage relative to competitors.

A2.128 While it does provide a route to LTE and so allows services that offer LTE advantages, it is unclear how important these are for credibility in the near term, though the importance is likely to grow over time.

A2.129 In terms of peak data rates, this portfolio may only have a maximum bandwidth for LTE of 2x10 MHz until September 2015, when it would increase to 2x15 MHz.

A2.130 This portfolio has the strength of a share of spectrum of 19%. Of the spectrum at 2.1 GHz and below (which gives some capacity and coverage advantages over 2.6 GHz spectrum), this portfolio has 15%.

A2.131 This portfolio is somewhat stronger than the portfolio we considered earlier of 2x15 MHz of 1800 MHz and 2x10 MHz of 2.6 GHz, as it contains an extra 2x10 MHz of 2.6 GHz spectrum. This increases the share of spectrum above our range for the necessary minimum. We also note that the additional 2.6 GHz spectrum in this portfolio may make it easier to deploy alternative ways of increasing coverage.⁴⁶

A2.132 On balance, we consider that this portfolio is likely to be sufficient to make H3G credible.

A2.133 We have also considered a portfolio involving just a large amount of 2.6 GHz spectrum (without 1800 MHz spectrum). Such a portfolio (combined with H3G's existing 2.1 GHz spectrum) would only have a relatively small share of spectrum at frequencies of 2.1 GHz and below (at 8%). It may meet the likely necessary minimum requirement for quality of coverage to be a credible national wholesaler, taking into account H3G's existing 2.1 GHz spectrum. But it would have a coverage disadvantage compared to national wholesalers with sub-1 GHz spectrum. Moreover, H3G would be relying for its lowest frequency spectrum for coverage on 2.1 GHz spectrum, which we consider is less likely to be used for LTE in Europe in the

⁴⁶ Capacity could, for example, be provided using 2.6 GHz spectrum to provide a layer of femto / pico cellular capacity and coverage, in separate spectrum from the main macrocellular layer in other spectrum such as 1800MHz, avoiding inefficiencies associated with interference between the layers.

timescales for our competition assessment. While we consider it unclear that it is necessary to deliver LTE services in the near term, it is more likely to be necessary longer term. In our view such a portfolio, considered in the round, would give a low level of confidence that it was sufficient to enable H3G to be credible. We also note that responses did not propose such a portfolio.

Treatment of a new entrant

A2.134 In considering the potential spectrum portfolios that H3G may require to be capable of being credible, we took into account its existing 2.1 GHz spectrum. In Section 4 and from paragraph A2.90 above we identified a range of alternative spectrum portfolios that, when combined with its existing holdings, we considered are likely to enable H3G to be a credible national wholesaler. Since a new entrant does not have 2.1 GHz spectrum it may need more spectrum to be credible than in these portfolios (see Section 4, paragraphs 4.149-4.151).

A2.135 In light of the analysis in Section 4, and consistent with the position set out in the January 2012 consultation, we have concluded that the most appropriate and proportionate approach to promote competition is through the reservation of spectrum for a fourth national wholesaler (a new entrant or H3G). In this section we consider whether the portfolios reserved for a new entrant should be the same or larger than the reserved portfolios for H3G.

A2.136 Since a new entrant does not have existing spectrum holdings, for it to be able to acquire all of the spectrum to enable it to be credible, we may need to:

- a) Reserve a larger spectrum portfolio for a new entrant than H3G; or
- b) Reserve the same spectrum portfolio, and rely on a new entrant buying any remaining amount of spectrum it needs in the Auction or subsequently or a coming together with H3G's 2.1 GHz spectrum in some way in the future (e.g. through network sharing, trade or merger) if necessary.

Summary of January 2012 consultation

A2.137 In the January 2012 consultation, we proposed to have the same reservation for H3G or a new entrant, despite H3G already having 2x15 MHz of 2.1 GHz spectrum and that the portfolios for a new entrant would leave it (assuming it acquired no further spectrum) with a share of spectrum that is below the range we considered as having an increased level of risk to credibility⁴⁷. There were several reasons for this⁴⁸:

- a) Reserving a larger portfolio(s) for a new entrant would not necessarily make it easier for it to obtain any reserved spectrum in competition with H3G. Since the winning set of bids would be those that maximised value (as reflected in Auction bids), if the new entrant's group of portfolios were bigger than H3G's, in order to win it would need to outbid other bidders (including Everything Everywhere, Telefónica and Vodafone) for the additional spectrum. As such, a larger reserved portfolio would not necessarily be easier for new entrant compared to a smaller portfolio and acquiring any remaining spectrum requirements in the Auction or subsequently.

⁴⁷ Paragraph 4.212 of the January 2012 consultation.

⁴⁸ Paragraphs 4.213 to 4.217 of the January 2012 consultation.

- b) When the amount of reserved spectrum is the same for H3G and a new entrant, then the new entrant can compete on equal terms for the reserved spectrum and has the option (and flexibility) of buying any additional spectrum it needs in the normal way in the Auction. We would expect the reserved spectrum to be obtained by the eligible bidder with the highest intrinsic value, which seems appropriate as we do not have a prior preference between H3G or a new entrant.
- c) It may be excessive to reserve more spectrum than the minimum necessary to be credible when combined with H3G's 2x15 MHz of 2.1 GHz spectrum⁴⁹. If a new entrant bought one of the reserved portfolios, it might be possible for it to launch a competitive LTE service initially (potentially leading to stronger competition). In the longer term, H3G and the new entrant might not each have sufficient spectrum to be credible. However, if necessary at that point, it might be possible for the two spectrum holdings to be brought together in some way, for example by network sharing, a trade or a merger, while still retaining at least four credible national wholesalers. In this way we consider that it might be possible for a new entrant to obtain only the reserved spectrum and to become credible in the longer term⁵⁰.

A2.138 On balance, we therefore considered that it was likely to be sufficient to set the same portfolios for H3G and a new entrant for ensuring that at least four operators have access to spectrum to enable them to be capable of being credible national competitors at the wholesale level after the auction. We considered that this did not preclude a new entrant obtaining sufficient spectrum in the Auction to be credible even in the longer term, but it might need to obtain more than the reserved spectrum (either in the Auction or subsequently). We also recognised that if spectrum holdings were more dispersed there would be some risk that they did not come together to enable at least four credible national wholesalers in the longer term. However, the risk of unnecessary restrictions on spectrum outcomes leading to an inefficient spectrum allocation would be higher if we were to reserve more than the minimum necessary to enable at least four national wholesalers to be credible in the longer term.

Further analysis

A2.139 We consider it desirable that one entity holds at least the minimum spectrum holding (i.e. a reserved portfolio plus 2x15 MHz of 2.1 GHz or equivalent) at the end of the Auction. Absent winning additional unreserved spectrum in the Auction, this avoids the potential reliance on subsequent and uncertain coming together of spectrum held by different entities, which we recognise may be more risky in achieving our objectives (as raised by some respondents). There may be some practical impediments to spectrum coming together (e.g. rivals may find it difficult to negotiate about the value of spectrum or the terms of any consolidation). Further, it would be reliant on the incentives of both parties being aligned at the same time, to deliver an outcome that was also in line with our overall policy objective. If the spectrum did not come together, both parties may be financially viable but the dispersion of spectrum holdings may mean they are not individually (nor collectively) capable of being credible, which may limit their capability to exert an effective constraint on rivals. As a

⁴⁹ Paragraph 8.52 of Annex 6 of the January 2012 consultation.

⁵⁰ We also recognised the potential risk of strategic incentives on Everything Everywhere, Telefónica or Vodafone to obtain one of these two spectrum holdings to prevent a fourth credible national wholesaler in the longer term, but if this were through a spectrum trade, it would be subject to a competition assessment at that time. See <http://stakeholders.ofcom.org.uk/binaries/consultations/trading-900-1800-2100/statement/900-1800-2100-statement.pdf>

result, we consider there to be a risk associated with relying on the subsequent coming together of spectrum.

A2.140 Therefore how we specify the reserved portfolios for a new entrant and H3G has implications for this risk and the extent we would be relying on spectrum subsequently coming together. But as discussed below it may also in turn affect competition in the Auction and the efficiency of the outcome.

A2.141 To assess this issue further, we have considered how the nature of competition between opted-in bidders may vary depending on the approach to reserved portfolios for a new entrant and for H3G. We then consider possible ways to mitigate any risks associated with these options.

Competition between opted-in bidders

A2.142 As described in Section 7, the set of winning packages in the Auction, including the winning opted-in bidder's reserved portfolio, is the combination of packages that yields the highest value (in terms of Auction bids) across both opted-in and other bidders, subject to there being one opted-in bidder winning one reserved portfolio (or a package that includes a reserved portfolio).

A2.143 Both H3G and new entrants are eligible to be opted-in bidders (and they become opted-in bidders if they decide to opt in to make bids for all of the reserved portfolios at reserve prices). The nature of competition in the Auction between H3G and a new entrant in different situations in terms of their respective reserved portfolios is as follows:

- a) Same reserved portfolios: Where two opted-in bidders, such as H3G and a new entrant, are bidding on the same reserved portfolio, the winning opted-in bidder is the one which makes the higher bids. (In the more complex situation in which there is a set of portfolios which are the same but one opted-in bidder makes higher bids for some of these portfolios and lower bids for other portfolios, the winner depends also on the bids by non opted-in bidders – this is then similar to the description under Different portfolios below).
- b) Larger reserved portfolios: This is where a new entrant's reserved portfolios are strictly larger than H3G's reserved portfolios, i.e. the new entrant's reserved portfolios include all of the specific spectrum in the corresponding reserved portfolios for H3G plus additional spectrum. In this situation, in order to win, the new entrant needs to outbid the combination of: (i) H3G's bid on the components of the reserved portfolios that are in common; and (ii) other bidders, i.e. non opted-in bidders, on the additional spectrum in its reserved portfolios.
- c) Different reserved portfolios: this is where the reserved portfolios of H3G and a new entrant include different spectrum. In this situation, the winner is the one whose bid is closer to (i.e. least below⁵¹) the bid of the non opted-in bidder that would be displaced if the opted-in bidder were to win.⁵²

A2.144 With the same reserved portfolios, H3G and a new entrant compete in the Auction for the reserved spectrum on equal terms. Taking the example of Portfolio 2, this

⁵¹ For ease of exposition this description assumes that the bids of non opted-in bidders would exceed those of opted-in bidders.

⁵² Except that in a package auction it could be more complicated and the choice of winning packages would recognise the value generated by awarding the spectrum to non opted-in bidders, taking into account all the knock-on effects on all packages assigned.

situation is illustrated in Figure A2.17 where both a new entrant and H3G have the same reserved portfolio shown in row (i).

Figure A2.17: Illustration of different approaches to reserved portfolios for H3G and new entrant

		800 MHz	2.1 GHz	2.6 GHz
(i)	Same reserved portfolios for H3G and new entrant: Portfolio 2	2x10 MHz		2x10 MHz
(ii)	Illustration of larger reserved portfolio for new entrant	2x10 MHz		2x25 MHz
(iii)	Hypothetical larger version of Portfolio 2 for H3G if its 2.1 GHz were in the Auction	2x10 MHz	2x15 MHz	2x10 MHz

A2.145 The second situation of larger reserved portfolios for a new entrant than for H3G is illustrated in Figure A2.17 by row (ii) for a new entrant compared to the reserved portfolio for H3G in row (i). It is likely to be harder for a new entrant to win a reserved portfolio in such a situation compared to the first situation of the same reserved portfolios (or the third situation of different portfolios). This is because, even if it matched H3G for the 2x10 MHz of 800 MHz and 2x10 MHz of 2.6 GHz that is common between the reserved portfolios for the new entrant and H3G, it would also need to outbid non opted-in bidders for the additional 2x15 MHz of 2.6 GHz⁵³ spectrum in order to win the reserved portfolio in row (ii).⁵⁴ This means that, in the situation of larger reserved portfolios for a new entrant, there is a risk of a distortion of competition in the Auction between opted-in bidders (favouring H3G over a new entrant) and of a corresponding distortion to spectrum efficiency.

A2.146 The reason why we might specify larger reserved portfolios for the new entrant is that H3G already holds 2x15 MHz of 2.1 GHz spectrum. In effect, the source of the risk of distortion of competition in the Auction between opted-in bidders and spectrum efficiency in the situation of larger reserved portfolios for a new entrant is that the value of H3G's 2.1 GHz spectrum is not reflected in the calculation of the winning combination of packages, even though it is relevant to efficient competition in the Auction between H3G and a new entrant.

A2.147 This is illustrated by considering the hypothetical scenario if H3G's 2x15 MHz of 2.1 GHz were included in the Auction and assuming that acquiring such spectrum would count towards satisfying H3G's reserved portfolios but not a new entrant's reserved portfolios. In terms of Figure A2.17 the reserved portfolio for H3G would be as shown in row (iii) and the reserved portfolio for the new entrant would be as shown in row (ii). This would therefore be an example of the third situation described in paragraph A2.143 above in which the reserved portfolios of H3G and the new entrant are different (i.e. the new entrant's reserved portfolio is not the same as H3G's, nor is it strictly larger).

A2.148 In this situation of different reserved portfolios, we consider that H3G and a new entrant would compete on equal terms. Both would be bidding to win a different reserved portfolio, but both would be competing against each other relative to the

⁵³ For simplicity we assume in Figure A2.17 this is the additional spectrum that a new entrant would need to enable it to be credible, but the analysis set out here does not rely on this specific assumption.

⁵⁴ As noted in the January 2012 consultation (see paragraph A2.137a), this is very similar to the situation of a new entrant seeking to acquire more spectrum than in its reserved portfolio, e.g. all of the spectrum shown in row (ii) of Figure A2.17 when its reserved portfolio is the same as H3G's, i.e. Portfolio 2 shown in row (i) of the Table. To be successful the new entrant would need to outbid the combination of H3G on Portfolio 2 and non opted-in bidders on the additional 2x15 MHz of 2.6 GHz.

bids of non opted-in bidders (for the spectrum that differs between their respective reserved portfolios).

A2.149 However, as noted above, this scenario is purely hypothetical because H3G's 2x15 MHz of 2.1 GHz spectrum will not be in the Auction. We have therefore identified different options to address the risk of distortion to competition in the Auction between opted-in bidders in a situation where a new entrant has larger reserved portfolios (the second situation described above).

Addressing the risk of distortion to competition between opted-in bidders with larger reserved portfolios for a new entrant

A2.150 The three options for reserved portfolios we have identified are:

- a) Specify larger reserved portfolios for a new entrant than for H3G, but address the risk of distortion by adding a suitable bidder credit to the new entrant's bids for its reserved portfolios. H3G has put forward a specific proposal along these lines in its response to the January 2012 consultation (referring to it as "handicapping");
- b) Specify larger reserved portfolios for a new entrant, and accept the risk of distortion to spectrum efficiency and competition in the Auction between opted-in bidders; or
- c) Specify the same reserved portfolios for H3G and a new entrant. This is the approach we proposed in the January 2012 consultation.

A2.151 As regards the first of these options, we agree with the principle behind H3G's handicapping proposal which is intended to "level the playing field"⁵⁵ in competition in the Auction between opted-in bidders.

A2.152 However, we disagree that H3G's specific handicapping proposal provides a bidder credit for a new entrant (or a handicap for H3G) on an appropriate basis. In particular, it does not address the source of the risk of distortion, which as explained above is that the value of H3G's 2x15 MHz of 2.1 GHz spectrum is missing from the Auction. Instead the bidder credit in H3G's proposal is based on something quite different, namely the difference between what it refers to as the "implicit subsidies" for H3G and a new entrant (where the implicit subsidy for each is the difference between final clock prices and reserve prices evaluated at their reserved portfolios). We therefore consider that H3G's handicapping proposal is not an effective way to mitigate the disadvantage that would be faced by a new entrant if its reserved portfolios were strictly larger than H3G's.

A2.153 We have not identified a suitable and practical method of reliably estimating the size of the appropriate bidder credit. It is especially difficult to do so, because the relevant information that is required relates to a hypothetical situation (the value of H3G's 2x15 MHz of 2.1 GHz if it were in the Auction).

A2.154 Therefore, we consider that there is a significant risk of regulatory failure with the first option of larger reserved portfolios and a suitable bidder credit for a new entrant:

- a) If the bidder credit were set too high, it would 'overshoot' with a risk of the opposite distortion of competition between opted-in bidders, i.e. distorting competition in the Auction in favour of the new entrant over H3G. The nature of such a distortion would be to adversely affect the choice of winning opted-in bidder and to reduce

⁵⁵ Annex B of H3G's non-confidential response to the January 2012 consultation.

the amount of spectrum in the Auction available for non opted-in bidders, leading to spectrum inefficiency.

- b) If the bidder credit were set too low, it would fail to achieve the intended objective and a risk of distortion in competition in the Auction between opted-in bidders (in favour of H3G) would remain.

A2.155 As regards the third option of the same reserved portfolios for H3G and a new entrant, this would avoid a distortion of competition in the Auction between opted-in bidders (as discussed in paragraphs A2.143 and A2.144 above).

A2.156 The disadvantage of the same portfolios is that there is a risk that such reserved portfolios for a new entrant may not be sufficient to enable it to be credible in the longer term. Therefore, if a new entrant is the winning opted-in bidder, our objective of promoting a credible fourth national wholesaler may rely on subsequent coming together of the new entrant's and H3G's spectrum. This disadvantage is avoided by either the first or the second options above of reserving larger portfolios for a new entrant.

A2.157 However, we consider that there are other advantages of having the same portfolios for H3G and new entrants, as set out in the January 2012 consultation (summarised above). This option provides the new entrant with more flexibility: it competes in the Auction with H3G on equal terms for the same reserved portfolios and can choose whether to seek to acquire additional spectrum in the Auction or subsequently, such as 2x15 MHz of 2.6 GHz. If it does compete for additional spectrum in the Auction, it is not worse off than if that additional spectrum had been included in its larger reserved portfolios (unlike the first and second options – see also footnote 54). It also means the winning opted-in bidder holds at least a complete reserved portfolio (as per H3G's). In light of these advantages and despite the risk of reliance for our objective of promoting competition between at least four credible national wholesalers on the subsequent coming together of the new entrant's and H3G's spectrum, it may be excessive to reserve larger portfolios.

Conclusion on portfolio reservation for new entrant

A2.158 Therefore in light of the analysis above, we consider that, on balance, specifying the same reserved portfolios for new entrants and H3G is likely to be appropriate and proportionate. In our view the potential disadvantage relative to other options is more than offset by the advantages.

Alternative portfolios reserved for fourth national wholesaler if the 2x15 of 1800 MHz divestment is sold before the Auction

Summary of January 2012 consultation

A2.159 If Everything Everywhere sold the 2x15 MHz of 1800 MHz spectrum that it is required to divest as part of its merger commitments before the Auction⁵⁶, the reserved portfolios will change depending on who acquires that spectrum. If the 2x15 MHz of 1800 MHz spectrum is bought by Vodafone or Telefónica, then the group of portfolios that would be reserved for a fourth national wholesaler reduces to those shown in the table below. We did not receive any consultation responses disputing this conclusion.

⁵⁶ Some respondents have raised concerns about the influence this may give Everything Everywhere over the future mobile market, and these are discussed from paragraph A3.574 Annex 3.

Figure A2.18: Alternative portfolios reserved for fourth national wholesaler when 2x15 of 1800 MHz spectrum is acquired by Vodafone or Telefónica

	800 MHz	1800 MHz	2.6 GHz
Portfolio 1	2 x 15 MHz	-	-
Portfolio 2	2 x 10 MHz	-	2 x 10 MHz

A2.160 In our Addendum to the second consultation⁵⁷, we set out two cases for how the reserved portfolios could change if a party other than Vodafone or Telefónica bought the 1800 MHz before the Auction. In particular, we considered what portfolios would be reserved and for which opted-in bidders in this situation.

A2.161 It seemed to us that the key issue in this situation is whether it would be sufficient to meet our objective of there being at least four credible national wholesalers, that parties other than Everything Everywhere, Telefónica and Vodafone collectively held (at least) the spectrum in one of the spectrum portfolios we have identified, even if they do not do so individually (Case 1); or whether it is necessary to meet our objective that there is at least one party who on its own holds (at least) one of the identified spectrum portfolios (Case 2).

A2.162 In Case 1, given that a party other than EE, Telefónica and Vodafone would already be holding the future rights to use the 2x15 MHz of 1800 MHz spectrum to be divested by EE, the spectrum portfolios in the Auction would be the same for all opted-in bidders, and would consist of the spectrum in excess of 2x15 MHz of 1800 MHz that we considered necessary to reserve to meet our objective. For example, in the case of the portfolios we have decided to adopt in this statement, the following portfolios would be on offer to all opted-in bidders in the Auction⁵⁸:

Figure A2.19: Case 1 - Reserved portfolios for all opted-in bidders (and in Case 2, reserved portfolios for purchaser of 1800 MHz if sold pre-Auction)

	800 MHz	1800 MHz	2.6 GHz
Portfolio 3a	2 x 5 MHz	-	-
Portfolio 4a	-	-	2 x 20 MHz

A2.163 In Case 2, the spectrum necessary to meet our objective would vary between bidders: in the case of the party that had acquired the 2x15 MHz of 1800 MHz spectrum the portfolios would be as in Case 1; in the case of other parties, the portfolios would be those that we considered necessary for them independently to acquire sufficient spectrum to meet our objective, and, of course, could not include the 1800 MHz spectrum already sold by EE. For example, in the case of the portfolios we have decided to adopt in this statement, the same portfolios as above would be on offer to the bidder that had already acquired the 2x15 MHz of 1800 MHz spectrum (assuming that they entered the Auction and opted-in), but the portfolios that would be on offer to other opted-in bidders in this case would be as follows:

Figure A2.19: Case 2 - Reserved portfolios for all other opted-in bidders

	800 MHz	1800 MHz	2.6 GHz
Portfolio 1	2 x 15 MHz	-	-
Portfolio 2	2 x 10 MHz	-	2 x 10 MHz

⁵⁷ Addendum to second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues of 12 January 2012”, 17 February 2012.

⁵⁸ We have presented the final portfolios here rather than those from the January 2012 consultation to avoid confusion.

Further analysis of Case 1 and Case 2

A2.164 A key consideration in Case 1 and Case 2 is the potential for dispersion in spectrum holdings, and any impact this may have on the risks to our objective of promoting at least four national wholesalers. This discussion of Case 1 and Case 2 draws on the responses received to the consultation, a summary of which can be found from paragraph A3.569 in Annex 3.

A2.165 As set out above, in our discussion of reserved portfolios for a new entrant if 1800 MHz is in the Auction, we consider that a fourth national wholesaler is likely to require at least one of the reserved portfolios plus H3G's 2x15 MHz of 2.1 GHz or equivalent in the longer term to be credible, and it is desirable to minimise the reliance on subsequent coming together of spectrum held by different entities to achieve this due to the potential risks. However, if 1800 MHz is in the Auction, we consider that the most appropriate and proportionate approach is to reserve the same portfolios for a new entrant and H3G (set out above). Therefore, if 1800 MHz is in the Auction and a new entrant were to win the reserved spectrum, it would hold a complete reserved portfolio but to be credible in the longer term would be to some extent reliant on winning additional spectrum in the Auction or subsequently or on spectrum holdings coming together in the future.

A2.166 Figure A2.20 illustrates the possible spectrum holdings when 1800 MHz is *not* in the Auction that could result under either Case 1 or 2. For this illustration we use Portfolio 3 from this Statement (2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz), in order to consider the compatibility of such outcomes with our objectives.

Figure A2.20: Illustrative spectrum holdings of Portfolio 3 if 1800 MHz sold pre-Auction

		800 MHz	1800 MHz	2.1 GHz	Possible outcome if 1800 MHz in Auction?
Required holding (Portfolio 3 + 2.1 GHz)		2x5 MHz	2x15 MHz	2x15 MHz	
Outcome A	H3G				Yes
	New Entrant				
Outcome B	H3G				Yes
	New Entrant				
Outcome C	H3G				No
	New Entrant				
Outcome D	H3G				No
	New Entrant				

A2.167 All of these outcomes, A to D, would be possible under Case 1. This is because in the event that 1800 MHz is sold pre-Auction, only the remainder of the portfolio (i.e. 2x5 MHz of 800 MHz in the case of Portfolio 3a), would be available to all opted-in bidders. However, only outcome A and B would be possible under Case 2 as the purchaser of 1800 MHz pre-Auction would be the only party able to buy the remainder of the portfolios containing 1800 MHz in the Auction (while a different

opted-in bidder would be able to bid for different but complete portfolios, i.e. Portfolios 1 and 2). Given this, it is important to consider how these outcomes fit with our objectives, and whether they increase risks to promoting at least four national wholesalers.

- A2.168 Outcome A is the only outcome for the reserved spectrum which would mean one party would hold at least the minimum spectrum holding (i.e. a reserved portfolio plus 2x15 MHz of 2.1 GHz or equivalent) at the end of the Auction, whereas the other three would rely to differing extents on subsequent coming together of holdings and/or H3G or a new entrant winning sufficient unreserved spectrum in the Auction to be a credible national wholesaler. As such, outcomes B, C and D all carry a risk to achieving our objectives.
- A2.169 However, whilst we consider it desirable to minimise the reliance on spectrum coming together in the future due to the potential difficulties of achieving this (as discussed above), this is only to the extent we consider it appropriate and proportionate for promoting our objectives to do so. Importantly, as discussed above when 1800 MHz is in the Auction, we consider that permitting a dispersion of holdings equivalent to outcome B (i.e. where one party holds a complete reserved portfolio, even if it does not hold a complete minimum spectrum holding), if a new entrant were to outbid H3G to be the winning opted-in bidder for reserved spectrum, may be the most appropriate way to achieve our policy aim. In light of this view when 1800 MHz is in the Auction, it would not be consistent to take steps to avoid outcome B in the event that 1800 MHz is sold before the Auction.
- A2.170 Outcomes C and D also rely on spectrum subsequently coming together, as a single opted-in bidder holds neither a complete minimum spectrum holding nor a complete reserved portfolio. In addition, the opted-in bidder who won the reserved spectrum in outcomes C and D would not have much early LTE spectrum (only 2x5 MHz of 800 MHz in the case of Portfolio 3) or would only have higher frequency early LTE spectrum (2x20 MHz of 2.6 GHz with Portfolio 4)⁵⁹. For both of these reasons, outcomes C and D increase the risk to effectively achieving our aim compared to outcomes A and B. This is due to the potentially greater dispersion of spectrum holdings since neither bidder holds at least a complete reserved portfolio (or indeed a minimum spectrum holding).⁶⁰
- A2.171 Unlike outcome B, we consider that outcomes C and D (and their associated risks) can be reasonably avoided through our approach to reserved portfolios. By adopting Case 2 rather than Case 1, outcomes C and D would not be possible, and so we would minimise the number of scenarios where spectrum coming together would be relied on to achieve our aim of ensuring that at least four operators have access to spectrum to enable them to be capable of being credible national wholesalers after the Auction (i.e. to outcome B, in which any winning opted-in bidder would hold at least a complete reserved portfolio).
- A2.172 However, we recognise that under Case 2 it is possible for more spectrum to be reserved, compared to Case 1 (if there is a pre-Auction acquirer of the 1800 MHz and then there is a different winning opted-in bidder in the Auction). In addition, we acknowledge that Case 2 involves different reserved portfolios for different opted in

⁵⁹ These outcomes would mean the reserved early LTE spectrum would be split between two parties.

⁶⁰ This is unlike the situation where 1800 MHz is in the auction, where the winning opted-in bidder would hold at least a complete reserved portfolio which we consider is consistent with our objectives, as discussed from paragraph A2.137.

bidders⁶¹. In light of the responses received to the consultation and the discussion above when 1800 MHz is in the Auction, we have considered whether having different portfolios for different opted-in bidders under Case 2 would favour the pre-Auction acquirer of the 1800 MHz spectrum in competing in the Auction against other opted-in bidders.

Is there a risk of distortion to competition between opted-in bidders under Case 2?

A2.173 The general nature of competition between opted-in bidders for reserved portfolios under different scenarios is set out from paragraph A2.143. In summary, we consider that it is likely to be harder for an opted-in bidder with a strictly larger portfolio to win a reserved portfolio compared to when all opted-in bidders have the same reserved portfolios or they have different (but not strictly larger) portfolios. In light of this, we do not consider that the pre-Auction acquirer of 1800 MHz spectrum would automatically obtain spectrum from the competition constraint when competing with another opted-in bidder under Case 2. We recognise that one of the portfolios for another opted-in bidder is a larger version of the portfolio for the pre-Auction acquirer of 1800 MHz, i.e. 2x15 MHz of 800 MHz compared to 2x5 MHz of 800 MHz. But the other portfolio is not – it has the same amount of paired spectrum but with a different mix of frequencies, i.e. 2x10 MHz of 800 MHz plus 2x10 MHz of 2.6 GHz compared to 2x20 MHz of 2.6 GHz.⁶² Therefore the selection of the winning opted-in bidder would also depend on the bids of the two parties for their respective different portfolios relative to the bids of non opted-in bidders.

A2.174 As a result, we do not consider that the Auction will automatically be distorted towards the pre-Auction purchaser of 1800 MHz under Case 2. However, if there were a risk of distortion to competition between opted-in bidders as a result of Case 2, we have considered whether it could be reasonably avoided. This issue is analogous to our discussion of the reserved portfolios for a new entrant when 1800 MHz is in the Auction, set out from paragraph A2.143. Rather than the absence of the value of H3G's 2.1 GHz spectrum from the Auction being the source of the risk of distortion, here it is the absence of the 1800 MHz spectrum from the Auction. However, for the reasons set out in the previous paragraph, we consider that the risk of distortion to spectrum efficiency and competition in the Auction between opted-in bidders under Case 2 (when 1800 MHz is sold before the Auction) is smaller than in our analysis of larger reserved portfolios for a new entrant (when 1800 MHz is in the Auction).

A2.175 We consider there to be three potential options for reserved portfolios, as follows:

- a) Specify different portfolios for the non-acquirer of 1800 MHz and use a bidder credit to address any potential distortion (Case 2 plus bidder credit);
- b) Specify different reserved portfolios for the non-acquirer of 1800 MHz, and accept the risk of distortion to spectrum efficiency and competition between opted-in bidders (Case 2); or

⁶¹ Given Case 2 already involves different portfolios for different opted-in bidders if 1800 MHz is sold pre-auction, we have considered whether we should increase the portfolios reserved for a new entrant to ensure the winning opted-in bidder holds a complete minimum spectrum holding at the end of the auction. However, we consider this would increase the risk of the distortions to competition between opted-in bidders discussed from A2.143 to A2.149.

⁶² This is different from the position in the January 2012 consultation as a consequence of our modification to the reserved portfolios.

- c) Specify the same reserved portfolio for the acquirer and non-acquirer of 1800 MHz pre-Auction (Case 1).

A2.176 In relation to the first option, we have not identified a suitable and practical method of reliably estimating the size of the appropriate bidder credit. It is especially difficult to do so because the relevant information that is required relates to a hypothetical situation (the value of 2x15 MHz of 1800 MHz if it were in the Auction). Although the 1800 MHz will have been sold, it will be subject to ALF at full market value if it is sold pre-Auction which would not be the case if it were in the Auction, meaning the value of this spectrum is unlikely to be revealed by the pre-Auction sale (e.g. we would expect the private sale price to be net of the purchaser’s expected level of ALF). As a result, if it is sold pre-Auction, we consider that similar significant risks of regulatory failure apply as with bidder credits if 1800 MHz is in the Auction (set out in paragraph A2.154).

A2.177 In relation to the third option, we consider that reserving the same portfolios for all opted-in bidders in the event that 1800 MHz is sold pre-Auction (i.e. Case 1) increases the risks of achieving our objectives for all the reasons discussed from paragraph A2.170. In particular, there would be a risk that an opted-in bidder does not acquire a complete reserved portfolio under this option, meaning no opted-in bidder holds a complete reserved portfolio (or a minimum spectrum holding). We consider this poses a greater risk to our objectives than Case 2.

A2.178 This risk to our objectives is smaller in Case 2, the second option, (as discussed in paragraph A2.171), as it would ensure that the winning opted-in bidder would hold a complete reserved portfolio (reflecting the possibility that it might result in more spectrum being reserved than in Case 1). This is not least because it minimises the reliance on additional spectrum acquisition (e.g. unreserved in the Auction) or subsequent coming together of spectrum to the extent we consider appropriate and proportionate, while still promoting at least four national wholesalers.

A2.179 Given this, and the fact that we do not consider Case 2 would automatically distort competition between opted-in bidders, we consider that the potential risk of disadvantages under Case 2 is more than offset by the advantages to our objectives relative to the other options.⁶³

Conclusion on addendum issue

A2.180 If the 2x15 MHz of 1800 MHz spectrum is bought by Vodafone or Telefónica before the Auction, then the group of portfolios that would be reserved for a fourth national wholesaler would be as follows:

Figure A2.21: Alternative portfolios reserved for fourth national wholesaler when 2x15 MHz of 1800 MHz spectrum is acquired pre-Auction by Vodafone or Telefónica

	800 MHz	1800 MHz	2.6 GHz
Portfolio 1	2 x 15 MHz	-	-
Portfolio 2	2 x 10 MHz	-	2 x 10 MHz

A2.181 In light of our conclusion on Case 2 above, if 1800 MHz is sold before the Auction to a party other than Telefónica or Vodafone, the reserved portfolios would be as follows:

⁶³ We comment in further detail on the other responses received to the consultation about Case 1 and Case 2 from paragraph A3.569 in Annex 3.

Figure A2.22: Reserved portfolios for opted-in purchaser of 1800 MHz if sold pre-Auction

	800 MHz	1800 MHz	2.6 GHz
Portfolio 3a	2 x 5 MHz	-	-
Portfolio 4a	-	-	2 x 20 MHz

Figure A2.23: Reserved portfolios for all other opted-in bidders if 1800 MHz is sold pre-Auction

	800 MHz	1800 MHz	2.6 GHz
Portfolio 1	2 x 15 MHz	-	-
Portfolio 2	2 x 10 MHz	-	2 x 10 MHz

Evidence on spectrum holdings and auction outcomes in Europe

Introduction

A2.182 This section sets out some relevant facts about the spectrum holdings and awards for mobile use in other countries. It focuses on the experience of other Western European countries as we consider these to be most comparable to the UK market.

A2.183 Much of this factual evidence is repeated from Annex 9 of our January 2012 consultation, with further information added where possible. We have included only those countries which have auctioned 2.6 GHz or 800 MHz spectrum and which have four national wholesalers (or where the auction outcome has allowed entry of a fourth national wholesaler to take place).⁶⁴ We present the facts and our observations first at a European level, and then at an individual country level.

Cross-country comparison

A2.184 Several European countries have already auctioned all or part of their newly available 800 MHz and 2.6 GHz spectrum. This sub-section presents the outcomes of these auctions and makes comparisons of these outcomes across countries, paying particular attention to the outcome for the fourth national wholesaler. Figure A2.24 below sets out some high level facts relating to the countries we have considered.

Figure A2.24: Facts on European auctions

Country	Bands Auctioned	Auction Measures (Caps/Reservations/Fourth national wholesaler support)	Unsold Spectrum	Date Auction Concluded (800 MHz)	Date Auction Concluded (2.6 GHz)
Austria	2.6 GHz	Cap of 2x30 MHz (applied to wholesalers that already had spectrum at 900 MHz or 1800 MHz)	No	N/A	October 2010
Belgium	2.6 GHz	Cap of 2x20 MHz	2x15 MHz of 2.6 GHz	N/A	November 2011
Denmark	800 MHz and 2.6	2x20 MHz cap on 800 MHz spectrum. 2x20 MHz cap on	No	June 2012	May 2010

⁶⁴ Several other countries have auctioned either the 800 MHz or 2.6 GHz bands but do not have four national wholesalers. Finland and Norway have awarded 2.6 GHz, but only feature three and two national wholesalers respectively. Portugal and Switzerland have auctioned both the 800 MHz and 2.6 GHz bands, but only have three national wholesalers. In Switzerland an operator (In&Phone) held a small amount of 1800 MHz spectrum, but does not operate as a national wholesaler. It focussed exclusively on business customers and as of March 2012 stopped operating.

	GHz	paired 2.6 GHz spectrum or the whole of unpaired spectrum.			
France	800 MHz and 2.6 GHz	Caps of 2x15 MHz of 800 MHz and 2x30 MHz of 2.6 GHz The bidder who did not win any 800 MHz spectrum (Iliad) has the right to request roaming rights from the holder of the middle 800 MHz block (SFR).	No	December 2011	September 2011
Germany	800 MHz, 1800 MHz, 2.12 GHz and 2.6 GHz	Caps on 800 MHz: 2x10 MHz for T-Mobile and Vodafone, 2x15 MHz for E-Plus and Telefónica, 2x20 MHz for new entrants. No caps on spectrum above 1 GHz.	No	May 2010	May 2010
Italy	800 MHz, 1800 MHz and 2.6 GHz	Caps of 2x20 MHz on sub-1 GHz, 55 MHz on joint paired and unpaired 2.6 GHz spectrum.	15 MHz unpaired 2.1 GHz	September 2011	
The Netherlands	2.6 GHz	Caps of 10 MHz for T-Mobile, 20 MHz for KPN, 25 MHz for Vodafone and 40 MHz for new entrants.	55 MHz unpaired 2.6 GHz and 9.7 MHz at 2010 – 2019.7 MHz	N/A	April 2010
Spain	800 MHz, 900 MHz and 2.6 GHz	Caps of 2x20 MHz on sub-1 GHz, 115 MHz on joint 1800 MHz, 2.1 GHz and 2.6 GHz. Yoigo holds a roaming and site sharing agreement with Telefónica. There was regulatory pressure to give access to the new entrant.	No	July 2011	November 2011
Sweden	800 MHz and 2.6 GHz	Caps of 2x10 MHz on 800 MHz, 140 MHz on 2.6 GHz.	No	March 2011	May 2008

A2.185 Figure A2.25 below shows the post auction paired spectrum holdings for other national wholesalers in Europe alongside the current spectrum holdings of the UK national wholesalers. It includes only those countries where the market is characterised by four national wholesalers, and both 800 MHz and 2.6 GHz spectrum has been released for mobile use. It distinguishes between sub-1 GHz (800 MHz, 900 MHz) and above 1 GHz (1800 MHz, 2.1 GHz, 2.6 GHz) holdings. The fourth national wholesaler (on the basis of market share and pre-auction spectrum holdings)⁶⁵ in each country has been highlighted.

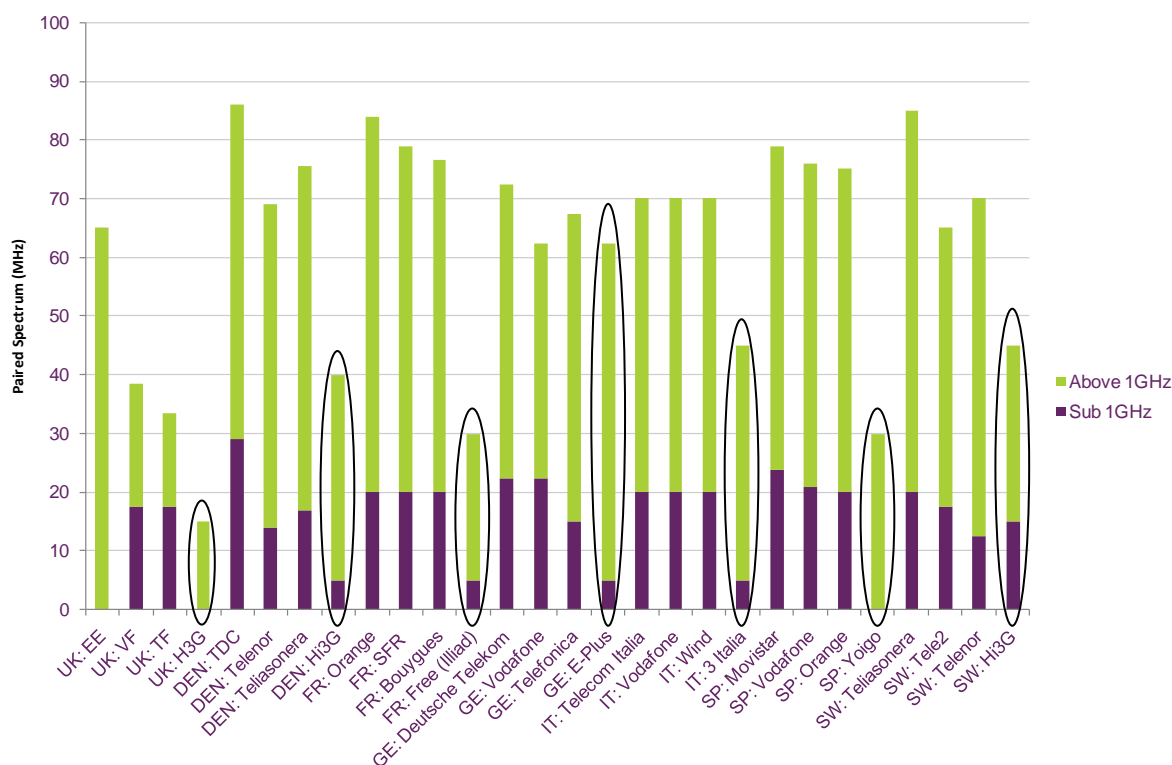
A2.186 It can be seen that for the countries we consider (and excluding the UK):

- With the exception of Germany, the fourth national wholesaler in each country has significantly smaller spectrum holdings than the other three national wholesalers.

⁶⁵ In Germany we consider E-Plus to be the fourth national wholesaler, despite Telefónica having a marginally smaller share of subscribers. The reason for this is that E-Plus has taken a more selective approach to the market, focussing on value for money and largely ignoring the corporate market.

- With the exception of Sweden, the fourth national wholesaler has the smallest holding of sub-1 GHz spectrum.
- All national wholesalers have sub-1 GHz spectrum except for Yoigo in Spain.
- The post auction holding of the fourth national wholesaler is greater than the current holding of H3G in the UK.
- Everything Everywhere's current holdings are smaller than most national wholesalers post auction, but are larger than the post-auction holdings for the fourth national wholesaler (though only marginally so in Germany).

Figure A2.25: Post auction spectrum holdings in European countries relative to the current UK holdings⁶⁶



A2.187 We do not consider that any strong implications for credibility can be drawn from the distributions of spectrum holdings elsewhere. This is because:

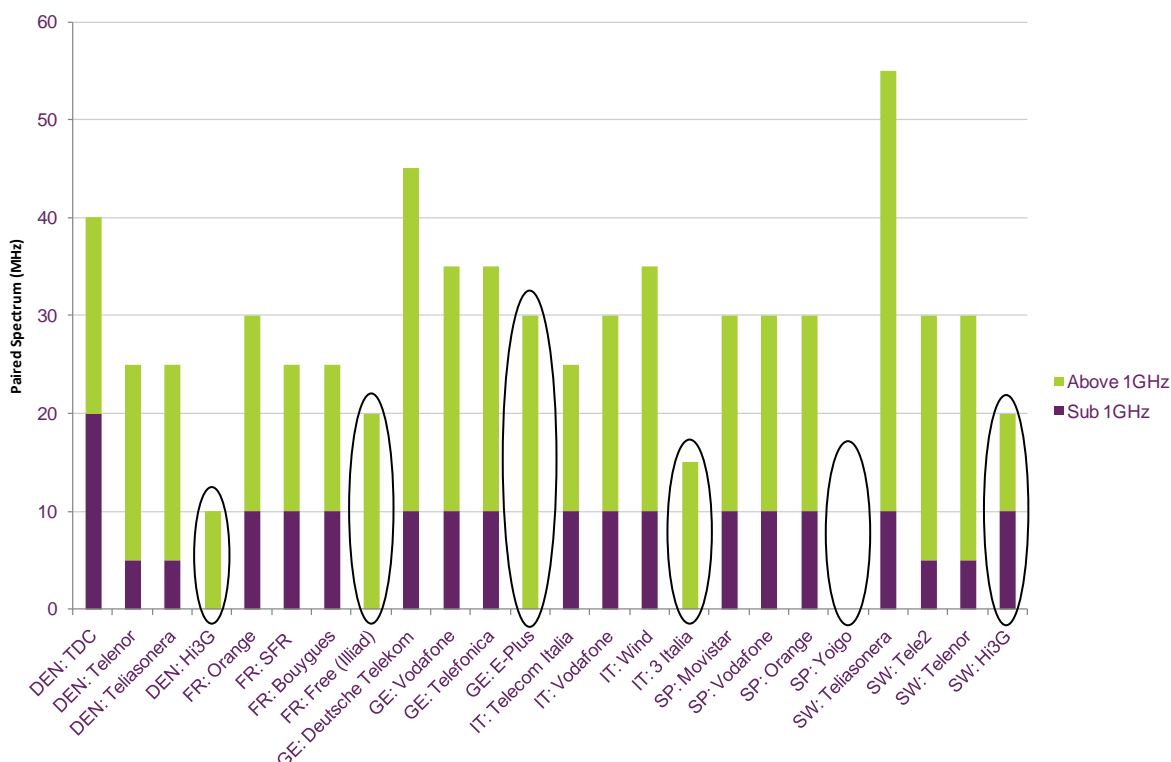
- The auctions of 800 MHz spectrum in European markets have happened quite recently, so it is too early to tell whether the national wholesalers with the weakest spectrum holdings are credible in the longer term. We have tried to provide some indication of views on the smaller wholesalers through the inclusion of some analysts' comments in the next section; however these are far from definitive.
- There may be quite significant differences (unrelated to spectrum holdings) between the markets in different European countries which influence the competitive conditions.

⁶⁶ We have included 2x5 MHz of 900 MHz and 2x10 MHz of 1800 MHz spectrum in 3 Italia's holdings as it is likely to obtain this spectrum in the near future.

A2.188 Figure A2.26 below sets out the spectrum which was awarded in the recent auctions that included the 800 MHz and 2.6 GHz bands. In some countries (Germany, Italy, Spain and Sweden) these auctions also included spectrum in other bands (900 MHz, 1800 MHz and 2.1 GHz) and these are included in the Figure. This evidence shows that in all countries where these frequencies have been awarded:

- With the exception of Sweden and Denmark, 800 MHz has been won by the three largest incumbents with each obtaining a 2x10 MHz block.⁶⁷
- Of those countries which made available 2x70 MHz of 2.6 GHz (the same as in the UK), a total of five out of seven auctions resulted in three operators winning 2x20 MHz and the remaining operator winning 2x10 MHz.⁶⁸ This is also evident in the distribution of 2.6 GHz in Figure A2.27 below.⁶⁹

Figure A2.26: Spectrum won in recent European auctions

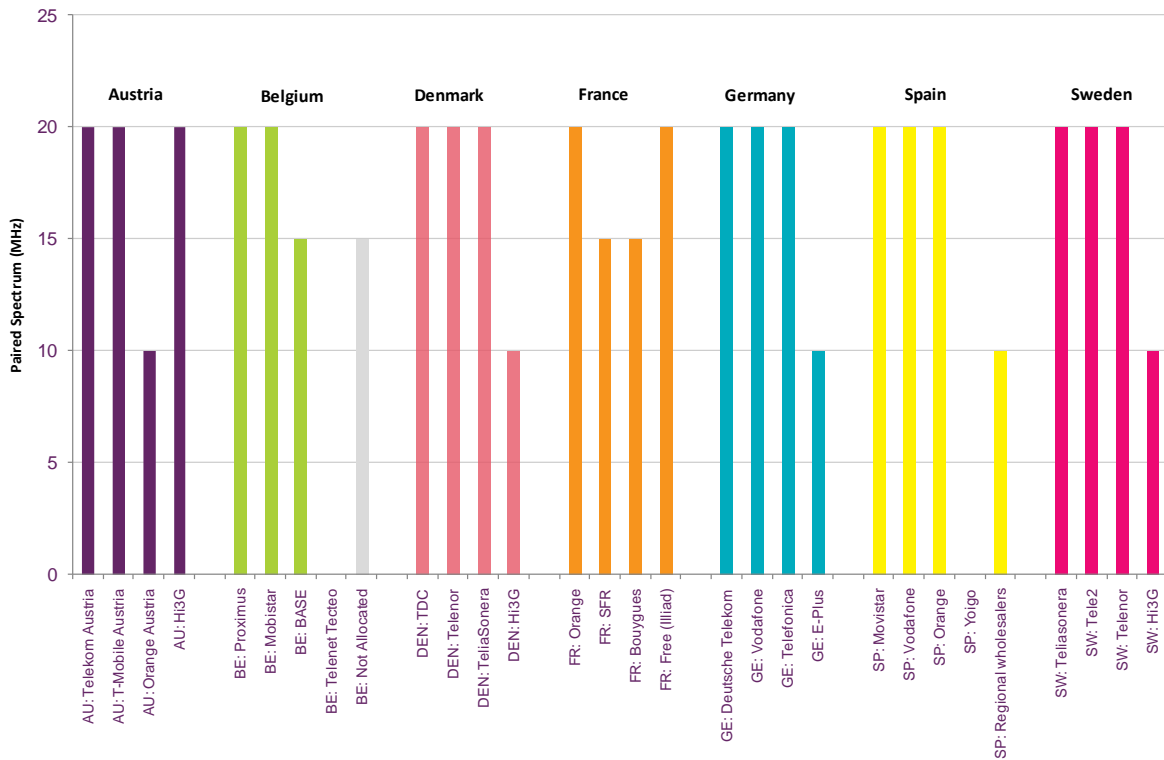


⁶⁷ In Sweden the 800 MHz band was shared between all four national wholesalers, with Tele2 and Telenor bidding as part of a joint venture to secure 2x10 MHz. In Denmark the largest wholesaler won 2x20 MHz, with the remaining 2x10 MHz won by a joint venture between the second and third largest national wholesalers.

⁶⁸ We note in Spain that 2x10 MHz was won by regional wholesalers, with Yoigo (the fourth national wholesaler) choosing not to bid.

⁶⁹ We did not include Italy or The Netherlands in this comparison as in these countries the amount of 2.6 GHz spectrum available in the auction was less than 2x70 MHz – 2x60 MHz and 2x65 MHz respectively.

Figure A2.27: Allocation of 2.6 GHz spectrum across European countries awarding 2x70 MHz



A2.189 Figure A2.28 below illustrates the shares of paired spectrum held by wholesalers in each European country which features at least four national wholesalers. This suggests that whilst the difference in spectrum holdings between the smallest and largest wholesalers is often considerable (with the exception of Germany), it is unusual for a national wholesaler in these countries to have less than 10% of the available spectrum. The exceptions are the new entrants in the Belgium and The Netherlands, however we note that there are opportunities for these operators to increase their share of spectrum in the near future – these are discussed further in the country level evidence below.

Figure A2.28: Shares of paired spectrum in European countries with four national wholesalers^{70 71}



Evidence at individual country level

A2.190 This section sets out further detail of the market and auctions which have taken place in several Western European countries. Information is included for those countries characterised by four national wholesalers, plus those where prior to the auction there were three, but the auction allowed entry of a fourth national wholesaler.

A2.191 For each country we list the national wholesalers and their respective subscriber shares plus any relevant information relating to pre- or post-auction reallocation of spectrum between operators. Secondly we outline what frequencies were available in the auction(s) of interest and any caps or reservations.

A2.192 A chart is constructed for each country which shows three stacked columns for each of the national wholesalers. The first column is the relevant wholesaler’s (paired) pre-auction holdings, the middle column is the (paired) spectrum assigned through the auction process and the third column shows the (paired) spectrum holdings post-auction⁷². Where possible (for countries where both 800 MHz and 2.6 GHz have been auctioned), we have included views from analysts in relation to the ongoing viability of the fourth national wholesalers.

Austria

Market and auction characteristics

⁷⁰ The white bars represent the 800 MHz spectrum not yet awarded, with the exception of the UK and Denmark where it also includes 2x70 MHz and 2x15 MHz of 2.6 GHz spectrum respectively.

⁷¹ In Denmark and Sweden where some of the 800 MHz band was awarded to operators bidding jointly, we assume that this spectrum is shared equally between the two wholesalers in each case.

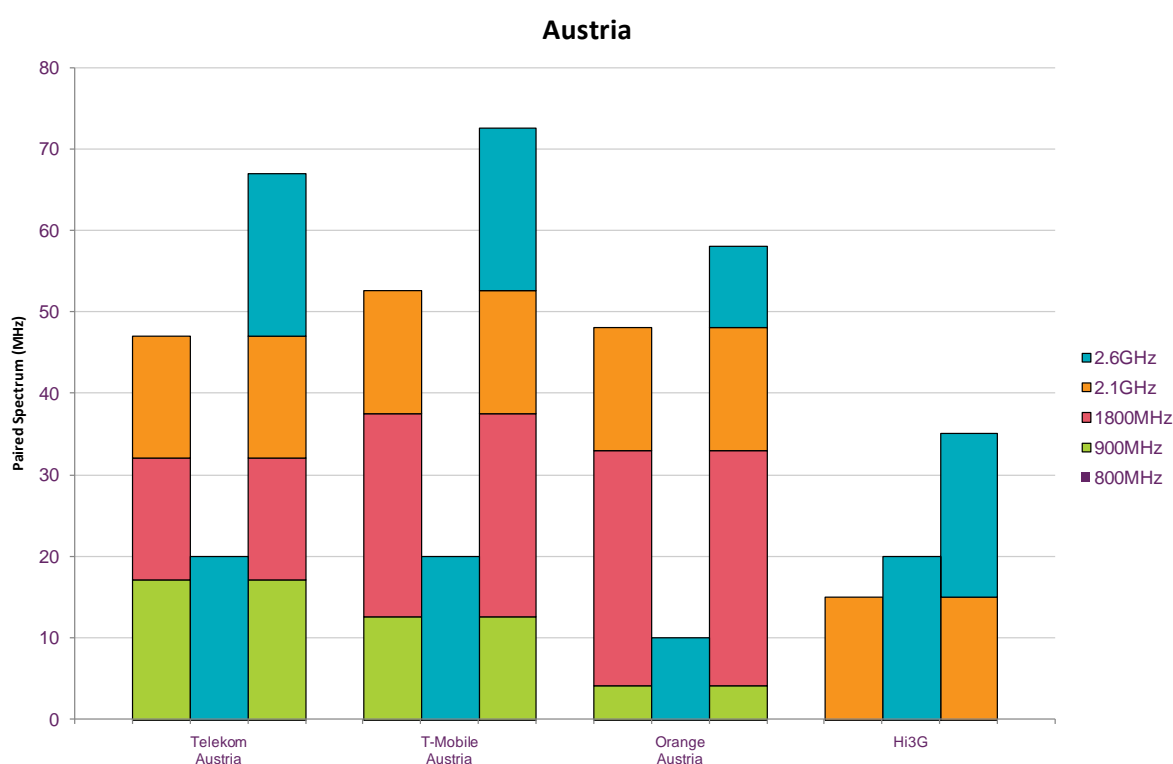
⁷² And associated beauty contest, as was the case in Spain.

- A2.193 Austria currently has four national wholesalers: Telekom Austria, T-Mobile, Orange and 3G Austria. Telekom Austria is the largest operator with a subscriber share of 41.3% followed by T-Mobile (30.8%), Orange (18.7%) and 3G Austria (9.2%).⁷³
- A2.194 In September 2010 the Telekom-Control-Kommission (TKK) completed the auction for the 2.6 GHz band which included 2x70 MHz of paired spectrum and 50 MHz of unpaired.
- A2.195 The auction featured a cap of 2x30 MHz which was applied to those wholesalers already holding spectrum in the 900 MHz or 1800 MHz bands (Telekom Austria, T-Mobile and Orange). This restriction was not binding for any of these wholesalers.
- A2.196 The combined award of 800 MHz, 900 MHz and 1800 MHz spectrum was scheduled for September 2012; however it has since been delayed due to the planned takeover of Orange Austria by Hutchison 3G Austria. A new timeline for the auction has not yet been announced due to the uncertainty regarding the duration of the merger proceedings.⁷⁴

Auction outcomes

- A2.197 All available spectrum in the 2.6 GHz spectrum auction was sold.
- A2.198 Figure A2.29 below sets out for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only). 25 MHz of unpaired 2.6 GHz spectrum was won by each of Telekom Austria and Hi3G.

Figure A2.29: Paired spectrum holdings by national wholesaler - Austria



⁷³ http://www.rtr.at/en/komp/TKMonitor_3_2011/TM3-2011.pdf

⁷⁴ http://www.telekomaustria.com/ir/news/24.04.2012_Frequency_Auction_in_Austria_postponed_IR-PR1.php

Observations

A2.199 Despite the assignment of 2.6 GHz frequencies in Austria matching that of several other countries (as described in paragraph A2.188 above), we note that the fourth national wholesaler (Hi3G) in this market obtained 2x20 MHz, with 2x10 MHz being acquired by the third national wholesaler.

Belgium

Market and auction characteristics

A2.200 Belgium currently has three national wholesalers: Belgacom, Mobistar and KPN Group (Base). In June 2011 the telecoms regulator, BIPT, granted a 3G licence (2x15 MHz at 2.1 GHz) to a new wholesaler, NV Telenet Tecteo Bidco, however it has yet to start offering services.

A2.201 In November 2011 Belgium held the auction for the 2.6 GHz band. In total there was 2x70 MHz of paired spectrum and 45 MHz of unpaired available in the auction.

A2.202 The auction included spectrum caps of 2x20 MHz applied to all bidders.

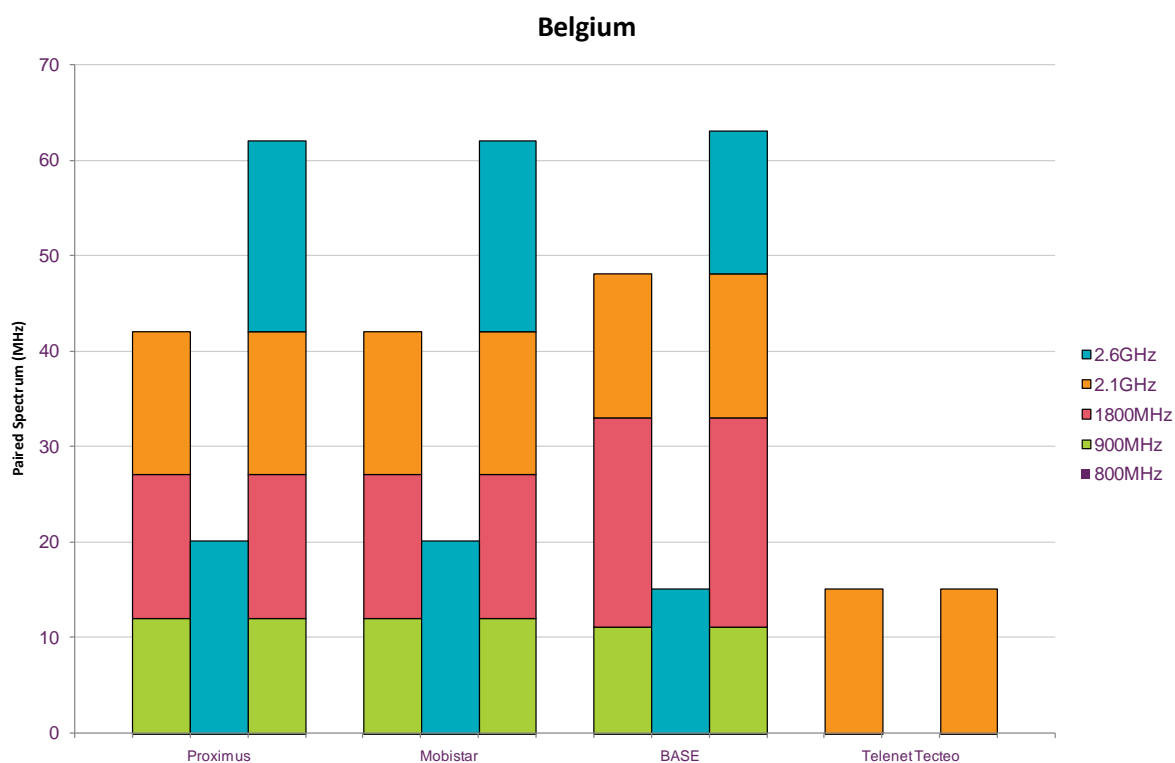
A2.203 While still to be confirmed, Telenet Tecteo Bidco is expected to exercise the option of acquiring the spectrum in the 900 MHz (2x5 MHz) and 1800 MHz (2x10 MHz) bands reserved for the fourth 3G operator (available from November 2015).

Auction outcomes

A2.204 2x55 MHz of paired and 45 MHz of unpaired spectrum was assigned through the auction process. The remaining 2x15 MHz of paired spectrum went unsold.

A2.205 Figure A2.30 below sets out, for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only). BUCD BVBA acquired all 45 MHz of unpaired 2.6 GHz spectrum available.

Figure A2.30: Paired spectrum holdings by national wholesaler - Belgium



Observations

A2.206 Telenet Tecteo did not win any spectrum in the 2.6 GHz award, therefore did not increase its current spectrum holdings.

Denmark

Market and auction characteristics

A2.207 Denmark has four national wholesalers, TDC, Telenor, Telia and Hi3G. TDC is the largest operator with a subscriber share of 43.9%, followed by Telenor (25.8%) and Telia (18.2%). Hi3G is the smallest and currently has a share of 6.2%.⁷⁵

A2.208 In June 2010 the National IT and Telecom Agency issued licences in the 2.6 GHz band by auction. A total of 2x70 MHz of paired spectrum and 50 MHz of unpaired were assigned through this process. In June 2012, 2x30 MHz of 800 MHz spectrum was awarded through an auction.

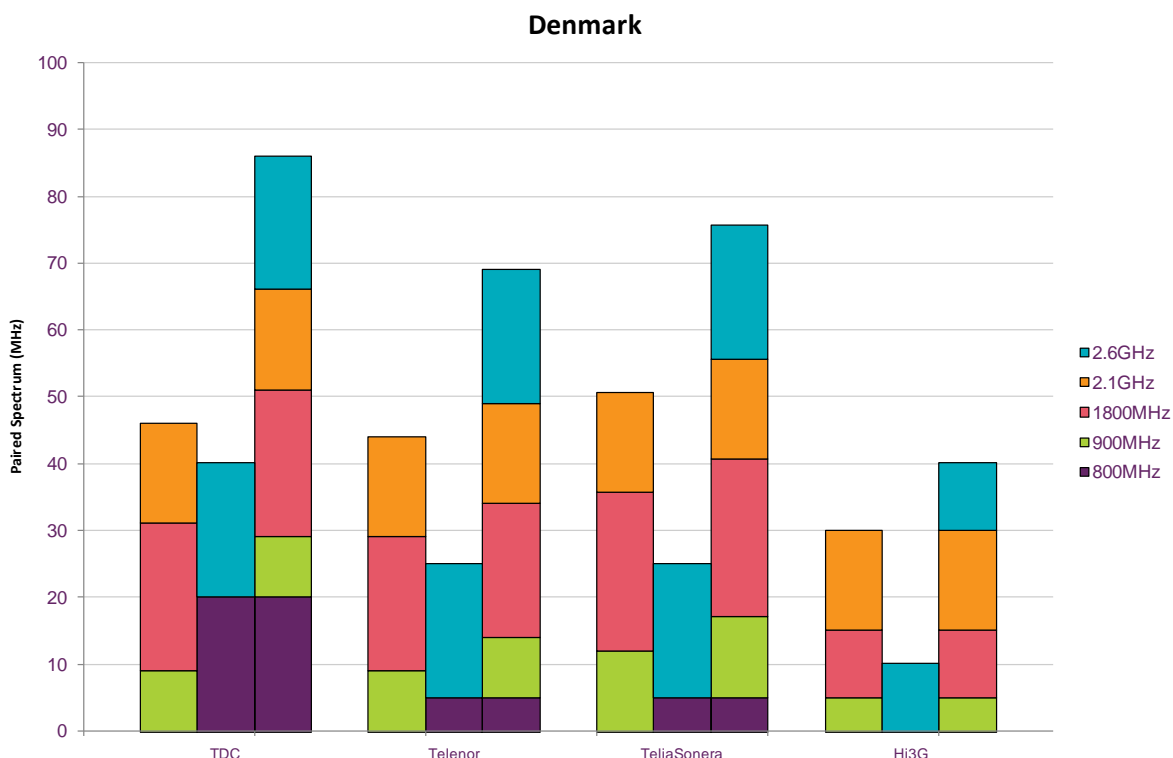
A2.209 The auctions included a spectrum cap applicable to all bidders of 2x20 MHz on 800 MHz, and 2x20 MHz on 2.6 GHz.

Auction outcomes

A2.210 Figure A2.31 below sets out, for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only). The unpaired 2.6 GHz spectrum was split between three operators: Telenor (10 MHz), Teliasonera (15 MHz) and Hi3G (25 MHz).

⁷⁵ The remaining share is split among more than 30 MVNOs.

Figure A2.31: Paired spectrum holdings by national wholesaler - Denmark



We have represented the 2x10 MHz of 800 MHz won by the joint venture by allocating 2x5 MHz to each of Telenor and Teliasonera.

A2.211 Espirito Santo analysts commenting after the completion of the 800 MHz auction in Denmark stated that:

“[The fact that] H3G failed to secure any additional spectrum will in our view lead to further questions about its long-term commitment to the Danish market.”⁷⁶

A2.212 Berenberg analysts took a slightly more positive view, but did not rule out the possibility of future consolidation, stating:

“It [Hi3G] is not necessarily spectrum-constrained given that it has 10% market share and 12% of the total FDD spectrum. *Additionally '3' has 30MHz of TDD spectrum which it would hope to dedicate to mobile broadband (dongles and home routers).* We do still believe this [auction outcome] increases the probability of '3' being acquired in Denmark.”⁷⁷

Observations

A2.213 800 MHz was awarded to TDC (2x20 MHz) and a joint venture infrastructure company between Telenor and Teliasonera called TT-Netvaerket (2x10 MHz).

⁷⁶ Espirito Santo, Telco Bullets, 28th June 2012.

⁷⁷ Berenberg, Telecommunications - European telecoms blog - W/E 29 June 2012, 2nd July 2012. Italicised text added to original quotation at the request of Berenberg.

A2.214 The allocation of 2.6 GHz spectrum in the Danish auction is consistent with many other countries across Europe – three wholesalers winning 2x20 MHz each, with the fourth wholesaler winning 2x10 MHz. We note that the 2x20 MHz caps on 2.6 GHz may have influenced this outcome.

France

Market and auction characteristics

A2.215 In France there are now four national wholesalers. France Telecom (Orange France) has the largest share of subscribers, followed by SFR and Bouygues. The fourth national wholesaler, Iliad (Free Mobile), which already held a strong position in the fixed broadband market, was granted a mobile licence in 2010. Iliad is now offering retail services using both its obtained spectrum and through a roaming agreement with France Telecom. Its current holdings in the 900 MHz band (2x5 MHz) were granted prior to the auction, following release of these frequencies by the three existing wholesalers.

A2.216 The French award for 2.6 GHz finished in September 2011 and the 800 MHz award was completed in December 2011. In contrast to other European auctions, only the paired 2.6 GHz spectrum was available in the auction (2x70 MHz), with the unpaired currently not allocated. A total of 2x30 MHz was available in the 800 MHz band, of which all was assigned. France adopted a hybrid auction/beauty contest format where operators' offers were evaluated with respect to both price and commitments (in terms of hosting MVNOs and regional coverage).

A2.217 As part of the provisions of the 800 MHz award, any winner of 2.6 GHz spectrum that failed to win 800 MHz will be able to purchase wholesale access from the winner of the two middle blocks of the 800 MHz band (SFR). Iliad (Free Mobile), who failed to obtain any 800 MHz spectrum, will be able to apply for roaming rights from SFR once its own 2.6 GHz network covers 25% of the population.⁷⁸ Iliad currently has a roaming agreement with France Telecom for its 3G services.

A2.218 The French auctions included a cap of 2x15 MHz on 800 MHz spectrum and 2x30 MHz on 2.6 GHz spectrum, applicable to all bidders.

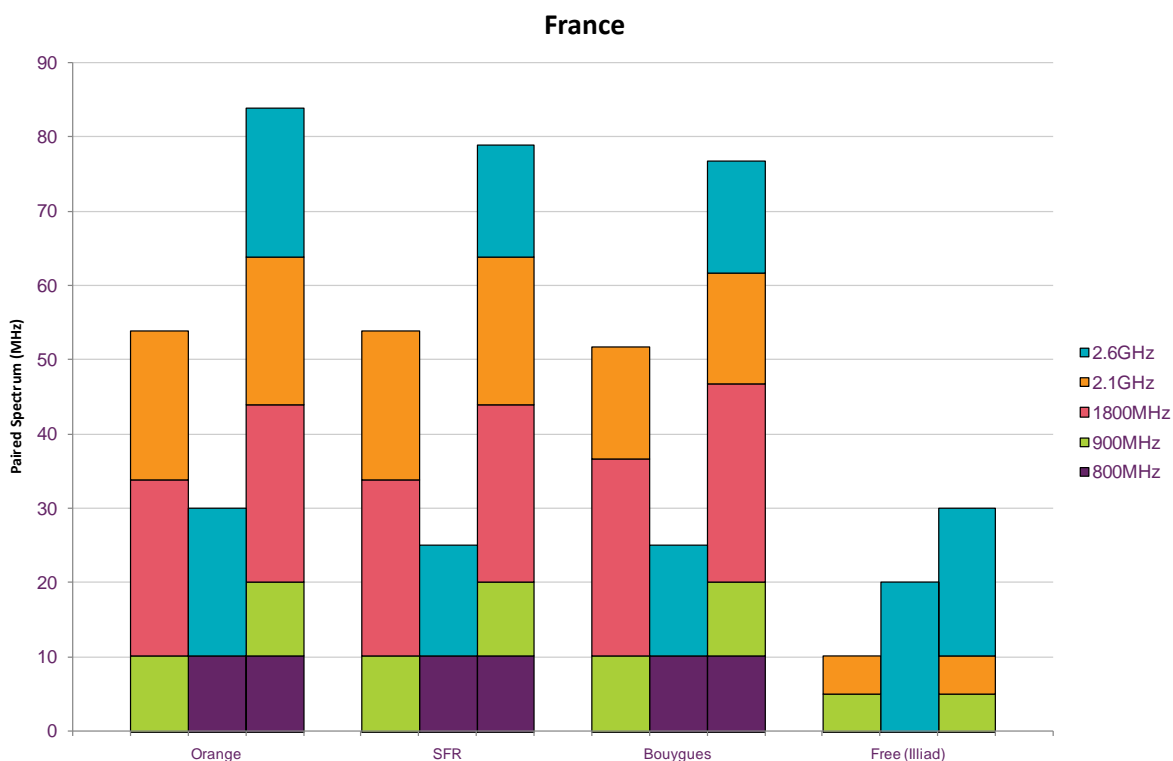
Auction outcomes

A2.219 Figure A2.32 below sets out for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only).

78

[http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1\[uid\]=1470&tx+gsactualite_pi1\[backID\]=1&cHash=80abfa005c](http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1470&tx+gsactualite_pi1[backID]=1&cHash=80abfa005c)

Figure A2.32: Paired spectrum holdings by national wholesaler - France



A2.220 J.P. Morgan Cazenove’s analysts commenting on the position of Iliad following the completion of the 800 MHz and 2.6 GHz spectrum auctions stated:

“Iliad’s spectrum position should be sufficient for the company to achieve >10% market share, even without additional spectrum, and despite the very generous data allowances.”⁷⁹

Observations

A2.221 The fourth national wholesaler (Iliad) was unable to win any 800 MHz spectrum, though notably already holds 2x5 MHz of 900 MHz. As it failed to win any of the 800 MHz licences, it will be able to apply for roaming rights on SFR’s network once its own 2.6 GHz network reaches 25% population coverage.

Germany

Market and auction characteristics

A2.222 Germany has four national wholesalers: Deutsche Telecom (T-Mobile), Vodafone, Telefónica and E-Plus. Deutsche Telecom is the largest operator with a subscriber share of 34%, followed by Vodafone (32%), E-Plus (17.5%) and Telefónica (16.5%). Despite Telefónica having the smallest share of subscribers in the German market, we consider E-Plus to be the ‘fourth operator’. JP Morgan Cazenove notes⁸⁰:

“DT and Vodafone are German market leaders, while Telefonica O2 is aspiring to compete through a similar full service value proposition. E-Plus meanwhile has a selective approach to the market, focused on

⁷⁹ JP Morgan Cazenove, Europe Equity Research – France Telecom and Iliad, 12th January 2012.

⁸⁰ JP Morgan Cazenove, Europe Equity Research – Wireless Services, 20th May 2010.

value for money, and (for instance) largely ignoring the corporate market.”

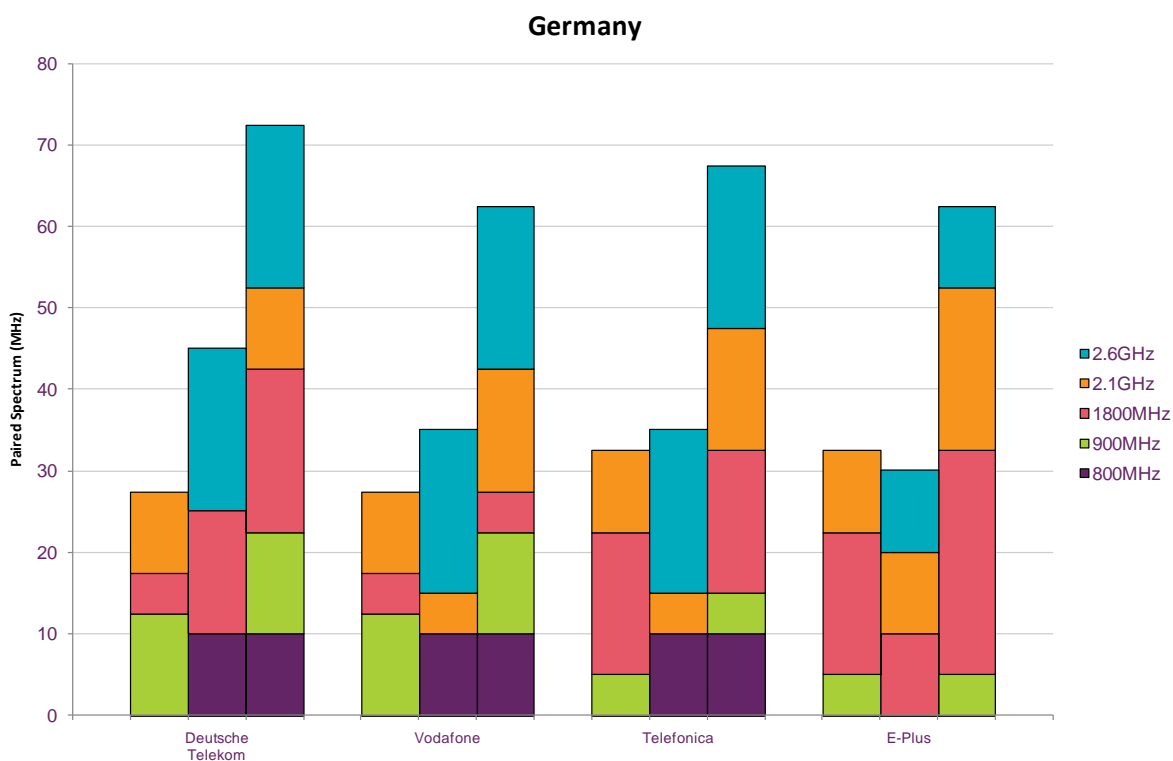
A2.223 Germany held its multiband auction in May 2010 which included frequencies in the 800 MHz (2x30 MHz), 1800 MHz (2x25 MHz), 2.1 GHz (2x20 MHz paired, 20 MHz unpaired) and 2.6 GHz bands (2x70 MHz paired, 50 MHz unpaired).

A2.224 The auction included asymmetric spectrum caps, specifically, Deutsche Telekom and Vodafone were subject to a cap of 2x10 MHz of 800 MHz, E-Plus and Telefónica were subject to a cap of 2x15 MHz of 800 MHz and any new entrants were limited to 2x20 MHz of 800 MHz. There were no caps on spectrum above 1 GHz.

Auction outcomes

A2.225 Figure A2.33 below sets out, for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only). The winners of the unpaired spectrum were as follows: Deutsche Telekom (5 MHz of 2.6 GHz), Vodafone (25 MHz of 2.6 GHz), Telefónica (19.2 MHz of 2.1 GHz and 10 MHz of 2.6 GHz) and E-Plus (10 MHz of 2.6 GHz).

Figure A2.33: Paired spectrum holdings by national wholesaler - Germany



A2.226 J.P. Morgan Cazenove’s analysts⁸¹ commenting on the position of E-Plus following the German multiband spectrum auction stated:⁸²

“E-Plus achieved a bargain in our view, acquiring 60 MHz of good quality spectrum for only €0.3bn, below our expected €0.8bn, but in

⁸¹ JP Morgan Cazenove note that their comments were made in the context of E-Plus already holding some sub-1 GHz spectrum.

⁸² JP Morgan Cazenove, Europe Equity Research – Wireless Services, 20th May 2010.

our view well sufficient for the company's medium to long term business plan."

A2.227 However they also noted;

"Not owning 800MHz spectrum will provide its competitors with a competitive advantage [and] it will be more difficult for E-Plus to develop a competitive proposition in the (rural) parts of Germany in which it is already underrepresented today."

Observations

A2.228 Each operator obtained a mixture of spectrum from different frequency bands. The 800 MHz spectrum was allocated equally (2x10 MHz) between the three largest incumbents, with E-Plus securing 2x30 MHz of spectrum across the three other available bands. Deutsche Telekom won the largest amount of spectrum in the auction, now having the largest holdings of the four wholesalers with in excess of 2x70 MHz.

A2.229 Germany is unique among the countries we have considered in that both prior to, and after the auction for spectrum, the fourth national wholesaler (E-Plus) has a share of spectrum which is comparable to the other wholesalers.

Italy

Market and auction characteristics

A2.230 Italy has four national wholesalers (subscriber share indicated in brackets): Telecom Italia (32.9%), Vodafone (32.5%), Wind (21.2%) and 3 Italia (9.6%). 3 Italia is highly likely to be assigned 2x5 MHz of 900 MHz (by 2013)⁸³ and 2x10 MHz of 1800 MHz (although timing is unclear)⁸⁴.

A2.231 In September 2011 the Italian Government auctioned lots in the 800 MHz (2x30 MHz), 1800 MHz (2x15 MHz), 2.1 GHz (15 MHz unpaired) and 2.6 GHz bands (2x60 MHz paired and 30 MHz unpaired).⁸⁵ All frequencies were sold with the exception of the unpaired 2.1 GHz lot.

A2.232 A spectrum cap of 2x20 MHz was applied to sub-1 GHz frequencies and a cap of 55 MHz applied to joint paired and unpaired 2.6 GHz spectrum. These caps were applicable to all bidders.

Auction outcomes

A2.233 Figure A2.34 below sets out, for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only). We

⁸³ As a condition of the refarming process, 2x5 MHz of 900 MHz spectrum has been released and reserved for a new entrant or a '3G only' operator (i.e. 3 Italia):

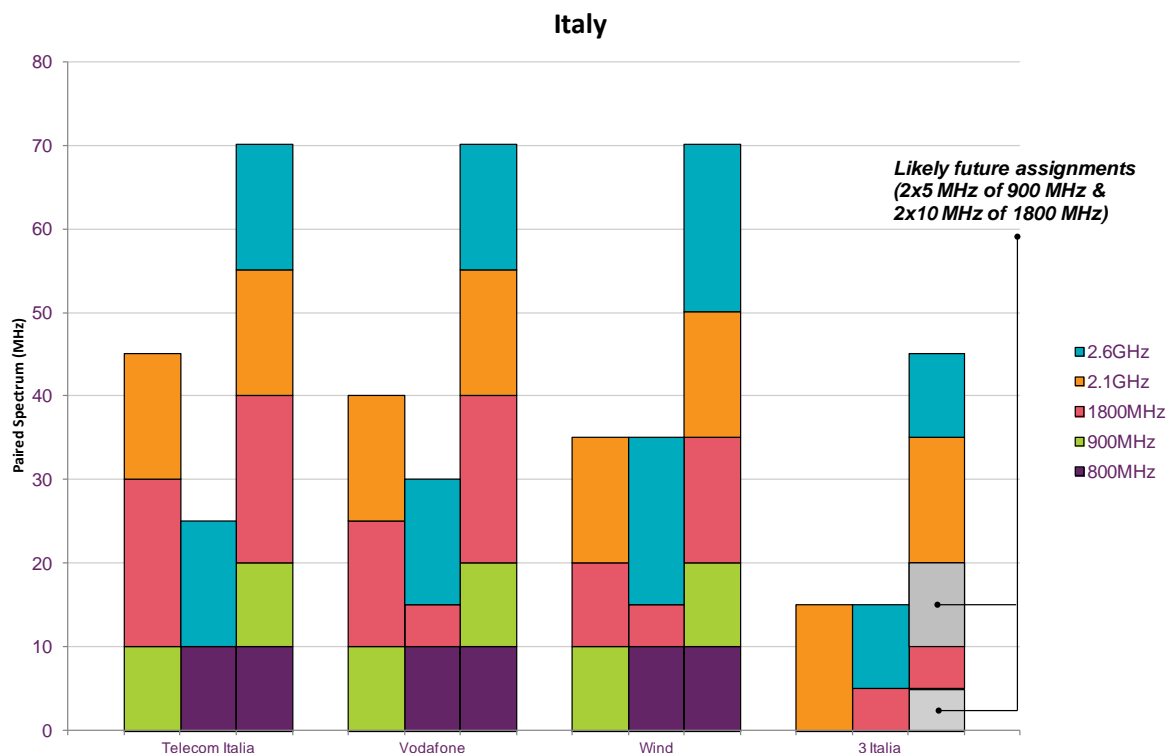
<http://www.agcom.it/default.aspx?DocID=2525>

⁸⁴ Telefónica stated in footnote 77 (Page 48) of their non confidential response that 3 Italia held 2x10 MHz of 1800 MHz prior to the auction. This was different to the information we had set out in Figure 9 of Annex 9 in the January 2012 consultation. We have checked with the Italian regulator AGCOM and confirmed that 3 Italia had not yet received this 1800 MHz spectrum. It has requested exercising the option, but this option has not yet been converted into a right of use.

⁸⁵ The number of available lots in the 2.6 GHz band was less than in other European countries as some spectrum was reserved for military use.

have also included the likely future assignments of 900 MHz and 1800 MHz to 3 Italia in their post-auction holdings. The 30 MHz block of unpaired 2.6 GHz spectrum was won by 3 Italia. 15 MHz of unpaired 2.1 GHz went unsold.

Figure A2.34: Paired spectrum holdings by national wholesaler - Italy



A2.234 J.P. Morgan Cazenove’s analysts⁸⁶ commenting on the position of 3 Italia following the Italian spectrum auction stated:

“its share of spectrum, at least when measured in terms of capacity, would be 2x its market share, hence it would be unlikely to be spectrum-constrained for many years to come.”⁸⁷

A2.235 Following the auction Barclays Research noted that:

“3 Italia already has 900 MHz spectrum to fall back on thus proving ample flexibility for the next few years”⁸⁸

A2.236 New Street Research commented on the position in Italy after the 800 MHz auction had ended, stating:⁸⁹

“We do not see any negative operational implications for H3G from this outcome if it is able to secure a lot in the 1.8 GHz band – this band would enable Hutchison to deploy 4G LTE services using its existing 3G cell site locations.”

⁸⁶ JP Morgan Cazenove note that their comments were made in the context of 3 Italia being assigned some sub-1 GHz spectrum in the near future.

⁸⁷ JP Morgan Cazenove, Europe Equity Research – Italian Mobile, 23rd September 2011.

⁸⁸ Barclays Capital, Equity Research – Spectrum: Still a barrier to consolidation, 27th September 2011.

⁸⁹ New Street Research, Snap Comment, Italian 800 MHz spectrum auction ends, 23rd September 2011.

And:

“We think H3G has been very rational to drop out of the 800 MHz band at such high prices, given the available alternatives.”

A2.237 However, some other analysts' were less optimistic about 3 Italia following the auction. Espirito Santo's analysts were not convinced 3 Italia could compete without 800 MHz holdings, stating:

“This adds to the woes of 3, which already lacked scale, and will now really struggle to compete in the crucial arena of mobile data into the long term...In our view it chronically undermines the business proposition of 3 Italia to the point that it will have no option but to exit at some point in the next year or so.”⁹⁰

Observations

A2.238 The allocations through the auction have brought the spectrum shares of the three largest national wholesalers more in line with one another, however 3 Italia holds significantly less. The fourth national wholesaler (3 Italia) did not win any 800 MHz spectrum, nor does it currently hold any other sub-1 GHz, however it is likely to be assigned 2x5 MHz of 900 MHz by 2013.

The Netherlands

Market and auction characteristics

A2.239 Prior to the recent spectrum auction there were three national wholesalers. KPN with a share of 30% to 35% is the largest operator in terms of subscribers. Vodafone and T-Mobile are the second and third largest with a share of 25% to 30% and 20% to 25% respectively.⁹¹

A2.240 The 2.6 GHz spectrum was awarded in 2010. A total of 2x65 MHz of paired spectrum and 55 MHz of unpaired was available.⁹² In the same auction, a single licence for 9.7 MHz at 2010-2019.7 MHz was also available. All paired spectrum was sold successfully; however all the unpaired spectrum went unsold. The auction included tight spectrum caps with the specific aim of facilitating new entry. These caps limited KPN to 20 MHz, T-Mobile to 10 MHz, Vodafone to 25 MHz and entrants to 40 MHz.

Auction outcomes

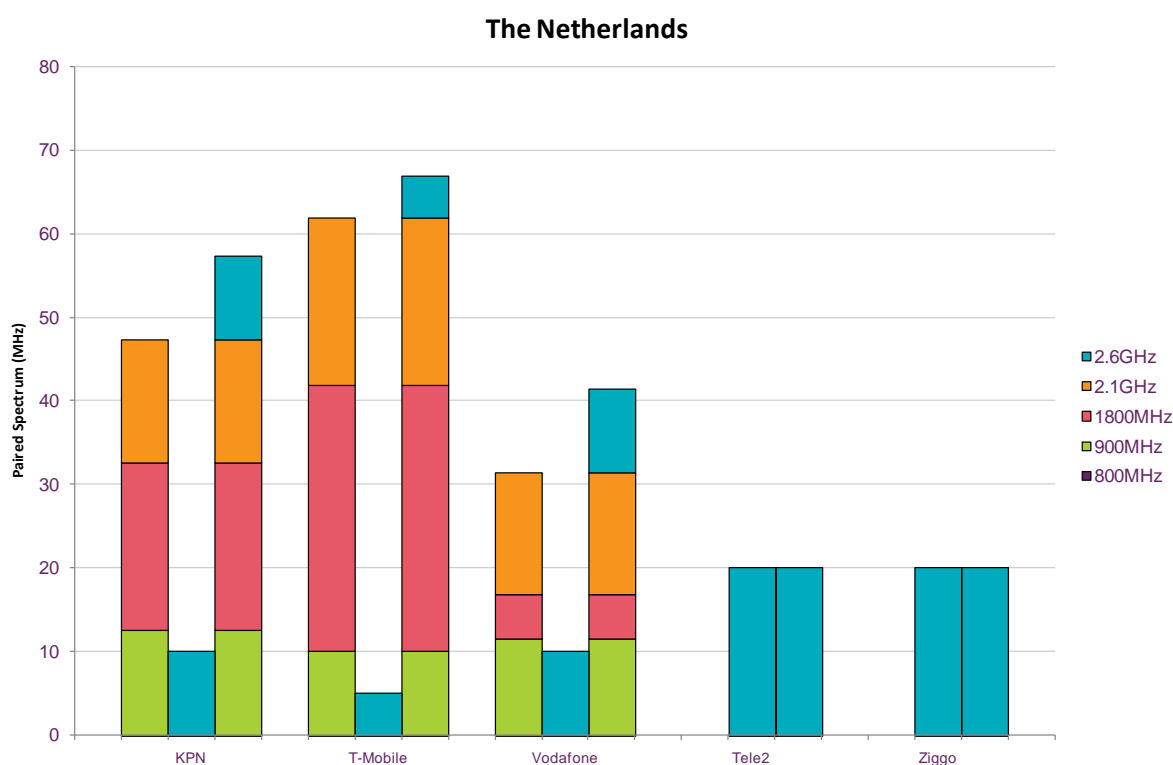
A2.241 Figure A2.35 below sets out, for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only).

⁹⁰ Espirito Santo, Telco Bullets, 23 September 2011.

⁹¹ The remaining share is served by SPs and MVNOs (<http://www.opta.nl/en/news/all-publications/publication/?id=3498>).

⁹² One 5 MHz block of the 2.6 GHz band was set aside as a low power guard block to protect radioastronomy above 2690 MHz. The effect of this was to reduce the available paired spectrum to 2x65 MHz and increase the available unpaired spectrum by 5 MHz.

Figure A2.35: Paired spectrum holdings by national wholesaler – The Netherlands



Observations

A2.242 The use of tight spectrum caps in the Dutch auction has led to entry of two new operators, both obtaining 2x20 MHz of 2.6 GHz (the maximum possible for new entrants).

A2.243 The two new entrants will have reservations of 2x10 MHz of 800 MHz and 2x5 MHz of 900 MHz when these bands are awarded in the future.

Spain

Market and auction characteristics

A2.244 There are currently four national wholesalers in Spain: Telefónica, Vodafone, Orange and Yoigo. The latter (a 3G only operator) entered the market in 2007 and presently has a small subscriber share (4.6%), though this is growing.

A2.245 In 2011 Spain awarded spectrum across four bands. The first award took place in May 2011, by beauty contest,⁹³ for one block of 2x5 MHz in the 900 MHz (released by existing licensees and won by Orange) and for three blocks of 2x5 MHz of 1800 MHz which Yoigo won.⁹⁴

⁹³ Under a beauty contest 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.

⁹⁴ Movistar and Vodafone were prevented from participating in the award, by beauty contest for the 2x5 MHz block of 900 MHz. Similarly, operators that already had 1800 MHz spectrum (Orange, Telefónica and Vodafone) could not participate in the beauty contest for the 2x15 MHz of 1800 MHz.

A2.246 The second award was an auction which included spectrum at 800 MHz (2x30 MHz), 900 MHz (2x10 MHz) and 2.6 GHz (2x70 MHz paired, 50 MHz unpaired).

A2.247 There was a 2x20 MHz cap on sub-1 GHz spectrum and a limit of 115 MHz on joint 1800 MHz, 2.1 GHz and 2.6 GHz spectrum. These restrictions were applicable to all bidders.

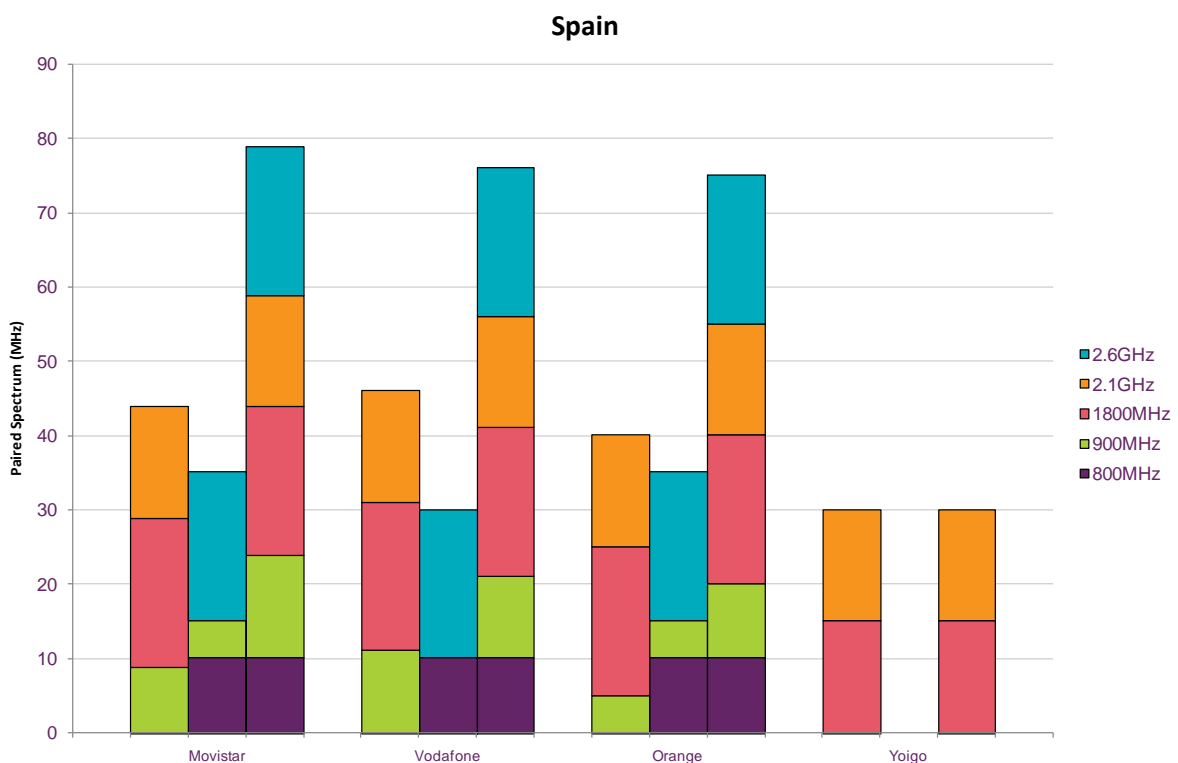
A2.248 Yoigo did not bid for any spectrum at 800 MHz, 900 MHz or 2.6 GHz. 2x5 MHz of 900 MHz and the entire unpaired 2.6 GHz block went unsold in this auction. Spain’s Ministry of Communications indicated that the reason for the spectrum not being sold was that the top three operators reached their sub-1 GHz spectrum caps. The unsold spectrum (both 900 MHz and 2.6 GHz unpaired) was re-auctioned, with spectrum caps raised to 2x25 MHz for the sub-1 GHz spectrum and to 135 MHz for higher frequencies so as to allow Telefónica, Vodafone and Orange to participate in the auction. The re-auction resulted in:

- Telefónica obtaining the 2x5 MHz block of 900 MHz.
- The unpaired 2.6 GHz assigned as follows: Orange (10 MHz), Vodafone (20 MHz) and Regional Wholesalers (10 MHz).

Auction outcomes

A2.249 Figure A2.36 below sets out, for each national wholesaler, the pre-auction spectrum holdings (including that awarded in the May 2011 beauty contest), spectrum won at auction (both the initial auction and re-auction of 800 MHz, 900 MHz, 2.6 GHz) and the post-award holdings (paired only).

Figure A2.36: Paired spectrum holdings by national wholesaler - Spain



A2.250 Morgan Stanley commenting on the Spanish mobile market after the spectrum auction stated:

“No major changes to competitive landscape expected as the fourth player did not bid for below 1GHz spectrum and cable companies only bid for regional licenses”⁹⁵

A2.251 Nomura Equity research, commenting specifically on Yoigo stated:

“We expect it to post strong customer growth in Q1, and it remains well positioned in a market that will remain heavily affected by austerity measures over the medium term.”⁹⁶

A2.252 Raymond James analysts referenced a recent Reuters report which suggested Teliasonera is looking to sell its stake in Yoigo:

“According to a Reuters report (11th July, 2012), Teliasonera is starting a sale process of its 76% stake in Spanish mobile operator Yoigo. Yoigo is a small (5% market share, €50m EBITDA) but meaningful player in the Spanish market. Its aggressive pricing strategy presents a significant threat to the incumbents and triggered the recent round of price cuts in Spain (May-June). While investing in Spain is a difficult decision at the moment, we nevertheless see good chances of a deal.”⁹⁷

Observations

A2.253 The 800 MHz spectrum was equally distributed across the three largest incumbents (2x10 MHz each), with the smallest wholesaler, Yoigo, not bidding for spectrum in any of the bands available. The 2.6 GHz band was won by the three largest incumbents (2x20 MHz each), with the remaining 2x10 MHz obtained by regional wholesalers.

A2.254 The three largest incumbents have a similar share of paired spectrum, whereas the fourth national wholesaler has significantly less.

Sweden

Market and auction characteristics

A2.255 In Sweden there are four national wholesalers: Teliasonera, Tele2, Telenor and Hi3G. The largest operator is Teliasonera with a subscriber share of 40%, followed by Tele2 (32%) and Telenor (17%). Hi3G is the smallest player in the market with a share of 9%. It was granted its 900 MHz holdings, which were released by the three other operators.

A2.256 The 2.6 GHz band (2x70 MHz paired, 50 MHz unpaired) was auctioned in 2008, with the spectrum in the 800 MHz (2x30 MHz) and 1800 MHz (2x35 MHz) bands awarded in 2011. Spectrum caps were applicable to all bidders and consisted of 2x10 MHz on 800 MHz and 140 MHz on 2.6 GHz.

⁹⁵ Morgan Stanley, Positive Outcome from the Spanish spectrum auction, 29th July 2011.

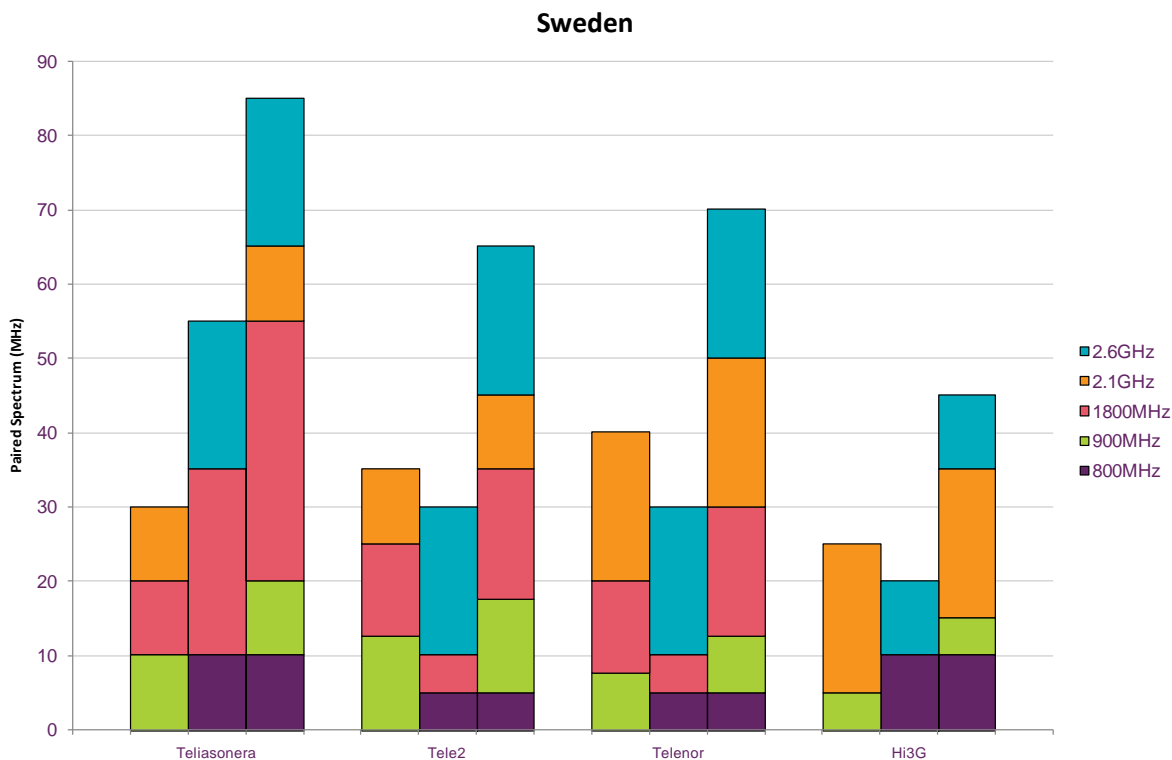
⁹⁶ Nomura Equity Research, European Telecom Services, A consolidation story in telecoms, combined with solid fundamentals, 17th April 2012.

⁹⁷ Raymond James, Telecommunications Services: Industry Tidbit - Potential sale of Yoigo: VOD, FTE or AMX possible bidders, 12th July 2012.

Auction outcomes

A2.257 Figure A2.37 below sets out, for each national wholesaler, the pre-auction spectrum holdings, what was won at auction and the post-auction holdings (paired only). The 50 MHz of unpaired 2.6 GHz was bought in the auction by Intel, but has subsequently been sold on to Hi3G.⁹⁸

Figure A2.37: Paired spectrum holdings by national wholesaler - Sweden



Net4Mobility, a joint venture between Tele2 and Telenor, won 2x10 MHz of 800 MHz and 2x10 MHz of 1800 MHz spectrum in the auction. This has been represented in by splitting these assignments equally between Tele2 and Telenor.

Observations

A2.258 Net4Mobility, a joint venture between Tele2 and Telenor, bid jointly for both 800 MHz and 1800 MHz spectrum. Intel won 50 MHz of unpaired 2.6 GHz spectrum in the auction, but 2 years later this was bought by Hi3G. Two other bidders, Com Hem and Netett Sverige, participated in the auction but did not win any spectrum.

A2.259 Teliasonera won a significant proportion of the 1800 MHz spectrum available in the auction, boosting its share of total paired spectrum. Prior to the auction it had the third largest holdings, now it holds the largest share.

⁹⁸ See Paragraph 118, Spectrum value of 800 MHz, 1800 MHz and 2.6 GHz, A DotEcon and Aetha Report for Ofcom, July 2012, published alongside this statement.

Annex 3

Summary of responses to our January 2012 competition assessment and Ofcom's comments

Contents

Ofcom's legal obligations including those under the Amended GSM Directive	68
Desirability of at least four national wholesalers	71
The importance of holding Sub-1 GHz spectrum	88
Refarming of 900 MHz and 1800 MHz spectrum	95
Capacity and average data rates	97
Ability to provide services with the highest peak data rates	108
Other LTE advantages	111
"In the round" assessment of credibility of spectrum holdings	118
Concern that fourth national wholesaler fails to acquire sufficient spectrum ¹²⁷	
Policy option assessment	155
Choice of portfolios for fourth national wholesaler	179
Impact of proposals on divestment of 1800 MHz spectrum	193
Treatment of new entrant (including Addendum and related issues)	194
Obligations on reserved spectrum (including possible roll out obligation)	202
Reservation and state aid	206
Shared low power use of spectrum	206

Annex 3

Summary of responses to our January 2012 competition assessment and Ofcom's comments

- A3.1 This Annex sets out a summary of the responses to the competition assessment in our January 2012 consultation. Our decision on the competition assessment, which takes account of these responses, is set out in Section 4.
- A3.2 This Annex sets out our response to each of the points raised. Where our response to the points raised is set out elsewhere in this Statement, this Annex cross-references to the relevant part where the issue has been addressed.

Ofcom's legal obligations including those under the Amended GSM Directive

Summary of responses

- A3.3 H3G argued that we have not met our legal obligations including those under the Amended GSM Directive⁹⁹. Specifically (page 23ff), H3G maintained that:
- although we adopt the right legal framework in many respects, we fail to acknowledge our obligations arising in relation to 900 MHz liberalisation;
 - we have not taken the steps required to identify and address the competitive distortions following from the 900 MHz liberalisation as required by the Government Direction, read consistently with the Amended GSM Directive. Should we fail to consider and address these matters we are at risk of misdirecting ourselves and have failed to consult properly;
 - Ofcom's only assessment of the risk of a distortion from 900 MHz liberalisation assumed that LTE800 would exert a competitive constraint on UMTS900, but the basis for that is no longer credible as the fourth operator may fail to obtain 800 MHz;
 - Ofcom's new test for credibility is unlikely to meet the requirements of the Direction and Amended GSM Directive, although H3G accept that the test proposed by Ofcom in the First Consultation would have resulted in an outcome consistent with the Directive
 - 900 MHz liberalisation will significantly distort competition to the disadvantage of the fourth national wholesaler;
 - Ofcom's new test for credibility expressly contemplates allowing the fourth national wholesaler to be disadvantaged, but Ofcom has not set out reasons for concluding this is proportionate;

⁹⁹ Directive 87/372/EEC as amended by Directive 2009/114/EC.

- Ofcom is obliged to – and H3G has a legitimate expectation that Ofcom will – consider and address the longer term impact of 900 MHz liberalisation in the competitive assessment ahead of the Auction (page 27); and
- Ofcom failed to consult on the risk of distortions arising from liberalisation in the period after the Auction (page 27).

A3.4 H3G also argued that the revised “credible” wholesaler test does not address the distortion from 900 MHz liberalisation or promote competition (page 36ff). It argues in particular that:

- prior to liberalisation of 900 MHz there was a competitive mobile data market (page 37ff);
- in the absence of remedial measures, liberalisation will distort future competition in the market;
- all other Western EU member states have addressed the risk of competitive distortion from 900 MHz liberalisation (page 42ff);
- our approach of ensuring four credible national wholesalers could address the distortion caused by liberalisation, but our approach to the question to what is required to be credible is untenable. In particular, we recognise our own uncertainty on the future importance of sub-1 GHz, and so should adopt a precautionary approach rather than risk a material degradation of competition (page 2, page 50ff); and
- liberalising the 1800 MHz spectrum for LTE use before the Auction will aggravate the competitive distortions arising from 900 MHz liberalisation and damage the future competitiveness of the mobile market(s).

A3.5 Conversely, Telefónica argued at paragraph 865 of its response that:

“At no point in its consultation does Ofcom use the outcome of the 2G liberalisation process to justify its proposals for the auction. This is the correct approach. If this approach is to be changed, as some stakeholders continue to suggest, then a further consultation will be required.”

Ofcom’s response

A3.6 Pursuant to Article 1(2) of the Amended GSM Directive, Member States have a specific obligation when implementing that Directive to examine whether the existing assignment of the 900 MHz band to the competing mobile operators in their territory is likely to distort competition and, where justified and proportionate, address such distortions in accordance with Article 14 of the Authorisation Directive.

A3.7 The UK Government implemented the Directive in the Direction which requires us, among other things, to vary the licences for use of the 900 MHz band to permit 3G use, and to make other variations to the 900 MHz licenses including the revision after the Auction of the annual licence fees payable for use of those frequencies to reflect full market value¹⁰⁰. As explained in the January 2012 consultation, the Government, on whom the obligation to implement the Directive falls, considered and took account of the risk of certain players being advantaged as a result of the liberalisation of the

¹⁰⁰ 2010 No. 3024, The Wireless Telegraphy Act 2006, (Directions to Ofcom) Order 2010, Articles 4, 5 and 6.

900 MHz licences when it made the Direction; see for instance Ed Vaizey MP's letter to the Business, Innovation and Skills committee of 27 July 2010 which states:

“I have considered any possible competitive imbalance that might be created by the liberalisation of the 900 MHz and the 1800 MHz spectrum. As part of this consideration, I have taken account of the rapid growth of smartphones and similar devices. This has resulted in the greater need for capacity on existing networks and I believe that this requirement cancels out any potential advantage of sub-1GHz spectrum in terms of rural reach and in building.”

- A3.8 We accordingly varied the 900 MHz licences to permit 3G use of the 900 MHz bands and will revise the annual licence fees for the 900 MHz spectrum after the Auction. We therefore, consider that the question of any distortion of competition arising from the liberalisation of the 900 MHz spectrum was considered when the Amended GSM Directive was implemented, and the UK's duties under the directive were therefore, appropriately discharged when the Amended GSM Directive was implemented through the Government's Direction.
- A3.9 We do not accept that Article 1(2) of the GSM Directive imposes a specific continuing obligation to address the effects of 900 MHz liberalisation for 3G use separately in every future decision for the allocation of mobile spectrum. This is without prejudice to the fact that, as also accepted by Ofcom in its advice to the Government in advance of the Direction being made¹⁰¹, the assessment under the Amended GSM Directive and the competition assessment that we have carried out for the purposes of the present Auction (pursuant to section 8 of the Government's Direction), are part and parcel of a single, broader objective to promote competition in mobile markets. Further, we have taken into account the holding of the liberalised 900 MHz spectrum by certain licensees when assessing likely future competition in markets for the provision of mobile services after the Auction.
- A3.10 In this regard, we note that H3G's arguments to the effect that our assessment of credibility runs counter to the Amended GSM Directive, are themselves in fact predicated on an assumption that Ofcom has not assessed the effects on competition of the 900 MHz liberalisation. We do not accept H3G's assertion that we have failed to take account of the effect of that liberalisation in our competition assessment here. For the reasons set out in this document, we consider that our competition assessment does take account of 900 MHz liberalisation for 3G use as well as the nature of different spectrum bands and the advantages that they can give to licensees. We have taken this into account in our decision to put in place appropriate and proportionate measures which will promote competition in the mobile communication services market after the Auction.
- A3.11 As to H3G's point about liberalising the 1800 MHz spectrum for use before the Auction, we are currently considering responses to our proposals on this and have not yet reached a final view on this.

¹⁰¹ Advice to the Government on the consumer and competition issues relating to liberalization of 900 MHz and 1800 MHz spectrum for UMTS, 25 October 2010.
<http://stakeholders.ofcom.org.uk/consultations/spectrumlib/advice-to-government/>

Desirability of at least four national wholesalers

Summary of our position in the January 2012 consultation

- A3.12 In our January 2012 consultation, we said the Auction is likely to be the last significant opportunity to obtain prime mobile spectrum for the foreseeable future, which we regard as being a critical asset for national wholesalers. We also considered that the distribution of spectrum after the Auction is therefore likely to be particularly important in shaping future competition in mobile markets for at least the next decade.
- A3.13 We also expressed our concern that if the Auction resulted in fewer than four credible national wholesalers, the market would not be as competitive as it would be if there were four national wholesalers. This is because, other things being equal, competitive intensity in a market will tend to be higher when there are more competitors (especially in a market with significant barriers to entry). We also noted that, since retail competition relies on a competitive wholesale market, there is indeed reason to conclude that there is a risk to wholesale and retail competition if only three credible national wholesalers survive.
- A3.14 We also noted that the Auction could effectively result in an increase in concentration in the market - hence we considered it useful to apply tools of assessment similar to those used in merger analysis. However, we also acknowledged that in the present case we are not considering a merger or acquisition, but the release into the market of a key strategic asset (spectrum) that could change the competitive landscape.
- A3.15 In summary, having applied tools similar to those used in merger assessment to the combined award we reached a provisional view that a consolidation from four national wholesalers to three would represent a large increase in concentration in an already highly concentrated market. Other things being equal, this would be likely to give firms an incentive unilaterally to raise prices or to be less competitive in other ways. For example, we considered that there is also some risk that coordination between suppliers would become easier, especially if a disruptive competitor were eliminated. This is in the context of a market where barriers to entry are high and there is little scope for buyers to exercise countervailing bargaining power. Finally, there is significant scope to achieve cost efficiencies without a reduction in the number of national wholesalers.
- A3.16 On this basis, we concluded that whilst alternative outcomes are possible, it appears credible, and perhaps likely, that a future consolidation from four to three players – and particularly one which eliminated a strong or disruptive competitive force – would lead to a reduction in competitive intensity.
- A3.17 A number of respondents made comments regarding our conclusion that an Auction outcome with four national wholesalers was desirable. We address them under the following headings:
- Need for a formal merger or market assessment
 - Need for four players
 - Effects of a consolidation

Need for a formal merger or market assessment

Summary of responses

A3.18 Vodafone (paragraphs 22 to 24) said that while Ofcom had treated its assessment as analogous to a merger situation, “Ofcom has failed to apply the tools of merger analysis correctly, and so its conclusions are purely speculative”.¹⁰² Vodafone added that:

“...it is widely recognised by competition authorities that not all mergers in concentrated markets lead to a reduction in competition, and that a case-by-case analysis is required. Whether or not a four to three merger would lead to a reduction in competition depends on a number of features of the market in question and the way that competition takes place. Unfortunately, Ofcom’s assessment of competitive effects in the UK mobile market is partial and misses salient features of the market (as revealed by Ofcom’s use of the phrase “...other things equal...””.

“Competition authorities assessing mergers in a concentrated market typically take into account a much richer set of considerations. [Footnote: reference to European Horizontal Merger Guidelines and the UK CC/OFT Joint Merger Guidelines.] In particular, Ofcom has not adequately assessed the two key theories of harm that competition authorities explore when assessing mergers in concentrated markets.”¹⁰³

A3.19 Vodafone further argued (Annex 3, page 68) that Ofcom has not met the requisite legal standard in reaching its conclusions on the potential harm to competition and consumers resulting from a reduction in the number of infrastructure operators. Vodafone stated that:

“...The legal test is clearly stipulated in what remains the leading case for the review of a merger (which by its nature is prospective). That case makes clear the standard to be discharged in a prospective analysis is, on an objective view, a high one. If Ofcom intends to employ some of the tools typically adopted by a competition authority when assessing the impact of a merger, then it must be accept [sic] that it is subject to the obligations that apply to a competition authority engaged in such a task.”

A3.20 Everything Everywhere (pages 9 to 10) argued that “Ofcom has not demonstrated the need for a bespoke competition assessment framework”. It noted that the Direction required a clear framework for assessing the degree of competition.

A3.21 Everything Everywhere said this should include an ex ante assessment to identify the baseline from which competition is being promoted in a clear and objective way. Such an assessment should “consider the structure of competition in the market including (but not limited to) an assessment of market shares, barriers to entry, the possibility of countervailing buyer power and whether there are regulatory / legal constraints on market power”.

¹⁰² Vodafone presented these arguments in the context of assessing the payoff from strategic investment.

¹⁰³ Vodafone went on to present arguments relating to these “two key theories of harm”, unilateral and coordinated effects. We consider these arguments below.

- A3.22 Everything Everywhere noted that the underlying discipline of market analysis did not differ between merger analysis and the consideration of whether firms had significant market power under the Electronic Communications Regulatory Framework. It said “[t]he key difference is therefore not in how competition is assessed, but rather in how the results of that assessment are used and the policy objectives which are being pursued”. This was analogous to Ofcom’s responsibilities as defined in the Direction, which also placed on Ofcom a requirement to undertake a forward-looking assessment of the degree of competition likely to result following the Auction.
- A3.23 Everything Everywhere argued that Ofcom’s approach “skims over such an assessment and, in particular, does not attempt any rigorous market definition”. It characterised Ofcom’s position as being that “the overall framework of merger analysis cannot be used because there is a greater degree of uncertainty around the outcome post the auction in terms of consolidation and because the timescales over which Ofcom is assessing competition are different to those typically considered in standard merger analysis”.
- A3.24 Everything Everywhere argued that “The basic framework of market/market structure and competition can [therefore] still be applied, even if the range of outcomes for market structure encompasses more than a simple merger situation”. It added that “The range of uncertainty with which Ofcom is faced means it must assess a wider range of possible market structures and outcomes, not that it should assess none”, and that “while Ofcom may infer that a particular competitor may face challenges to its existence from holding an inadequate spectrum portfolio, it cannot draw general conclusions about the overall market’s competitiveness”.
- A3.25 In particular Everything Everywhere argued (footnote 5) that:
 “If the main concern centres around whether the loss of a fourth national wholesaler reduces competition in a material way this could have been addressed by undertaking a standard merger analysis under three separate scenarios: effectively where H3G merges with a 900 MHz operator, with Everything Everywhere or with a third industry party (such as one of the main MVNOs or fixed operators). This type of analysis would be no more burdensome than Ofcom’s existing assessment of credibility under multiple possible scenarios.”
- A3.26 Everything Everywhere (page 13) also criticised our reference to the HHI, arguing that:
 “Ofcom’s approach raises two key concerns. First, use of HHI thresholds is the start, not the end, of the analysis. An increase in HHIs which suggests an increase in concentration is a trigger for further and deeper analysis on the competitive market structure and whether this increase in concentration is an actual concern. The Consultation in contrast presents the fact its HHI calculations lead to increases above the merger guidelines thresholds as meaningful in itself. Further, and just as fundamentally, alternative market definitions could lead to the reverse outcome. The HHI actually decreases if a data subscribers market is defined and H3G is assumed to exit with the other existing national wholesalers taking equal numbers of its customers.”
- A3.27 Telefónica (page 13) cited comments by Mr Ed Vaizey, the Minister for Culture, Communications and Creative Industries, who said that “there is nothing to say that further consolidation may not occur in the future as a result of market forces”.

A3.28 Telefónica commented (paragraphs 50-51) that:

“This suggests to us that any competition remedy must be the least prescriptive possible. Regulators cannot second guess the optimal market structure, nor should they. Regulators should review mergers when they are notified and make decisions on the facts at that time, rather than create hostages to fortune through ex ante policy statements.

If Ofcom can make a case for securing “n” players it should intervene to the absolute minimum extent necessary to ensure that there is effective competition between the “n”. Again this does not automatically equate to predetermining which operator should get what out of the auction. That is what auctions do. Whatever the remedy, it must also not act to the detriment of those not subject to it.”

Ofcom’s response

A3.29 In considering these points, it is useful to distinguish between two questions:

- Whether we have identified the correct framework to assess the effect of a consolidation of the market from four to three players; and
- Whether we have applied that framework at an appropriate level of detail.

A3.30 Taking the parties in turn:

- Vodafone did not argue that we have adopted the wrong framework, but rather that we have applied this framework incorrectly. However, its specific criticism related to the assessment of unilateral effects and coordinated effects. While Vodafone disagreed with our assessment of these issues, in doing so it engaged with the framework used in the January 2012 consultation, which included a consideration of these effects. (We consider Vodafone’s points on these issues from paragraph A3.79 below).
- Everything Everywhere argued that we have adopted a “bespoke” framework. However, while we have referred to merger analysis, Everything Everywhere noted that the underlying discipline of competition assessment is the same regardless of whether or not the context is one of merger analysis. It also referred to criteria, such as barriers to entry and countervailing buyer power, of which we have taken explicit account in our assessment. The essence of Everything Everywhere’s objection appears to be that Ofcom “skimmed over” its assessment, and in particular that we did not conduct a formal market definition. We consider these points below.
- Telefónica appears to suggest that we have sought to determine the optimal market structure, and the outcome of the Auction. However, it did not demonstrate that we have sought to do either of these things. Rather, we consider that our approach is consistent with the least prescriptive intervention to achieve our objectives.

A3.31 In considering the arguments set out above:

- We begin by setting out our approach, and explaining how the situation differs from a merger situation;

- Next we set out our reasons for not conducting a formal market definition;
- We then consider Everything Everywhere's argument that we should have considered a wide range of outcomes;
- We consider Everything Everywhere's argument relating to the use of HHI; and
- Finally we consider Telefónica's arguments relating to our approach.

Our approach, and its relationship to a merger situation

- A3.32 If the Auction led to a reduction in the number of competitors, the effect on competition of that outcome could be similar in some respects to a merger between two existing firms. However, it does not follow that we are required to conduct a merger assessment, or that such an assessment could meaningfully be conducted or has been conducted in the present context.
- A3.33 We are not assessing a merger which falls to be considered under the merger control legislation or undertaking a market review imposed under the Communications Act. Rather, we are taking a decision (which will be given effect through the exercise of our powers under section 14 of the Wireless Telegraphy Act) in light of our primary duty and the requirements of the Direction, on what appropriate and proportionate measures to put in place to promote competition in the mobile communication services markets after conclusion of the Auction¹⁰⁴. This contrasts to a merger assessment which aims to assess the incremental effect on competition of a specific merger transaction by reference to a particular statutory test (e.g. substantial lessening of competition, as in the Enterprise Act 2002) or a market review which seeks to assess a defined market with a view to imposing ex ante regulatory obligations where competition is not effective (i.e. in markets where there are one or more undertakings with Significant Market Power, and where national and Community competition law remedies are not sufficient to address the problem).
- A3.34 Within the context of the framework of our duties and the Government's Direction, we have considered whether we should put in place appropriate and proportionate measures to seek to ensure that at least four operators have access to spectrum to enable them to be capable of being credible national competitors at the wholesale level after the Auction.
- A3.35 In the January 2012 consultation we applied some of the same types of economic assessment as a merger control authority might do when looking at a merger to illustrate some of the concerns that underpinned our policy decision.¹⁰⁵ Specifically, for the purposes of effective consultation, we set out analysis as to why we were concerned that competition could be reduced if there were fewer national wholesalers than at present. This analysis was consistent with the standard approach to merger regulation, and arises from the same economic theory. Respondents have engaged with this analysis, and we consider their detailed comments below. However, in undertaking this analysis, we were not seeking to carry out a full merger control analysis as would be required under merger control legislation, nor did we consider it would have been appropriate to do so. Given that we have not sought to undertake a merger analysis (or indeed an assessment of whether competition is effective in the context of a market review) we disagree with Vodafone's points on the standard of

¹⁰⁴ Our policy aim is discussed in Section 4.

¹⁰⁵ Annex 6, paragraphs 2.62 and 2.63.

analysis. We are satisfied that, in the context of the nature of the policy decision we are taking, we have met the requisite standard.

- A3.36 In addition to it being inappropriate, there would also be significant difficulties with carrying out a full merger analysis in this case for a number of reasons. First, we are not assessing a specific transaction involving two identified merging entities. This creates a greater degree of uncertainty as to the impact on competition. Second, we are considering the release into the market of a key strategic asset that is not currently held by any of the operators and could change the competitive landscape. Third, the timeframe for our competition assessment is significantly longer than is typical in merger assessment, in a sector which is expected to change rapidly in the coming years. We remain of the view that a more detailed analysis would not advance our assessment given the strong assumptions that we would need to make about future market developments.
- A3.37 Vodafone noted that not all mergers in concentrated markets lead to a reduction in competition and argued that a case-by-case analysis is required. We agree, and consider that our approach is consistent with the analysis of any specific concentrative situation proposed by the relevant parties after the Auction being carried out on such a case-by-case basis by the relevant competition authorities at the time (whether using merger control or other relevant competition law provisions) - see paragraph 4.24 in Section 4.
- A3.38 We also explained in Section 4 that our intention is to avoid the effects of consolidation through the Auction. Therefore, in our view, for us to be satisfied that it was appropriate to allow Auction outcomes that are likely to lead to a significant increase in concentration through one or more national wholesalers failing to acquire sufficient spectrum to be credible, it would need to be established that the specific circumstances were such that a material reduction in competition to the detriment of consumers would be avoided. This would need to be established despite the market already being highly concentrated with large barriers to entry, an absence of significant countervailing buyer power, and the potential for network or spectrum sharing to realise cost efficiencies without reducing the number of national wholesalers. We note that no respondent has provided the evidence to justify such a conclusion.
- A3.39 Further, we also consider that in the case of the Auction it is not appropriate to use the analytical framework that would be used in a market review to assess whether a communications provider has Significant Market Power (SMP). First, there is scope for competition concerns to arise and for there to be a sound basis for measures to promote competition even in the absence of SMP (e.g. in the context of a non-collusive oligopoly). Second, the timeframe for our competition assessment is significantly longer than is typical in market reviews, in a sector which is expected to change rapidly in the coming years, e.g. LTE services do not exist yet in the UK.

Our reasons for not conducting a formal market definition

- A3.40 We now address Everything Everywhere's comment on the need for a formal market definition.
- A3.41 We remain of the view set out in the January 2012 consultation that it is not useful to undertake a formal market definition exercise for the purposes of this competition assessment.¹⁰⁶ First, we note that market definition is a means to an end, assisting in

¹⁰⁶ See paragraphs 2.27-2.31 and 2.39 in Annex 6 of the January 2012 consultation.

the analysis of competitive constraints, not an end in itself.¹⁰⁷ In our competition assessment we analyse the implications for competitive constraints and the strength of competition directly in terms of the sources of competition concern arising from possible Auction outcomes. Second, the precise delineation of the market(s) under market definition would not necessarily advance the analysis. Our competition assessment is consistent with a range of possible market definitions. Relevant competition concerns can arise, and measures to promote competition may be appropriate and proportionate, whether or not there is a single market or separate markets for mobile services. Third, in any case we are unlikely to reach a definitive view on market definition, and there would be considerable scope for error if we tried to do so, given the scope for product differentiation,¹⁰⁸ the long time frame of this review, and uncertainty over future consumer preferences for the various characteristics and quality dimensions of mobile services.

Our reasons for not considering a wide range of outcomes

- A3.42 Our largest competition concern relates to a reduction in the number of credible national wholesalers, but as noted above, unlike in a merger situation, there is before us no specific market transaction or particular increase in market concentration. We have identified that each of the existing four national wholesalers has, to date, been a strong competitive force in the supply of mobile communication services. However, there are larger or smaller risks relating to the future competitive strength of different national wholesalers.
- A3.43 Everything Everywhere suggested that we could undertake a standard merger analysis under three separate scenarios of H3G merging with (i) Telefónica or Vodafone, (ii) Everything Everywhere, or (iii) a fixed network operator or MVNO. However, if one of the current national wholesalers were not to be credible in future (and we consider the risks to all current national wholesalers, not just H3G), there is a multitude of possibilities as to how quickly and in what specific ways this might affect market concentration and the positions of other competitors, such as their market shares. The implications would also depend on the relative competitive strengths of the remaining competitors, which may be affected in various ways by the outcome of the Auction. Given this, we do not consider that it would be a productive exercise to construct distinct scenarios based on, for example, different assumptions about market shares resulting from exit (or entry) by different firms. In particular we consider that any reduction in the number of credible national wholesalers is likely to be of concern to overall competitiveness, and this is not dependent on which firm or firms would not remain credible in such a scenario.
- A3.44 As to the other factors suggested by Everything Everywhere for scenario analysis (barriers to entry, countervailing buyer power and regulatory/legal constraints on market power), we have had regard to these factors in reaching our view. In the January 2012 consultation,¹⁰⁹ we considered that there are high barriers to entry to being a national wholesaler; these include in particular the need to have access to the right quantity and type of spectrum but also the fixed costs involved with access

¹⁰⁷ Merger Assessment Guidelines, a Joint Publication of the Competition Commission and the Office of Fair Trading, September 2010, paragraph 5.2.2 notes that “Market definition is a useful tool, but not an end in itself, and identifying the relevant market involves an element of judgement.”

¹⁰⁸ See, for example, footnote 14 to paragraph 2.27 in Annex 6 of the January 2012 consultation, which discusses the risk of an “artificial line-drawing exercise” in market definition exercises in the context of product differentiation.

¹⁰⁹ See paragraph 4.49 of the January 2012 consultation.

to a radio access network, and the need to build up a customer base.¹¹⁰ In the same consultation we also considered that there is little scope for buyers to exercise countervailing buyer power: while MVNOs have the scope to switch supplier in order to get a better deal (or threaten to switch), this depends on a competitive wholesale market.¹¹¹ Furthermore 87% of residential mobile phone customers are supplied directly by one of the four national wholesalers, so MVNOs account for a relatively small proportion of the market.¹¹² Individual retail consumers are unlikely to have countervailing buyer power.

A3.45 Nor do we consider that legal and regulatory constraints on dominance can be relied upon as Everything Everywhere suggests. This is because (a) a reduction in competition may lead to poorer consumer outcomes while falling short of an abuse of dominance, and (b) if the Auction were to lead to a structural change in the market, we would expect that any subsequent regulatory action to address this would have to be highly interventionist to be effective.

Use of HHI

A3.46 Turning to Everything Everywhere's criticism of our use of HHI estimates, we note that Everything Everywhere (page 10) includes "assessment of market shares" as an element of assessing competition in a market. The HHI is essentially a way of summarising market share data. We have not presented HHI as "the end of the analysis". For example, we also considered whether each of the national wholesalers was a strong competitive force, having regard to their individual market shares in addition to other factors.

A3.47 While we have not conducted a formal market definition, for the reasons summarised above, our calculation of HHI is based on the number of mobile subscribers supplied by national wholesalers. We consider this a reasonable approach in the context of our competition assessment which covers all mobile services.

A3.48 As regards Everything Everywhere's suggestion of a market for data subscribers – by which it seems to mean datacard and dongle subscribers - we noted in our January 2012 consultation (Annex 6, paragraph 5.98) that H3G has pursued a strategy focussing on aggressive pricing of data services to high end users. It is not clear that H3G has a long-term advantage in this area, which its rivals could not erode by competing more strongly. To the extent that H3G has won its large share of data subscribers by competing strongly, a decrease in HHI following H3G's exit from the data service market would not represent an improvement in competition in the supply of data services.

A3.49 Furthermore, when Everything Everywhere says that "The HHI actually decreases if a data subscribers market is defined and H3G is assumed to exit *with the other existing national wholesalers taking equal numbers of its customers*", the second part of this

¹¹⁰ See paragraphs 5.47 to 5.54 of Annex 6 of our March 2011 consultation for a fuller description of the high barriers to entry for national wholesalers.

http://stakeholders.ofcom.org.uk/binaries/consultations/combined-award/annexes/Annex_6.pdf

¹¹¹ Merger Assessment Guidelines, a Joint Publication of the Competition Commission and the Office of Fair Trading, September 2010, paragraphs 5.9.3-4 note that "Typically the ability to switch away from a supplier will be stronger if there are several alternative suppliers to which the customer can credibly switch, or the customer has the ability to sponsor new entry or enter the supplier's market itself by vertical integration... It is possible, for example, that a merger may reduce a customer's ability to switch or even to sponsor new entry and, if this reduction adversely affects the negotiating position of a customer significantly, that customer's buyer power will not be sufficient to be countervailing."

¹¹² Communications Market Report, 2011, Ofcom, Figure 1.34.

assumption (in italics here) is crucial to the result. In particular, this result is driven by the assumption that Telefónica, which currently has only 3% of datacard/dongle subscribers would win a further 17% of such subscribers (as would each of Everything Everywhere and Vodafone in this scenario) following H3G's exit. The result is that HHI decreases by about 140 points. However, it is perhaps more likely that if H3G were to exit, its datacard/dongle subscribers might be split between the remaining national wholesalers proportionate to their respective shares of datacard/dongle subscribers. If H3G's subscribers were split between the remaining three national wholesalers in this way, HHI would increase by nearly 725 points.¹¹³

A3.50 Finally, the analysis of HHI above refers to datacard/dongle subscribers, a specific sub-set of consumers of mobile data services and mobile services more generally, which may decline in relative importance over the longer term due to the use of other devices such as smartphones. Therefore, even if Everything Everywhere's HHI calculation were reasonable, it would only relate to a specific sub-set of the services and consumers that would be affected by an increase in concentration arising from a reduction in the number of national wholesalers. We also question the importance of dongles for enabling a national wholesaler to be a credible competitor in paragraph 4.65 of Section 4. In our view, a calculation of the change in HHI for datacard/dongle subscribers is significantly less relevant or representative in the context of our competition assessment covering all mobile services than the calculation of change in HHI for mobile subscribers which we presented.

Telefónica's arguments

A3.51 As regards Telefónica's point regarding creation of hostages to fortune, we note that we are not ruling out further consolidation in the market. Any such circumstances would have to be assessed on their specific facts at the time. We do not accept that decisions we have decided to take in relation to this specific Auction, taking account of the Direction and our statutory duties, create any rigid position which could fetter our discretion in other, future contexts.

A3.52 We have decided to take the minimum measures necessary in this Auction to seek to ensure that at least four national wholesalers have access to spectrum they need to be credible. In doing so we have not predetermined the outcome of the Auction – rather we have sought to allow the Auction to determine what spectrum the fourth national wholesaler will win out of four possible portfolios. We have also carefully considered the impact of our measures on other bidders in reaching our view that the measures are proportionate.

The need for four players

Summary of responses

A3.53 Everything Everywhere (page 10) argued that “while Ofcom may infer that a particular competitor may face challenges to its existence from holding an inadequate spectrum portfolio, it cannot draw general conclusions about the overall market's competitiveness”.

A3.54 On a related point, Everything Everywhere (page 12) argued that our approach divides an abstract consideration of the number of players from the assessment of the individual competitiveness of each player. It said (as noted above) that a

¹¹³ Figures are based on datacard/dongle subscribers in Q1 2011, reported in our January 2012 consultation, Annex 6, Figure 5.7, page 119.

competition assessment should take account of actual market structures under different scenarios, and the degree of overall competition which arose from the relative competitiveness of each market participant. Everything Everywhere said that our approach had the effect of protecting individual competitors, rather than competition.

- A3.55 Everything Everywhere also argued that the notion of “credibility” is novel and not clearly defined, and that Ofcom’s assessment of credibility is unclear and flawed. It said that the Consultation does not define what is meant by a credible competitor, and there are no objective criteria or explanation on how to judge when the disadvantages become serious enough to make a competitor lose credibility.
- A3.56 Telefónica (paragraphs 60-72) argued that “Ofcom tries to side-step Vodafone’s well evidenced argument that Hutchison is not really a competitor on the national wholesale market today, having no MVNOs supported on its network”. It adds (paragraph 63) that:
- A3.57 “Ofcom accepts, in terms, that an operator which does not supply MVNOs but holds a retail market share of 7% is all that is required to act as an indirect constraint on the active wholesalers. To secure the level of competition that we see in the wholesale market today, therefore, Ofcom need do no more than secure the presence of three credible national wholesalers plus one indirect constraint with sufficient resources to supply around 7% of the retail market. To do more would be disproportionate.”
- A3.58 In support, Telefónica cites the US Department of Justice’s position¹¹⁴ on the recently proposed merger between AT&T / T-Mobile USA, which referred to the latter’s deployment of HSPA+, marketed as 4G. In its complaint to the US courts (the “DoJ Complaint”), the DoJ argued that T-Mobile USA was an important source of competitive pressure on its three larger rivals. Telefónica said that the DoJ specifically identified T-Mobile USA’s deployment of HSPA+ as a response to LTE. T-Mobile USA’s HSPA+ service uses the AWS band.¹¹⁵
- A3.59 Telefónica infers from the DoJ’s position that smaller services relying on HSPA+ can act as a competitive constraint on larger LTE providers.^{116 117} Telefónica (paragraph 8) argued that:
- “The Department of Justice’s position on the proposed merger of AT&T and T-Mobile USA is cited as supporting Ofcom’s “four player” hypothesis. A closer inspection, however, points to an endorsement of “three plus one”. T-Mobile USA does not have any sub-1GHz spectrum to deploy LTE, rather it offers HSPA+ services in the AWS band (c.2100MHz) – a position analogous to Hutchison in the UK market today. The logic of the DoJ’s position is that there would still be “four” if Hutchison won no spectrum for LTE.”
- A3.60 Telefónica concluded that “this suggests that Ofcom need only intervene to the absolute minimum extent necessary to secure an indirect constraint on three players, rather than to absolutely guarantee the creation of a full blown fourth national wholesaler”.

¹¹⁴ DoJ complaint dated 31 August 2011. Available at:

<http://www.justice.gov/atr/cases/f274600/274613.pdf>

¹¹⁵ 1710-1755 MHz paired with 2110-2155 MHz.

¹¹⁶ Telefónica non-confidential consultation response, paragraph 76.

¹¹⁷ Telefónica did add the caveat that this was from a “capability standpoint” and “[put] aside issues of capacity”. Telefónica consultation response, paragraph 74.

A3.61 Telefónica also argued that if Ofcom persists with its “policy preference” for four players then we will have created a rigid “policy objective” that must guide our future decision making.

Ofcom’s response

A3.62 We disagree with Everything Everywhere’s argument that our approach protects individual competitors rather than competition. Our analysis and the resulting competition concerns we have identified relate to the overall competitiveness of market(s) for the provision of mobile services. The position of individual competitors only matters to the extent that it affects this overall market competitiveness (see paragraph 4.30 in Section 4).

A3.63 For example, our view is that, if the Auction led to an outcome in which fewer than four national wholesalers had the spectrum they needed to be credible, this is likely to reduce the overall competitiveness of the market (as explained in Section 4). We consider that our approach will promote competition. No existing national wholesaler is guaranteed spectrum under our measures.¹¹⁸ It is possible that our measures may be to the advantage of certain wholesalers, but we have sought to take the minimum measures necessary to promote competition.

A3.64 On Everything Everywhere’s comment about the notion of credibility, in this Statement we provide further clarification of what we mean by a credible national wholesaler and the framework for our assessment in the round whether any given spectrum holding is sufficient to enable a national wholesaler to be credible.¹¹⁹

A3.65 Turning to Telefónica’s arguments, these appear to be:

- H3G is not a direct constraint on its rivals today (based on an earlier argument by Vodafone);
- It is an indirect constraint in two senses (a) it does not supply any MVNOs, and (b) it offers HSPA+ services.
- However, this indirect constraint will be sufficient for competition.

A3.66 We consider that Telefónica’s first argument that H3G is not really a competitor today on the national wholesale market is misconceived because it is divorced from the purpose of focussing on national wholesale competition. We emphasise the importance of such competition because of the role that national wholesalers play in supporting retail competition to the benefit of consumers. They do so directly, as all current national wholesalers (including H3G) have downstream businesses that are significant retail competitors. They also support retail competition indirectly through supply of wholesale access to other retail competitors such as MVNOs and sub-national RANs. From this perspective, H3G as a national wholesaler directly affects retail competition even if it is not currently active as a supplier of wholesale access to third parties. In other words, given the purpose of considering national wholesale competition, self-supply of wholesale access to a national wholesaler’s own downstream arm is an essential and important part of our analysis. Telefónica’s (and previously Vodafone’s) suggestion that, in effect, such self-supply is irrelevant is therefore wrong.

¹¹⁸ Unless, among eligible bidders, H3G is the only one prepared to pay the reserve prices for all reserved portfolios and so is the single opted-in bidder.

¹¹⁹ See from paragraph 4.25 of Section 4.

- A3.67 We note the term “indirect constraint” is generally used¹²⁰ to refer to a situation where a wholesaler (such as Telefónica) is constrained from raising prices to a retailer (such as an MVNO) which it supplies, because even if the MVNO does not switch to a different wholesaler, it is likely to pass the price increase on to its customers, some of whom may respond by switching to a vertically-integrated provider (such as H3G), to an extent that the price rise is not profitable. In this case, the vertically-integrated wholesaler imposes an indirect constraint at the wholesale level, arising from switching in the downstream market. In contrast, if the MVNO had switched to a different wholesaler, this would suggest a direct constraint.
- A3.68 In this manner, H3G can be seen as acting as an indirect constraint on other national wholesalers (although it is also a potential direct constraint in that it could wholesale to MVNOs). However, Telefónica appears to use the term “indirect constraint” to refer to the prospect of H3G acting as a competitive constraint to LTE providers by offering services based on HSPA+ standard (which it could offer based on its current spectrum holding).¹²¹ In other words, it is describing a difference in the extent, rather than the type, of constraint.
- A3.69 Leaving aside the use of the term “indirect constraint” and the question of wholesale supply, Telefónica appears to be arguing in its paragraph 63, quoted above, that:
- Since Ofcom accepts that a fourth national wholesaler with 7% market share is all that is required to act as a competitive constraint on the active wholesalers; then,
 - To secure the level of competition that we see today, Ofcom need do no more than secure the presence of three credible national wholesalers plus one competitor with sufficient resources to supply around 7% of the market.
- A3.70 If this is an accurate characterisation of Telefónica’s argument, we consider the argument to be incorrect. There is a fundamental difference between a firm that only has a 7% market share as an outcome of competition with other firms (and potentially other factors), and a firm that is only *capable* of serving 7% of the market. At its most basic, competition between firms means that firm A is constrained from raising prices by the threat that customers will respond by switching to firm B. If firm B is unable to serve any more customers than it serves at present, then firm A will have no such concern.¹²²
- A3.71 In our January 2012 consultation (Annex 6, paragraph 2.59) we noted that although H3G had a relatively small market share it had proved to be a strong competitive force. We noted that it had priced competitively against rivals, been innovative in pricing offers, and introduced new services. In the future, a fourth national wholesaler which was prevented (by its spectrum holdings) from increasing its market share substantially above current levels would have very little incentive to compete aggressively in the way that we consider H3G has to date. A market share fixed at around 7% would greatly limit the payoff of investment in aggressive pricing, marketing or new services. Clearly it would still have some incentive to compete in

¹²⁰ For example see Roman Inderst and Tommaso M. Valletti: “Market analysis in the presence of indirect constraints and captive sales”, *Journal of Competition Law and Economics* 2007 3(2):203-231.

¹²¹ For example, Telefónica includes a heading (before paragraph 65) “AT&T / T-Mobile USA – evidence that indirect constraints are sufficient” but in the subsequent discussion T-Mobile USA is distinguished only by virtue of the fact that it does not offer LTE services, not by having no wholesale customers. Similarly in paragraph 74 it comments that “based on the DoJ’s thesis, all MNOs can act as an indirect constraint on three LTE players in the future wholesale market”.

¹²² In a less extreme case, if firm B can serve some more customers than it serves at present, but its ability to expand is limited, then the competitive constraint on firm A is also likely to be limited.

order to sustain its existing market share in the face of customer churn, but the potential competitive threat to the other three operators could be substantially reduced.

- A3.72 We consider that the DoJ's decision, which identified a risk that a reduction in the number of competitors from four to three would lead to a reduction in competition, is broadly relevant to the present case.¹²³ However, the circumstances underpinning that decision are materially different in several respects.
- A3.73 For example, the decision facing the DoJ was whether T-Mobile USA should continue as an existing competitor or not. Telefónica characterises this as a “three plus one” solution and uses it to argue (paragraph 64) that “[t]he proportionate competition objective is to secure “three plus one”, not four.” But the DoJ was not deciding between three-plus-one and four. Even if we were to accept the characterisation of T-Mobile USA as “plus one” then to put it simply the DoJ had a choice between three and three-plus-one, not between three-plus-one and four. It did not have the option of, for example, giving T-Mobile USA a larger share of spectrum than it had before the merger.
- A3.74 Rather, the focus of the DoJ's decision was whether the removal of a HSPA+ competitor would reduce competition, and it concluded that it would. The question before us instead is whether *in the future*, as demand for LTE-based services grows, a competitor with limited spectrum holdings will be credible. Our view is that H3G (or another prospective fourth national wholesaler) will need additional spectrum to remain credible in the future.
- A3.75 We also note that:
- Telefónica correctly stated that the DoJ considered T-Mobile USA as a “significant competitive force”.¹²⁴ This was central to the DoJ's opposition to the proposed merger. However, contrary to Telefónica's claim, the DoJ Complaint does not “cite [T-Mobile USA's] deployment of HSPA+ ... as an innovative product launched as a competitive response to LTE”. The Complaint does not refer to LTE.¹²⁵
 - Telefónica's inferences rest upon the assumption that T-Mobile USA would remain a HSPA+ operator while the other three national US operators moved to LTE. The DoJ Complaint does not shed light on whether Telefónica's assumption is factually correct. However the Federal Communications Commission (“FCC”) produced a staff report analysing the proposed merger (“the FCC Report”).¹²⁶ This suggests that T-Mobile USA would in fact have offered LTE services in the future, which would mean that Telefónica's assumption is incorrect.

¹²³ In our January 2012 consultation, we acknowledged (Annex 10, paragraph 10.145) that a consolidation from four to three in the UK would have different facts as well as some similarities, but we did not suggest the case was a close analogy. We noted (Annex 10, paragraph 10.146) that the DoJ /FCC “illustrates that a four-to-three merger among national wholesalers can lead to competition concerns, which in that case were sufficiently serious for the DoJ to seek to block the merger”.

¹²⁴ DoJ Complaint, paragraph 3.

¹²⁵ One of the paragraphs cited by Telefónica refers to AT&T adding HSPA+ devices to its portfolio after T-Mobile USA did and “in reaction to potential loss of speed claims” (DoJ Complaint, paragraph 30). Similarly the FCC states that T-Mobile's deployment of HSPA+ led AT&T to accelerate its deployment of HSPA+ (paragraph 26).

¹²⁶ Staff analysis and findings, FCC, WT Docket No. 11-65. Available at:

http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db1130/DA-11-1955A2.pdf

- In particular the FCC Report considered the impact of the proposed merger on LTE services. It stated that "... the proposed transaction would eliminate T-Mobile as a potential provider of LTE-based services in the AWS and/or PCS bands (where it was considering launching LTE-based services in the future), which could mean less nationwide competition in the provision of these services where consumers have LTE handsets that can roam on these frequency bands."¹²⁷ The FCC also considered an engineering model as part of its assessment of the benefits of the proposed merger. The FCC stated that "While LTE deployment is less certain but not impossible for T-Mobile, we also find ample documentation in the record to at least question whether no LTE penetration is appropriate as a model input for T-Mobile."¹²⁸
- A3.76 In summary, we do not agree with Telefónica's claim that "the DoJ believes that HSPA+ competition at 2100 MHz is sufficient to provide a competitive constraint on three larger LTE players, delivering an effectively competitive wholesale market".¹²⁹ The DoJ Complaint did not consider LTE's performance relative to HSPA+ at all. Moreover, the FCC Report saw the potential impact of the merger on future LTE provision as a concern.
- A3.77 In any event, we did not characterise credibility for a national wholesaler as the ability to offer LTE services. Indeed we have concluded that it is unclear that an early route to LTE is necessary in order to be credible, and the clearer necessary minimum requirements relate to capacity and coverage. Even if one was to assume that LTE and HSPA+ were perfectly substitutable, our analysis indicates that a national wholesaler without enough spectrum (such as H3G's existing holdings) would not be able to be credible over the relevant timeframe of our analysis.
- A3.78 As regards Telefónica's point about a rigid policy objective, see our response to a related Telefónica point at paragraph A3.51 above.

Effects of a consolidation

Summary of responses

- A3.79 Vodafone (Annex 1) contested our view of the potential unilateral and coordinated effects of a consolidation.
- A3.80 In discussing unilateral effects, Vodafone referred to the Bertrand model of competition to argue that where firms' products are homogeneous, they do not face capacity constraints and/or can adjust capacity quickly, cheaply and easily in response to demand, market outcomes will be at the competitive level as long as there are at least two firms in the market. It suggested that the wholesale supply of network services corresponds to this model.
- A3.81 Vodafone also argued that strong competition at the retail level (as recognised by Ofcom) will continue to provide an incentive for network operators to invest in their networks to enhance their competitive position at the retail level. On the subject of coordinated effects, Vodafone argued that Ofcom has not set out its concerns in sufficient detail. It commented that:

¹²⁷ FCC Report, paragraph 102 (footnotes omitted).

¹²⁸ FCC Report, paragraph 213.

¹²⁹ Telefónica consultation response, paragraph 76.

- a) There is an apparent contradiction between saying that coordination on prices is unlikely, but that coordination could take the form of not competing aggressively for each others' customers – including on prices.
- b) High customer churn would make it difficult to monitor a market sharing agreement.
- c) Coordinating to delay innovation would require agreement on which innovations this would apply to, and the length of delay, along with monitoring and punishment mechanisms, while first-mover advantage would create an incentive to cheat.

Ofcom's response

- A3.82 We first respond to Vodafone's comments in relation to unilateral effects and then turn to its comments on coordinated effects.
- A3.83 We disagree with several aspects of Vodafone's discussion of unilateral effects, which we address in turn below. Firstly, Vodafone characterised the wholesale market according to the textbook homogeneous product Bertrand model of competition in an oligopoly. However, the results that Vodafone relies on for its argument only hold under extreme assumptions. For example, it is debatable that wholesalers would not face capacity constraints so that they could swiftly and cheaply adjust capacity; in this case, investment decisions in capacity are also likely to be relevant to the analysis as well as pricing decisions.
- A3.84 Vodafone also assumes that wholesale mobile services are perfectly homogeneous (which is a condition of the textbook Bertrand result cited by Vodafone). However, as we discuss extensively in this Statement, the services offered by national wholesalers can differ over a range of dimensions, such as average data rates, coverage, peak data rates, and latency. These sources of product differentiation could have a significant impact on their relative attractiveness to MVNOs. In addition the relative strengths and weaknesses of different national wholesalers' networks following the Auction could influence the extent to which they are a good fit with the needs of different MVNOs. We therefore consider that there is not a sound basis for assuming that national wholesalers offer homogeneous products.
- A3.85 Secondly, even if homogeneity was a reasonable assumption in this case, it is questionable that the undifferentiated Bertrand model¹³⁰ is an appropriate characterisation of competition. For example, in their survey of merger simulation, Budzinski and Ruhmer note that: "*Thus there is a widespread consensus that Bertrand [differentiated product] competition is the first choice for heterogeneous oligopolies whereas Cournot competition is the first choice for more homogeneous oligopolies*".¹³¹ Indeed they go on to consider the adequacy of both Bertrand and

¹³⁰ The Bertrand model of competition is a one-shot game in which firms compete on price (whereas in the Cournot model they compete on quantity). Vodafone's response refers to the textbook undifferentiated Bertrand model involving competition between firms with homogeneous products. Another version of the Bertrand model (referred to in the quotation in the next sentence in the paragraph) involves firms with heterogeneous or differentiated products. This version does not display the result referred to by Vodafone, i.e. that the market outcome is at the competitive level with at least two firms in the market.

¹³¹ Budzinski and Ruhmer (2010), *Merger Simulation in Competition Policy: A Survey*, Journal of Competition Law and Economics, 6(2), 277-319, page 279. The authors also note (page 306) that "If the market structure changes in a narrow oligopoly, say for instance from 4 to 3 or 3 to 2, this implies a particularly severe change of the business environment for the oligopolists and, therefore, their adjustment of strategies might be more than marginal." They suggest that in these circumstances the form of competition may switch, for instance from Bertrand to Cournot.

Cournot models in describing real market competition and note that “*This might impose some limitations if neither class of models suffices to match a given case, as real-world competition is a complex and multifaceted phenomenon whose features reach beyond available advanced oligopoly models*”.¹³² From this perspective, Vodafone’s argument, that the wholesale market’s supposed resemblance to a textbook homogeneous product Bertrand model means that two players are enough to ensure competitive outcomes, does not appear tenable.

- A3.86 Thirdly, Vodafone presented arguments relating to the wholesale and retail levels in turn, but does not appear to take account of the interplay between them.
- A3.87 In the textbook undifferentiated Bertrand model, rivals will undercut one another in order to win market share until they are each pricing at marginal cost. However in this model the rivals are typically presented as supplying directly to consumers.¹³³ Vodafone has presented the results of this model as being equally valid in describing the incentives and outcomes of vertically integrated national wholesalers in supplying access to MVNOs with whom they compete in the retail market.
- A3.88 The retail terms (prices and quality) which MVNOs can offer, and therefore their ability to compete in the retail market against national wholesalers, depend on the terms on which they can negotiate wholesale access. We would expect national wholesalers to take this fact into account in deciding the terms they are willing to offer to MVNOs.
- A3.89 In particular, a vertically integrated wholesaler might be expected to anticipate that lowering the wholesale price to MVNOs could enable them to compete more aggressively with its own retail service. The terms on which each national wholesaler will be willing to supply (and compete to supply) MVNOs will be aimed to maximise the joint profit from its wholesale and retail operations. For example, a wholesaler might be willing to undercut rivals in order to supply an MVNO which was serving service or customer segments which the wholesaler itself was not serving. However, it might be less willing to undercut rivals’ wholesale access prices to an MVNO, if lower wholesale access prices would increase the MVNO’s ability to cannibalise the wholesaler’s own retail service.
- A3.90 Vodafone also argued from the premise that there is currently a competitive retail market “with competition taking place between the MNOs, H3G and MVNO operators”. But again, competition at the retail level depends on competition between wholesalers. For example, if H3G were no longer a credible national wholesaler (in the sense that it effectively wholesales to itself, and is therefore able to compete downstream independently of the other three, and also in that it has the potential to supply MVNOs) then the remaining three national wholesalers could have an incentive to set higher prices and offer poorer terms both to their own retail customers and to MVNOs than would otherwise be the case, despite the threat that other wholesalers may offer the MVNO access to their networks.
- A3.91 Turning to coordinated effects, while we agree with Vodafone that a co-ordinated agreement on retail prices could be difficult to reach and sustain, rivals can observe when a substantial number of their customers switch to a rival in response to aggressive competition (which may include pricing). They may be able to infer from this that the rival is competing aggressively (for example, by undercutting existing price levels), even if they cannot directly monitor rivals’ prices.

¹³² Ibid, page 305.

¹³³ For example, see pp 209-210 of Tirole (2003), *The Theory of Industrial Organisation*, MIT Press.

- A3.92 We recognise that high customer churn may increase the difficulty of monitoring a (possibly tacit) market-sharing agreement. However, we note that national wholesalers have to date had relatively stable market shares.¹³⁴ In addition, the process for number portability may help retailers to know which rival is winning a customer from them, for example they might ask customers who they are moving to when they request a Porting Authorisation Code.¹³⁵ ¹³⁶ To the extent that high customer churn is due to customers switching to find better deals, this could increase the incentive to coordinate, and make it easier for firms to punish deviations from a coordinated agreement (i.e. by pricing aggressively to win customers back from the cheater).
- A3.93 With respect to Vodafone's argument on the lack of incentives to delay innovation, we recognise that there is a risk to providers in delaying innovation and giving rivals a first-mover advantage. However, we also note that investment in innovation is costly and likely to cannibalise the existing business of a large operator, so that it will be defensive to some extent. Evidence tends to suggest that, other things being equal, a smaller operator such as H3G may force the pace of innovation; for example, we note that H3G was the first to supply 3G mobile services, and as noted in our January 2012 consultation (Annex 6, paragraph 2.59), H3G has promoted new services such as Skype and pioneered new products such as mobile broadband dongles aimed at a mass-market audience.

Other issues

Summary of responses

- A3.94 Everything Everywhere (pages 11 and 13) argued that we have not taken account of sub national operators and other existing providers of national wholesaler services (such as UK Broadband).
- A3.95 Telefónica (§53) commented that on 3rd February 2012 Hutchison Whampoa announced the proposed merger between 3 Austria and Orange Austria, which would create a three national wholesaler market in that EU Member State.

Ofcom's response

- A3.96 We considered the role of potential competition by players other than incumbent national wholesalers. We remain of the view that existing providers using non-mainstream frequency bands are not a sufficient competitive constraint for national wholesale mobile services. For example, we do not anticipate that UK Broadband could act as an effective competitive constraint on the national wholesalers with its existing spectrum. This is because its spectrum is high frequency (higher than 2.6 GHz) and does not currently benefit from an internationally harmonised 'ecosystem'

¹³⁴ See for example Figure 5.4, Annex 6 of our January 2012 consultation.

¹³⁵ According to research we commissioned in the context of our consultation on the review of mobile number portability in 2009, 45% of consumers who switched network decided to port their number. See slide 9 here:

http://stakeholders.ofcom.org.uk/binaries/consultations/gc18_mnp/TNS_UK_and_RoI_omnibus_surv1.pdf

¹³⁶ This assumes that the sample of consumers who port their number is representative of the whole population of switching consumers, which we do not regard as unreasonable in the absence of clear evidence to the contrary.

for user devices or network equipment to the extent of the mainstream mobile spectrum frequencies.¹³⁷ See also paragraphs A2.74 to A2.75 in Annex 2.

- A3.97 We also considered entry or expansion by other sub-national RAN operators in the form of concurrent low power users which could facilitate innovative business models, including through the deployment of 'inside-out' networks. We considered that they could deliver significant benefits to consumers but the extent of such benefits is uncertain.¹³⁸
- A3.98 Both supporters and opponents of low power entry have noted that there are commercial and technical issues to be resolved. A successful outcome would depend on firms using the spectrum to enter the market. To date only two firms have consistently expressed an interest in delivering such services, while a third firm changed its mind about doing so during our consultation process. Furthermore, if large scale entry of such services should occur, their success and their competitive impact on national wholesalers remains to be seen.
- A3.99 Finally, the extent of the competitive constraint that sub-national RAN operators might exercise on national wholesalers is limited by their geographic scope, and their potential dependence on national wholesalers supplying access if they (the sub-national RAN operators) wish to offer a national retail service.
- A3.100 Hence, while we welcome any additional competitive pressures provided by current sub-national RAN operators, such as UK Broadband, and we are seeking to create an opportunity for further entry by allowing aggregation of bids in the Auction by low power users, in our view we cannot rely on the prospect of effective future entry by sub-national RAN operators to constrain national wholesalers.
- A3.101 As regards Telefónica's comment, we have not relied on H3G's views per se about the competitive benefits of retaining four players in the UK. Where H3G has presented evidence on this point, we have considered that evidence on its merits.

The importance of holding Sub-1 GHz spectrum

Summary of our position in January 2012 consultation

- A3.102 In paragraphs 3.71 to 3.140 of Annex 6 of the January 2012 consultation, we considered the importance of coverage and the spectrum needed to deliver sufficiently good coverage to be credible.
- A3.103 Our assessment was based on evidence on:
- i) the extent of coverage differences associated with networks using different frequency spectrum;
 - ii) alternative technologies or mitigation techniques for delivering coverage; and
 - iii) the likely consumer valuation for good quality coverage.
- A3.104 To inform our assessment of the extent of coverage differences associated with networks using different frequency spectrum (issue (i) above), we drew on evidence from our technical model of the performance of LTE macrocell networks. The model

¹³⁷ See Annex 6 to the January 2012 Consultation, footnote 66.

¹³⁸ See Section 4, sub-section on "Competition Assessment: future retail competition".

results indicated that, when comparing the coverage delivered by networks using 800 MHz, 1800 MHz and 2.6 GHz spectrum:

- there is little difference in the predicted coverage outdoors across the three frequency bands;
- inside buildings, coverage is lower for all frequencies. The extent of coverage degradation is greater for 2.6 GHz and smaller for 800 MHz, with 1800 MHz in between;
- the differences in coverage between frequencies is greater the 'deeper' into the building the user is; and
- under certain assumptions (maximum variation or 'Maxvar'), the difference in degradation between frequencies is considerable, while under other assumptions (minimum variation or 'Minvar') the differences are small.

A3.105 We concluded that, based on the technical modelling results, the potential advantages with lower frequency spectrum in term of coverage are likely to be greater the more prevalent and important deep indoor (or 'hardest to serve') locations are.

A3.106 In relation to alternative technologies and mitigation techniques, we concluded that use of small cell solutions may help to address some of the gap in coverage faced by operators with higher frequency spectrum, particularly in terms of offering consumers good quality coverage in their home or office, where a significant proportion of mobile data use is likely to take place.

A3.107 However, we identified a number of practical challenges to using small cell solutions as a means to providing consistently good coverage depth across all hardest to serve locations, particularly inside buildings but outside of the home or office. It may be necessary to hold sub-1 GHz spectrum in order to deploy consistent good coverage in these location types. We did not have specific evidence on the prevalence and importance of mobile use in these location types.

A3.108 Taking all of this into account, we concluded that:

- a national wholesaler with just 1800 MHz or 2100 MHz spectrum is likely to be able to provide sufficient quality of coverage to be credible;
- there is a material risk that a national wholesaler with just 2.6 GHz spectrum would not act as a credible national wholesaler; and
- while a national wholesaler may be credible without sub-1 GHz, it may act as a weaker competitor in particular service or customer segments than a wholesaler with sub-1 GHz.

Responses relating to technical modelling

A3.109 There were a significant number of responses to our consultation suggesting that we had either overestimated or underestimated the extent of technical advantages associated with lower frequency spectrum. A significant part of these responses related to our approach to technical modelling. We have considered the merit in the arguments put forward in more detail in Annex 10. Stakeholders also drew our

attention to other evidence that may be indicative of the extent of the technical advantages associated with sub-1 GHz spectrum. We consider these below.

‘Expert’ views on the importance of sub-1 GHz spectrum

Summary of responses

- A3.110 H3G presented evidence and quotes that highlight the superior propagation characteristics of sub-1 GHz spectrum relative to higher frequency spectrum from various parties, including from other regulators, mobile operators, industry associations, academics, consultants and equipment vendors.¹³⁹
- A3.111 Much of the evidence cited illustrates that it is well established that sub-1 GHz spectrum provides better in-building penetration and coverage than higher frequency spectrum. There is also evidence to indicate that, for those operators with some sub-1 GHz spectrum, these advantages may translate into cost advantages. For example, H3G referred to evidence that holding sub-1 GHz spectrum can minimise the number of additional sites that need to be built (e.g. evidence from The Global Mobile Suppliers Association, Technical University of Vienna for BNetzA and Jan Markendahl of Sweden’s Royal Institute of Technology, Analysys Mason and Motorola).
- A3.112 H3G also pointed to evidence that operators with sub-1 GHz spectrum may enjoy a timing advantage relative to operators without sub-1 GHz spectrum. It cited a paper by Jan Markendahl of Sweden’s Royal Institute of Technology which argues that sub-1 GHz allows for a faster time-to-market as reaching the same LTE coverage with supra 1 GHz spectrum would require rolling out more sites for coverage, which would take time. H3G concluded that this is a competitive disadvantage that can lead to long-term impacts on market shares.
- A3.113 H3G provided a number of quotes that also suggest that holding sub-1 GHz spectrum may deliver competitive advantages, for example:
- the FCC said “[...] providers whose spectrum assets include a greater amount of spectrum below 1 GHz spectrum may possess certain competitive advantages for providing robust coverage when compared to licensees whose portfolio is exclusively or primarily comprised of higher frequency spectrum”¹⁴⁰
 - Ericsson argued that: “To provide sufficient coverage and capacity it is essential to ensure a mix of sub-1 GHz bands, having the propagation characteristics necessary to give full area coverage with spectrum also higher up in the frequency range where more bandwidth is easier to find.”¹⁴¹

Ofcom’s response

- A3.114 We agree with much of the evidence put forward on the technical advantages associated with sub-1 GHz spectrum. This is consistent with our own technical

¹³⁹ Page 187, Annex C, H3G’s non-confidential response to our January 2012 consultation.

¹⁴⁰ See Page 197 of H3G’s non-confidential response, and FCC: Fifteenth Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services, 2011, paragraphs 293-307.

¹⁴¹ See Page 211 of H3G’s non-confidential response and, Nilsson, Mats: Ericsson comments on European Commission Public consultation on the Radio Spectrum Policy Programme, 23 December 2009.

modelling evidence which indicates that sub-1 GHz spectrum delivers better quality coverage when using a macrocell network when considered on a like-for-like basis.

- A3.115 We agree that, to some extent, operators without sub-1 GHz may have an incentive to build additional sites in order to improve their coverage. The evidence presented by H3G indicates that it might be costly to deliver coverage comparable to a network with sub-1 GHz by deploying more sites. This, in itself, does not suggest that sub-1 GHz is necessary for a national wholesaler to be credible. We remain of the view that national wholesalers with sub-1 GHz are likely to have some advantage in coverage over those without such low frequency spectrum, e.g. in terms of our lesser competition concern about competition for particular service or customer segments. But this is not the same question in relation to our larger competition concern about credibility of at least four national wholesalers. In our view, holding sub-1 GHz is only necessary if it is not possible or practical to deliver the minimum coverage required to be credible without sub-1 GHz spectrum.

Actions taken by other regulators

Summary of responses

- A3.116 H3G said that most European regulators recognise the importance of sub-1 GHz spectrum and many have taken measures to ensure a more even distribution of low frequency spectrum.¹⁴² Several regulators have adopted sub-1 GHz spectrum caps in combination with redistribution or re-auctioning. H3G said that some regulators explicitly suggest that some amount of sub-1 GHz spectrum is required for an operator to be competitive in the future (e.g. Opta in the Netherlands and ARCEP in France). H3G said that in all European countries that have already made a decision on the future use of the 900 MHz band, operators either already held comparable amounts of sub-1GHz spectrum or regulators intervened in order to ensure a more even distribution of that spectrum.
- A3.117 Everything Everywhere pointed out that, of the five selected countries we consider in our assessment of the importance of holding sub-1 GHz, the third operator holds a significant share of sub-1 GHz spectrum.¹⁴³ It said there is no country, which has allowed sub-1 GHz spectrum to be concentrated between just two operators. Operators previously without sub-1 GHz spectrum have been allowed preferential access to at least 2x5 MHz of sub-1 GHz spectrum.

Ofcom's response

- A3.118 We acknowledge that most other regulators have taken action to redistribute sub-1 GHz spectrum. The case for taking regulatory action to redistribute spectrum, such as sub-1 GHz spectrum, needs to be considered on a country-by-country basis, and should aim to address the specific risks to competition in a particular market. In this Statement we have set out our decision on the appropriate and proportionate measures which will promote competition in mobile communication services markets in the UK after the Auction. In relation to sub-1 GHz spectrum, this includes a safeguard cap, which ensures that sub-1 GHz spectrum is held by at least three national wholesalers. Whilst at the end of the Auction all national wholesalers could have sub-1 GHz spectrum, depending on the bidding in the Auction, we have rejected measures that ensure that outcome because we do not consider them appropriate and proportionate, as set out in Section 4 of this Statement.

¹⁴² Pages 189-190, H3G's non-confidential response.

¹⁴³ Page 17, Everything Everywhere's non-confidential response.

Commercial importance of good indoor coverage

Summary of responses

- A3.119 Everything Everywhere argued that a significant percentage of mobile data use is “deep indoors” and this will affect the majority of users at some point (especially higher value and business customers).¹⁴⁴
- A3.120 H3G referred to general evidence on the importance of coverage for customer satisfaction, for both residential consumers and business consumers.¹⁴⁵
- A3.121 H3G also argued that, based on past experience in the fixed broadband market, consumers are likely to be sensitive to quality differences in the provision of mobile broadband services. It said consumers in the fixed internet access market respond quickly and in large numbers to perceived differences in quality and consumer expectations can rise very quickly when better services appear on the market (as evidenced by the decline in dial-up connections and the rapid take-up of super-fast broadband).¹⁴⁶
- A3.122 H3G suggested that customer expectations and technological innovation reinforce each other: upgrades in network capabilities allow better services and applications, which in turn raise customer expectations and, in turn, encourage further rounds of investment in network capacity and innovation.¹⁴⁷ H3G also pointed out that consumer preferences and expectations are changing fast and new, innovative services will be available with the combination of the ‘cloud’ and the emergence of machine to machine (M2M) applications.

Ofcom’s response

- A3.123 We agree with Everything Everywhere that, while the poorer coverage associated with networks without sub-1 GHz spectrum may only affect a limited proportion of calls and data sessions, it is possible that a significantly higher proportion of customers may be affected at some points in time. In particular, if there is significant movement of customers in and out of the hardest to serve locations, it may be that the majority of customers could experience poorer coverage with an 1800 MHz network, for example, than they would with an 800 MHz network, at some stage.
- A3.124 However, to some extent other technologies (such as femtocells and Wi-Fi) are an alternative way to provide indoor coverage. Other technologies may be particularly relevant for some locations (such as in the home) which consumers use much more frequently. For the reasons set out in paragraphs A2.38, we consider small cells to be an important alternative way to provide good quality coverage for those without sub-1 GHz spectrum. It may also be possible to partly reduce the coverage difference through a larger macrocell network.
- A3.125 Also, the fact that the consequences of poorer indoor coverage associated with 1800 MHz networks (relative to 800 MHz networks) may be dispersed across many customers does not in itself suggest there are likely to be substantial competitive advantages from holding sub-1 GHz spectrum. Although the proportion of customers experiencing differences in coverage quality may be relevant, the extent of any competitive advantages from holding sub-1 GHz will also depend on:

¹⁴⁴ Page 18, Everything Everywhere’s non-confidential response.

¹⁴⁵ Page 219, H3G’s non-confidential response.

¹⁴⁶ Page 225, H3G’s non-confidential response.

¹⁴⁷ Page 232, H3G’s non-confidential response.

- the extent of any coverage advantages from sub-1 GHz over higher frequency networks (including the number of types of locations affected as well as the effect that the poorer coverage has on the quality of service);
- how often a particular customer is affected (which may be lower where the effects are more 'dispersed' due to movement across different location types, as described by Everything Everywhere above, or because more frequently used indoor locations, especially in the home, are more amenable to alternative ways to provide good quality coverage using small cells such as Wi-Fi); and
- the extent to which customers are aware of the differences in quality of coverage between networks with and without sub-1 GHz spectrum (given that networks with sub-1 GHz spectrum will also not be able to reach some locations), and place significant value on the superior coverage associated with sub-1 GHz networks, given the availability of alternative technologies, such as small cells to deliver good indoor coverage.

A3.126 While we accept that, in principle, many customers on a 1800 MHz network may be affected, at some point, by any inferior coverage (relative to sub-1 GHz spectrum), we ultimately judge it unlikely that the coverage disadvantage is so significant and prevalent that a national wholesaler could not be credible without sub-1 GHz spectrum. We set out the reasons for this conclusion from paragraph 4.74 in Section 4.

A3.127 We agree with H3G that, while it is not possible to predict exactly how demand for mobile services will evolve in response to changes in quality, evidence from fixed broadband market is indicative that consumers generally respond to improvements in quality by increasing demand and may switch networks if they are not receiving a sufficiently high quality service. However, we do not consider that the parallels with fixed broadband are close enough to explore in detail whether there are strong implications for mobile service and, in particular, to inform whether sub-1 GHz spectrum is necessary to enable a national wholesaler to be credible. For example, mobile network quality varies from place to place, so it is much harder for consumers to understand differences in quality, and some consumers may rely on other technologies (such as femtocells or Wi-Fi) for coverage in some areas.

Limitations on use of small cells as an alternative to sub-1 GHz

Summary of responses

A3.128 H3G suggested that small cell solutions are not realistic to mitigate the impact of not being able to reach deep indoor and hard to serve locations compared to using a sub-1 GHz macrocell solution.¹⁴⁸ Everything Everywhere also argued that small cell solutions can only ever be a partial solution.¹⁴⁹

Ofcom's response

A3.129 We consider that small cell solutions are likely to be particularly helpful in addressing small gaps in coverage and that, while helpful, they may not fully match the coverage that can be delivered using sub-1 GHz spectrum with a macrocell in all locations. We therefore agree with Everything Everywhere that they are only a partial solution and may not remove the difference in coverage between a network with sub-1 GHz

¹⁴⁸ Page 61, H3G's non-confidential response.

¹⁴⁹ Page 18, Everything Everywhere's non-confidential response.

spectrum and a network without. From paragraphs A2.38 above, we discuss the evidence we have drawn on relating to small cells..

Credibility without sub-1 GHz spectrum

Summary of responses

- A3.130 H3G argued that Ofcom does not have sufficient evidence to conclude that a national wholesaler can be credible without sub-1 GHz spectrum after the Auction.¹⁵⁰
- A3.131 H3G also argued that a fourth operator without sub-1 GHz spectrum will suffer from lack of scale because network deployment in a higher frequency band increases the number of cell sites needed to cover rural, urban and suburban areas. This will translate into a cost disadvantage.¹⁵¹ It also argued that an operator without sub-1 GHz is unlikely to be able to constrain mobile prices across a large proportion of the market after the Auction, because its service will not be attractive to the majority of smartphone users, particularly when compared against the service that Vodafone and Telefónica will be able to provide. H3G argued that the fourth national wholesaler may be forced to exit the market as the market for customers that do not value reliable mobile coverage will shrink rapidly over time or become a low price/low quality provider that does not act as a competitive constraint on operators with sub-1 GHz spectrum.¹⁵²
- A3.132 Conversely, Vodafone noted that in Italy Hutchison Whampoa's Group Managing Director stated that 3 Italia will be able to achieve "comparable performance" to the incumbent operators with only 2x15 MHz of additional spectrum, i.e. using its recently acquired 1800 MHz (2x5 MHz) and 2.6 GHz (2x10 MHz) spectrum.¹⁵³ H3G commented on the same quotation in its response, claiming it was taken out of context as 3 Italia has been granted 2x5 MHz of 900 MHz spectrum as part of UMTS liberalisation. As a consequence 3 Italia has a highly beneficial coverage layer to complement its holdings at 1800 MHz and 2.6 GHz is expected to receive 2x5 MHz of 900 MHz in the near future.¹⁵⁴

Ofcom's response

- A3.133 We agree with H3G that we do not have definitive evidence that a national wholesaler can be credible without sub-1 GHz spectrum (nor do we have definitive evidence that a national wholesaler would not be credible without such spectrum). But having considered the evidence and responses, our judgement is that it is unlikely to be necessary to hold sub-1 GHz spectrum to be a credible national wholesaler. We do not consider it appropriate and proportionate to take measures to ensure at least four national wholesalers have sub-1 GHz spectrum, although such an outcome remains a possibility depending on bidding in the Auction. See Section 4 and also from paragraph A2.3 for explanation of our decision and the evidence we drew on.
- A3.134 The statement regarding 3 Italia being able to offer "comparable performance" to its rivals, without access to as much sub-1 GHz spectrum, is consistent with our view that sub-1 GHz is not necessary to be credible. However, as H3G noted, 3 Italia is expected to get 2x5 MHz of 900 MHz spectrum in the near future which is likely to improve its ability to be credible. As a result we do not think it is possible to draw

¹⁵⁰ Page 82, H3G's non-confidential response.

¹⁵¹ Page 103, H3G's non-confidential response.

¹⁵² Page 82, H3G's non-confidential response.

¹⁵³ Vodafone's non-confidential response to the January 2012 consultation, pages 20-21.

¹⁵⁴ Page 108, H3G's non-confidential response.

strong conclusions on the importance of sub-1 GHz spectrum from this statement. (Also, we are cautious of drawing strong inferences for credibility from the distributions of spectrum holdings in a small number of international examples because there may be particular reasons for the circumstances in those countries).

Refarming of 900 MHz and 1800 MHz spectrum

Summary of our position in January 2012 consultation

A3.135 In Annex 8 of the January 2012 consultation, we concluded that:¹⁵⁵

- It is likely that Vodafone and Telefónica would find it profitable to refarm at least 2x10 MHz of 900 MHz spectrum from 2G to UMTS by around 2016, if UMTS offers significant advantages to consumers over 2G. If the advantages of UMTS (or LTE) were sufficiently large, it might be profitable for them to refarm earlier and incur costs of dealing with displaced 2G traffic (or ceasing to serve it).
- The move to LTE900 is longer term and there is considerable uncertainty over when it might be profitable. This partly depends on how much of a commercial advantage LTE gives over HSPA – the larger the advantage, the more incentive Vodafone and Telefónica have to refarm. If LTE has a significant advantage over HSPA, we would expect Vodafone and Telefónica to progressively refarm 900 MHz spectrum to LTE, as the availability of LTE900 user devices increases.
- Everything Everywhere will be able to start refarming 1800 MHz spectrum to LTE quickly. It is likely to be able to refarm at least 2x10 MHz by the time of the first tranche of divestment in September 2013. It can then refarm progressively more of the 2x45 MHz of 1800 MHz that it will retain after divestment over time, as 2G-only devices fall in importance.

Summary of responses

A3.136 Vodafone argued that to minimise the difference in data performance between HSPA and LTE, the band would need to be cleared of all voice traffic.¹⁵⁶

A3.137 Telefónica considered that Ofcom's suggestion that there would be a faster move to LTE900 the greater the performance difference between HSPA+ and LTE failed to take account of the potential lack of an LTE900 ecosystem, which would be dependent on whether operators in other countries had a demand for LTE900.¹⁵⁷

A3.138 Telefónica also considered that there were inconsistencies in Ofcom's description of how 900 MHz spectrum could be refarmed to LTE and other parts of Ofcom's proposals. If Telefónica needed to implement HSPA+DC to be competitive with LTE800, this would leave only 2x7.4 MHz of 900 MHz spectrum for GSM. But Telefónica considered that Ofcom's own argument was that LTE in a bandwidth of only 2x5 MHz provides little performance improvement. Telefónica therefore considered that this implied a post-refarming configuration of spectrum of either:

- 2x10 MHz LTE, 2x5 MHz HSPA and 2x2.4 MHz GSM, which Telefónica considered would drastically reduce the experience of HSPA users and probably make GSM cease to function; or

¹⁵⁵ See in particular paragraphs A8.3, A8.30 and A8.36 of Annex 8 to the January 2012 consultation.

¹⁵⁶ Vodafone's non-confidential response, answer to question A8.1, page 45.

¹⁵⁷ Telefónica's non-confidential response, paragraph 297.

- 2x10 MHz LTE, 2x7.4 MHz GSM and no HSPA.
- A3.139 Telefónica considered that this must make the date at which they could refarm to LTE either when GSM was due to be switched off, or when all HSPA devices are also LTE900 devices. In either case, it considered that this may not be for another decade.
- A3.140 Everything Everywhere agreed with Ofcom that Vodafone and O2 could refarm 2x10 MHz of 900 MHz spectrum by 2016. Furthermore, it did not expect the cost (in terms of displaced 2G traffic) of bringing this forward to 2013/14 would be very significant. Everything Everywhere considered Ofcom's estimate for when it could refarm 1800 MHz spectrum for LTE to be reasonable.¹⁵⁸

Ofcom's response

- A3.141 We agree with Telefónica that the speed of the development of an LTE900 ecosystem is partly dependent on whether operators in other countries have a strong demand for LTE900. We also recognise that there is currently a paucity of LTE900 user devices and that there is some uncertainty on when there will be a good selection of LTE900 capable devices. However, as set out from paragraph A2.59, there is evidence that support for LTE900 is gaining momentum. We consider that if national wholesalers wanted to use 900 MHz spectrum for LTE, they would be able to obtain a reasonable selection of LTE900 user devices.
- A3.142 We do not agree with Telefónica that our arguments are inconsistent, for the reasons set out below. We do not agree that it (and Vodafone) would necessarily need to wait until either GSM was switched off or all HSPA devices are also LTE900 devices before refarming some 900 MHz spectrum for LTE.
- A3.143 Given that refarming between technologies is likely to happen gradually over time, envisaging a single 'post-refarming' configuration may make little sense. Rather, there are likely to be a number of different paths that refarming may follow, which will involve different configurations over time.
- A3.144 Telefónica and Vodafone can choose their own paths for refarming. At some point in time, these paths may include one of the two configurations that Telefónica mentions, or they may not.
- A3.145 Other possible paths may involve, for example, only refarming 2x5 MHz of 900 MHz spectrum for LTE at some point. Also, as we noted at paragraph A8.6.3 of the January 2012 consultation, LTE has been designed to operate in small blocks of 2 x 1.4 MHz and 2 x 3 MHz, to ease the transition if refarming directly from 2G. Another path might therefore involve progressively refarming small amounts of 900 MHz spectrum from 2G directly to LTE.
- A3.146 Depending on how Telefónica and Vodafone choose to manage refarming, it is possible that at some points in time they will have a single 2x5 MHz carrier at HSPA900 and a single 2x5 MHz LTE block. For the period for which this is the case, we accept that if they did not have 800 MHz spectrum they would have lower peak data rates with sub-1 GHz spectrum compared to those using LTE with wider bandwidth at 800 MHz. However, this may be a temporary issue until they refarm more spectrum to LTE, and we anyway consider that highest peak data rates are unlikely to be necessary for credibility.

¹⁵⁸ Everything Everywhere's non-confidential response, answer to question A8.1, page 45.

- A3.147 If however high peak data rates turned out to be very important to consumers, this would be likely to mean it was more profitable to rapidly refarm large amounts of 900 MHz spectrum for LTE (or HSPA+DC), and reduce the spectrum used for 2G (and perhaps also HSPA).
- A3.148 More generally, Telefónica and Vodafone have discretion over how to use their 900 MHz spectrum. They will seek to use it in the most profitable way, which is likely to involve trying to deliver services that consumers most value. The most profitable use of the spectrum is likely to change over time, depending on consumers' demand, the stock of user devices (which is partly under Telefónica and Vodafone's control) and the costs of the different options. We would expect Telefónica and Vodafone to continue using some 900 MHz spectrum for GSM and HSPA if that were more profitable than using it all for LTE.
- A3.149 Whether or not GSM would strictly cease to function as Telefónica argued, we consider that only 2x2.4 MHz spectrum would give very low capacity and high overheads in terms of signalling, which may not be very efficient. Even if it did not function, it would not change our conclusion. It would merely reduce the number of refarming paths available for Telefónica and Vodafone.
- A3.150 We therefore consider that our provisional conclusions in the January 2012 consultation on refarming 900 MHz and 1800 MHz spectrum are reasonable.

Capacity and average data rates

Summary of our position in January 2012 consultation

- A3.151 In the January 2012 consultation, we said the capacity in a mobile network can be defined as a network's ability to supply a given traffic demand at a specified level of quality. Capacity can therefore impact both the number of customers that can be served and the quality of services that can be delivered to them. For a given number of customers, the greater the capacity, the higher the data rates those customers will tend to receive. We said that consumer research suggested that consumers value higher data rates.¹⁵⁹
- A3.152 We concluded that it was necessary at a minimum for national wholesalers to have sufficient capacity in order to serve enough customers with sufficiently high data rates for them to be credible. However, we also noted that there are other approaches to increasing capacity besides spectrum acquisition, and so national wholesalers with smaller spectrum shares than their competitors may be able to deliver comparable levels of capacity by relying on these other approaches. In any case, we considered that it is not necessary for national wholesalers to have the same capacity as the largest in order to be a credible competitor, as a national wholesaler that faces some constraints on capacity or that is more capacity constrained than its competitors may still be able to act as a competitive constraint across a large proportion of the market.
- A3.153 Therefore we did not consider that national wholesalers need the same, or close to the same, overall quantities of spectrum in order to act as credible national wholesalers and influence competition. This is consistent with what is observed in other countries where spectrum holdings vary considerably.

¹⁵⁹ See paragraphs 3.14 to 3.70 of Annex 6 of the January 2012 consultation for our full discussion of capacity and average data rates.

- A3.154 While there are a number of substitutes available, we recognised that spectrum is an important input to capacity and national wholesalers with very small quantities of spectrum may struggle to deliver the minimum level of capacity and average data rates needed to provide a significant competitive constraint. This was also consistent with evidence from other European and non-European countries. Further, we considered that it will be increasingly important for national wholesalers to have sufficient spectrum and capacity in the longer term, given our expectations for increasing demand for data services. Therefore we concluded that national wholesalers with very small spectrum shares may represent a weak competitive threat because their costs for expanding to serve more consumers or meeting increased expectations of existing customers may be substantially higher than for their competitors.¹⁶⁰
- A3.155 We noted¹⁶¹ that it is difficult to identify what the minimum level of spectrum a national wholesaler would need in order to be credible, and considered that to some extent this will depend on the frequency of spectrum held and the ability to deliver other quality dimensions. But, broadly, we provisionally concluded that there would be a material risk that a national wholesaler would not have enough capacity to be credible if it held less than 10% to 15% of total paired spectrum holdings¹⁶². The smaller the share of spectrum held below this the greater the risk that a national wholesaler would not be credible and the risk reduces the higher that share is beyond 15%.
- A3.156 In relation to our second type of competition concern about competition across a wide range of services and customers, we recognised that a national wholesaler with lower shares of spectrum relative to its competitors may be a weaker competitor in some particular segments of services or customers, even if it has enough spectrum to act as a credible national wholesaler.

Topics in responses

- A3.157 There was no strong disagreement in responses with the view that average data rates matter to consumers. Responses focussed on our conclusion of the share of spectrum. In the following sections, we group responses under the following headings:
- Factors other than proportion of total spectrum are relevant for capacity;
 - Concerns with the use of international comparisons to determine minimum amount of spectrum required;
 - Exclusion of unpaired spectrum in capacity analysis;
 - Role of frequency in capacity; and
 - Commercial strategies to mitigate capacity limitations.
- A3.158 We consider these in turn below first summarising responses and then setting out our response.

¹⁶⁰ Paragraph 4.73 of the January 2012 consultation.

¹⁶¹ Paragraph 4.74 of the January 2012 consultation.

¹⁶² See Table 4.1 of the January 2012 consultation.

A3.159 After considering these issues, we then briefly discuss related points raised in some responses to our Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences.¹⁶³

Factors other than proportion of total spectrum are relevant for capacity

Summary of responses

- A3.160 As well as absolute spectrum holdings, Everything Everywhere¹⁶⁴ argued that having sufficient capacity to provide services to a particular number of customers is also dependent on a range of other inputs, and so it cannot be as simple as suggesting a certain share of overall spectrum available will inevitably make an operator credible. Instead, it argued the implications for other costs also need to be taken into account. For example, the interaction between capacity and the amount of backhaul required should be taken into account as the number, type and location of sites (which to a significant extent is determined by the composition of spectrum holdings) will also determine the cost of the relevant backhaul capacity, the demand for which will increase as data demand increases.
- A3.161 Everything Everywhere¹⁶⁵ also argued that considering the amount of spectrum relative to the overall amount of mobile spectrum available ignores the issue of capacity required by each operator in order to support a particular size of customer base. It argued therefore that Ofcom appeared to be in effect assuming that either each operator should be considered as having the same market share; or that 10-15% of available spectrum capacity is required in order to reach minimum efficient scale. Although it considered that neither of these assumptions was made explicit, it further argued that under either approach the basis for the assumption and why this amount of spectrum capacity is required for credibility is unclear.
- A3.162 In relation to the latter assumption, Everything Everywhere¹⁶⁶ argued that the concept of minimum efficient scale is not a relative issue affecting the relative competitiveness of operators (e.g. asymmetries in spectrum holdings in terms of overall capacity or access to important bands). Instead, it argued that it relates to whether an operator is credible on a standalone basis, which requires an assessment of the absolute concept of minimum efficient scale. This, it argued, requires an absolute amount of spectrum which is able to deliver sufficient capacity to serve enough customers (capacity per customer) to compete against others, but also generate sufficient revenue to earn a reasonable return. So it argued that if we were suggesting that H3G (or even Vodafone or O2) is below minimum efficient scale, we have not provided justification, evidence or reasoning for that position. It argued that such an assessment would need to take account of the different network assets required at different frequencies to provide a sufficient amount of capacity (including the different backhaul costs required for different numbers of sites) and what was required to make a reasonable return from these assets.
- A3.163 Further, Everything Everywhere¹⁶⁷ argued that operators should be able to acquire sufficient spectrum in the Auction such that the relative spectrum to customer ratio allows individual operators to compete effectively (and that operators have an

¹⁶³ Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences to allow use of LTE and WiMAX technologies, Ofcom, 13 March 2012:

<http://stakeholders.ofcom.org.uk/consultations/variation-1800mhz-lte-wimax/>

¹⁶⁴ Everything Everywhere's non-confidential response, page 15.

¹⁶⁵ Everything Everywhere's non-confidential response, page 16.

¹⁶⁶ Everything Everywhere's non-confidential response, page 16.

¹⁶⁷ Everything Everywhere's non-confidential response, page 17.

appropriate mix of available spectrum, including sufficient spectrum to ensure competitive levels of coverage). Ofcom's 10% - 15% benchmark, it argued, is irrelevant to this consideration. This is because the relative amounts of spectrum currently held by individual operators, and under a range of reasonably likely outcomes from the Auction, do not provide an extreme position in relation to the amount of spectrum per customer, and a competitive market does not require equal market shares or symmetric operators.

Ofcom's response

- A3.164 We agree that there are a range of inputs other than share of total paired spectrum holdings which affect the credibility of a national wholesaler. This is in part why we considered other ways to increase capacity (rather than just spectrum) and the effectiveness and cost implications of these. It is also why we do not consider that spectrum holdings need to be equal across four national wholesalers. However as set out in the January 2012 consultation (paragraph 3.26 of Annex 6 onwards) and in Section 4 from paragraph 4.56, spectrum is an important input to capacity as there are limits to the suitability of alternative ways to increase capacity, meaning an operator with a very small share of total spectrum holdings may struggle to deliver the minimum level of capacity needed to provide a significant competitive constraint. As a result, a key part of our assessment of credibility relates to the trade off between spectrum and other ways of providing capacity, and what this implies for the minimum share of total spectrum holdings required for an operator's capacity to be credible. The implications for the costs of other inputs, including backhaul, are clearly relevant to this assessment.
- A3.165 As discussed in the January 2012 consultation, the marginal cost for incremental units of capacity through investment in macrocells tends to be higher for operators with a very small share of total mobile spectrum than those with a greater share. This is because more sites will need to be added for any given capacity increase if a national wholesaler has little spectrum. As part of this, we also discussed the practicality of very large site numbers, including planning permissions and the likely higher cost per site as site numbers increase.¹⁶⁸ This overall view of marginal costs for additional capacity also implicitly reflects the costs of other inputs (such as backhaul) that may also be higher with more sites¹⁶⁹, even though they were not explicitly quantified individually in the January 2012 consultation. In light of this assessment of costs, we considered that it was possible that the level of network investment required to serve customers may threaten the credibility of a national wholesaler if it only had a very small spectrum share.
- A3.166 We also note the potential role that small cells could play to provide additional capacity, but consider there to be a limit to the extent they can substitute for a macrocell network (as discussed in Section 4).
- A3.167 Therefore while there are a number of partial substitutes, spectrum is an important input to capacity. Other input costs were reflected in our conclusions that the more sites that are required the higher the marginal cost of additional capacity. Therefore the greater the risk that an operator with a small share of total spectrum may not be able to establish enough capacity through alternatives to spectrum to provide a significant competitive constraint (and so act as a credible competitor).

¹⁶⁸ See, for example, paragraph 3.35 of Annex 6 of the January 2012 consultation.

¹⁶⁹ It seems reasonable to assume that backhaul costs (in aggregate) will tend to increase as the number of sites increases (or indeed, as data demand increases), and so the general conclusion still appears relevant.

- A3.168 In relation to Everything Everywhere's argument about capacity requirements being an absolute rather than a relative issue, we are not assuming each operator has or should have equal market share or equal capacity. This is reflected in our view that not all spectrum holdings need to be the same between four national wholesalers¹⁷⁰, and the fact that the 10-15% range is indicative (below which we consider the risk to credibility increases) rather than a definitive "non-credible" level.
- A3.169 Furthermore, our analysis is not an attempt to establish the minimum efficient scale, which is the level of output (or traffic capacity) at which average costs are minimised. Instead we seek to identify the minimum share of spectrum, an important input, required to be credible given that a national wholesaler's marginal cost of expanding output is likely to be higher than its competitors if it has significantly less spectrum. It is therefore more reliant on other inputs (such as sites) to expand capacity. This question relates to the relative spectrum holdings of competitors and how this affects their mix of inputs and relative competitiveness, given the availability of other ways to increase capacity.
- A3.170 The assessment of what is required to be capable of exerting an effective constraint on its rivals is strongly influenced by a relative comparison of one national wholesaler compared to its rivals, as rivals need to be able to compete with one another for there to be strong competition. Whilst national wholesalers do not need to be in fully symmetric positions, if one faces very high costs to expand its capacity compared to its rivals, then it may cease to be able to exert a competitive threat across a large proportion of the market. National wholesalers with very small spectrum shares will be limited in the proportion and type of consumers they can serve and/or the average data rates they can provide.
- A3.171 As a result, we consider it necessary for national wholesalers to have sufficient capacity relative to rivals to serve enough customers with sufficiently high data rates for them to be credible. However we do not consider it appropriate to base this assessment on spectrum per customer estimates, particularly based on existing customer bases. This is because it is not clear why current market shares or customer numbers would necessarily be optimal in the longer term, and so restricting the analysis to spectrum per customer on this basis does not seem the most appropriate benchmark for assessing whether a national wholesaler will be credible in the future.
- A3.172 We take into account the role that other factors may have in affecting credibility by recognising that to some extent the minimum amount of spectrum required will depend on the frequency of spectrum held, and the ability of national wholesalers to deliver other quality dimensions. As such, the 10-15% range was provided as an indicative range, where we broadly considered that there is some risk that a national wholesaler would not have enough capacity to be credible if it held less than this, and the smaller the share held below this the greater the risk. Conversely, we considered that the risk that a national wholesaler does not have the necessary minimum spectrum for capacity reduces as the share increases above 15%. Therefore the range was used to provide an indication on a scale of risk to credibility rather than a threshold above which the risk to credibility immediately and automatically disappeared. Having considered the importance of all four quality dimensions (not just capacity), we then separately assessed the specific spectrum holdings of existing operators against these. This reflected individual bands and quantities held as well as

¹⁷⁰ And indeed, we recognised that a national wholesaler that faces some constraints on capacity or that is more capacity constrained than its competitors may still be able to act as a competitive constraint across a large proportion of the market.

network assets, and set out our interpretation of what this suggests for their credibility as national wholesalers (both with current spectrum holdings and under different Auction outcomes)¹⁷¹.

A3.173 Finally, if we considered that the Auction would definitely achieve an outcome with four credible national wholesalers without intervention, we would tend to agree that our 10-15% indicator of total spectrum holdings is unlikely to be relevant for individual operators or their bidding strategies. However, we need an indication of the minimum spectrum requirements for a national wholesaler to be credible in order to assess whether the Auction is likely to deliver such an outcome. Further, we do not agree with Everything Everywhere that, without measures, every national wholesaler will necessarily be able to acquire sufficient spectrum such that it is able to compete effectively without intervention. We previously set out the reasons around strategic investment and intrinsic value in the January 2012 consultation and they are considered further in this statement.

A3.174 Therefore we consider that an indicative proportion of total spectrum holdings available after the Auction at which there is a risk to credibility (and below which the risk increases), is relevant in considering what Auction outcomes may raise competition concerns. In addition, we note that this proportion is entirely consistent with the view that a competitive market does not require equal market shares or symmetric operators.

Concerns with the use of international comparisons to determine minimum amount of spectrum required

Summary of responses

A3.175 Several concerns were raised about the validity and robustness of international comparisons. Everything Everywhere¹⁷² considered that the underlying issue around capacity was that a competitive market structure would require individual competitors to have sufficient spectrum to reach minimum efficient scale (discussed above). This level of operation, it argued, would be market specific in that it is an interaction between the spectrum available, an operator's network, and the number of subscribers/volume of services the spectrum and network in combination can support. Further, it argued that the scale required for future competitiveness is also likely to be operator specific. Consequently, Everything Everywhere argued that having sufficient spare capacity will depend on the specific circumstances and the consultation does not explain why international comparisons should be the relevant benchmark.

A3.176 Even if the international comparisons were appropriate, some concerns were raised about the conclusions that had been drawn from them. In particular, abstracting from its concerns over their use, Everything Everywhere¹⁷³ argued that the analysis of spectrum shares in countries with four operators does not, if taken at face value, support a notion that no operator holds less than the 10-15% range. It noted that two of the nine countries show a national wholesaler with holdings of less than 10%, and argued it was unclear that this should be viewed as "unusual", as concluded by Ofcom in Annex 9 (Figure 9.5). In addition, it noted that only two out of the nine countries showed the smallest spectrum holding to be 15% or more (Sweden and

¹⁷¹ The assessment of specific operators was set out in Section 4 of Annex 6 of the January 2012 consultation and in Section of this Statement.

¹⁷² Everything Everywhere's non-confidential, page 15.

¹⁷³ Everything Everywhere's non-confidential, page 16.

Germany), and so by Ofcom's previous definition of the term, it argued that the upper value of the range would also be considered unusual. Everything Everywhere also argued that the "15%" seems to have been added when bringing in evidence from Annex 9 into the design of an intervention, but 15% is not mentioned there. Everything Everywhere therefore considered that Ofcom's setting of the appropriate range as being between 10% and 15% seemed arbitrary.

- A3.177 In addition, Everything Everywhere¹⁷⁴ questioned the usefulness of the international benchmarks as all auctions in European countries had some form of caps. As a result, Everything Everywhere argued that these spectrum distributions in figure 9.5 of Annex 9 of the consultation are the result of regulatory interventions rather than an indication of appropriate levels of competition. As a result, they argued that it is not clear they show anything other than the result of those caps restraining some operators in the amount of spectrum they could acquire.
- A3.178 Everything Everywhere¹⁷⁵ also argued that although Ofcom recognised some of the difficulties in using international comparisons, the concerns raised there did not feed into the conclusion that there is "some risk" if an operator holds less than 10-15% in paragraph 3.69, where the only supporting evidence for this figure, other than the international comparisons, is two quotations from analysts. Therefore Everything Everywhere considered that while such comparisons could be used to inform a judgement of the relevant minimum efficient scale, it should not be the only evidence relied on. It also argued¹⁷⁶ that the caveatted judgement that there is "some risk" that a national wholesaler would not be credible without 10-15% of overall spectrum evolved in the summary table to a simplified and more concrete view that sufficient capacity has the status of "being necessary".

Ofcom's response

- A3.179 Everything Everywhere's argument about minimum efficient scale is discussed further above. While we agree that the minimum share of spectrum required to be credible may be affected by a number of market-specific factors, we consider that international comparisons can help inform this assessment. We acknowledged in the January 2012 consultation the potential difficulties in drawing firm lessons from auctions held elsewhere.¹⁷⁷ However, we still consider such comparisons can provide relevant evidence for our assessment, as long as the limitations are reflected, since we are considering the minimum share of spectrum necessary to be credible (rather than the absolute concept of minimum efficient scale).¹⁷⁸ The following discusses the other issues raised by Everything Everywhere and in doing so describes our view of the role of international comparisons and why we consider them relevant, providing they are used and interpreted carefully.
- A3.180 Capacity is an important part of our analysis of the requirements for a credible national wholesaler, and so it was important to take a view on the share of spectrum holdings required since spectrum is an important input to the provision of capacity. As a result, we did not consider that the difficulties in interpreting the international information and its application to the UK were sufficient to make such comparisons

¹⁷⁴ Everything Everywhere's non-confidential response, page 16.

¹⁷⁵ Everything Everywhere's non-confidential response, page 15.

¹⁷⁶ Everything Everywhere's non-confidential response, page 19.

¹⁷⁷ For example in paragraph 3.63 of Annex 6 of the January 2012 consultation.

¹⁷⁸ The more operator-specific considerations (in section 4 of Annex 6 the January 2012 consultation) were reflected separately and subsequent to the general analysis of the importance of quality dimensions for credibility (in Section 3 of Annex 6 the January 2012 consultation, and specifically paragraphs 3.14-3.70 for capacity).

irrelevant for this assessment. Nor do we consider that this was the only evidence which informed our view. Instead, having considered the importance of capacity for consumers, expected growth in data rates, the suitability of alternative ways to use spectrum to increase capacity (and how this impacted the marginal cost of increasing capacity) and the international comparisons, we provisionally concluded that there was a material risk a national wholesaler may struggle to be credible if it held a very small share of spectrum.

A3.181 We were of the view that this was consistent with evidence from other countries which showed, in general, the minimum share of spectrum held by a national wholesaler is close to 10%. We acknowledge that the fourth national wholesaler in two of the countries we presented has a share of spectrum below this level, but both Belgium and The Netherlands have spectrum that has not been assigned yet (as set out from paragraph A2.184 of Annex 2). In some countries (especially in the EU), the spectrum shares were driven by very recent auctions¹⁷⁹. We did not consider it clear that the national wholesalers with the smallest shares were necessarily credible. We considered it possible that those with very small shares may have limited influence on competition. For this reason, we did not think it safe to conclude that 10% was necessarily a safe minimum share for a national wholesaler to be credible solely on the basis that two operators in other countries held less than this.

A3.182 Similarly, we recognise that in only two of the countries presented in the January 2012 consultation did the fourth national wholesaler hold more than 15% of total paired spectrum after the auction. However, we do not consider that this undermines the upper value of the range given its purpose. We are not seeking to make the spectrum holdings of a fourth national wholesaler identical to those in other countries, but instead understand the level of spectrum capacity at which there is a material risk to credibility. However, in light of the difficulties in assessing the minimum share of spectrum necessary to be credible and our concerns around relying solely on 10% discussed above, we could not scientifically calculate a value. Instead, we sought an indicative range that we could then use to help assess an operator's credibility, but subsequently taking into account a range of other factors (in the "in the round" assessment). Based on international experience, 15% seemed like a reasonable upper limit in light of our views of 10%, but again, reflecting the potential limitations around international comparisons, this was not rigidly applied. As such, we do not consider 15% to be unreasonable.

A3.183 In addition, no respondent has provided clear evidence that a spectrum share below that range poses a low risk to credibility in the UK. That said, to further reflect the limitations of international comparisons, we did not use a rigid and mechanistic threshold defining capacity as either "credible" or "not credible". Instead, the 10-15% range was provided to indicate the minimum share of total paired spectrum required at which there was some risk to credibility (with the degree of risk increasing as the share moved below this and decreasing as the share moved above this).

A3.184 Therefore our conclusion is that there is a material risk a national wholesaler would not have enough capacity to be credible if it held less than 10-15% of total paired spectrum holdings available after the Auction¹⁸⁰ (and the smaller the share below this, the greater the risk they would not be credible). This is ultimately a regulatory judgement based on the information available, recognising the limitations and uncertainties around some of the evidence including the international information.

¹⁷⁹ For example, a description of the situation in Belgium is set out in paragraph A3.389.

¹⁸⁰ See, for example, Table 3.3 of Annex 6 the January 2012 consultation.

A3.185 We consider that this balanced risk-based judgement was reflected throughout the analysis, and this is discussed further below in relation to responses on the “in the round” assessment. However, specifically in relation to capacity, it is very cumbersome to fully repeat the caveats at every stage of a document (and every time capacity is mentioned), but we consider that the language clearly reflects the risk-based intention of our capacity analysis rather than a more definitive threshold view of 10-15% of total spectrum. For example:

- a) We noted it was difficult to identify the minimum amount of spectrum since to some extent it will depend on the frequency of spectrum held and ability to deliver the other quality dimensions¹⁸¹. As such, we built on our initial conclusions on the importance of different quality dimensions by reflecting operator-specific considerations in the national wholesaler-specific “in the round” assessment of credibility, rather than applying the 10-15% mechanically¹⁸².
- b) 10-15% of total spectrum holdings was not rigidly applied in considering the various portfolios, since one of our smaller portfolios would place a fourth national wholesaler below the 10% share if they did not win any other spectrum. Our view of this outcome was that it would “only give a low level of confidence” of credibility, not that it would definitively fail to be credible.
- c) Overall uncertainties around capacity and any trade-offs with other dimensions were discussed in the full “in the round” analysis in Section 4 of Annex 6 in the January 2012, see for example paragraph 4.44.

A3.186 Therefore we acknowledge the limitations of the data and information used to inform our provisional conclusion that there is a risk that a national wholesaler would not have enough capacity to be credible if it held less than 10-15% of total paired spectrum available after the Auction. Indeed many of the limitations of international comparisons raised by Everything Everywhere were also acknowledged in the January 2012 consultation and in this Statement (see Annex 2). However, we ultimately made a regulatory judgement based on the information available (including the importance of capacity for consumers and spectrum alternatives), and for all the reasons above we consider this judgement recognised the limitations and uncertainties around some of the international information. We also note that no respondents suggested an alternative range or provided a quantified alternative approach to assess the minimum spectrum holding required to be credible.

A3.187 As such, we do not agree that these limitations around the international comparisons make the range irrelevant or that the range is arbitrary, providing the purpose of the 10-15% figure is maintained and applied consistently across operators and portfolios. Namely, rather than representing a point at which there is a definitive credibility concern, it should be interpreted broadly as a range of shares of the total paired spectrum available after the Auction below which we consider there to be a material risk that a national wholesaler would not have enough capacity to be credible. The smaller the share of spectrum held below 10-15% the greater the risk that a national wholesaler will not be credible, and the risk reduces the higher that share is beyond 15%. For the reasons discussed above, this was the intention in the January 2012 consultation, and is also maintained in this Statement.

¹⁸¹ See, for example, paragraph 3.69 of Annex 6 of the consultation.

¹⁸² Section 4 of Annex 6 of the consultation.

Exclusion of unpaired spectrum in capacity analysis

Summary of responses

A3.188 One respondent suggested that the unpaired spectrum (in particular, 2.6 GHz TD-LTE) should be included in the reserved portfolios for capacity purposes.

Ofcom's response

A3.189 We explain our reasons for excluding unpaired 2.6 GHz from the reserved portfolios in Section 4 and from paragraph A.277 of Annex 2.

Role of frequency in capacity

Summary of responses

A3.190 As well as a minimum amount of spectrum, one respondent noted that low frequencies have additional capacity benefits and considered we had understated these. In particular, it argued that 2x15 MHz of 800 MHz is superior to the same bandwidth of 1800 MHz from a capacity perspective (as well as coverage and speed).

A3.191 Further, a respondent argued that a single low frequency band has advantages over a multiple band portfolio with the same total bandwidth because the signal quality in-building is on average higher due to the better coverage properties of the low frequency spectrum.

Ofcom's response

A3.192 We agree lower frequency spectrum can deliver more capacity, and consider this was expressed in the January 2012 consultation¹⁸³ as reflected in our view that to some extent the minimum level of spectrum a national wholesaler would need to be credible depends on the frequency held. This is also discussed in paragraph 4.69] in Section 4. We consider we have taken this into account in our assessment of the portfolios in the round.

A3.193 We also agree that a single low frequency band has advantages over a multiple band portfolio with the same total bandwidth because the signal quality in-building is on average higher due to the better coverage properties of the low frequency spectrum. Again, we consider we have taken this into account in our assessment of the portfolios in the round.

Commercial strategies to mitigate capacity limitations

Summary of responses

A3.194 Another argument raised in responses was that there are commercial strategies (such as pricing of usage and limiting supply of devices in some areas) that can help mitigate any capacity limitations as well as the other measures identified by Ofcom.¹⁸⁴ In particular, it was argued that a constrained operator should still be able to maintain sufficiently high levels of quality for the majority of its customers by designing the

¹⁸³ For example, see paragraph 3.47 onwards.

¹⁸⁴ In paragraph 3.23 onwards of Annex 6 of the January 2012 consultation.

customer proposition appropriately in a way that maximises the data speeds from its capacity.

Ofcom's response

- A3.195 As set out in the January 2012 consultation we consider there to be a range of approaches that can allow a national wholesaler to compete with smaller capacity, including by adopting different commercial strategies.¹⁸⁵ Therefore we consider that a national wholesaler that faces some constraints on capacity or that is more capacity constrained than its competitors may still be able to act as a competitive constraint across a large proportion of the market. This is why we do not consider it necessary for national wholesalers to have the same capacity (let alone the same quantity of spectrum) in order to be credible competitors.¹⁸⁶
- A3.196 However, we consider there is a limit to this. A national wholesaler with a very small share of total spectrum may cease to be credible. In particular, if at a minimum a national wholesaler did not have sufficient capacity in order to serve enough customers with sufficiently high data rates, the scope to manage this and remain credible through these strategies may be limited. In addition, restricting the supply of devices in certain areas or adapting pricing to reflect capacity usage in response to having insufficient capacity to be considered credible rather than in response to customer demands or competitive pressures in the market may weaken the competitive threat posed by that national wholesaler. As such, for an operator with a very small share of spectrum, these commercial strategies could further undermine its credibility as a national wholesaler rather than improve it.
- A3.197 While it is difficult to know precisely how much capacity might be needed in the future for a typical national wholesaler, future data growth projections largely show a strong upward trend. Therefore a national wholesaler with only a very small proportion of total spectrum holdings may find such commercial strategies to manage capacity undermine their credibility as a competitor.

Responses to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences

- A3.198 Some responses to our Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences argued that if the 1800 MHz spectrum were liberalised for LTE, Everything Everywhere would initially be able to provide much higher average data rates to consumers served with the 1800 MHz spectrum. This would be due primarily to the large amounts of spectrum available per customer compared to on existing 3G networks, i.e. the LTE network would be lightly loaded.¹⁸⁷
- A3.199 Some responses also provided evidence of significantly higher average data rates that have been achieved either in LTE trials or with commercial LTE developments internationally, which was partly due to them being lightly loaded.
- A3.200 Responses generally regarded these higher average data rates as an important advantage.

¹⁸⁵ See for example, paragraph 3.22 of Annex 6 of the January 2012 consultation.

¹⁸⁶ Paragraph 4.72 of the January 2012 consultation.

¹⁸⁷ <http://stakeholders.ofcom.org.uk/consultations/variation-1800mhz-lte-wimax/?showResponses=true>

A3.201 We consider these views are consistent with our view in this Statement that average data speeds are important for consumers, and that as a result of this the share of spectrum is important when considering the credibility of a national wholesaler.

Ability to provide services with the highest peak data rates

Summary of our position in January 2012 consultation

A3.202 We considered three forms of data rate:

- **The peak data rate** which the technology can deliver under ideal signal conditions and without contention between users (i.e. a single user occupying all of the resources of one cell and very close to the base station).
- **The single user throughput** is the maximum data rate that a single user would theoretically be able to receive if the only user in the serving cell demanding service at any particular instant of time, but when the user may not be at a location with ideal signal conditions. If the user is very close to the base station, the single user throughput would be the same as the peak data rate.
- The **average data rate** is the data rate which users actually experience under realistic conditions in a network shared with other users.

A3.203 At paragraphs 3.153-3.172 of Annex 6 of the January 2012 consultation we stated that, while the peak data rates that can be delivered using HSPA are increasing, they are significantly less than those that can be delivered for the same standards release using LTE. However, consumers are unlikely to experience peak data rates very often in practice. We stated that it is unclear whether the capability to deliver high peak data rates is necessary to be a credible national wholesaler. However, in relation to our concern about competition across a wide range of services and customers, national wholesalers that are unable to deliver high peak speeds could be weaker competitors in some customer segments/services. We considered that, in the near term, national wholesalers would need at least 2x15 MHz of contiguous spectrum suitable for LTE in order to compete effectively for those that value high peak speeds.

Summary of responses to the January 2012 consultation

A3.204 Responses to the January 2012 consultation generally said little about peak data rates:

- Everything Everywhere characterised our position on the importance of peak data rates as relatively “tentative”.¹⁸⁸
- In support of its view that 900 MHz spectrum is not a good substitute for 800 MHz spectrum, Vodafone stated that LTE provides higher peak data rates than a 2x10 MHz HSPA service.¹⁸⁹
- Telefónica noted a submission that H3G made to the Culture, Media and Sport Committee (the “Culture Committee Submission”) in which H3G stated that the differences in peak download speeds are “marginal” between HSPA+ and LTE.¹⁹⁰

¹⁸⁸ Everything Everywhere non-confidential consultation response, page 18.

¹⁸⁹ Vodafone non-confidential consultation response, paragraph 77.

- H3G stated that one benefit of LTE is higher peak data rates.¹⁹¹

Summary of responses to the Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences

A3.205 In response to the separate Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, stakeholders raised a number of further points that were not contained in their responses to the January 2012 consultation but are relevant to the decisions being taken in this Statement. We deal with these points below to the extent that they are relevant to this Statement.

A3.206 Everything Everywhere made the following observations:

- It stated that LTE will bring about significant increases in peak data rates. It accepted that consumers are unlikely to experience peak data rates in practice. However it stated that high peak data rates can improve overall capacity by minimising the resources needed to serve users with very good signal conditions (it cited the January 2012 consultation in support of this proposition).¹⁹²
- It distinguished between the peak data speeds that could be achieved using a 2x20 MHz carrier and using a 2x10 MHz or 2x5 MHz carrier. Everything Everywhere cited H3G's Culture Committee Submission in support of the proposition that, with a smaller carrier size, LTE offers only a modest increase in peak download speeds over HSPA+.¹⁹³

A3.207 Vodafone made the following observations:

- It provided evidence on the extent to which peak data rates differ between LTE and HSPA+. It stated that, in practice, HSPA Dual Carrier 43.2Mbps would achieve peak data rates of around 30Mbps. This compares to around 50Mbps for LTE using 2x10 MHz of bandwidth.¹⁹⁴
- It stated that, while actual data rates experienced by consumers are more important, high peak data rates can be a significant marketing focus. In support it cited examples from the US.¹⁹⁵

A3.208 A confidential response also stated that Everything Everywhere would be able to capitalise on the "exaggerated" claims based around the peak data speeds achievable using LTE.

¹⁹⁰ Telefónica non-confidential consultation response, paragraph 75. This referred to *Spectrum*, House of Commons Culture, Media and Sport Committee, eighth report of session 2010-12, page Ev119. Available at:

<http://www.publications.parliament.uk/pa/cm201012/cmselect/cmcmds/1258/1258.pdf>

¹⁹¹ H3G non-confidential consultation response, page 113. In a confidential part of its response, H3G referred to the peak data rates it reported in the Culture Committee Submission and made a number of other observations. H3G consultation response, confidential report at Annex I, pages 7 and 29.

¹⁹² Everything Everywhere non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, page 33.

¹⁹³ Everything Everywhere non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, page 33.

¹⁹⁴ Vodafone also referred to the current availability of devices supporting the highest HSPA data rates e.g. devices supporting 57.6Mbps Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, pages 24-25.

¹⁹⁵ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, pages 38-39.

Ofcom's response

A3.209 Our analysis of the importance of peak data rates is structured as follows:

- First, we consider the further technical evidence we have received on the extent to which peak data rates differ between LTE and HSPA.
- Second, we consider the importance of offering high peak data rates to the credibility of a national wholesaler.

Further technical evidence on peak data rates

A3.210 A number of stakeholders have referred to evidence on peak data rates that H3G set out in the Culture Committee Submission. Table 10 from that submission is reproduced below.

Figure A3.1: H3G's comparison of peak data rates

Technology	MIMO usage	Carrier size (MHz)	Peak downlink data rates (Mbps)
HSPA+	Single stream	5	21
LTE	Single stream	5	22
HSPA+	MIMO (2x2)	5	42
LTE	MIMO (2x2)	5	43
HSPA+	Single stream	10	42
LTE	Single stream	10	43
HSPA+	MIMO (2x2)	10	84
LTE	MIMO (2x2)	10	86

A3.211 This Figure illustrates the theoretical peak downlink speed as a function of carrier bandwidth and capability of different HSPA+ and LTE terminal categories. For LTE all of these capabilities are available from terminals compliant with release 8 of the 3GPP specifications, whereas for HSPA+ these capabilities cover a range of 3GPP releases from release 7 to release 9.

A3.212 It is worth noting that for HSPA+ the maximum bandwidth is limited to 10 MHz in release 8 (i.e. two 5 MHz carriers operating together in dual cell mode) rising to 20 MHz in release 9 (i.e. four 5 MHz carriers operating together). On the other hand LTE allows a maximum bandwidth of 20 MHz from release 8 rising to 100 MHz in release 10 (i.e. five 20 MHz carriers operating together).

A3.213 From a pure spectral efficiency point of view, it is true that current implementations of LTE and HSPA+ are very close to each other. Both are capable of 2x2 MIMO and 64QAM modulation in the downlink. However, LTE is already capable of using wider bandwidths than HSPA+ and in a few years (when release 10 becomes widespread) will be able to offer significantly wider bandwidths still. Also LTE allows up to 4x4 MIMO in release 8 whilst HSPA+ is limited to 2x2 MIMO. In future, LTE release 10 will allow up to 8x8 MIMO, whereas it does not look likely that HSPA+ will move beyond 2x2 MIMO.

- A3.214 The comparison given in the figure above, whilst accurate, does not give a full picture of the peak data rate advantages that LTE has over HSPA+. Crucially, this Figure only looks at smaller carrier sizes. Through carrier aggregation, LTE allows a larger bandwidth to be used for data services, compared to the equivalent standards release for HSPA. This allows considerably higher peak speeds to be delivered using LTE. As indicated in Table 3.1 of Annex 6 of the January 2012 consultation the theoretical peak downlink speed available from HSPA+ release 8 is 84 Mbps whereas for LTE release 8 it is 300 Mbps (using a 20 MHz carrier). For HSPA+ release 10 this rises to 169 Mbps whereas for LTE release 10 it rises to 3000 Mbps.
- A3.215 In conclusion, our view remains unchanged from the January 2012 consultation. Delivering relatively high peak data rates in the near term requires 2x15 MHz or 2x20 MHz of contiguous spectrum suitable for LTE.¹⁹⁶ HSPA+ services use smaller bandwidths and cannot match the peak data rates that can be achieved by using larger LTE carriers.

Importance of high peak data rates to credibility

- A3.216 The importance of high peak data rates to the credibility of a national wholesaler depends on the importance of those peak data rates to consumers.
- A3.217 As noted in the January 2012 consultation, consumers are unlikely to experience peak data rates very often in practice. Given that consumers generally do not experience these rates, we have seen little evidence on the extent to which high (or the highest possible) peak data rates are important.
- A3.218 Respondents to the January 2012 consultation did not present any further evidence that would allow us to clarify this point. However, in responses to the separate Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, some stakeholders did argue that high peak data rates provide a marketing advantage.
- A3.219 We recognise that being able to deliver the highest peak data rates might potentially provide a marketing advantage. In the January 2012 consultation we provided examples of advertising in other countries.¹⁹⁷ However, in order not to be misleading, such advertising may need to make clear that the conditions under which peak data rates might be achieved are limited. This would reduce the impact of such marketing.¹⁹⁸
- A3.220 Our conclusions on the importance of high peak data rates to credibility are set out in Section 4.

Other LTE advantages

Summary of our position in January 2012 consultation

- A3.221 Areas of network performance where LTE and HSPA differ include: (i) cell spectral efficiency (which affects the capacity available to an operator); (ii) peak data rates; (iii) latency; (iv) ability to prioritise traffic; and (v) voice support and capacity.¹⁹⁹ We

¹⁹⁶ January 2012 consultation, Annex 6, paragraph 3.169.

¹⁹⁷ January 2012 consultation, Annex 6, paragraphs 3.195-3.196. We noted that some of the advertised differences may reflect LTE networks initially being uncongested, rather than being specific to the technology being offered.

¹⁹⁸ See the footnote to paragraph 4.95 in Section 4 for examples of the actions that have taken in relation to the marketing of fixed broadband.

¹⁹⁹ January 2012 consultation, Annex 6, paragraphs 3.178-3.180.

have already discussed capacity and peak data rates above. We now set out our position in the January 2012 consultation on the other differences between LTE and HSPA:

- **Latency:** this is a measure of the time it takes a single packet of data to travel from its source to its destination. At paragraphs 3.181-3.186 of Annex 6 we stated that LTE appears to have a more developed roadmap to reduce latency over time than HSPA, although the gap is arguably not large. The difference is more pronounced when comparing older releases of HSPA with later releases of LTE (this corresponds to comparing an initial LTE deployment to pre-existing HSPA infrastructure). We stated that the extent to which consumers are aware of these latency differences will vary. Latency is likely to be important for real time applications that are sensitive to delays, including VoIP (voice over IP), video streaming, video conferencing and gaming.
- **Ability to prioritise traffic:** at paragraphs 3.187-3.190 of Annex 6, we stated that LTE includes features that allow capacity to be shared unequally between users (depending on their requirements, tariff package etc) and to prioritise traffic that is sensitive to delays (such as voice). While HSPA also incorporates such features, implementation is more complex than for LTE and differing services may cause some inference with each other. The consumer benefits of prioritising traffic could potentially be significant in the future (particularly if it leads to new innovative services) but are very uncertain.
- **Voice support and capacity:** as explained at paragraphs 3.191-3.193 of Annex 6, HSPA offers built-in support for circuit-switched voice services whereas LTE does not. However later LTE releases can potentially support more calls per unit of spectrum compared to earlier HSPA releases.

A3.222 Our provisional conclusion was that there are some advantages of LTE over HSPA.²⁰⁰

A3.223 At paragraphs 3.194-3.217 of Annex 6 we considered a number of other issues:

- We expected LTE to be deployed in the 800 MHz and 2.6 GHz spectrum bands soon after the spectrum becomes available (around end 2013). Internationally, 1800 MHz is emerging as an important band for LTE and we assumed that, in the period after the Auction, 1800 MHz spectrum would be used for LTE.²⁰¹ We referred to the considerable uncertainty about when 900 MHz spectrum will move to LTE, although we expected it to be some years later than the 800 MHz and 2.6 GHz bands. 2.1 GHz is less likely to be used for LTE in the timescales we are considering.
- We stated that LTE may offer a marketing advantage, beyond the inherent technical capabilities of the service.
- Based on experience in other countries, it was unclear how important LTE services will be for consumers. Further, it was unclear how quickly the range and variety of LTE devices will grow.

²⁰⁰ January 2012 consultation, Annex 6, paragraph 3.218.

²⁰¹ January 2012 consultation, Annex 6, paragraph 3.201. Depending on the outcome of our analysis of Everything Everywhere's request to vary its 1800 MHz licences, it is possible that 1800 MHz spectrum might be used for LTE even earlier.

- We expected the gap between LTE and HSPA to increase over time. Longer term it may thus be important for national wholesalers to hold spectrum suitable for delivering LTE services.
- We stated that, if some national wholesalers hold spectrum that allows them to deliver LTE services before others, this temporary advantage is not inevitably detrimental to competition.

A3.224 In the January 2012 consultation, we used the term “early route to LTE” to encapsulate our discussion of these factors. In this context, “early” meant from around the end of 2013.²⁰² Overall, our provisional conclusion was that it was unclear that a national wholesaler will need an early route to LTE in order to be credible. However, in the longer term, it may be more important to be able to offer LTE services, as the advantages over HSPA become more pronounced. Further, national wholesalers that do not hold the spectrum necessary for an early route to LTE may act as weaker competitors in some particular segments of services/customers.²⁰³

Summary of responses to the January 2012 consultation²⁰⁴

A3.225 Everything Everywhere characterised our position on the importance of early access to LTE as relatively “tentative”. Further, Everything Everywhere stated that the extent to which LTE provides benefits for operators, over and above HSPA+, is a matter of commercial judgement on which different operators take different views.²⁰⁵ Everything Everywhere stated that the January 2012 consultation did not take sufficient account of the disadvantages of early entry into LTE, namely the availability and price of LTE devices and the potential for devices to experience teething issues such as reduced battery life.²⁰⁶

A3.226 Vodafone “endorse[d] Ofcom’s recognition” that HSPA cannot match the performance of LTE in terms of latency and prioritisation.²⁰⁷ Vodafone also stated that it (and Telefónica) may be particularly disadvantaged in the early years of LTE “when network reputations are established” if they have limited capacity to deliver data services.²⁰⁸

A3.227 H3G stated that the benefits of LTE include lower latency and better quality of service guarantees.²⁰⁹ Elsewhere in its response, H3G stated that LTE is a “transitional technology” and that in the short to medium term LTE is expected to deliver similar performance to HSPA+. However, in the longer term, LTE Advanced will deliver higher quality services.²¹⁰

²⁰² In the January 2012 consultation we considered that access to 800 MHz, 1800 MHz and/or 2.6 GHz spectrum provided an early route to LTE (this is implicit in the final row of Table 3.3 in Annex 6). These bands would allow LTE to be deployed around the end of 2013 (Annex 6, paragraph 3.202).

²⁰³ January 2012 consultation, Annex 6, paragraphs 3.220-3.221.

²⁰⁴ See also Telefónica’s inferences about the DoJ’s position, as discussed in Annex 2.

²⁰⁵ Everything Everywhere non-confidential consultation response, page 18.

²⁰⁶ Everything Everywhere also referred to the price of network equipment for early entrants. Everything Everywhere non-confidential consultation response, page 18.

²⁰⁷ Vodafone also referred to speed, capacity and spectral efficiency. Vodafone non-confidential consultation response, page 3.

²⁰⁸ Vodafone non-confidential consultation response, footnote 17 to paragraph 77(a).

²⁰⁹ H3G also referred to greater spectral efficiency and higher peak data rates. H3G non-confidential consultation response, page 113.

²¹⁰ H3G non-confidential consultation response, page 99.

A3.228 H3G considered that 900 MHz liberalisation had distorted competition and that these distortions would be aggravated by 1800 MHz spectrum liberalisation, thereby weakening the position of the fourth national wholesaler. H3G characterised 1800 MHz liberalisation as giving Everything Everywhere a “15 month head start”.²¹¹

- H3G considered that, given how “dynamic” the market for mobile data was, Everything Everywhere would be able to “lock-in” new customers and obtain a significant market share.
- H3G also considered that Everything Everywhere could build a reputation as a provider of superior data services.
- H3G characterised Ofcom’s position as being that there is “significant and urgent demand for 4G data services”. H3G inferred that this demand would shift *en masse* to the first mover. Further, H3G stated that Ofcom failed to investigate how ‘sticky’ these customers are.
- H3G stated that at it was “implausible” that the first mover benefits would be soon undone.

Summary of responses to the Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences

A3.229 In response to the separate Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, stakeholders raised a number of further points (that were not contained in their responses to the January 2012 consultation).

A3.230 In terms of latency:

- Everything Everywhere stated that LTE will reduce latency compared to 3G networks and cited material from the January 2012 consultation in support. It stated that lower latency improves the consumer experience for interactive tasks such as gaming, video, cloud-based services and business applications.²¹²
- A confidential response referred to the latency advantages of LTE and, in particular, stated that consumers will perceive a “substantial improvement” when downloading webpages. This respondent stated that tests on a Finnish LTE network delivered substantially lower average latency compared to 3G networks.

A3.231 In terms of the marketing advantages of LTE:

- Vodafone cited marketing material from Australia emphasising the speed and more technologically advanced nature of LTE.²¹³ It also provided confidential material on consumers’ perception of different companies in Australia.
- A confidential response argued that the superior performance of LTE data services would provide a marketing advantage and, in support, pointed to advertising campaigns in Australia and the US.

²¹¹ H3G non-confidential consultation response, pages 58-59; also pages 7 and 112-113.

²¹² Everything Everywhere non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, page 35.

²¹³ Vodafone response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, pages 38-39.

A3.232 Respondents made a number of general observations about the differences between LTE and HSPA:

- Everything Everywhere stated that the extent to which consumers value the features of LTE, over and above HSPA+, is untested. In support it cited the January 2012 consultation. While Everything Everywhere considered that LTE represented a material improvement in network performance, it stated that this was not as significant as the change from 2G to 3G. Everything Everywhere considered that LTE services will be constrained by competition from HSPA and HSPA+ services for a number of years (at least) e.g. due to the limited range of LTE handsets.²¹⁴
- Vodafone supported our view in the January 2012 consultation about the technical advantages of LTE over HSPA. It stated that the extent of the superiority of 2x5 MHz (say) of LTE over 2x5 MHz of HSPA “remains somewhat of an open question”.²¹⁵
- Vodafone cited our 2011 Communications Market Report in which we referred to the launch of LTE networks as bringing “a step change in the performance of mobile networks”.²¹⁶ Vodafone also cited research by Morgan Stanley that stated that LTE will improve streaming of content onto devices. Vodafone emphasised Morgan Stanley’s view that “The speeds achieved [by LTE] are a step change in ... wireless experience”.²¹⁷

A3.233 In terms of the availability of LTE devices:

- Vodafone stated that the historic limitation on customer take-up of LTE services due to the limited number of LTE1800 devices is being “rapidly eroded”.²¹⁸ Vodafone stated that evidence from other countries demonstrates that top-tier handset and device availability drive a significant increase in LTE take-up. As a result, the UK is likely to experience “rapid” adoption of LTE.²¹⁹ Vodafone provided evidence on the availability of LTE1800 devices.²²⁰
- Everything Everywhere emphasised the particular importance of handset availability.²²¹ Everything Everywhere agreed with the Real Wireless research for the January 2012 consultation on LTE device availability and considered that a wide range of equipment will be available for the 800 MHz, 1800 MHz and 2.6 GHz

²¹⁴ Everything Everywhere non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, pages 42-43.

²¹⁵ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, pages 30-32.

²¹⁶ Communications Market Report, August 2011, page 267. Cited at Vodafone response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, page 39.

²¹⁷ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, page 38.

²¹⁸ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, page 37.

²¹⁹ Vodafone also cited evidence on the demand for data services from our discussion of the importance of capacity in the January 2012 consultation. Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, pages 42-43.

²²⁰ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, pages 35-37.

²²¹ Everything Everywhere non-confidential response to Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences, pages 49-50.

bands by 2013.²²² It also made a number of confidential observations in relation to handset availability.

- A confidential response provided evidence on the number of LTE1800 devices that are currently available and stated that device availability is expected to grow.

A3.234 In terms of the take-up of LTE services:

- We were provided with confidential estimates of the number of LTE subscribers Everything Everywhere might attract, in the event that we were to allow it to use its 1800 MHz spectrum to provide LTE services.
- A confidential response also pointed to the relatively gradual take-up of LTE in Sweden.
- Vodafone also provided evidence on the take up of LTE services in other countries. In Australia, Telstra attracted over 100,000 LTE customers in the first three months.²²³ In Japan, NTT Docomo attracted 2m LTE subscribers by March 2012 (15 months after it launched LTE services).²²⁴ In the US, Verizon had 8m LTE subscribers by Q1 2012 (approximately 15 months after it had launched LTE services).²²⁵

A3.235 Vodafone supported our view that it is unlikely that the 900 MHz band would be used for LTE services until after such services have been deployed in the 800 MHz and 2.6 GHz bands.²²⁶

Ofcom's response

A3.236 As noted above, in the January 2012 consultation we used the term “early route to LTE” to encapsulate our discussion of these factors. For clarity, we have changed the way we refer to these advantages to help explanation. We now refer to “other LTE advantages” to make clearer that this dimension of capability is distinct from and does not overlap with the capabilities assessed under other dimensions. In addition, our views on the timing at which various spectrum bands are likely to be used for LTE services (taking into account the availability of suitable devices) are set out in Annex 2.

A3.237 Everything Everywhere, Vodafone and H3G's responses to the January 2012 consultation raised a number of issues that had already been considered in that consultation:

- Everything Everywhere referred to the potential disadvantages of early LTE entry, including device availability. In the January 2012 consultation we discussed device availability at Annex 6, paragraphs 3.206-3.208 and first mover disadvantages at Annex 6, paragraph 3.217.

²²² Everything Everywhere non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, pages 24-25.

²²³ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, page 37.

²²⁴ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, pages 39-40.

²²⁵ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, pages 40-41.

²²⁶ Vodafone non-confidential response to Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences, page 26.

- Vodafone referred to reputation effects. These may reflect differences in average data rates (capacity) or peak data rates, both of which are discussed separately above. In any event, in the January 2012 consultation we discussed reputation effects at Annex 6, paragraph 3.214.
- H3G, like Vodafone, referred to reputation effects. H3G also referred to obstacles to switching. In the January 2012 consultation we discussed these at Annex 6, paragraphs 3.215 and 5.91-5.96.

- A3.238 Everything Everywhere, Vodafone and H3G did not provide any additional evidence on these topics in their response to the January 2012 consultation. Since we have already considered the implications of these factors for the credibility of national wholesalers, these responses would not lead us to change from the position set out in the January 2012 consultation.²²⁷
- A3.239 H3G characterised our position as that there is “significant and urgent demand for 4G services”.²²⁸ This is not correct. We discussed the growing demand for data services at paragraphs 3.15-3.22 of Annex 6 of the January 2012 consultation. We stated that “Going forward, national wholesalers may need to expand capacity in order to be able to meet increasing demands for data volumes, particularly since we expect increasing take-up of smartphones and other devices (e.g. tablets) that make heavy use of data services”. This supported our views on the impact of capacity on credibility. We did not say that there was “significant and urgent” demand for the other features of LTE, such as high peak data rates and reduced latency.
- A3.240 H3G’s response to the January 2012 consultation claimed that it is “implausible” that the first mover advantages from liberalisation of Everything Everywhere’s 1800 MHz spectrum would be “soon undone”.²²⁹ We are considering this matter as part of our separate assessment of Everything Everywhere’s application to vary its 1800 MHz licence. H3G’s claim is a strong one and it did not present evidence in its response to the January 2012 consultation to support it.
- A3.241 We received a considerable amount of additional material on the attractiveness of LTE in response to our separate Notice of proposed variation of Everything Everywhere’s 1800 MHz spectrum licences. This included confidential forecasts of LTE take-up, in the event that we were to allow Everything Everywhere to use its 1800 MHz spectrum to provide LTE services.
- A3.242 For the purposes of this Statement, we note that in principle such forecasts provide some indication of the attractiveness of the various features of LTE. This includes the other LTE advantages and how attractive they are for consumers, as well as any advantages from peak data rates or higher average data rates. However, in practice there are a number of limitations to using these forecasts to assess credibility in the context of this competition assessment.²³⁰
- A3.243 Specifically on latency, we recognise that it is likely to be important for real time applications that are sensitive to delays and require a high degree of responsiveness, including VoIP (Voice over IP), video conferencing and gaming. What the evidence available to us does not make clear is whether the size of the differences in latency

²²⁷ Issues such as operators’ reputation and consumer switching costs are relevant to our separate analysis of Everything Everywhere’s application to liberalise its 1800 MHz spectrum. We will be considering these issues further in that context.

²²⁸ H3G non-confidential consultation response, page 59.

²²⁹ H3G non-confidential consultation response, page 59.

²³⁰ For example, the forecasts only relate to a limited time period.

between early LTE and what is possible with HSPA is significant enough to make a difference to the credibility of a national wholesaler.

A3.244 Vodafone's response to the Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences referred to a quote from our Communications Market Report that "*a step change in the performance of mobile networks will come with the launch of LTE networks*". This report then stated that "*LTE networks will offer much higher theoretical speeds (commercial deployments elsewhere in the world are delivering speeds in excess of 50Mbit/s), but also much greater capacity. In part, increased capacity will come from greater spectral efficiency. However, the main driver of increased capacity will come from the allocation of more spectrum.*"²³¹ In other words, the particular reasons we gave for the superior performance of LTE networks was increased capacity and the peak data speeds, both of which have already been discussed above.

"In the round" assessment of credibility of spectrum holdings

Summary of our position in January 2012 consultation

A3.245 As discussed above, we identified four dimensions of capability that could be important to the credibility of a national wholesaler: available capacity and average data rates; ability to deliver good quality coverage; ability to deliver highest peak data rates; and ability to deliver LTE services. Using our provisional conclusions on the importance of these dimensions (and recognising the interactions between them), we evaluated the risks faced by each of the existing national wholesalers and a potential new entrant as to whether they are likely to be credible national wholesalers in the future. As well as assessing their existing holdings, we also considered what spectrum a national wholesaler would need to allow it to become credible if it was not with its existing holdings. We also evaluated whether there are areas in which they may be at a competitive disadvantage in competing across a wide range of services and customers.²³²

A3.246 In order to do this, we assessed the strengths and weaknesses of the spectrum portfolios of different categories of national wholesalers, by first presenting 'traffic light' tables to indicate at a high level the areas of strength and weakness for a particular spectrum portfolio using a macrocell network (also abstracting from the importance of particular dimensions of capability). We recognised that the colour-coding approach masked some of the more subtle differences between capabilities, but their use was to assess whether the portfolios allow a particular dimension to be met rather than any judgement about the importance of that dimension or the extent to which weaknesses can be mitigated. We then combined these tables with the further analysis of the importance of capabilities and the potential to mitigate weaknesses to conduct an "in the round" assessment of whether the spectrum portfolio may be sufficient to enable a national wholesaler to be credible, taking into account the relative strength and importance of different advantages and disadvantages²³³.

²³¹ Communications Market Report, August 2011, page 267.

²³² This analysis was set out in full in Section 4 of Annex 6 of the January 2012 consultation, and summarised in paragraphs 4.107 to 4.143 of the consultation.

²³³ Paragraph 4.110 to 4.118 of the January 2012 consultation.

A3.247 While we noted that there is significant uncertainty regarding which Auction outcomes could be detrimental to competition, we provisionally concluded the following²³⁴:

- a) Everything Everywhere's existing holdings are likely to be sufficient for it to be a credible national wholesaler in the future even if it wins no additional spectrum;
- b) Telefónica and Vodafone's existing holdings are likely to be sufficient to be credible in the near term for at least as long as HSPA900 is competitive with LTE. But there is some potential risk of them not being credible in the longer term if LTE900 equipment is not available soon thereafter, or because of the relatively limited overall spectrum share they would hold if they did not win spectrum;
- c) H3G is unlikely to be credible without additional spectrum; and
- d) A new entrant obviously needs to obtain spectrum in the Auction to be credible.

A3.248 Even if a national wholesaler is credible, we provisionally concluded that it may not be well placed to deliver certain dimensions of service, or for serving some particular product or customer segments (our second type of competition concern). We identified five ways in which competition could be weaker:

- a) If one or more competitors does not have:
 - o sub-1GHz spectrum (which particularly affects Everything Everywhere, H3G and a new entrant);
 - o early route to LTE (which particularly affects Telefónica, Vodafone, H3G and a new entrant);
 - o 2x15 MHz or 2x20 MHz of contiguous block for LTE (which particularly affects Telefónica, Vodafone, H3G and a new entrant); or
 - o enough spectrum for capacity and average data rates for all service and customer segments (which particularly affects H3G, a new entrant and also Telefónica and Vodafone to a lesser extent).
- b) If one competitor has a very large share of spectrum (to which potentially all national wholesalers are vulnerable).

Topics in responses

A3.249 Below we group responses on the in the round assessment under the following headings:

- Analytical framework for "in the round" assessment;
- Use of LTE in framework; and
- Perceived ambiguity in the "in the round" assessment of existing spectrum holdings.

A3.250 We consider these in turn below first summarising responses and then setting out our response.

²³⁴ Paragraph 4.142 of the January 2012 consultation.

Analytical framework for “in the round” assessment and factors considered

Summary of responses

A3.251 H3G argued that the following should also be taken into account in the assessment:

- a) Indoor data speeds experienced by users (which are dependent on coverage and available bandwidth) – in the hardest to reach areas, it argued, user experience of speed will be driven to a large extent by the amount of low frequency spectrum held and so MSPs with 2x15 MHz of 800 MHz spectrum would support the highest user speeds at the deepest indoor locations. In principle, where a user has coverage, greater bandwidths will increase the user’s experience of speed (assuming the same demand loadings). User experience of speed will also be influenced by the efficiency of load balancing achievable in any particular multi-band network²³⁵.
- b) Efficiency of load balancing – in a multi-frequency environment, keeping effective cell radii for each frequency as small as possible while maintaining a similar traffic loading for all frequencies is needed to achieve optimal speed for all users. If the frequencies available or the bandwidth at each frequency require heavier loading and/or larger cell radii in order to provide coverage, speeds will fall and it will not be possible to carry as much data (as the efficiency of transmission will be affected more by path loss). In other words, the spectrum will not be used as efficiently as it could be with a better spread of holdings²³⁶, and so it argued this criterion is important because the efficiency of spectrum usage is a matter to which Ofcom is required to have regard.²³⁷

A3.252 Everything Everywhere argued that treating coverage as one of four criteria underplays the importance of access to the important sub-1 GHz spectrum band. Providing competitive coverage levels must be a central component of any assessment of relative competitiveness of operators and the overall competitiveness of a particular set of spectrum holdings, and Ofcom’s approach of trading this off against other criteria is not appropriate.²³⁸

A3.253 Everything Everywhere argued that there is little reason for the middle column in the traffic light matrices, other than to develop the visual representation aspect of these tables. It argued that assessing credibility does not require a differentiation of spectrum other than between above and below 1 GHz, since sub-1 GHz spectrum is important and represents a quantifiable difference in quality which is not the case for spectrum upwards from 1800 MHz. The 2.1 GHz band, it argued, appears to have been effectively excluded from the analysis as being devoted to existing UMTS services for the foreseeable future and so the analytical benefit of creating a “sub-2 GHz” category is not clear and is effectively a veiled way of differentiating Everything Everywhere on the basis of its 1800 MHz holdings. It argued that if it were considered that an operator could not provide credible coverage using 2.6 GHz spectrum alone, then this would be the only justification for using a table of the dimensions Ofcom does. However, the consultation does not consider this situation

²³⁵ H3G argued that in a multi-band network with a sub-optimal spread of frequencies, the lower frequency will be quickly filled to capacity and the higher frequency will be forced to operate over a larger effective footprint (subject to received signal strength and signal to interference limitations). This will substantially constrain the speeds achievable by those using the low frequency and even degrading speeds by those using the higher frequency.

²³⁶ Page 134 of H3G’s response to the January 2012 consultation.

²³⁷ Page 127 of H3G’s non-confidential response to the January 2012 consultation.

²³⁸ Page 18, Everything Everywhere’s non-confidential response to the January 2012 consultation.

separately and argued that the new entrant position can be rolled up with that of H3G as a “fourth national wholesaler” and therefore there is no justification or need for dividing up supra 1 GHz spectrum in the way Ofcom does.²³⁹

A3.254 Everything Everywhere also argued that the importance of large existing site numbers in the “in the round” assessment is unclear as this is not a factor mentioned in the discussion of the criteria, and these sites have been invested in over time (incurring a cost) in order to compensate against the competitive disadvantage of not having access to sub-1 GHz. Furthermore, through the network sharing arrangements with Everything Everywhere, it argued that H3G will also have access to a large number of 3G sites.²⁴⁰

Ofcom’s response

A3.255 In relation to H3G’s additional criteria, we consider that user experience of indoor speed is more a combination of the first two criteria of capacity (which also reflects speed) and coverage rather than a distinct quality dimension in its own right. Therefore the issues H3G raised were discussed as part of the individual analysis of these criteria and the interaction between the two (including the potential trade-off).²⁴¹ We have considered the interaction of capacity and coverage when we have considered particular portfolios (see for example from paragraph A2.90 of Annex 2).

A3.256 Our understanding of H3G’s argument on load balancing is that it involves constraining the use of higher and lower frequency carriers so that some measure of loading or quality of service is balanced between the two frequencies.

A3.257 National wholesalers have discretion over how they schedule and load their networks. Ultimately, this is likely to be driven by consumers’ preferences. For example, if consumers value having a near constant service regardless of how hard they are to serve, then this would imply different load balancing compared to if consumers were content with a very variable service with high data rates when they are easy to serve and low data rates when they are hard to serve. Whether one of these was regarded as being more efficient than the other would depend on the metric used to assess this. We do not consider that load balancing is sufficiently important or distinct from considering capacity and coverage independently to be considered as an independent standalone criterion.

A3.258 As regards Everything Everywhere’s comment, we recognise the importance of sufficient quality of coverage in order to be credible, which is why it is one of our quality dimensions. In our elaboration of the framework for the “in the round” assessment in this Statement (Section 4), we distinguish between: (i) minimum spectrum requirements that are necessary for credibility, including coverage; and (ii) the spectrum that can contribute towards the sufficiency of an overall spectrum portfolio to allow the national wholesaler to be credible. Consistent with Everything Everywhere’s comment, there is no trade-off of coverage against other criteria in terms of the necessary minimum requirements, i.e. category (i). However, in our framework there is some potential for a trade-off between criteria in terms of category (ii), which we consider is appropriate as in our view there is more than one overall spectrum portfolio (beyond the necessary minimum requirements) that can enable a national wholesaler to be credible.

²³⁹ Page 20, Everything Everywhere’s non-confidential response to the January 2012 consultation.

²⁴⁰ Footnote 31, Everything Everywhere’s non-confidential response to the January 2012 consultation.

²⁴¹ See for example paragraph 3.92 and 3.141 et seq. of Annex 6 of the January 2012 consultation.

- A3.259 We disagree with Everything Everywhere's concerns about the middle column used in the analysis, as we do consider there to be a purpose for this category of spectrum. As set out throughout²⁴², we consider there to be a more granular differentiation between spectrum that is relevant for the analysis rather than just above and below 1 GHz, as set out in Section 4.
- A3.260 We have used three broad classifications of spectrum holdings by frequency. We consider this to be useful not only due to the different characteristics between these categories that would be otherwise masked if all frequencies above 1 GHz were merged, but by setting the table out with these categories it also showed how the other quality dimensions may vary with frequency (and quality of coverage).
- A3.261 In addition, we have not created a "sub-2 GHz" category as Everything Everywhere has commented, as the middle category actually represents spectrum at 2.1 GHz and below. As a result, we have not excluded 2.1 GHz from the analysis as suggested by Everything Everywhere. It is included in this "2.1 GHz and below" middle category, and so Everything Everywhere is not differentiated in this category on the basis of its 1800 MHz.
- A3.262 We discuss the scope to expand capacity or coverage through investment in macrocells in Section 4. Our conclusions do not rest on differences in current site numbers between national wholesalers.

Use of LTE in framework

Summary of responses

- A3.263 Although Telefónica found the framework Ofcom adopted for assessing the credibility of spectrum holdings to be useful, it considered that it was necessary to consider spectrum holdings separately under two alternative hypotheses, namely:
- When HSPA+ is a competitive technology to LTE; and
 - When HSPA+ is not a competitive technology to LTE.²⁴³
- A3.264 Telefónica presented 'traffic light' tables for these two scenarios, and considered that under both it has a higher risk profile closer to H3G than to Everything Everywhere. It therefore considered that Ofcom's analysis is highly selective in its assessment of HSPA+ as a competitive technology to LTE.
- A3.265 Everything Everywhere argued that since two of the criteria relate to early access to LTE which is not technology neutral (as required under Section 4 of the Communications Act 2003), they should not be taken into account. The nature of the mobile market, it argued, means it is the ability of an operator to provide voice and data services which should be considered, taking account of different quality/cost tradeoffs (and whether there are any particular quality aspects which are required to be competitive) rather than the technology used to provide it. It considered it conceivable that HSPA+ may cost more to provide the same service as LTE, but argued this is not relevant to credibility as operators are able to make a technology/spectrum trade-off which is a commercial decision.²⁴⁴ As such, it

²⁴² See, for example, paragraphs 3.136 et seq., 3.152 and 4.10, and Table 3.3 in Annex 6 of the January 2012 consultation.

²⁴³ Paragraph 123 of Telefónica's non-confidential response to January 2012 consultation.

²⁴⁴ It argued this is similar to the argument Ofcom has previously suggested that the mere fact that rolling out the same coverage at higher frequencies involves higher network costs is not a competitive

considered that the technology which is used to provide the services is not, in itself, relevant unless there is a data market in which national wholesalers compete which can only be serviced through LTE technology, which Ofcom has not shown.²⁴⁵

- A3.266 Everything Everywhere also argued that the ability to offer highest peak data rates and having an early route to LTE are essentially the same criterion. As a result, it argued that using two separate criteria, which are in any event tentative potential competitive differentiators (by Ofcom's own assessment), distorts the resulting analysis by overly stressing their importance and giving greater weight than is warranted to this single factor.²⁴⁶
- A3.267 Finally, Everything Everywhere argued that the advantage from its ability to deploy LTE is not only of lesser importance according to the criteria, but is also reliant on Ofcom liberalising the 1800 MHz band.²⁴⁷

Ofcom's response

- A3.268 Telefónica's revised version of the traffic light tables involves changes to the 'capacity and average data rates – near term' row so that it is different in the two alternative hypotheses that Telefónica considers (i.e. when HSPA+ is a competitive technology to LTE, and when it is not). We do not agree with these changes. It is necessary to consider why HSPA+ may not be a competitive technology to LTE. We considered a number of potential differences between the two technologies, including that LTE has greater spectrum efficiency, that larger bandwidths of LTE have higher peak data rates and that LTE has other advantages (such as better latency).
- A3.269 For average data rates, the primary difference between HSPA+ and LTE is that LTE has greater spectral efficiency (as we discussed in paragraphs 3.49 to 3.56 of Annex 6 of the January 2012 consultation). But we do not consider that the differences between the two technologies are so fundamental that we should only take account of LTE spectrum for average data rates. HSPA+ can also contribute to delivering capacity for higher average data rate services. We consider that we have adequately considered the other potential advantages of LTE when we consider peak data rates and other LTE advantages.
- A3.270 Moreover, we consider that the difference between LTE and HSPA+ is unlikely to be as binary as Telefónica suggested, at least in the near term. As well as the two extreme hypotheses put forward by Telefónica, a further possible outcome is that there may be some advantages of LTE that are attractive to some customers to some extent, but that a national wholesaler with HSPA+ can still compete for many customers even if it is slightly less attractive for some. And for some customers, there could also be advantages of HSPA over LTE because of a larger range or stock of compatible devices.
- A3.271 We agree with the general thrust of Telefónica's conclusions that the larger the advantages of LTE, the stronger Everything Everywhere's existing holdings. But we also consider that Telefónica may have a coverage advantage due to its sub-1 GHz spectrum (as reflected in paragraph 4.38 of Annex 6 of the January 2012 consultation). As a result, the comparison between Telefónica's and Everything

disadvantage as individual operators can each make a choice between higher cost spectrum (sub-1 GHz) or higher network costs.

²⁴⁵ Page 21, Everything Everywhere's non-confidential response to the January 2012 consultation.

²⁴⁶ Page 21, Everything Everywhere's non-confidential response to the January 2012 consultation.

²⁴⁷ Footnote 31, Everything Everywhere's non-confidential response to the January 2012 consultation.

Everywhere's existing holdings depends on the relative importance of sub-1 GHz compared to the advantages of LTE.

- A3.272 But, where the advantages of LTE over HSPA+ are not large, we do not agree that Telefónica necessarily has a closer risk profile to H3G than Everything Everywhere. In this situation, Telefónica is significantly better placed than H3G because it has sub-1 GHz spectrum and a greater share of spectrum. In addition, in this case Everything Everywhere does not have a large advantage from LTE, although it does still have a larger share of spectrum which may provide a capacity advantage. As a result, whether Telefónica is regarded as being similar to Everything Everywhere depends on the relative importance of sub-1 GHz compared to capacity advantages. Again, this risk is reflected in our conclusion, which recognises there is some risk of Telefónica not being credible in the longer term because of the relatively limited overall spectrum share it will hold if it does not win any in the Auction, despite its sub-1 GHz holdings.
- A3.273 This trade-off in strengths and weaknesses, as well as the importance of quality dimensions and risks to credibility are discussed further in the "in the round" assessment in Section 4.
- A3.274 In relation to the point raised by Everything Everywhere, we agree that we are required to be technology-neutral. However, we consider there is an important distinction between analysis of the market and regulatory intervention. In order to assess whether there are any Auction outcomes which might risk fewer than four credible national wholesalers, we need to consider how the market may develop. Part of this includes consumer demand for, and ability of operators to provide, particular quality dimensions for voice and data. However, we do not consider that this can easily be done in abstract from technology, as the technology used will impact on an operator's ability to provide different quality dimensions, including capacity, coverage, peak speeds and other qualities such as latency. The key point here is that technology affects the quality dimensions of data services received by consumers, and so we consider it should be reflected to the extent that it is relevant (and so may affect credibility).²⁴⁸ Beyond this, we were not, and indeed are not, suggesting any cost differential between HSPA+ and LTE should be a fundamental part of the analysis (unless it were so significant that it affects credibility) as we tend to agree with Everything Everywhere that there is a technology/spectrum trade-off that can be commercially decided.
- A3.275 Therefore it is important to consider the next evolution of technology and how it affects the delivery of quality dimensions as part of these market developments in order to be able to assess the importance of different dimensions of quality for credibility as well as the credibility of national wholesalers under different spectrum portfolios. As a result, we do not consider that the analysis of credibility would be complete or sufficiently robust without recognition of how future technological changes may affect the performance of different spectrum bands/portfolios in delivering quality dimensions of data (and therefore credibility).²⁴⁹

²⁴⁸ For example, although LTE is in the title of the fourth dimension, it explicitly relates to a group of quality dimensions (namely latency, ability to prioritise traffic and voice support) that LTE is able to deliver rather than the existence or otherwise of LTE *per se*. Similarly, LTE may be able to deliver higher peak speeds than HSPA+, but the focus is the ability to deliver the highest peak speeds as a dimension of quality of mobile services and not the technology used for technology's sake.

²⁴⁹ As discussed in footnote 51 of Annex 6 of the January 2012 consultation, we focused on LTE as although WiMAX is an alternative mobile technology for data services, interest in it in the UK and

- A3.276 However, when considering the potential sets of regulatory measures to promote national wholesale competition, it is important to be as technology neutral as possible. Therefore we set out in the January 2012 consultation that although we expect the spectrum in the Auction to be used for LTE technology, our proposals will be as technology neutral as possible in order to allow licensees the greatest scope possible on technology choice.²⁵⁰ We therefore consider our analysis and measures are consistent with our statutory duties, including those relating to technology neutrality.
- A3.277 We do not agree that the last two dimensions are effectively the same criterion as “early route to LTE” explicitly reflected aspects not covered by the other criteria, including latency, ability to prioritise traffic and voice support. This is clearly set out, for example in paragraph 3.180 and footnote 153 of Annex 6 of the January 2012 consultation, and in Section 4 of this statement. But to avoid any confusion we have now relabelled this dimension as “Other LTE advantages”.
- A3.278 While we recognise that Everything Everywhere’s capability in relation to LTE is dependent on Ofcom liberalising the 1800 MHz band (which is itself being considered separately and on which we have not as yet reached a final decision), we consider it reasonable to assume that the liberalisation would have happened soon after the Auction even if it has not happened before.

Perceived ambiguity in the “in the round” assessment of existing spectrum holdings

Summary of responses

- A3.279 Everything Everywhere argued that the way the “in the round” assessment has been undertaken is opaque.²⁵¹ In particular, it argued that although Ofcom pointed to a number of future uncertainties over the relevance of the criteria (particularly in relation to the final two), the summary of the criteria in Table 3.3 of Annex 6 is a simplified and more concrete version of the detailed conclusions on the individual criteria.²⁵² Further, it argued that at each stage of the analysis the nuances and uncertainty seem to disappear, and in taking the conclusions forward into the traffic light analysis the approach is not sufficiently granular to take account of the real uncertainties or subtle differences between capabilities described in the preceding text.
- A3.280 Additionally, Everything Everywhere argued that there is no clear explanation about the link between an operator being credible and the traffic light analysis. In particular, although the consultation explained that a national wholesaler can be credible even if it is disadvantaged in some areas relative to others (so long as the disadvantages are not too large or are compensated by other advantages), it argued that it is not clear how the importance of different dimensions is taken into account in the actual implementation of the traffic light analysis. That is, while stating that the assessment is in the round, it argued that the consultation does not clearly set out how the different cells in the traffic light matrices are interpreted, how different red and green cells are considered to balance each other, or what outcome would be considered credible or not credible (i.e. how many cells need to be red or amber for a national

Europe has diminished substantially in recent years and stakeholder plans suggest that the spectrum in the auction is likely to be used for LTE.

²⁵⁰ See footnote 51 of Annex 6 of the January 2012 consultation.

²⁵¹ Pages 19-20, Everything Everywhere’s non-confidential response to the January 2012 consultation.

²⁵² For example, it argued that the caveated judgement around capacity evolved in the summary table to a view that sufficient capacity is “necessary” (discussed further under the capacity responses).

wholesaler to be considered as not credible). Therefore Everything Everywhere argued that to some extent the visual representation aspect of the traffic light analysis has predominated in a way that has no sound basis, and it is not clear what function it is playing.²⁵³

A3.281 In light of this, Everything Everywhere argued that exactly how the different uncertainties around each criterion were taken into account was unclear, and that the relative weights ascribed to different criteria and the competitive concerns which arise from them (in particular the trade-off between various strengths and weaknesses) are entirely implicit²⁵⁴. While accepting it may not be possible to express such weights in quantitative terms, Everything Everywhere argued that Ofcom should be more explicit in the qualitative tradeoffs it has made in balancing criteria and relative weightings of different concerns as it is currently opaque.²⁵⁵

Ofcom's response

A3.282 In relation to the first issue, we agree that there are some important nuances and uncertainties around the quality dimensions, as set out in Section 3 of Annex 6 of the January 2012 consultation. However, the traffic light tables were not a representation of the complete analysis in their own right, but instead were only intended to provide a simplified (and factual) visual representation of the ability of different spectrum portfolios to deliver the quality dimensions. In particular, we stated that the purpose of the tables was:

“to summarise the risks in terms of what can be delivered with a macrocell network...it does not take account of the importance of the different dimensions nor whether any potential weaknesses could be partially mitigated through other means... the table needs therefore to be combined with an assessment of these considerations before drawing conclusions”.²⁵⁶

A3.283 Indeed, we fully recognised that the colour-coding cells may miss some of the more subtle differences between capabilities.²⁵⁷ Instead, the text that accompanied them provided the operator-specific “in the round” assessment of credibility by incorporating the earlier judgements made about the importance of particular service dimensions and the extent to which weaknesses can be mitigated. Therefore we agree that the traffic light tables are not sufficiently granular to take account of the real uncertainties described in Section 3, which is why the “in the round” assessment was conducted in the text which followed these tables.

A3.284 However, we do not agree that the nuances and uncertainty disappear across the analysis. It is cumbersome to fully repeat the caveats at every stage of the analysis, but we consider that the language used in Section 4 of the January 2012 consultation clearly reflected the risk-based intention of our analysis rather than a more definitive view of the quality dimensions. For example in the text assessing the credibility of national wholesalers, it refers to “risks” to credibility and the balance between important strengths and weaknesses (see, for example, paragraphs 4.41, 4.44 and

²⁵³ Page 20, Everything Everywhere's non-confidential response to the January 2012 consultation.

²⁵⁴ For example, it argued that since the lack of sub-1 GHz spectrum in the discussion of the criteria is considered a material disadvantage, the basis for its other spectrum holdings (i.e. route to LTE, share of total spectrum) being considered to counteract the disadvantages of not holding sub-1 GHz for both the primary and secondary competition concern is not clear (and potentially inconsistent).

²⁵⁵ Page 19, Everything Everywhere's non-confidential response to the January 2012 consultation.

²⁵⁶ Paragraph 4.9 of Annex 6 of the January 2012 consultation.

²⁵⁷ For example, see paragraph 4.15 of Annex 6 of the January 2012 consultation.

4.49 of Annex 6 in the January 2012 consultation), rather than definitive issues. This is also reflected in the analysis presented in this Statement (see Section 4).

A3.285 In addition, paragraph 4.16 of Annex 6 of the January 2012 consultation set out that the use of colour coding was to “*merely assess whether the portfolio allows a particular service dimension to be met*” according to the colour scoring system in paragraph 4.13, and was “*not making any judgement about the importance of that service dimension or the extent to which weaknesses can be mitigated*”. Therefore it is clear from this that there is no need to set out how the different colours balance each other or what colour outcome would render an operator credible, as this was clearly not the purpose of the traffic light tables. Instead, as set out in paragraph 4.17 of Annex 6, “*when we assess whether a spectrum portfolio may be sufficient to enable a national wholesaler to be credible, we take into account the importance of the quality dimensions*”, and this was done in the text which followed the tables.

A3.286 Therefore we consider that the balanced risk-based judgement was reflected in the “in the round” assessment. That said, we recognise there was some confusion from stakeholders around the purpose of the colour coded tables used in Section 4 of Annex 6 of the January 2012 consultation, and the potential for it to be interpreted as representing importance or as placing a greater emphasis on defined quality dimensions. We also recognise there may have been some confusion among stakeholders around the qualitative trade-offs between (and weightings of) the different quality dimensions, and the extent of disadvantage associated with different spectrum holdings (including the importance of sub-1 GHz spectrum). As a result, we have changed the presentation of our analysis in this Statement to avoid any stronger interpretation of the quality dimension than was intended from the traffic light tables as discussed at paragraph A2.89 of Annex 2, and we have sought to provide greater clarification on our conclusions in Section 4, see especially Figure 4.2.

Concern that fourth national wholesaler fails to acquire sufficient spectrum

A3.287 Below we set out our assessment of the arguments that stakeholders have raised in relation to our concern that a fourth national wholesaler will fail to acquire sufficient spectrum to be credible. Our response to stakeholders’ submissions is structured as follows:

- First, we discuss stakeholders’ submissions concerning differences between national wholesalers in their intrinsic value of spectrum.
- Second, we discuss stakeholders’ submissions relating to the risk of strategic investment.
- Third, we discuss the inferences that stakeholders drew from the experience in other European countries.

A3.288 As in the January 2012 consultation, the key question is the risk that a fourth national wholesaler fails to acquire sufficient spectrum. It is not our purpose to derive definitive predictions of the behaviour of Auction participants or the outcome of the Auction, under different circumstances. We do not consider that we could reliably make such predictions.

Lower intrinsic value

A3.289 In the January 2012 consultation we said that, while it is difficult to conclude what the most likely outcome is based on intrinsic value, the evidence suggests that there is a material risk that a fourth national wholesaler has a lower intrinsic value for the spectrum that it requires to be credible. Further, given the nature of the Auction process, even small advantages in intrinsic values may have a large impact on Auction outcomes.²⁵⁸

A3.290 Stakeholders raised a number of arguments in relation to intrinsic value, which we discuss below:

- The effect of forecasting errors.
- Whether H3G's intrinsic valuation of the spectrum it requires to be credible reflects its enterprise value.
- Whether H3G is disadvantaged by its existing market position.
- Whether relying on H3G's existing market position to justify reserving spectrum for a fourth national wholesaler creates a risk of moral hazard.
- Other points raised by stakeholders.

The effect of forecasting errors

Telefónica's position

A3.291 Telefónica cited our comment that "even small advantages in intrinsic value may have a large impact on the auction outcomes" but added that "Ofcom will need to clearly demonstrate that differences in valuation predominate over the risk of forecasting errors, which will affect all firms".²⁵⁹

Ofcom's response

A3.292 Telefónica's argument seems to be that, even if one bidder truly had a lower intrinsic value than another, forecasting errors could (other things being equal) lead to the former bidder winning the spectrum, either because it was overly optimistic, or its rival was overly pessimistic, or both, about their respective intrinsic values. Telefónica appears to suggest that we must rule out this possibility in identifying the risk that a fourth national wholesaler will fail to acquire the spectrum it needs to be credible due to having a lower intrinsic value.

A3.293 We do not consider that we can, or need to, rule out such a possibility. In the absence of evidence about different directions of forecast errors by different bidders, forecasting errors are as likely to increase as decrease any difference in intrinsic value. Furthermore, as noted above we do not seek to derive a definitive prediction of the outcome of the Auction – we are simply seeking to establish the risk that lower

²⁵⁸ January 2012 consultation, Annex 6, paragraph 5.117.

²⁵⁹ January 2012 consultation, Annex 6, paragraph 5.177. Quoted in Telefónica consultation response, Figure 11 on page 42. Similarly Telefónica referred to our observation at Annex 6, paragraph 5.38 about the difficulties bidders face in forecasting intrinsic values. Telefónica inferred that if intrinsic values are a large contributing factor to our decision then that decision will be "highly vulnerable". Telefónica consultation response, paragraph 154.

intrinsic value will lead to a fourth national wholesaler not acquiring the spectrum it needs to be credible.

H3G's intrinsic valuation reflects its enterprise value

Vodafone's position

A3.294 Vodafone said that if additional spectrum were critical for H3G's future then its intrinsic value must be greater than for other operators that did not require more spectrum (such as, in Vodafone's view, Everything Everywhere) or that might only require it in the future (Vodafone and Telefónica). If additional 4G spectrum were critical for a national wholesaler then the intrinsic value of such spectrum would be up to the total net present value of its future UK cash flows. Vodafone approximated this by estimating H3G's enterprise value. Vodafone estimated H3G's enterprise value to be around £3 billion based on a €4.3 billion estimate of the value of 3 Italia.²⁶⁰ Vodafone argued that H3G's high intrinsic valuation also meant that we had significantly underestimated the cost of strategic investment.²⁶¹

Ofcom's response

A3.295 We agree with Vodafone that if H3G requires a particular block of spectrum in order to be a credible national wholesaler then this is likely to increase its intrinsic value of that spectrum. In contrast, if Vodafone, Telefónica and Everything Everywhere are credible without that block of spectrum then their intrinsic values will likely be less than if they required it. However, for the reasons set out below, we do not agree that H3G's enterprise value is a good proxy for H3G's intrinsic value of the spectrum it requires to be credible.

A3.296 By equating H3G's intrinsic value of the spectrum it needs to its entire enterprise value, Vodafone is implicitly assuming that H3G has no value without the spectrum in question.²⁶² In other words, it assumes that without this spectrum H3G's future profits are zero and that all of its assets are sunk. We do not consider that this is a reasonable assumption, even as an approximation. We recognise that the profits are likely to be diminished if it is no longer a credible national wholesaler. However if H3G were not a credible national wholesaler, there are options for it to continue to be a commercially viable business:

- H3G could continue to operate at the retail level. In particular, H3G could purchase wholesale access from one of the three remaining national wholesalers (akin to an MVNO), and combine this with its 2.1 GHz spectrum. This could allow, for example, H3G to retail LTE services;²⁶³ or
- H3G could identify specific service or customer segments which could be served with its existing spectrum holdings.

²⁶⁰ Valuation of 3 Italia taken from *Telecom Italia*, Deutsche Bank, 13 July 2011, page 6. Since H3G's subscribers were approximately 80% of 3 Italia's subscribers, Vodafone made a pro rata adjustment in order to estimate the value of H3G. Vodafone consultation response, paragraphs 7 and 10-11.

²⁶¹ Vodafone consultation response, paragraphs 11 and 18.

²⁶² We note that the estimate of £3 billion presented by Vodafone is a simple adjustment (accounting for a difference in subscriber numbers) of an estimated value of 3 Italia. We do not rely on £3 billion being a reasonable approximation of H3G's enterprise value.

²⁶³ Indeed in its response to the March 2011 consultation, Vodafone discussed whether H3G would have a continuing presence at the retail level (paragraph 34) and said that "Based on the current state of competition in the wholesale access market, there should be no reason why [H3G] should be unable to secure a competitive wholesale access product" (paragraph 35).

- A3.297 Alternatively, or in addition, H3G could realise the value of some or all of its assets (which currently form part of its enterprise value). This could include spectrum rights, network, or brands.
- A3.298 None of the outcomes suggested above would be satisfactory in terms of promoting competition, because H3G would no longer operate independently as a credible national wholesaler. However, they would allow H3G to retain a potentially significant proportion of its enterprise value.²⁶⁴ This supports our view that Vodafone's claim that H3G might bid up to its enterprise value for the spectrum that it needs to be credible is unlikely to be realistic.
- A3.299 As a result, we consider that Vodafone has significantly overstated H3G's intrinsic value of the spectrum that it requires to be credible.

Impact of H3G's existing market position

Vodafone's position

- A3.300 Vodafone did not agree that H3G's smaller customer base is likely to reduce its intrinsic value of additional spectrum. Vodafone considered that there would be a level playing field between H3G and other national wholesalers in the provision of services to likely early adopters of 4G, arguing that:²⁶⁵
- An existing base of 2G subscribers does not provide a competitive advantage, since they are unlikely to be early adopters of 4G services; and
 - While 3G subscribers might be more relevant to attracting early adopters, H3G is in a "strong" position in this regard (having 5.6m subscribers). H3G is also the market leader in the provision of dongles (having a 52% share of subscribers).
- A3.301 Vodafone also said that the take-up of 3G services was not consistent with the proposition that an existing customer base of voice users is important. Vodafone said that H3G is now an experienced provider of mobile services, unlike in the early period after the launch of 3G services.²⁶⁶

Ofcom's response

- A3.302 Vodafone's response focuses on H3G's position in relation to those consumers who are likely to be early adopters of 4G services. However, over the longer term we expect 4G services to be widely used. This is consistent with the clear trend towards moving from 2G services to high speed data services.²⁶⁷ As noted in the January

²⁶⁴ In the January 2012 consultation we said (at Annex 6, paragraph 5.171) that "When specific spectrum is essential to be credible, failing to acquire it has a large impact on the victim national wholesaler's profitability. In the worst scenario where this leads to exit, the intrinsic value that a victim places on the required spectrum is very high because it reflects the fact that without it its overall profits would be (close to) zero." This comment was made in the context of comparing the intrinsic value of a loss of credibility with the intrinsic value of avoiding a disadvantage in competing across a wide range of services. While the overall point of that paragraph stands (that costs of strategic investment may be lower where credibility is not at stake), we consider that, for the reasons we have just discussed, the text quoted above overstates the likely impact on profitability of a loss of credibility, even in the worst case scenario of exit from the market.

²⁶⁵ Vodafone consultation response, paragraph 6(a)-(d).

²⁶⁶ Vodafone consultation response, paragraph 6(e).

²⁶⁷ For example, 3G subscriptions have risen from 7% of mobile subscriptions in 2005, to 25% in 2008 and to 41% in 2010. Specifically, in 2005, there were 4.6m 3G handset subscriptions out of a total of 65.8m mobile subscriptions. In 2008, there were 16.9m 3G handset subscriptions and 2.6m 3G mobile

2012 consultation, this trend is forecast to continue.²⁶⁸ We thus consider that H3G's share of overall subscribers is relevant to the value that H3G can generate from LTE spectrum in the longer term. In this respect H3G is at a disadvantage compared to other operators. We thus remain of the view that H3G's smaller existing customer base is likely to reduce its value of spectrum relative to other national wholesalers to some degree.

A3.303 As discussed from paragraph 4.174 in Section 4, H3G's share of 3G subscribers fell rapidly as the market grew – from around 75% in 2005 to 17% in 2010. Vodafone suggests that this was due to H3G's inexperience as a provider of mobile services in its early years. However, we consider the history of 3G adoption to be consistent with the view that H3G's large share of early adopters of 3G did not give it a significant advantage as the market grew. At 17%, H3G's share of 3G customers was below the three larger providers in 2010, and on a declining trend. In any case, the experience of 3G suggests that any advantage (or smaller disadvantage) H3G might have, in supplying 4G services to potential 'early adopters' among its existing 3G customers, may well be dissipated as take-up of 4G services becomes more widespread.

Moral hazard

Telefónica's position

A3.304 Telefónica said that H3G has experienced higher churn rates, higher complaints and lower satisfaction with customer service than its competitors. Telefónica considered that the difficulty with H3G's business model was its inability to retain customers, and that intervening to "prop-up the failing operator" could create moral hazard. Specifically, it would demonstrate to bidders that if they fail to be successful then Ofcom will nonetheless support them. Telefónica considered that this would encourage operators to make riskier investment decisions. It considered that such an approach is not in consumers' interests.²⁶⁹

Ofcom's response

A3.305 Our response to Telefónica's moral hazard argument is broken down into five issues and structured as follows:

- First, we do not accept Telefónica's characterisation of our position.
- Second, we set out why we consider Telefónica's explanation for H3G's position to be unproven.
- Third, we note that H3G's market share is not the only reason why it may fail to acquire sufficient spectrum in the Auction.
- Fourth, we set out our view that the size of any moral hazard (even if it exists) is likely to be small.
- Fifth, we explain why our approach is appropriate even if there is a risk of moral hazard since the benefits are likely to be large relative to the costs.

broadband subscriptions out of a total of 76.7m mobile subscriptions. In 2010, there were 28.4m 3G handset subscriptions and 4.8m 3G mobile broadband subscriptions out of a total of 81.1m mobile subscriptions. *Communications Market Report 2011*, August 2011, Figure 5.55 on page 293.

²⁶⁸ January 2012 consultation, Annex 6, paragraph 5.88; see also Annex 8 for future forecasts of smartphone take up.

²⁶⁹ Telefónica consultation response, paragraphs 181-184.

A3.306 Firstly, Telefónica criticised “interven[tion] to prop-up the failing operator [i.e. H3G]...”.²⁷⁰ Our rationale for intervention is promoting competition by ensuring that the Auction results in a spectrum allocation that allows at least four credible national wholesalers to operate in the market. We have no preference as to the identity of the fourth national wholesaler and therefore, we do not consider Telefónica’s characterisation of our position to be an accurate one.

A3.307 Secondly, we do not accept Telefónica’s characterisation of H3G as a “failing operator” that is responsible for its “inability to retain customers, in a competitive market”.²⁷¹ Telefónica cited the following evidence in support of its position:

- H3G’s higher level of churn i.e. customers leaving its network.
- Complaints. In Q3 2011, complaints to Ofcom about mobile services were much lower than for fixed line telephony and fixed broadband services. However Ofcom received more complaints about H3G than about Telefónica, Everything Everywhere, Vodafone or Virgin Mobile. The complaints against H3G appeared to have been driven by disputed charges and customer service issues. Note that this only relates to complaints to Ofcom.²⁷²
- Satisfaction with customer service. Research for Ofcom found that H3G had higher proportions of faults issues and complaints than average.²⁷³

A3.308 Insofar as Telefónica’s characterisation of H3G as a “failing operator” is intended to suggest that H3G is a declining business that is at risk of exiting the market, then this is not correct (and is not supported by Telefónica’s evidence). For example, in 2010 H3G’s revenues were growing relatively quickly.²⁷⁴

A3.309 In addition, we note that other survey evidence paints a less negative picture of H3G’s performance:

- A recent brokers’ report said that H3G’s churn fell from 23% in the first half of 2011 to 18% in the second half of the year. This compared to churn of 13% for Everything Everywhere, 14% for Telefónica and 18% for Vodafone in the second half of 2011.²⁷⁵
- A survey by YouGov found that H3G’s mobile internet service was well regarded.²⁷⁶ H3G was ranked second out of the five main consumer brands, behind O2 (Telefónica).²⁷⁷ H3G’s net promoter score was buoyant and higher than

²⁷⁰ Telefónica consultation response, paragraph 183.

²⁷¹ Telefónica consultation response, paragraphs 182-183.

²⁷² *Telecoms Complaints, Q3 (July to September) 2011*, Ofcom, 20 December 2011, paragraphs 1.5 and 1.8. Available at: <http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/complaints/Telecoms-ComplaintsQ3.pdf>

²⁷³ *Quality of customer service*, GfK for Ofcom, 21 July 2011, pages 48-51 and 55. Available at: <http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/Quality-of-customer-service.pdf>

²⁷⁴ See *Communications Market Report 2011*, August 2011, page 288.

²⁷⁵ *H3G FY2011 results: UK strengthens more, Italy weakens further*, Enders Analysis, 4 April 2012 [2012-036], pages 2-3.

²⁷⁶ *The Smartphone, Mobile Internet, eXperience (SMIX)*, wave 10 (March 2012), YouGov (“SMIX wave 10”).

²⁷⁷ The five brands looked at were H3G, O2, Orange, T-Mobile and Vodafone. SMIX wave 10, slides 36, 38 and 46-48.

that of the other brands.²⁷⁸ In December 2011 H3G was ranked either top or second in terms of overall quality, overall value for money and overall satisfaction with its mobile internet service (although H3G's relative score on these metrics was less favourable in previous years).²⁷⁹

A3.310 In addition, the perceived quality of H3G's network depends at least in part on its current spectrum allocation. YouGov found that H3G's service was relatively poorly perceived in terms of network performance for voice and text services.²⁸⁰ The quality of H3G's network (in terms of coverage and reliability) and poor customer services were cited as particular reasons why respondents churned away from H3G (unlike other operators, where price was the key factor).²⁸¹ YouGov described H3G's network coverage as "polarising", with some respondents positive and others regarding it as a negative factor.²⁸²

A3.311 Moreover H3G may have fewer subscribers than other operators for reasons which are not related to its quality of service, such as:

- The time of entry. H3G entered in 2003, which is considerably later than the other national wholesalers.²⁸³ It naturally takes time for a new entrant to reach a comparable size to incumbents. For example, in our 2007 statement on mobile call termination we separately modelled an efficient "3G-only" operator. We assumed that that operator would reach market share parity (20% of traffic) from 2016/17 onwards.²⁸⁴
- Termination rates. Historically mobile termination rates have been above the pure LRIC cost of termination. In 2011 we said that, when mobile termination rates are above pure LRIC there are barriers to expansion and retail competition between mobile operators is reduced.²⁸⁵

A3.312 In conclusion, H3G's smaller market share is the result of a range of different circumstances. However, the evidence taken in the round does not support Telefónica's characterisation of H3G as a failing operator, or one that is unable to retain customers due to poor service levels.

A3.313 Thirdly, Telefónica said that H3G's existing market share appears to be an important factor that led Ofcom to suggest that there is a material risk that H3G will fail to

²⁷⁸ YouGov asked respondents how likely they were to recommend their current operator to a friend or colleague for the mobile internet. Respondents were grouped into three categories: "promoters", "passives" and "detractors". The net promoter score is simply the percentage of "promoters" minus the percentage of "detractors". SMIX wave 10, slides 38 and 49.

²⁷⁹ SMIX wave 10, slide 45.

²⁸⁰ SMIX wave 10, slides 38 and 51-52.

²⁸¹ SMIX wave 10, slide 66.

²⁸² SMIX wave 10, slide 38.

²⁸³ T-Mobile entered in 1993 and Orange entered in 1994. Vodafone and Telefónica entered even earlier.

²⁸⁴ *Mobile call termination*, Ofcom, 27 March 2007, paragraph A5.38. Available at:

http://stakeholders.ofcom.org.uk/binaries/consultations/mobile_call_term/statement/statement.pdf

Note that we did not separately model a 3G-only operator for our 2011 mobile call termination statement. However in that statement we did assume that an average efficient operator reaches market share parity by 2020/21. Moreover, in an earlier consultation we did model a "3G-only" operator and assumed it enters in 2003/4, achieves a 10% market share by 2009/10 and a 25% market share by 2014/15. Wholesale mobile voice call termination, Ofcom, 1 April 2010, paragraph A11.21. Available at:

http://stakeholders.ofcom.org.uk/binaries/consultations/wmctr/annexes/wmvct_annexes.pdf

²⁸⁵ Wholesale mobile voice call termination, Ofcom, 15 March 2011, paragraph 8.159. Available at:

http://stakeholders.ofcom.org.uk/binaries/consultations/mtr/statement/MCT_statement.pdf

secure sufficient spectrum.²⁸⁶ Telefónica is correct to highlight H3G's current share of subscribers as an aspect of our analysis. However, H3G's existing market position is not the only factor behind our concern that a fourth national wholesaler will not acquire sufficient spectrum. Another reason is that H3G's smaller spectrum holdings mean that it requires additional spectrum in order to be credible and may therefore be more vulnerable to strategic investment by other operators.²⁸⁷

A3.314 Fourthly, we consider that the reservation of spectrum is unlikely to have a significant impact on H3G's incentives to operate effectively:

- A moral hazard argument is forward looking. In other words, the proposition is that, as a result of the spectrum reservation in the forthcoming Auction, H3G believes that it will receive favourable regulatory treatment in the future provided it continues to be a relatively small national wholesaler. This in turn may dampen H3G's incentives to operate effectively. However it is not obvious that H3G would draw this inference from our decision to reserve some spectrum in this Auction. Indeed the allocation of 800 MHz and 2.6 GHz spectrum is a particularly large and important award. Given the special importance of this Auction, it is not obvious that H3G would (or should) infer from our reservation decision that Ofcom is likely to act in its favour in future regulatory decisions, particularly where those future decisions were not essential to H3G (or another fourth national wholesaler) remaining a credible national wholesaler. Moreover it is not clear what the nature of any future favourable regulatory treatment might be and when it might occur. In other words, H3G is unlikely to confidently infer that it will receive future regulatory rewards should it remain a small operator. This implies that any impact on H3G's incentives may be limited.
- Moreover, H3G is likely to face competitive pressures to provide services in an effective manner that meets customers' needs. Day to day competition is likely to act as a stronger and more immediate source of incentives for H3G. In particular, H3G currently has a market share of subscribers of around 7%. It does not appear realistic to expect that, following the Auction, H3G would underperform, risking a loss of customers leading to an even lower market share, in the hopes that Ofcom would respond by supporting it in some way.

A3.315 Fifthly, to the extent that reservation could dampen H3G's incentives to operate as effectively as it can, this needs to be weighed against the considerable benefits of seeking to ensure the presence of a fourth credible national wholesaler. We consider that the risk of moral hazard is outweighed by the benefits of reserving spectrum for a fourth national wholesaler.

Other points raised by stakeholders

Stakeholders' position

A3.316 Telefónica claimed that we arbitrarily chose a "very narrow investment horizon" on which to assess the bidding incentives of Hutchison Whampoa. Telefónica noted that Hutchison Whampoa is a large, well resourced company, and suggested that, looking at a UK presence as a long run investment, it is rational to pay what is required to make a long run return.²⁸⁸

²⁸⁶ Telefónica consultation response, paragraph 179.

²⁸⁷ To the extent that H3G's smaller customer base may give it a lower intrinsic value of spectrum than rivals, this will tend to make strategic investment less costly to those rivals, and therefore more likely.

²⁸⁸ Telefónica consultation response, paragraph 180.

- A3.317 Telefónica also said that H3G and Everything Everywhere will have low intrinsic valuations of spectrum for the purposes of capacity because they already have access to large, dense cell grids. It argued that this meant that the incremental cost for these companies of increasing capacity (absent further spectrum) was limited.²⁸⁹
- A3.318 In the section of its response dealing with strategic investment, Telefónica characterised our position in the Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences as creating a "monopoly" credible national wholesaler if Everything Everywhere's 1800 MHz spectrum were liberalised before the launch of LTE services by other national wholesalers. Telefónica stated that such a monopolist would have an incentive to try to impede 800 MHz and 2.6 GHz spectrum becoming available. Telefónica stated that our position in the Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences calls into question our position in the January 2012 consultation.²⁹⁰
- A3.319 Vodafone referred to the 2x15 MHz of 1800 MHz spectrum that Everything Everywhere will divest. It asserted that it "cannot be credible" that it or Telefónica have a higher incremental intrinsic valuation for this spectrum over and above 800 MHz spectrum than H3G's intrinsic value of this 1800 MHz spectrum alone.²⁹¹
- A3.320 H3G told us that the intrinsic value of new spectrum would tend to be lower for a smaller national wholesaler or new entrant due to the time and cost entailed in achieving market share. It said that the UK 3G auction in 2000 for 2.1 GHz provided evidence of this, in that the incumbents were seen as having advantages over entrants, and they each paid £2 billion per 2x5 MHz block, whereas the new entrant paid £1.5 billion following a highly competitive bidding both between incumbents for different lots and between potential entrants for the new entrant licence.²⁹²

Ofcom's response

- A3.321 As regards Telefónica's first argument, our assessment of intrinsic value is not predicated on a particular time horizon. Similarly, our assessment is not predicated on the resources available to bidders i.e. we have not relied on some bidders facing a lower cost of raising finance. Rather our focus in the intrinsic value analysis is what spectrum is worth to each bidder – H3G (like other bidders) will not pay more than the amount it expects to earn from the spectrum.
- A3.322 Regarding Telefónica's second argument, our view is that H3G is unlikely to have sufficient capacity in the future with its existing sites and spectrum holdings. However, we do not expect that Everything Everywhere is likely to need additional spectrum to enable it to be credible.
- A3.323 We also note that as neither Everything Everywhere nor H3G currently holds sub-1 GHz spectrum, they may also put value on this spectrum for coverage reasons. One consequence is to increase their intrinsic value of 800 MHz spectrum.
- A3.324 As regards its third argument, Telefónica's claim that our position in the January 2012 consultation is called into question seems to rely on its assertion that, if Everything Everywhere's 1800 MHz spectrum were liberalised before the launch of LTE services by other national wholesalers, Everything Everywhere would become the "monopoly" credible national wholesaler and the other three current national wholesalers would

²⁸⁹ Telefónica consultation response, Figure 11 on page 42.

²⁹⁰ Telefónica consultation response, paragraphs 22-23.

²⁹¹ Vodafone consultation response, paragraph 6(f).

²⁹² H3G consultation response, Section 5.2.

not be credible competitors. Telefónica seems to suggest that creating such a monopoly position through 1800 MHz liberalisation would be inconsistent with our approach in this competition assessment to promote national wholesale competition. However, first, Telefónica's characterisation of our position as creating a monopoly credible national wholesaler is not, in our view, an accurate representation of our analysis in the Notice of proposed variation of Everything Everywhere's 1800 MHz spectrum licences. Second, that Notice is part of a separate project to the competition assessment considered in this Statement. In that separate project we are still in the process of considering responses to the Notice, including Telefónica's arguments, and we have as yet reached no conclusion on the liberalisation of Everything Everywhere's 1800 MHz spectrum. Third, we make the general observation that there is a distinction between the analytical frameworks that are used and the conclusions that are reached when applying those frameworks. The application of consistent frameworks can lead to different conclusions in two cases if there are differences between those cases in terms of the relevant questions to be addressed or the applicable facts and circumstances. Fourth, in our assessment of competition after the Auction we take into account Everything Everywhere using its 1800 MHz spectrum for LTE.

A3.325 Turning to Vodafone's argument, we accept that in general the marginal value of additional spectrum to a national wholesaler would tend to fall as its existing holdings (or the amount it seeks to acquire) increases.²⁹³ However Vodafone has presented no evidence that it "cannot be credible" that other operators will have a higher incremental value of 1800 MHz spectrum on top of 800 MHz spectrum than H3G has for 1800 MHz spectrum alone. In particular, as explained above, existing spectrum holdings are not the only influence on bidders intrinsic value – factors such as market position (where Vodafone has a much larger customer base than H3G) are also relevant. Furthermore, the fourth national wholesaler can be prevented from acquiring the spectrum it is likely to need to be credible even if it acquires 1800 MHz (since it also needs spectrum in the 800 MHz or 2.6 GHz bands).

Strategic investment

A3.326 In the January 2012 consultation we said that, even if the fourth national wholesaler has a higher intrinsic value, we would be concerned that it may fail to acquire the spectrum it requires because of the possibility of strategic investment by Everything Everywhere, Vodafone and Telefónica. Even if the spectrum requirements were rather limited, there would still be a realistic risk that a fourth national wholesaler will be excluded or weakened by strategic investment.²⁹⁴

A3.327 We have grouped stakeholders arguments in relation to strategic investment under three headings:

- Impact on ALF;
- Coordination between strategic investors; and
- Effect of our measures on the risk of strategic investment.

Impact of strategic investment on ALF

Vodafone's position

²⁹³ A point we made at January 2012 consultation, Annex 6, paragraph 5.19.

²⁹⁴ January 2012 consultation, Annex 6, paragraph 5.178.

A3.328 Vodafone said that increases in Auction prices due to strategic investment will be passed through to ALF. There was thus a significant “multiplier effect” that increased the cost of strategic investment.²⁹⁵

A3.329 Vodafone acknowledged that the use of other benchmarks to set ALF would dampen the extent to which higher Auction prices are passed through into ALF. The extent of this dampening is uncertain. It thus recognised that its calculations are an upper bound of the costs of strategic investment.²⁹⁶

A3.330 Everything Everywhere does not have 900 MHz spectrum. However Vodafone said that strategic investment by Everything Everywhere for 800 MHz spectrum could be expected to increase the price of 1800 MHz spectrum, which could increase ALF for its holdings of 1800 MHz spectrum.²⁹⁷

Ofcom’s response

A3.331 We have not yet decided precisely how ALF will be set and will separately consult on this issue after the Auction.

A3.332 As discussed in paragraph 12.11 of Section 12, we accept there may be some risk that some bidders who will be paying ALF will shade their bids or that bidders not paying ALF will try to push up ALF for their competitors. However, we intend to take account of a range of information and not to have a mechanistic link between Auction prices and ALF. Because of this, we consider that the risk of a distortion to Auction bidding has been overstated by Vodafone. It would in our view be risky for bidders to alter their bids to try to influence ALF because we may place little weight on their bids if we consider there is better information available, or if we consider that they may have changed their bids for strategic reasons. Thus we do not consider that the potential link with ALF prevents there being a material risk of strategic investment.

Coordination between strategic investors

Stakeholders’ position

A3.333 Vodafone said that for an individual national wholesaler to engage in unilateral exclusionary conduct it would need to purchase so much spectrum that a fourth national wholesaler is not credible. Vodafone said that this is not possible under the proposed Auction rules.²⁹⁸ To illustrate, Vodafone gave an example in which a fourth national wholesaler is not credible unless it acquires at least 2x10 MHz of 800 MHz spectrum (scenario A from the January 2012 consultation):

- Vodafone said that absent coordination it would need to acquire 2x25 MHz of 800 MHz spectrum to be certain that it had excluded H3G. This was not permitted under the proposed spectrum cap rules.
- Even if it were known that Everything Everywhere attached the highest intrinsic valuation to 2x10 MHz of 800 MHz spectrum, Vodafone would still need to purchase 2x15 MHz of 800 MHz spectrum to be certain that it had excluded H3G. Again, this was not permitted under the proposed spectrum cap rules.

²⁹⁵ Vodafone consultation response, paragraphs 12 and 15.

²⁹⁶ Vodafone consultation response, paragraph 12.

²⁹⁷ Vodafone consultation response, paragraph 14.

²⁹⁸ Vodafone consultation response, paragraphs 30-33.

- Vodafone described as “extremely unlikely” a scenario in which two larger national wholesalers were known to have the highest intrinsic valuations of 2x10 MHz of 800 MHz spectrum but the third had a lower intrinsic value than H3G. Vodafone acknowledged that, in this situation, the third wholesaler could unilaterally exclude H3G. However Vodafone considered that absent coordination an individual bidder is unlikely to be sufficiently certain that this was truly the situation.

A3.334 Vodafone thus said that strategic exclusion of H3G would require the larger operators to coordinate their behaviour in the Auction. They would therefore need to solve a “coordination problem” – if any of the larger operators did not engage in strategic investment then exclusion would fail and other operators would not be willing to engage in strategic investment either.²⁹⁹ Vodafone said that a non-exclusionary strategy of simply bidding up to the intrinsic value was more likely since it was less risky:³⁰⁰

- It does not rely on coordinated behaviour; and
- Strategic investment is potentially very costly if coordination fails, with operators paying “far above” their intrinsic valuations.

A3.335 Vodafone said that strategic exclusion requires the three larger operators to each independently reach the view that all of their spectrum valuations exceed H3G’s intrinsic valuation. Further, each needs independently to reach the view that the others’ have reached a similar judgement. Vodafone said that the presence of a small amount of uncertainty about another operators’ valuation means the strategic exclusion is unlikely to happen. Vodafone considered that a significant degree of such uncertainty is created by the differences between the larger operators (in terms of market shares and spectrum holdings).³⁰¹ This uncertainty means that each operator will default to the “safe” option of bidding non-strategically.³⁰²

A3.336 Vodafone said that it expected H3G’s intrinsic valuation in the face of potential exclusion from the market to be relatively high, raising the cost of unsuccessful strategic investment and reducing the payoff (cost minus benefit) of successful strategic investment.³⁰³

²⁹⁹ Vodafone consultation response, paragraph 34.

³⁰⁰ Vodafone consultation response, paragraphs 35-37. Vodafone also set out an example in which one bidder (Everything Everywhere) had a relatively low intrinsic valuation of 800 MHz spectrum so that, even when its strategic valuation was taken into account, it was unwilling to outbid H3G. Vodafone considered that this illustrates that strategic investment may not be feasible (given that side payments are not permitted). Vodafone consultation response, paragraphs 46-49.

³⁰¹ Vodafone illustrated this with two examples. In the first, Vodafone believed that Everything Everywhere’s strategic valuation was less than H3G’s intrinsic valuation. In the second, Vodafone believed that Everything Everywhere considers that Vodafone’s strategic valuation was less than H3G’s intrinsic valuation. In both examples, Vodafone is not prepared to bid strategically. Vodafone consultation response, paragraphs 38-42.

³⁰² At footnote 8 of its consultation response, Vodafone said that not engaging in strategic investment is the risk dominant equilibrium. It claimed that the economic literature predicts that, in the presence of uncertainty about how others will behave, the risk dominant equilibrium will arise in coordination games. In support Vodafone cited *The Evolution of Conventions*, H P Young, January 1993, *Econometrica* vol. 61(1), pages 57-84. Available at:

http://www.eecs.harvard.edu/~parkes/cs286r/spring06/papers/young_ec93.pdf

³⁰³ Vodafone consultation response, paragraphs 44-45.

- A3.337 Similarly, Telefónica said that strategic investment that requires coordination between the three larger operators in the 800 MHz band is less likely than scenarios where one party can act unilaterally.³⁰⁴
- A3.338 Vodafone said that if H3G also required 2x15 MHz of 1800 MHz spectrum to be credible then coordination would be even harder to achieve. In particular, both Vodafone and Telefónica would prefer that the other engaged in strategic investment for 1800 MHz spectrum (this is in addition to the difficulties Vodafone identified above).³⁰⁵
- A3.339 H3G argued that a fourth national wholesaler was at the greatest risk of strategic investment, because it had the least to lose from early exit of the market. It said that Ofcom underestimated the risk of strategic investment by failing to recognise that sub-1 GHz spectrum was essential to be credible, and also because evidence from European markets suggested that the presence of a 3G entrant was associated with 19% lower prices for voice and 28% lower prices for broadband, leading to a much greater difference in consumer surplus than suggested by Ofcom. Accordingly, it said that the value to incumbents of foreclosing a fourth national wholesaler could be at least £1 billion each and conceivably tens of billions of pounds each, giving rise to considerable incentives to strategically invest against a fourth national wholesaler.³⁰⁶

Overview of our response

- A3.340 Our assessment of the coordination arguments raised by Vodafone and Telefónica is structured as follows:
- First, we set out our views on the importance of coordination.
 - Second, we consider the costs and benefits of strategic investment.
 - Third, we consider the 1800 MHz case.

The importance of coordination

- A3.341 Vodafone's examples illustrate that, given our proposed spectrum caps and unless there is a particular configuration of intrinsic values, unilateral strategic investment by a single party is unlikely to prevent the fourth national wholesaler obtaining sufficient spectrum, except in the case where the other two national wholesalers have a higher intrinsic value than the fourth. For example, if Telefónica and Everything Everywhere each had a higher intrinsic value for 2x10 MHz of 800 MHz spectrum than a fourth national wholesaler, but Vodafone did not, then strategic investment by Vodafone in the remaining 2x10 MHz could potentially exclude a fourth national wholesaler from the 800 MHz band. In the examples Vodafone provides, it appears to assume that the fourth national wholesaler has a higher intrinsic value than other operators – i.e. that it will be able to win any available spectrum that is not subject to strategic investment.
- A3.342 As suggested above, a fourth national wholesaler could be excluded even if some firms are not behaving strategically. For example, for Vodafone, strategic investment in 2x10 MHz of 800 MHz spectrum could be worthwhile if it thinks there is a high enough probability that:

³⁰⁴ Telefónica consultation response, Figure 12 on paged 43-44.

³⁰⁵ Vodafone consultation response, paragraph 43.

³⁰⁶ H3G response, Section 5.3.

- Telefónica has a higher intrinsic value than a fourth national wholesaler for a further 2x10 MHz, or that Telefónica will strategically invest in this spectrum to exclude a fourth national wholesaler; and
- Everything Everywhere has a higher intrinsic value than a fourth national wholesaler for a further 2x10 MHz, or that Everything Everywhere will strategically invest in this spectrum to exclude a fourth national wholesaler.³⁰⁷

A3.343 In summary, for Vodafone to invest strategically it does not have to have certainty about the intrinsic value of its rivals.

A3.344 While Vodafone has presented a simple choice between strategic investment and bidding intrinsic value, in practice a firm has a choice about how much it is willing to invest strategically in the Auction. It may be that if Vodafone sees the probability of successful foreclosure as low (but not zero) it will bid closer to its intrinsic value than if it sees a higher probability of success.³⁰⁸

A3.345 We also note that there can be clear focal points to assist strategic investors to coordinate. For example, in the 800 MHz band, each of Everything Everywhere, Telefónica and Vodafone winning 2x10 MHz of 800 MHz spectrum (as discussed further in Section 4 of this Statement).

Costs and payoffs of strategic investment

A3.346 Vodafone considered that the “potential prize associated with successful coordination” is likely to be small. This was because H3G’s intrinsic value was relatively high and this would reduce the net benefits for national wholesalers of successful strategic investment. However:³⁰⁹

- We address Vodafone’s submissions in relation to H3G’s intrinsic value above. In particular, we consider that Vodafone’s use of H3G’s enterprise value is likely to significantly overstate H3G’s intrinsic valuation of spectrum.
- As discussed in Section 4, it is likely that a reduction in the market from four credible national wholesalers to three would lead to a reduction in competition. There is potentially a large payoff from successful strategic investment.

A3.347 Vodafone considered that strategic investment is “potentially very costly if it fails” and that not engaging in strategic investment is a “safe” option when the “risk of

³⁰⁷ For simplicity we assume here that a fourth national wholesaler is not strategically investing in 800 MHz, i.e. it bids its intrinsic value. Also for simplicity, we consider only a single band – we recognise that the need for strategic investment across several bands increases the cost.

³⁰⁸ Vodafone characterised not engaging in strategic investment as the “risk dominant” equilibrium Vodafone consultation response, footnote 8 to paragraph 42. Risk dominance is a concept from game theory. In a simple, symmetric game the risk dominant strategy can be thought of as the best response if there is a 50% chance the other player engages in strategic investment and a 50% chance that they do not. Whether or not engaging in strategic investment is risk dominant depends on the relative payoffs from different outcomes to the game. In support of its reference to the concept of risk dominance, Vodafone also refers to an academic paper by Young (1993). We consider that this paper is of limited relevance to the facts at hand. In particular, it looks at which equilibrium is most likely to arise over very many iterations of a game, given perturbations in the strategies adopted by participants. We thus consider that the details of this paper are of limited relevance to the auction which seems more akin to a one-off event rather than the culmination of a repeated series of similar awards.

³⁰⁹ Vodafone consultation response, paragraphs 44-45.

coordination failing is sufficiently high".³¹⁰ Vodafone considered that strategic investment is likely to be costly because H3G's intrinsic value is high.³¹¹

- A3.348 However, unsuccessful strategic investment does not necessarily drive up the price of spectrum.³¹² In a second price auction, the price is determined by the final bidder to drop out. Thus, absent any strategic investment, the price is determined by the intrinsic value of the final bidder to drop out. Whether or not there is a cost to unsuccessful strategic investment depends on whether that final bidder engages in strategic investment and thereby drives up the price. Vodafone focused on H3G's intrinsic value. However, if H3G is able to acquire sufficient spectrum (and strategic investment is unsuccessful) then it is presumably not the final bidder to drop out and thus the price is not determined by H3G's intrinsic value.³¹³
- A3.349 As a stylised illustration, assume there are three lots of spectrum in a band, and Vodafone is considering whether to bid. Bids go up in increments of 150 (e.g. £150 million). It knows its own intrinsic value is 300, and knows (or confidently expects) that Everything Everywhere has an intrinsic value of 600, and that a fourth national wholesaler's intrinsic value is 450. It similarly knows Telefónica has an intrinsic value of 300 but will bid 600 if acting strategically. All players know that there will not be a strategic gain to excluding any player other than a fourth national wholesaler from the band. From Vodafone's perspective, the only uncertainty is whether Telefónica bids strategically or not.
- A3.350 Strategic investment by Vodafone has two possible outcomes, depending on how Telefónica behaves. The possible outcomes of strategic investment by Vodafone are illustrated in the table below. If Telefónica does not act strategically, but rather bids its intrinsic value, then a fourth national wholesaler will not be excluded, but under the second price rules the cost per lot will be 300. So Vodafone will not have incurred a cost from (unsuccessful) strategic investment. If Telefónica does act strategically, a fourth national wholesaler will be successfully excluded, and the cost of strategic investment to Vodafone will be 150 (because the second price has gone up from Telefónica's intrinsic valuation of 300, to a fourth national wholesaler's intrinsic valuation of 450). Vodafone will therefore invest strategically if it values excluding a fourth national wholesaler at 150 or above.
- A3.351 This simple example illustrates that (a) unsuccessful strategic investment could potentially be costless or low cost, because the Auction price is determined by the highest losing bid, and (b) strategic investment could in principle be an optimum strategy even with uncertainty as to how others will bid – in that Vodafone's optimum strategy is to bid 600 regardless of whether Telefónica invests strategically.

	Telefónica does not invest strategically	Telefónica invests strategically
Vodafone	600	600
Telefónica	300	600
Everything Everywhere	600	600

³¹⁰ Vodafone consultation response, paragraphs 37 and 42.

³¹¹ Vodafone consultation response, paragraphs 44-45.

³¹² As explained at paragraph 5.71 in Annex 6 of the January 2012 consultation.

³¹³ In addition, see our response to Vodafone's submissions on H3G's intrinsic value above.

Fourth national wholesaler	450	450
Auction price per lot	300	450

Strategic investment in 1800 MHz spectrum

A3.352 Vodafone noted a potential coordination problem in relation to strategic investment in 1800 MHz spectrum.³¹⁴

- If Vodafone believes that Telefónica will engage in strategic investment in order to acquire 2x15 MHz of 1800 MHz spectrum then Vodafone would simply wish to bid an amount that reflects its intrinsic value for this spectrum. Essentially Vodafone can free ride on the effects of Telefónica's strategic investment – it would benefit from the foreclosure of H3G, while avoiding the risk of both engaging in strategic investment and thereby needlessly driving the price up (above the level necessary to prevent H3G acquiring the spectrum).
- In contrast, if Vodafone believes that Telefónica will simply bid its intrinsic value for this spectrum then Vodafone may have an incentive to engage in strategic investment.

A3.353 The fact that two firms could each strategically invest unilaterally means there could be a free rider problem. There is a possibility that both Vodafone and Telefónica (incorrectly) believe the other will strategically invest in 1800 MHz spectrum, thereby allowing a fourth national wholesaler to 'slip through' and acquire this spectrum. (Alternatively, if either party found itself bidding aggressively against another bidder, it would be uncertain whether the rival was a fourth national wholesaler.) However, we consider there is a material risk that a fourth national wholesaler may fail to acquire sufficient spectrum. In particular:

- It is possible that a fourth national wholesaler would be excluded from 1800 MHz even in the absence of strategic investment, i.e. because of lower intrinsic value. In this case, it would only need to have lower intrinsic value than either Telefónica or Vodafone for this single block of spectrum in order to fail to acquire it.
- If Vodafone and Telefónica do not successfully coordinate, strategic investment may be more costly (because they may be bidding against each other at levels above their intrinsic value rather than one of them bidding against H3G at such levels). But faced with uncertainty whether or not the other will strategically invest, it could still be more profitable for each to decide to strategically invest (at least up to some level) than for each to decide only to bid their intrinsic value with a greater risk that H3G 'slips through' and acquires the 1800 MHz spectrum. Whether or not this is the case depends on a range of considerations, including the relative expected payoffs to Vodafone and Telefónica in the different scenarios and the expected probability that the other will strategically invest.

³¹⁴ The coordination problem facing Vodafone and Telefónica in this 1800 MHz example to minimise the cost of strategic investment is to adopt a *different* approach to the other because there is a single lot of 2x15 MHz of 1800 MHz (e.g. simply bid intrinsic value if the other engages in strategic investment and vice-versa). In contrast, the coordination problem to deny 800 MHz to a fourth national wholesaler discussed above involved large operators having an incentive to adopt the *same* approach as the others because multiple lots of 800 MHz need to be acquired for this to be successful (e.g. if the others engage in strategic investment then doing likewise).

- A focal point may exist to assist in coordination between Vodafone and Telefónica. One possibility arises from the placement of their existing 1800 MHz spectrum holdings: the 1800 MHz spectrum being divested by Everything Everywhere is contiguous with the 2x5.8 MHz of 1800 MHz spectrum already held by Vodafone. We also note the announcement in June 2012 by Vodafone and Telefónica of their plan for network sharing arrangements including for 4G – if it proceeds, it could assist in coordination between them in this context.³¹⁵

Risk of strategic investment with our measures to promote competition

Telefónica's position

A3.354 Telefónica argued (paragraph 165) that “In its analysis of the feasibility of strategic investment, Ofcom ... fails to realise that the risk is also affected by the volume of spectrum reserved for other bidders...”

Ofcom's response

A3.355 We assess the risk of strategic investment against Everything Everywhere, Vodafone or Telefónica with our measures to promote competition in Section 4, paragraphs 4.270 to 4.280]. In the cases of Vodafone and Telefónica, we assess what the risk would be if they needed 2x10 MHz of spectrum to be credible.

A3.356 We consider it unlikely that Vodafone or Telefónica will need to acquire a contiguous block of 2x15 MHz to be credible. However we assess below the risk that, if either needed 2x15 MHz, they would fail to acquire it, with our measures to promote competition.

A3.357 We do not consider it likely that Vodafone or Telefónica will fail to acquire the spectrum they may require in the Auction to be credible due to having a lower intrinsic value than other bidders, either with or in the absence of our measures to promote competition, since they are both established national wholesalers with large customer bases. This will also affect the cost of strategic investment against them.

A3.358 There is a possibility that our measures to promote competition would increase the risk to Vodafone or Telefónica of not acquiring 2x15 MHz of contiguous spectrum. Taking the case of strategic investment against Telefónica:

- i) The cap on sub-1 GHz spectrum would prevent either party from acquiring 2x15 MHz of 800 MHz spectrum, so if either needed 2x15 MHz of additional spectrum, they would have to acquire it in another band;
- ii) Strategic investment in 2x15 MHz of 1800 MHz spectrum by Vodafone or a fourth national wholesaler could prevent Telefónica from acquiring this spectrum; and
- iii) For Telefónica to be prevented from acquiring 2x15 MHz of 2.6 GHz spectrum would require Everything Everywhere, Vodafone and a fourth national wholesaler (and low power sharers) collectively to acquire 2x60 MHz.

A3.359 The risk of strategic investment leading to conditions (ii) and (iii) above holding will depend, in part, on which portfolio is reserved for a fourth national wholesaler. However, which portfolio is reserved depends on the relative bids for the different

³¹⁵ <http://www.vodafone.co.uk/consumer/groups/public/documents/webcontent/vftst162773.pdf>

spectrum bands as between opted-in and non opted-in bidders, which could be influenced, in turn, by strategic investment.

- A3.360 In particular, suppose that Everything Everywhere strategically invested in 2x20 MHz of 800 MHz spectrum and Vodafone strategically invested in the remaining 2x10 MHz. This would push the fourth national wholesaler into Portfolio 4 – i.e. a reservation of the 1800 MHz spectrum and 2x20 MHz of 2.6 GHz spectrum. This would leave 2x50 MHz of 2.6 GHz spectrum available. Telefónica could be prevented from acquiring 2x15 MHz of this spectrum by Everything Everywhere and Vodafone each strategically investing in 2x20 MHz.
- A3.361 While we cannot rule out this risk, we note that it relies on Everything Everywhere acquiring a large amount (2x20 MHz) of 800 MHz spectrum. This is twice the amount of 800 MHz spectrum that has been won by any bidder in other European auctions (apart from Denmark). In addition, while Everything Everywhere may have a relatively high intrinsic value for 2x5 MHz or 2x10 MHz of 800 MHz spectrum, its marginal intrinsic value for additional 800 MHz spectrum above this amount is likely to be lower (which affects the cost of strategic investment).
- A3.362 Compared to the previous scenario, if the fourth national wholesaler were to acquire a reserved portfolio including 800 MHz spectrum, this would be associated with larger opportunities for Telefónica to acquire 2x15 MHz in the 1800 MHz and/or 2.6 GHz bands, depending on the specific reserved portfolio. Accordingly the cost of successful strategic investment against Telefónica (or Vodafone) would be higher and the risk lower for Telefónica (or Vodafone). For example, if the fourth national wholesaler won Portfolio 2 (2x10 MHz of 800 MHz and 2x10 MHz of 2.6 GHz), Telefónica (or Vodafone) could acquire the 1800 MHz spectrum or 2x15 MHz out of the remaining 2x60 MHz in the 2.6 GHz band. If the fourth national wholesaler won Portfolio 3 (2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz), Telefónica (or Vodafone) could acquire 2x15 MHz out of the remaining 2x70 MHz of 2.6 GHz.
- A3.363 In conclusion, with our measures to promote competition, there is some increase in the risk of effective strategic investment against either Vodafone or Telefónica if they needed 2x15 MHz rather than 2x10 MHz (as considered in Section 4, from paragraph 4.272). However in our view this would still be less than the risk of effective strategic investment against a fourth national wholesaler in the absence of our measures. Furthermore, we consider it unlikely that either Vodafone or Telefónica requires 2x15 MHz of contiguous spectrum in the Auction to be credible.

Strategic Investment – International Experience

Our position in the January 2012 consultation

- A3.364 In our January 2012 consultation we said (Annex 6, paragraph 3.57) that while it was difficult to draw any firm lessons from auctions held in other countries, some common features of these auctions might help inform the likely minimum share of spectrum needed to be credible. We noted (Annex 6, paragraph 3.68) that the evidence from international auctions was consistent with our view that national wholesalers with very small quantities of spectrum might struggle to deliver the minimum level of capacity and average data rates needed to provide a significant competitive constraint.
- A3.365 We also noted (Annex 6, paragraph 3.130) that evidence from international markets showed that sub-1 GHz spectrum was more valuable than higher frequency spectrum. However we said that evidence from international markets should be treated cautiously, because:

- a) The auctions of 800 MHz spectrum in European markets had happened quite recently, so it was likely to be too early to tell whether sub-1 GHz spectrum was necessary to being a credible national wholesaler.
- b) The distribution of sub-1 GHz spectrum had been influenced by regulatory intervention to allocate such spectrum more widely. As a result, holdings of sub-1 GHz spectrum might not reflect what was required to be a credible wholesaler or what national wholesalers themselves believed they needed in order to be credible.

Stakeholders' responses

A3.366 Vodafone said other European spectrum awards offered no evidence of strategic investment by incumbent operators, and that no small operator has been driven below the 10-15% share of spectrum which Ofcom saw as the minimum required for capacity purposes.³¹⁶ Vodafone referred to nine other European countries³¹⁷ in which the smallest operator(s) are expected³¹⁸ to secure at least a 10% share of spectrum. Operators in four of these countries required additional paired 2.6 GHz spectrum in order to achieve this threshold. Vodafone inferred that in these countries strategic investment could have rendered the smallest operator uncompetitive but that it did not occur.³¹⁹

A3.367 Vodafone said that in seven out of the nine European countries the smallest operator acquired at least 2x10 MHz of 2.6 GHz spectrum. The exceptions were Belgium and Spain. Vodafone said it appeared that Telenet Tecteo (in Belgium) and Yoigo (in Spain) believed that they did not require 2.6 GHz spectrum in order to be credible, given the low price of this spectrum suggested that budget constraints were not an issue. Vodafone drew a number of inferences from these Auction outcomes,³²⁰ namely that:

- a) An operator that needed 2.6 GHz spectrum could be assured of acquiring at least 2x10 MHz;
- b) There is no evidence of strategic investment on the part of incumbent operators;
- c) There is evidence from Belgium and Spain that the smaller portfolios provide enough spectrum for a fourth operator.
- d) The risk of making 2x10 MHz of 2.6 GHz part of a minimum package is that the fourth bidder does not actually want it very much, but is forced to take it anyway

A3.368 Telefónica drew conclusions from the European auction outcomes which related to intrinsic value and strategic investment respectively:

- a) As regards intrinsic value, it referenced the awards in Austria, France, Germany and Sweden, stating that the allocations observed in these auctions showed that the fourth player does not always have the lowest valuation of spectrum. More specifically, it pointed to the large amounts of 2.6 GHz spectrum won by smaller

³¹⁶ January 2012 consultation, Annex 6, paragraph 3.2; Vodafone consultation response, paragraph 54(b).

³¹⁷ Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Spain and Sweden.

³¹⁸ We derived the expected future share by including all spectrum assignments an operator is expected to acquire (with reasonable certainty) in the next few years.

³¹⁹ Namely Austria, Denmark, France and Italy. Vodafone consultation response, paragraphs 52 and 53(c).

³²⁰ Vodafone consultation response, paragraphs 54(a-c).

operators in Austria and France (relative to operators with a larger market share) and the fourth national wholesalers' ability to win 800 MHz spectrum in Germany and Sweden. Telefónica Germany won 2x10 MHz of 800 MHz, although the third operator won more capacity, and Hi3G in Sweden won more 800 MHz than the second and third operators.³²¹

- b) Telefónica said there was no evidence of strategic investment in these auctions. It noted that in Austria, Denmark, Sweden and Italy the fourth largest operator (by market share) was able to win at least enough spectrum to satisfy Ofcom's medium portfolios. In the Austrian and Danish 2.6 GHz auctions, the fourth largest operator won 2x20 MHz and 2x10 MHz respectively. In Sweden and Italy it acquired 2x10 MHz of 2.6 GHz spectrum plus some additional spectrum in other bands (2x10 MHz of 800 MHz spectrum in Sweden; a further 2x5 MHz of 1800 MHz spectrum in Italy).³²² Telefónica said that in all of these countries, despite the fact strategic behaviour was more executable due to auction design, strategic investment was not profitable and the fourth largest operator acquired sufficient additional spectrum, without requiring the reservation of 2.6 GHz spectrum.³²³

A3.369 Telefónica said that auction outcomes in Denmark, Germany, Italy and Spain are not comparable to the UK, since the smaller operator had already access to 1800 MHz spectrum prior to the auction. As a result, operators in these countries had less need for additional spectrum.³²⁴

Ofcom's response

A3.370 We remain of the view that auction outcomes in other countries, while potentially informative, do not provide conclusive evidence as to likely outcomes in the UK, and must be treated with caution. As we shall discuss, there are specific reasons why certain outcomes in other European auctions may not be relevant to the UK situation. But more generally, all such inferences should be treated with caution because (a) auction outcomes elsewhere may be influenced by country-specific circumstances of which we are not fully aware, such as differences in network density and in the competitive, regulatory, and overall economic environment, and (b) it is too soon to tell whether these auction outcomes will lead to four credible national wholesalers in the markets concerned.

A3.371 In this response we begin by setting out circumstances in each country which may have affected outcomes for the fourth national wholesaler. Next we consider the position in relation to acquisition of 800 MHz spectrum, acquisition of 2.6 GHz spectrum, and outcomes in terms of overall share of spectrum. Finally, we consider the price of spectrum in other European awards. In each of these cases we address the relevant arguments from Vodafone and Telefónica.

Country-specific circumstances

A3.372 We have outlined below the country specific circumstances which may have influenced the auction outcome in each of the countries below:

- **Austria** – Currently only the 2.6 GHz band has been awarded recently in Austria. The 800 MHz spectrum will be awarded along with re-award of the 900 MHz and 1800 MHz spectrum in the next few years. This provides scope for fairly significant

³²¹Telefónica consultation response, paragraphs 153 and 177(a).

³²²Telefónica consultation response, figure 15 on page 48.

³²³Telefónica consultation response, paragraphs 171 and 177(b).

³²⁴Telefónica consultation response, paragraphs 169(b) and 178.

changes in distribution of frequencies as the award will make available a total of 2x140 MHz of spectrum. We therefore consider that outcomes to date in Austria are of limited value in informing our position.

- **Belgium** – The fourth national wholesaler in Belgium (Telenet Tecteo) has the option to acquire 2x5 MHz of 900 MHz and 2x10 MHz of 1800 MHz spectrum in 2015. This would significantly boost its share of spectrum, and includes the benefits of sub-1 GHz. We therefore place limited weight on their apparent lack of demand for 2.6 GHz spectrum.
- **Denmark** – Prior to the Danish 2.6 GHz auction, 2x5 MHz of 900 MHz and 2x10 MHz of 1800 MHz were sold in auctions where the releasing operators (TDC, Telia and Telenor) were not allowed to participate. This spectrum was won by the fourth national wholesaler (Hi3G). Hi3G was therefore potentially less at risk of strategic investment in the 2.6 GHz band than may be the case for H3G in the UK. In addition, the amount that an individual operator could win was capped at 2x20 MHz. As a result, the three largest operators could (and did) win a maximum of 2x60 MHz in aggregate which effectively reserved 2x10 MHz for a fourth operator. In the Danish 800 MHz auction, the second and third largest incumbents jointly bid for spectrum (via a joint venture). Joint bidding will not be facilitated in the UK, and the application of spectrum caps may mean that certain forms of joint bidding are relatively restrictive.
- **France** – Prior to the auction in 2011 the fourth national wholesaler (Iliad) was granted 2x5 MHz of 900 MHz released by the three existing wholesalers in the 900 MHz band. In addition, the French multiband auction included a provision where any winner of 2.6 GHz spectrum that failed to win 800 MHz spectrum would have the right to purchase wholesale access from the winner of the two middle blocks in the 800 MHz band. The outcome of the auction means Iliad will be able to apply for roaming rights from SFR once its own 2.6 GHz network covers 25% of the population. Given Iliad's access to sub-1 GHz and the additional provisions within the auction to protect the bidder who failed to win spectrum, we consider Iliad may have been less prone to strategic investment than a fourth national wholesaler in the UK (without measures to promote competition).
- **Germany** –The spectrum shares in Germany prior to the auction were relatively balanced across the four national wholesalers, with each having access to at least 2x5 MHz of sub-1 GHz spectrum. This is significantly different to the position in the UK and therefore very difficult to draw any direct comparisons on the prospect of strategic investment.
- **Italy** – The fourth national wholesaler (3 Italia) has the option to acquire 2x5 MHz in the 900 MHz band by 2013, and 2x10 MHz at 1800 MHz (uncertain timing). This makes 3 Italia's medium term spectrum holdings significantly different from H3G in the UK.
- **The Netherlands** –The Dutch market was characterised by three national wholesalers prior to the auction. The award for frequencies in the 2.6 GHz band featured very tight spectrum caps which effectively guaranteed entry (provided a new entrant was willing to pay the reserve price). In addition, existing licences in the 900 MHz and 1800 MHz bands will not be renewed on expiry; instead they will be awarded through an auction. Given the Dutch market was three national wholesalers prior to the auction, and the outcome is largely a result of very tight spectrum caps, we consider any meaningful conclusions relevant to the UK are very limited.

- **Spain** – Prior to the auction in 2011 Spain awarded spectrum through a beauty contest (2x5 MHz of 900 MHz and 2x15 MHz of 1800 MHz) in which existing holders of spectrum in the respective bands could not bid. The fourth national wholesaler (Yoigo) won 2x15 MHz of 1800 MHz. In addition, Yoigo holds a roaming agreement with Telefónica which came about due to a regulatory obligation to offer access to new entrants and MVNOs.
- **Sweden** – Prior to the recent auction for 800 MHz and 2.6 GHz, 2x5 MHz of 900 MHz spectrum was freed by the three largest incumbents and granted to Hi3G (the fourth national wholesaler). This boosted its share of spectrum prior to the auction, as well as having the advantages of sub-1 GHz. Also we note within the most recent auction there was joint bidding on 800 MHz spectrum which may have contributed to the outcome of Hi3G being able to win 2x10 MHz of 800 MHz. The fourth national wholesaler’s pre-auction holdings were stronger than H3G in the UK, and the presence of joint bidding in the auction means it is difficult to rely on this outcome to assess the prospect of strategic investment in the UK.

A3.373 In a number of cases (Denmark, France, Italy, Sweden) the regulator has made an explicit decision to reallocate spectrum in favour of a fourth national wholesaler, either prior to, or in the few years following the auction. This will have reduced the spectrum requirement for these operators in the respective auctions. In the case of France and The Netherlands, the auction included provisions to ensure an outcome where at least four national wholesalers would exist post auction – through the use of caps in The Netherlands, and access obligations in France. In Austria and The Netherlands frequencies in the 900 MHz and 1800 MHz bands will be auctioned alongside the 800 MHz providing an opportunity to secure a potentially significant amount of spectrum in the near future. Germany is fairly distinct in that the third and fourth national wholesalers are similar in terms of subscriber numbers.³²⁵ This will tend to reduce the risk of strategic investment as the likely victim may be less obvious.

A3.374 This evidence shows that in many of the auction outcomes cited by Vodafone and Telefónica there were circumstances which may have led to differences with the UK in both the relative intrinsic value of the fourth national wholesaler, and the prospect of strategic investment.

A3.375 We now consider the extent to which the current position of H3G in the UK is similar to that of the position of fourth national wholesalers prior to the relevant spectrum auctions. H3G’s UK spectrum holdings (2x15 MHz of 2.1 GHz) are generally weaker than the pre-auction holdings of the fourth national wholesaler in other European countries – see Figure A3.2 below.

Figure A3.2: Pre-award spectrum holdings of the fourth largest operator

Country (operator)	Pre-award share of paired spectrum	Held 900 MHz spectrum pre award?	Held 1800 MHz spectrum pre award?	Additional Notes
Austria (Hi3G). In Austria	9%	No	No	900 MHz and 1800 MHz to be re-awarded
Belgium (Telenet)	10%	No	No	Telenet Tecteo has option to buy 2x5 MHz of

³²⁵ As explained in paragraph A2.222, E-Plus is generally considered to be the fourth player in Germany, even though Telefónica Germany has slightly fewer subscribers.

Tecteo)				900 MHz and 2x10 MHz of 1800 MHz
Denmark (Hi3G)	18%	Yes	Yes	
France (Iliad)	6%	Yes	No	
Germany (E-Plus)	27%	Yes	Yes	
Italy (3 Italia)	11%	No	Yes	Likely to receive 2x5 MHz of 900 MHz and 2x10 MHz of 1800 MHz
Spain (Yoigo)	19%	No	Yes	Reflects position after May 2011 beauty contest
Sweden (Hi3G)	19%	Yes	No	
UK (H3G)	9%	No	No	

Note: Pre-award share of paired spectrum is calculated with reference to the paired spectrum available for mobile at that time in the respective countries.

A3.376 This data indicates the following:

- H3G UK's pre-Auction share of paired spectrum is similar to that of the fourth largest operator in Austria, Belgium and Italy. However, operators in these countries have the potential to obtain additional 900 MHz and 1800 MHz spectrum (an option to buy this spectrum in Belgium and Italy; re-award of this spectrum in Austria).
- H3G UK's pre-Auction share of paired spectrum is higher than that of Iliad in France but Iliad possessed 2x5 MHz of 900 MHz spectrum.
- H3G UK's pre-Auction share of paired spectrum is lower than that of the fourth national operator in Denmark, Germany, Spain and Sweden. Moreover in each of these countries the smaller operator had 900 MHz and/or 1800 MHz spectrum. Indeed in Germany, while E-Plus is generally considered to be the 'fourth player' it actually has a slightly higher share of subscribers than Telefónica Germany.

A3.377 In summary, according to the three measures set out above, H3G's spectrum holdings in the UK are weaker than the fourth operator in five out of eight countries – Denmark, Germany, Italy, Spain and Sweden, and not necessarily stronger than the fourth operator in the remaining three countries.

A3.378 H3G UK's relatively weak pre-Auction spectrum holdings have two implications:

- On the one hand, it may tend to increase H3G's intrinsic value of additional spectrum compared to that of smaller operators in other European countries.³²⁶

³²⁶ As explained in paragraphs 5.19-5.28 of the January 2012 consultation, in general the marginal value a national wholesaler places on additional spectrum tends to fall as its spectrum holdings increase. As we discuss in Section 4, intrinsic value also depends on other factors such as the size of the fourth operator's customer base.

- On the other hand, it implies that H3G may need to acquire a greater amount of spectrum than its European counterparts to be credible. It may thus be more vulnerable to strategic investment by larger operators.

A3.379 This evidence would tend to suggest we should be cautious about drawing strong conclusions on the risk of strategic investment in the UK based on European auctions because the fourth national wholesalers were in markedly different positions prior to the auction. H3G in the UK has a smaller spectrum holding than many of the other fourth national wholesalers in Europe prior to the auctions. In other countries, where operators had a small pre-auction holding, there was future provision/opportunities to acquire further spectrum (either through direct assignment or further auctions).

800 MHz awards and allocation

A3.380 Next we consider the awards of 800 MHz across Europe and the possible implications for our concerns about strategic investment and intrinsic value. Figure A3.3 below sets out the position of the fourth national wholesaler in other countries where 800 MHz has been awarded.³²⁷

Figure A3.3: Allocation of 800 MHz spectrum in Europe

Country (fourth largest operator)	Three bidders each won 2x10 MHz?	Fourth largest operator won 800 MHz spectrum?	Notes
Denmark (Hi3G)	No	No	An incumbent won 2x20 MHz. Joint bidding between other incumbents. Hi3G has 900 MHz
France (Iliad)	Yes	No	Iliad has 900 MHz spectrum and wholesale access
Germany (E-Plus)	Yes	No	E-Plus has 900 MHz spectrum, similar sized operator to Telefónica Germany
Italy (3 Italia)	Yes	No	3 Italia expected to receive 900 MHz spectrum
Spain (Yoigo)	Yes	No	Yoigo did not bid for 800 MHz
Sweden (Hi3G)	Yes	Yes	Joint bidding between two incumbents

³²⁷ Portugal and Switzerland are not included in this Table since there are only three national wholesalers in each of these countries. They are thus less relevant to the circumstances in the UK. Note, however, that in both Portugal and Switzerland each operator won 2x10 MHz of 800 MHz spectrum i.e. an equal three-way split of this spectrum.

A3.381 In five of these six auctions the 2x30 MHz of 800 MHz spectrum available was ultimately split between three bidders, each of which acquired 2x10 MHz. In Denmark, France, Germany, Italy and Spain the fourth largest operator failed to secure any 800 MHz spectrum. In Sweden the fourth national wholesaler acquired 2x10 MHz, as a result of joint bidding between two incumbents and spectrum caps. As noted above, there are a number of differences with the UK:

- Prior to the French auction, Iliad was granted 2x5 MHz of 900 MHz spectrum and under the award rules, any winner of 2.6 GHz spectrum (such as Iliad) that failed to acquire 800 MHz spectrum would be able to purchase wholesale access from a successful bidder.
- E-Plus in Germany held 2x5 MHz of 900 MHz spectrum prior to the auction. Note also that it is broadly similar in size to Telefónica Germany, which did successfully secure 800 MHz spectrum (indeed Telefónica's response characterised Telefónica Germany as the fourth operator).
- It is expected that 3 Italia will be awarded 2x5 MHz of refarmed 900 MHz spectrum.
- In Sweden, the second and third largest operators formed a joint venture (Net4Mobility) that successfully bid for 2x10 MHz of 800 MHz spectrum. A spectrum cap of 2x10 MHz applied to all bidders for this spectrum, so a necessary implication of joint bidding was that the three largest operators would not acquire all the available 800 MHz spectrum. Joint bidding will not be facilitated in the UK Auction.

A3.382 In Denmark, TDC, which is considerably larger than the other Danish operators, won 2x20 MHz of 800 MHz spectrum. The second and third largest operators (Telenor and Teliasonera) jointly bid for 2x10 MHz of 800 MHz spectrum. The smallest operator (Hi3G) did not win any 800 MHz spectrum. Hi3G does have 2x5 MHz of 900 MHz spectrum as well as 2x10 MHz of 1800 MHz spectrum.

A3.383 Overall, the evidence from other European auctions supports the existence of a clear focal point (three operators each acquiring 2x10 MHz of 800 MHz spectrum). This outcome has arisen in most other European countries (the only exception being Denmark). Caution is required in interpreting other implications of these auctions for the UK because of the differences in country circumstances set out above.

2.6 GHz awards and allocation

A3.384 We set out the European experience in relation to allocation of 2.6 GHz in Figure A3.4 below:³²⁸

Figure A3.4: Allocation of paired 2.6 GHz spectrum in Europe

Country (operator)	Amount of 2.6 GHz spectrum won by fourth operator	Additional Notes
Austria (Hi3G)	2x20 MHz	

³²⁸ The nine countries set out in this Table were cited by Vodafone in its consultation response (table after paragraph 52). In addition, 2.6 GHz spectrum has also been allocated in Finland, Portugal and Switzerland. However there are only three national wholesalers in each of these countries. They are thus less relevant to the circumstances in the UK.

Belgium (Telenet Tecteo)	None	2x15 MHz of 2.6 GHz spectrum was not sold in the auction.
Denmark (Hi3G)	2x10 MHz	
France (Iliad)	2x20 MHz	
Germany (E-Plus)	2x10 MHz	
Italy (3 Italia)	2x10 MHz	
Netherlands (Tele2 and Ziggo)	2x20 MHz each	Tight caps on three incumbents supported entry by Tele2 and Ziggo.
Spain (Yoigo)	None	Yoigo did not bid for 2.6 GHz spectrum.
Sweden (H3G)	2x10 MHz	

A3.385 This evidence shows that, with the exception of Belgium and Spain, the fourth national wholesaler in other European countries has been able to obtain 2.6 GHz spectrum. We note the circumstances in the Belgian and Spanish auctions:

- **Belgium** - 2x15 MHz of 2.6 GHz spectrum went unsold in the Belgian award. This was due to the caps imposed, the lot sizes available, and also Telenet Tecteo's decision not to bid for spectrum in this band. The lot sizes were dependent on the number of operators which were admitted into the auction – Telenet Tecteo was admitted into the auction and therefore the band was split into 4 lots of 2x15 MHz and 2 lots of 2x5 MHz.³²⁹ Given the auction also featured caps of 2x20 MHz on 2.6 GHz spectrum, it was not possible for any operator other than Telenet Tecteo to bid for the remaining 2x15 MHz lot, which it chose not to do. This resulted in the spectrum going unsold.
- **Spain** - All paired 2.6 GHz spectrum was sold in the Spanish auction, with Yoigo choosing not to bid for any. The reasons for not bidding are noted in paragraph A3.390 below. In addition we also note Yoigo's recent acquisition of 2x15 MHz of 1800 MHz spectrum prior to the auction of 2.6 GHz.

A3.386 If we focus on those countries where the fourth national wholesaler obtained paired 2.6 GHz spectrum, we note that in 4 out of 7 cases, the fourth operator secured 2x10 MHz, with the remaining frequencies split equally (2x20 MHz each) between the remaining three incumbents. This is consistent with our view that each of the three larger operators acquiring 2x20 MHz of 2.6 GHz spectrum could be a focal point for strategic investment, if the fourth national wholesaler needed 2x20 MHz of 2.6 GHz to be credible.

A3.387 On the other hand, we recognise that ability of the fourth national wholesaler to acquire 2x10 MHz of 2.6 GHz in each of these cases is consistent with a view that there is a lower risk of a fourth national wholesaler failing to win 2x10 MHz of 2.6 GHz. The risk of strategic investment in 2.6 GHz spectrum against the fourth national wholesaler is discussed further from paragraph 4.195 in Section 4.

³²⁹ See the DotEcon and Aetha Report, paragraphs 121-122 for further details.

A3.388 We now consider Vodafone's claim that in Belgium and Spain the fourth operator did not bid as they each took the view that 2.6 GHz was not required to be credible.

A3.389 We consider that the circumstances in Belgium outlined above, where the fourth national wholesaler has an option to acquire additional 900 MHz and 1800 MHz spectrum in the near future, are likely to have had a bearing on its incentives to bid for 2.6 GHz in the auction.³³⁰ It is possible Telenet Tecteo, which is a relatively new entrant³³¹, took a medium term view of its spectrum requirements including the frequencies it has the option to acquire in 2015. Doing so would have reduced the incremental value of additional 2.6 GHz spectrum relative to a scenario where it only considered its current holdings in the 2.1 GHz band. In addition, the digital dividend spectrum (800 MHz) has not yet been made available in Belgium and while the strategy for release has not been decided at present, the Belgian regulator (BIPT) has stated it is likely to come in line with EU policy, releasing it for mobile use.³³² This would provide another opportunity for Telenet Tecteo to obtain more spectrum if required. Further, as it is a recent entrant it is unlikely to be spectrum constrained in the near future until it builds up a more significant customer base. We therefore do not consider that any strong conclusions can be drawn from Telenet Tecteo about the likely outcome in the UK.

A3.390 The fourth national wholesaler in Spain (Yoigo), also a relatively new entrant, acquired 2x15 MHz of 1800 MHz prior to the auction and chose not to bid for any frequencies in the 800 MHz, 900 MHz or 2.6 GHz bands. Its share of spectrum post auction is 11%, but its holdings (2x15 MHz of 1800 MHz and 2x15 MHz of 2.1 GHz) are less than those which we have specified in our medium portfolios. In an interview following the auction, Yoigo CEO Johan Andsjö said that Yoigo's decision not to participate in the mobile spectrum auction was mainly due to fears of a bad investment, stating:

"With the price that [the government] has set; if we had bought the frequencies auctioned we would have got return on investment only in ten years. Moreover, the payment had to be made now, while the frequencies cannot be used until 2015"³³³

A3.391 Moreover, a key question is whether Yoigo will be credible in the near and longer term with this spectrum holding. We are cautious of drawing strong conclusions about this, for the following reasons:

- The Spanish auctions were relatively recent, in 2011, and the 800 MHz spectrum is not yet available, and may not be available until the end of 2014.³³⁴ This means that the implications of the very different spectrum shares may not yet have influenced the market.
- In the last quarter of 2011, Yoigo only had a 4% share of mobile revenues (and in terms of subscribers had 5.5% in April 2012), though we recognise that considering

³³⁰ If TelenetTecteo exercises the option to buy this additional spectrum, its share of paired spectrum would rise from 7% to 12%.

³³¹ It only obtained its 3G licence (for 2x15 MHz of 2.1 GHz spectrum) in 2011.

³³² <http://www.aspectconsulting.eu/en/assets/File/mobile-challengers-nov2010-ok.pdf>

³³³ <http://www.telecompaper.com/news/spanish-mobile-tariffs-to-drop-by-another-30-yoigo-ceo>

³³⁴ <http://www.minetur.gob.es/es-ES/GabinetePrensa/NotasPrensa/2011/Paginas/nplandividendodigital.aspx>

market share alone may not give a good indication of whether or not Yoigo is credible.³³⁵

- As explained above, Yoigo holds a roaming agreement with Telefónica which came about due to a regulatory obligation to offer access to new entrants and MVNOs. For the reasons set out in Section 4 we are promoting competition at the national wholesale level between at least four credible national wholesalers, and we have decided not to impose regulatory access obligations at present (see also paragraph A3.454 below).

Post auction shares of spectrum

A3.392 We now consider Vodafone's argument that, since no small operator was driven below Ofcom's minimum spectrum share requirement (10-15%) these auctions provided no evidence of strategic investment.

A3.393 As noted in paragraphs A3.370-A3.379 above, we consider that the experience of other European auctions, while potentially informative, does not provide conclusive evidence as to likely outcomes in the UK. We recognise that our analysis of these auctions does not provide direct evidence of strategic investment. It would be very difficult to make such an inference either way, since bidders' intrinsic value of the spectrum is not widely known. However this evidence does not in our view remove our concern about the risk of strategic investment against a fourth national wholesaler in the UK, especially given the differences in circumstances set out above.

The price of spectrum in other European countries

A3.394 As set out above, Telefónica considered that the hypothesis that the fourth national wholesaler has the lowest valuation of spectrum is not always supported by the evidence from other European countries.³³⁶

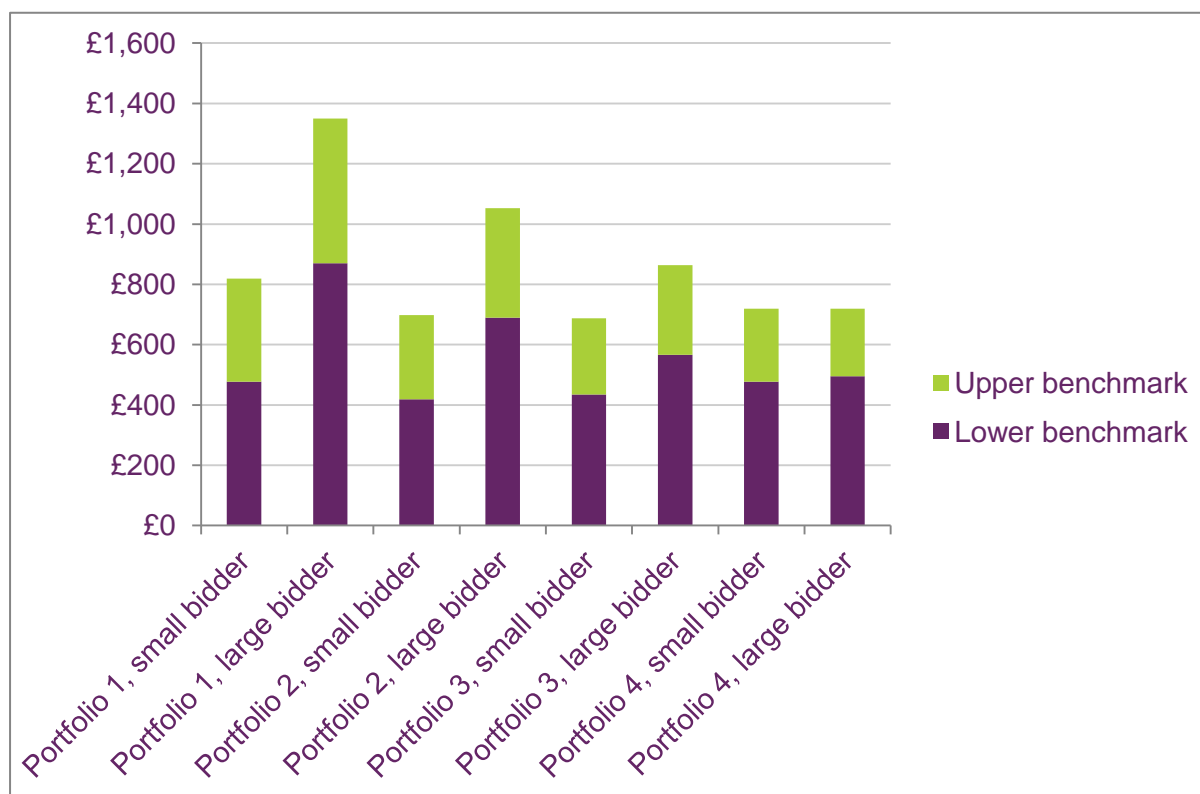
A3.395 As part of our analysis of reserve prices, Table 8.2 in Section 8 sets out benchmark values for paired 800 MHz, 1800 MHz and 2.6 GHz spectrum, based on the international experience. This Table sets out high and low benchmarks for the amounts paid by small bidders (specifically the fourth player) and large bidders (specifically the top three incumbent operators). We have used these to calculate high and low benchmarks for the values of the four reserved spectrum portfolios to small and large bidders.³³⁷ The results are set out in Figure A3.5 below.

³³⁵ http://cmtdata.cmt.es/cmtdata/jsp/inf_trim.jsp?tipo=2
http://www.cmt.es/c/document_library/get_file?uuid=7fd4c7c8-802c-4d10-bcd7-066b3933f91a&groupId=10138

³³⁶ Telefónica consultation response, paragraph 153.

³³⁷ We multiplied the benchmark value of spectrum by the amounts of spectrum in each of the reserved spectrum portfolios.

Figure A3.5: Values of reserved spectrum portfolios using benchmarks from Reserve Price Study (£m)



A3.396 For Portfolios 1 and 2, the benchmarks for larger bidders are considerably higher than those for the fourth operator (with the lower benchmark for the larger bidders being close to the upper benchmark for a small bidder). For Portfolio 3, the benchmarks for the larger bidders are also higher than those a smaller bidder. However, for Portfolio 3 there is overlap between the upper end of the range of a small bidder's valuation and the lower end of the range of a large bidder's valuation. It is only for Portfolio 4 (which does not contain any 800 MHz spectrum) that the benchmarks are similar. It is relevant to the comparisons for Portfolios 3 and 4 that the much more limited evidence on benchmarks available for 1800 MHz compared to 800 MHz did not enable different benchmark figures to be derived as between small and large bidders (even if such differences were present).

A3.397 We do not draw strong inferences from this evidence, given that circumstances in other countries may differ from those in the UK (as described above). Nonetheless it is broadly consistent with our conclusion on intrinsic value in Section 4, i.e. that there remains a risk that a fourth national wholesaler may have a lower intrinsic value for the spectrum in the Auction than the other national wholesalers.

Policy option assessment

Summary of our position in January 2012 consultation

A3.398 In Section 8 of Annex 6 of the January 2011 consultation we considered seven policy options for promoting national wholesale competition, namely:

- Option 1: No measures in the Auction to promote national wholesale competition
- Option 2: Safeguard caps only

- Option 3: Tight caps to promote at least four national wholesalers
- Option 4: Reservation for a fourth national wholesaler and safeguard caps
- Option 5: Reservations to ensure at least four national wholesalers when sub-1 GHz spectrum is essential, and safeguard caps
- Option 6: Reservations to ensure at least four national wholesalers when an early route to LTE is essential, and safeguard caps
- Option 7: Reservations of spectrum to mitigate all risks to national wholesaler competition, and overall cap

A3.399 We considered each of these options in terms of its effectiveness in addressing the potential competition concerns we had identified and also the risk of the option resulting in spectrum inefficiency or other disadvantages.

A3.400 We summarised our assessment in the following table (Figure 8.3 in Annex 6 of the January 2012 consultation). The final column shows our view of the importance for each concern. The final row summarises our view of how restrictive each option is (relative to Option 1, no measures).

Figure A3.6: Comparison of effectiveness of options

	Effectiveness of Option in addressing competition concerns compared to Option 1 (no measures)						Importance of concern
	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	
Concern that fewer than four credible national wholesalers							
1. Fourth national wholesaler not credible because insufficient share of spectrum & no sub-1 GHz spectrum & no spectrum for early route to LTE or high peak data rates with early LTE	Low	High	High	High	High	High	High
2. Everything Everywhere not credible because no sub-1 GHz spectrum	Medium	High	Low (may worsen)	High	Low (may worsen)	High	Low to Medium
3. Telefónica/Vodafone not credible because no spectrum for early route to LTE, high peak data rates with early LTE or greater capacity	Low	High	Low (may worsen)	Low (may worsen)	High	High	Low to Medium
Concern that even if at least four credible national wholesalers one or more wholesalers is at a disadvantage in competing across a wide range of services and customers							
4. Weaker competition because one or more competitors does not have sub-1 GHz spectrum	Medium	High	Medium	High	Medium	High	Low
5. Weaker competition because one or more competitors does not have early route to LTE	Low	Medium to High	Low to Medium	Low (may worsen)	High	High	Low
6. Weaker competition because one or more competitors does not have 2x15 or 2x20 contiguous block for LTE	Low	Medium to High	Low	Low	Low	Low	Low
7. Weaker competition because one or more competitors does not have enough spectrum for capacity and average data rates	Low to Medium	Medium to High	Medium to High	Medium	Medium to High	Medium to High	Low
8. Weaker competition because one competitor has a very large share of spectrum	Medium to High	High	Medium to High	Medium to High	Medium to High	Medium to High	Low
Restrictiveness of option	Low	High	Low to Medium	Medium	Medium	High	

A3.401 We preferred Option 4. This was because it was likely to be effective at addressing what we considered to be the most significant competition concern, and did this in a more proportionate way than the other options. We recognised that it did not address all the potential competition concerns as effectively as some other options, but we considered it was not proportionate to put in place highly restrictive options to address all potential competition concerns.

A3.402 In Section 6 of Annex 6 of the January 2012 consultation we also considered the possible use of bidder credits to promote a fourth national wholesaler, but we did not include this as one of the main options we assessed. This was because we considered it had disadvantages compared to a reservation.

A3.403 When we reply to responses below, we summarise in more detail our views in the January 2012 consultation on some of these options.

Division of topics in responses

A3.404 We summarise responses and set out our reply by considering the following topics:

- Overlapping competition concerns and inconsistent scoring;
- Assessment criteria and approach;
- Feasibility of secondary trading;
- Reversibility of measures to ensure four national wholesalers;
- Choice of policy options, under which we consider:
 - a) Tight caps;
 - b) Competition constraint (as in Option 4 of the January 2012 consultation);
 - c) Set aside; and
 - d) Bidder credit.

A3.405 Below for each of these in turn we summarise responses on the topic and our response.

Overlapping competition concerns and inconsistent scoring

Summary of responses

A3.406 Everything Everywhere considered Ofcom's assessment of options was non-systematic, inconsistent and cursory. It considered our competition concerns overlapped quite significantly. For example, it considered that competition concerns numbered 1 and 2 were related to competition concern number 4.

A3.407 It also considered our assessment of the policy options was inconsistent and biased against it. It gave the following example:

"It ranks Option 4 as "Low (may worsen)" against concern number 2 (Everything Everywhere is not credible because it does not have any sub-1 GHz spectrum), whilst at the same time ranking Option 4 as "Medium" against concern number 4 (weaker competition because one or more competitors does not have sub-1 GHz spectrum).

Surely if Option 4 is not effective in addressing concern number 2 (Everything Everywhere's access to sub-1 GHz spectrum), it would not be effective in addressing concern number 4 (avoiding the risk of weaker competition due to lack of sub-1 GHz) either? It would appear that in this instance the scoring for concern number 4 is akin to the average of the "High" score against concern number 1 and the "Low (may worsen)" score against concern number 2, when it would have been more appropriate to take the lower score against 1 or 2 and apply to 4. This is repeated in the scoring of Option 6. In contrast, the "Low to medium" and "Low" scoring of Option 4 against concern number 5 and 6 (which are more relevant to Vodafone and O2) does indeed take the lower of the scores against concern number 1 and 3

as opposed to the average, which would have produced a “Medium”.
[...]³³⁸

Ofcom’s response

- A3.408 While competition concerns 2 and 4 both relate primarily to sub-1 GHz spectrum, they are distinct. One concern (concern 2) relates to Everything Everywhere not being credible because it does not have sub-1 GHz spectrum. The potential magnitude of this concern is high, but we consider the likelihood is low, because we consider it unlikely that Everything Everywhere needs sub-1 GHz spectrum to be credible.
- A3.409 In contrast, the other concern (concern 4) is when there are four credible national wholesalers, but one or more may not be able to compete as strongly as it might for some services or customers due to lack of sub-1 GHz spectrum. We consider the magnitude of this concern is lower because competition would only be weaker for particular segments of services or consumers and (by definition) would not involve fewer than four national wholesalers with enough spectrum to be credible.
- A3.410 In terms of the scoring, we do not regard differences in the score of the two competition concerns as being inconsistent. Since competition concerns 1 and 2 are distinct from concern 4, the scoring of concern 4 is not an average of concerns number 1 and 2. We scored concern 4 as being “Medium” because the possible reservation of sub-1 GHz spectrum for a fourth national wholesaler and the sub-1 GHz cap would mitigate this concern. With these measures, there would be at least three national wholesalers with sub-1 GHz spectrum, although there may not be four.
- A3.411 In contrast, the reason we scored concern 5 as “Low to Medium” was because with these measures only at least two national wholesalers would be assured of an early route to LTE, though more are likely. We scored concern number 6 as “Low” as our measures do not address this concern well. As we described in Figure 8.3 in Annex 6 of the January 2012 consultation, the safeguard caps have an ambiguous effect on this concern, though the possible reservation could make it easier for a fourth national wholesaler to obtain 2x15 MHz of some frequency.
- A3.412 Because of the concerns raised by Everything Everywhere, we have reviewed some of the scores of the options. The scores are relative to no measures being taken. As a result of reviewing the scores, we now consider that we should amend how effectively competition concern 2 (i.e. Everything Everywhere is not credible because no sub-1 GHz spectrum) is addressed for some options. We have amended the scores for competition concern 2 as follows:
- Option 4 (reservation for a fourth national wholesaler and safeguard caps) from ‘Low (may worsen)’ to ‘Medium’
 - Option 6 (reservations to ensure at least four national wholesalers when an early route to LTE is essential and safeguard caps) from ‘Low (may worsen)’ to ‘Medium’
 - Option 2 (safeguard caps only) from ‘Medium’ to ‘Medium to High’;
- A3.413 We previously scored competition concern 2 as “Low (may worsen)” for Option 4 because we said it had an ambiguous effect on whether Everything Everywhere was more or less likely to obtain sub-1 GHz spectrum. We said: “*while the sub-1GHz*

³³⁸ Everything Everywhere’s non-confidential response, pages 27 and 28.

spectrum cap tends to mitigate the concern that Everything Everywhere does not obtain sub-1GHz spectrum by limiting how much each of Telefónica and Vodafone can acquire, the possible reservation for a fourth national wholesaler of sub-1GHz (if a portfolio with sub-1GHz spectrum was acquired by a fourth national wholesaler) tends to increase the concern because there would be less left for others” (in Figure 8.3 of Annex 6 of the January 2012 consultation).

- A3.414 However, we now consider that the reservation for a fourth national wholesaler may only slightly increase the risks of Everything Everywhere failing to obtain sub-1 GHz spectrum if it needs it to be credible. This is because one of the alternative portfolios that is reserved for a fourth national wholesaler contains no sub-1 GHz spectrum (i.e. the portfolio of 2x15 MHz of 1800 MHz and 2x20 MHz of 2.6 GHz spectrum). The competition constraint ensures that a fourth national wholesaler obtains one of the portfolios, with the particular one being determined by bids in the Auction. The winning set of bids would be those that maximised value (as expressed in Auction bids), subject to meeting the constraint of a fourth national wholesaler obtaining one of the possible reserved portfolios. Therefore the higher the bids that Everything Everywhere (and other non opted-in bidders) make for 800 MHz spectrum, the less likely it is that the portfolio reserved for a fourth national wholesaler will include sub-1 GHz spectrum.
- A3.415 The effect of reservation for a fourth national wholesaler on Everything Everywhere’s risk of failing to acquire sub-1 GHz spectrum is more subtle. Reservation (compared to no reservation) may reduce the price that a fourth national wholesaler would have to pay for a winning portfolio that included sub-1 GHz spectrum as compared with the price that they would have to pay without reservation.³³⁹ As such, it may have some effect in increasing the chances of a fourth national wholesaler acquiring sub-1 GHz spectrum. However, it is questionable that this would be at the expense of Everything Everywhere failing to acquire sub-1 GHz spectrum. Everything Everywhere is likely to have a higher intrinsic value for sub-1 GHz spectrum than a fourth national wholesaler, if both need it to be credible, for example because of its larger customer base. Everything Everywhere is also likely to have a higher intrinsic value for sub-1 GHz spectrum than Telefónica or Vodafone, if it needs such spectrum to be credible whereas Telefónica and Vodafone do not. So, on balance, the sub-1 GHz spectrum caps combined with the competition constraint are in our view reasonably effective at reducing this competition concern.
- A3.416 For Option 6 (reservations to ensure at least four national wholesalers when an early route to LTE is essential), we now consider that the score for the effectiveness of this of addressing competition concern 2 should be also ‘Medium’, rather than ‘Low (may worsen)’. This is for the same reasons as for Option 4, namely that the competition constraint makes it only slightly harder for Everything Everywhere to obtain sub-1 GHz spectrum compared to just having the sub-1 GHz spectrum, and the sub-1 GHz spectrum cap reduces this competition concern.

³³⁹ Without reservation, a fourth national wholesaler would have to pay the full opportunity cost, the auction bid of the highest losing bidder (abstracting from the complications of a package auction). With reservation, it may pay a lower price to win a portfolio that includes reserved spectrum, which may include sub-1 GHz spectrum. To illustrate, consider the simple case of only one opted-in bidder. If this single opted-in bidder were to win the portfolio imposing the lowest opportunity cost on other bidders (i.e. the package that causes the least reduction in the total value of auction bids) they would only have to pay the reserve price for that portfolio. In order for the opted-in bidder to win a portfolio that imposes a higher opportunity cost (for example one that includes sub-1 GHz spectrum perhaps) it will have to bid and pay the additional opportunity cost in addition to the reserve price for the less valuable package, but it will probably not have to pay the full opportunity cost of the more valuable package.

- A3.417 We have also increased the score for the effectiveness of Option 2 (safeguard caps only) for addressing competition concern 2 from ‘Medium’ to ‘Medium to High’. The safeguard caps ensure at least three national wholesalers have sub-1 GHz spectrum, but do not ensure four. As we expect Everything Everywhere to have higher intrinsic value for the sub-1 GHz spectrum than a fourth national wholesaler, if both need it to be credible, we consider the sub-1 GHz cap is likely to be quite effective at mitigating the risk that Everything Everywhere would not obtain sub-1 GHz spectrum. (This also applies to the set aside option we consider below).
- A3.418 For clarity, we note that our judgement is that it is unlikely that Everything Everywhere needs sub-1 GHz spectrum to be credible (as set out from paragraph 4.121 in Section 4). This is reflected in the importance we put on this concern, which is ‘Low to Medium’. This level of importance is a combination of considering that the potential magnitude of this concern (of Everything Everywhere not being credible) is high, but we consider the likelihood to be low.

Assessment criteria and approach

Summary of responses

- A3.419 H3G argues that Ofcom recognises its own uncertainty on the future importance of sub-1 GHz and so should adopt a precautionary principle rather than risk a material degradation of competition. H3G argues that this is consistent with the policy Ofcom has taken in other contexts.³⁴⁰
- A3.420 Everything Everywhere considered that our assessment had a number of defects. These included that we had regarded a number of Options as being equally effective when they were clearly not. It considered this gave a misleading impression that the choice of intervention boils down to which option is “least onerous”, including any adverse, disproportionate effect. It considered that the discussion of which is “least onerous” is rigidly framed by Ofcom’s design of the options under consideration.³⁴¹

Ofcom’s response

- A3.421 In response to H3G’s argument about a precautionary principle, we need to balance the desire to avoid risks to competition in the future with the potential costs of taking unnecessary measures. We have assessed the advantages and disadvantages of the policy options systematically, recognising the uncertainties. We consider that it is right to consider the potential costs of each option as part of this assessment, in order to ensure the policy decision is appropriate and proportionate.
- A3.422 In response to Everything Everywhere’s claim that we regarded options as being equally effective when they were clearly not, this is not the case. We regarded Options 3 to 7 as being effective in addressing our key competition concern to a sufficient degree. But we clearly do not regard all of Option 3 to 7 as being equally effective. We said that Option 3 (tight caps) and Option 7 (mitigate all risks) address more of the competition concerns.³⁴² But we did not choose those options because we did not consider them to be the most appropriate and proportionate options. In response to Everything Everywhere comments, we have revised the description of our assessment to make it clearer.

³⁴⁰ H3G’s non-confidential response, from page 54.

³⁴¹ Everything Everywhere’s non-confidential response, page 30.

³⁴² See for example paragraph 8.171 of Annex 6 of the January 2012 consultation.

A3.423 In response to Everything Everywhere's argument that our assessment is rigidly framed in terms of the particular options we considered, we note that we consulted on a wide range of options and also included variations of those options.

Feasibility of secondary trading

Summary of responses

A3.424 Everything Everywhere considered that we have exaggerated the costs of tight caps. One of the reasons for this was that it considered we had ignored the scope for secondary trading to rectify any inefficiency that the primary allocation may have caused. It said that if there were great differences in valuations between Auction winners and other potential buyers who could not bid in the Auction, they should be incentivised to trade subsequently.³⁴³

Ofcom's response

A3.425 We agree that in theory it could be possible that any inefficiency in the primary allocation could be unwound through subsequent spectrum trading. However, in practice we consider that spectrum trading may not do so and inefficiencies resulting from the Auction could therefore be enduring. For example, rivals may find it difficult to negotiate about the value of spectrum and may be cautious of trading a strategically important asset with rivals.

A3.426 We observe that trades of mobile spectrum are relatively rare internationally, but this might be because existing holdings of spectrum are already efficient or because of impediments to trading from strategic motivations or regulation. And that there are a few examples of trades suggests it is possible for trading to occur.³⁴⁴ Nevertheless, even if trading is more likely to mitigate the largest inefficiencies (as the gains from trade are larger), we consider there are likely to be some practical impediments to trading and that it therefore cannot be guaranteed to remove any inefficiencies. Therefore we consider that excessively restrictive Auction rules could result in lasting inefficiencies.

Reversibility of measures to promote four national wholesalers

Summary of responses

A3.427 Telefónica notes that Ofcom argued that one factor that mitigates the risk of regulatory failure from promoting an Auction outcome with at least four national wholesalers when it would have been in consumers' interests to have fewer, is that this decision could be reversible.³⁴⁵ It would be possible to consider a spectrum trade or a consolidation after the Auction.

A3.428 Telefónica argued that we have made a "reversibility fallacy" by assuming any regulatory failure could be undone by a merger. It said:

"We have concerns regarding the reliance on reversibility through merger. One needs to consider the counterfactual situation first. In

³⁴³ Everything Everywhere's non-confidential response, page 30.

³⁴⁴ For example, in 2010 H3G in Sweden bought the unpaired 2.6 GHz spectrum from Intel.

<http://www.pts.se/upload/Beslut/Radio/2010/intel-26-GHz-to-3-10-10444o10445.pdf>

³⁴⁵ Telefónica refers to the arguments Ofcom made at paragraphs 7.23 to 7.25 of Annex 6 of the January 2012 consultation.

that counterfactual there may be a different set of winners (or the winners may be a sub-set) and the allocation of resources between those winners will be different to an auction run with Ofcom's proposed reservation for Hutchison.

It does not necessarily follow, therefore, that there will be just one party that is subject to a misallocation. There may be multiple affected parties, Ofcom will never know, because it has not run the counterfactual auction.

If one of the affected parties seeks to acquire Hutchison (as the beneficiary of the misallocated resources) it may indeed reverse the misallocation to itself. However, such a merger will not reverse the misallocation to other bidders. The effect of the remedy cannot be fully reversed and even the partial reversal will incur frictional costs to the detriment of consumers (as identified by Ofcom)."³⁴⁶

Ofcom's response

A3.429 We consider there is some merit in Telefónica's argument. We agree that the set of spectrum holdings of all parties may be different as a result of the reservation. Even with a merger, this may make it more difficult to obtain the same set of spectrum holdings as would have existed without the reservation. This is partly because we consider that in practice there may be impediments to trading, as discussed above.

A3.430 However, while it may be difficult to obtain the same set of spectrum holdings as would otherwise have existed, we nevertheless consider that reserving spectrum for a fourth national wholesaler may be reversible to a significant extent through a subsequent merger. While the same spectrum allocation may not necessarily result, a merger (potentially including a divestment merger remedy) may allow the worst of any spectrum inefficiencies to be corrected.

Choice of policy options

Summary of responses

A3.431 Everything Everywhere considered our reasons for discounting Option 3 (tight caps) and preferring Option 4 (spectrum reservation for fourth national wholesaler) were not robust. It considered that an intervention along the lines of the tight caps in Option 3 was much preferred to Option 4.³⁴⁷

A3.432 Everything Everywhere considered we had underestimated the costs of Option 4. It considered the introduction of spectrum floors to a combinatorial clock auction to be a novel approach that was untested and may produce unintended and unforeseen consequences. It considered the complexity of the proposals were so extreme that they threatened the practicability and integrity of the Auction process.

A3.433 Everything Everywhere also considered that we have exaggerated the costs of tight caps for two reasons:

- Firstly, it considered Ofcom overstated the risks of unsold spectrum. Everything Everywhere noted that we stated in the January 2012 consultation that the

³⁴⁶ Telefónica's non-confidential response, paragraphs 114 to 116.

³⁴⁷ Everything Everywhere's non-confidential response, section 6.

combination of tight caps and relatively high reserve prices would lead to a risk of unsold spectrum, even if there were other parties who valued it higher than the reserve price. We said that there would be an inevitable delay before the spectrum could be re-auctioned and, given the value attached to 800 MHz spectrum and to a lesser extent 2.6 GHz spectrum, any such delay could be very inefficient. Everything Everywhere says this cost could be entirely removed by Ofcom including provisions for a simple 'follow-up process' in the Auction regulations. It said there are several examples of countries that have successfully organised quick follow-up auctions in the event of unsold spectrum for example the 2.6 GHz auction in Norway or Spain's multi-band auction in 2011.

- Secondly, Everything Everywhere said that Ofcom had completely ignored the scope for the secondary market to rectify any inefficiency that the primary allocation may have caused.

A3.434 We have discussed the second of these reasons at paragraph A3.425 above.

A3.435 Everything Everywhere considered it would be highly relevant to question whether and how the particular tight caps in Option 3 could be made less intrusive while still maintaining their effectiveness. It suggested that an attractive variant of Option 3 could involve:

- 2x22.5 MHz cap on sub-1 GHz spectrum, and
- 2x15 MHz cap on 800 MHz spectrum.

A3.436 Everything Everywhere considered that this would allow four national wholesalers good access to sub-1 GHz spectrum without prescribing the relative quantities in advance of the Auction.

A3.437 Vodafone argued against the proposed competition constraint and spectrum floors. In addition to questioning the case for reserving spectrum for particular bidders, it also considered that competition credits (which we refer to as bidder credits) were a better way of promoting a fourth national wholesaler than a reservation. This was partly because Vodafone considered bidder credits mitigate the risk that those who will not pay ALF will inflate artificially the price of spectrum to push up ALF for those that do pay it. Vodafone provided a confidential example of how the bidder credit could work.³⁴⁸

A3.438 Telefónica strongly rejected that the spectrum floor (Option 4) was a more targeted measure than caps. It considered caps were better targeted in the sense they only acted on parties that accrue rights beyond a certain level. In contrast, it considered that the spectrum floor had negative effects on all other bidders. This was because the overall supply of spectrum to other bidders would be reduced, potentially pushing up prices for other bidders. It considered Ofcom should therefore minimise the size of any reservations. Telefónica said it had not objected to either the sub-1 GHz cap or the overall cap because they were suitably targeted remedies.³⁴⁹

A3.439 One respondent argued that all bidders should be treated equally and was concerned about the risk of poor outcomes from placing constraints on market competition, citing the rail industry as an example.

³⁴⁸ Vodafone's non-confidential response, for example paragraphs 72 and 103. See also Annex 4 on auction design responses.

³⁴⁹ Telefónica's non-confidential response, paragraphs 97 to 110.

- A3.440 Some responses, such as the Federation of Communication Services, encouraged Ofcom to retain the possibility of wholesale access obligations as a potential licence criteria to ensure delivery of services.
- A3.441 BT accepted Ofcom's approach of promoting national network competition by ensuring that four national wholesalers can obtain sufficient spectrum in the Auction. However, it considered that Ofcom should clarify, within the licences, that these may be varied in future to include wholesale access obligations, if necessary to promote competition (without the agreement of the licensee, but after consultation and in accordance with relevant European and national law). It also considered that Ofcom should commit formally to review the situation soon after the Auction and again 2-3 years later. Of the seven options that Ofcom has identified, BT agreed that Option 4 was suitable.

Ofcom's response

- A3.442 Some responses relating to the policy options effectively questioned whether we should be promoting a fourth national wholesaler. We have responded to this issue earlier in this Annex, see from paragraph A3.12 above.
- A3.443 Other responses questioned whether the option we favoured was the most appropriate and proportionate. In particular they challenged our assessment of the costs of some of the options. In light of this, we have expanded the discussion on the potential costs of some of the options.
- A3.444 We now distinguish between the following possible costs in terms of potential spectrum inefficiency:
- Complex auction design leading to an inefficiency, where bidders bid incorrectly (which Everything Everywhere refers to);
 - The fourth national wholesaler obtaining more spectrum than necessary to be credible as a consequence of the intervention (that is, the reason it obtains more spectrum is as a result of the intervention rather than because it values the additional spectrum more highly); and
 - Excessively restrictive proposals. More generally than just the fourth national wholesaler obtaining more spectrum than necessary, this risk relates to the distribution of spectrum holdings being different to that which would result from an unrestricted auction to a greater extent than is strictly necessary to ensure four national wholesalers have sufficient spectrum to be credible. For example, even if the fourth national wholesaler obtains the minimum spectrum to be credible, the distribution of the spectrum between the other three could be restricted unnecessarily.
- A3.445 We have not included a risk that the policy option would allow non-ALF payers to push up prices for ALF payers. Vodafone argued that bidder credits mitigate this risk better than the competition constraint. We have made changes to our Auction design compared to that in the January 2012 consultation that we consider sufficiently address this risk. In particular, we have decided not to implement the Final Price Cap. See Section 7 for more details.
- A3.446 In the following sections, we have considered again the following types of policy options. We use the term 'competition constraint' to describe a reservation of a

portfolio from a set of possible portfolios to distinguish it from 'set aside' where specific spectrum is reserved.

- **Tight caps** (as in Option 3 of the January 2012 consultation): tight caps would restrict the amount of spectrum any one national wholesaler can acquire to alleviate competition concerns, such as by leaving enough spectrum after the three national wholesalers with the largest spectrum holdings have reached their caps for a fourth national wholesaler to be able to obtain sufficient spectrum to be credible;
- **Competition constraint and safeguard caps** (as in Option 4 of the January 2012 consultation): we would reserve one of a group of portfolios for a fourth national wholesaler. Exactly which of the portfolios was acquired by a fourth national wholesaler would be determined by the Auction. The winning set of bids would be those that maximised value (as expressed in Auction bids), subject to meeting the constraint of a fourth national wholesaler obtaining one of the possible portfolios (assuming a fourth national wholesaler were willing to pay the reserve price). This was our preferred option in the January 2012 consultation.
- **Set aside and safeguard caps**: a set aside (or specific reservation) would involve specific spectrum being reserved for a fourth national wholesaler.
- **Bidder credit and safeguard caps**: a bidder credit would involve increasing the bids of a potential fourth national wholesaler, either by a fixed sum of money or in percentage terms, when determining who wins spectrum in the Auction. The maximum amount the fourth national wholesaler would pay for spectrum it won would exclude the bidder credit.

A3.447 We have reconsidered tight caps and the competition constraint because responses raised concerns about our assessment of the relative costs and benefits of these two options. We consider bidder credits because Vodafone proposed bidder credits.

A3.448 We also consider a set aside mechanism because that would be another way of dealing with Everything Everywhere's concern about the degree of Auction complexity with the competition constraint.

A3.449 When we assess the competition constraint, bidder credits and set aside below, we consider that each is accompanied by safeguard caps as set out in the January 2012 consultation.

A3.450 We have not re-evaluated all the options that we considered in the January 2012 consultation. In particular, we have not re-evaluated:

- Option 1: No measures in the Auction to promote national wholesale competition
- Option 2: Safeguard caps (on their own)
- Option 5: Reservations to ensure at least four national wholesalers when sub-1 GHz spectrum is essential, and safeguard caps
- Option 6: Reservations to ensure at least four national wholesalers when an early route to LTE is essential, and safeguard caps

- Option 7: Reservations of spectrum to mitigate all risks to national wholesaler competition, and overall cap

A3.451 Responses did not focus on these options. In general, we consider our assessment in the January 2012 consultation is sufficient and robust for these options (although we have amended one of the scores for Options 2 and 6 as discussed at paragraph A3.412 above).

A3.452 We also consider that Option 5 could be revised to make it less restrictive than the main variant we considered in the January 2012 consultation. The main variant involved reserving 2x10 MHz of 800 MHz spectrum for at least two national wholesalers (and more for the fourth national wholesaler), but we also considered a variant that reserved 2x5 MHz of 800 MHz spectrum. In the event that holding sub-1 GHz spectrum was necessary, we now consider that 2x5 MHz of 800 MHz spectrum would be a sufficient amount when combined with 1800 MHz spectrum.³⁵⁰ Option 5 could therefore involve reserving 2x5 MHz of 800 MHz spectrum for at least two national wholesalers, rather than the 2x10 MHz.

A3.453 This would make Option 5 less restrictive compared to if 2x10 MHz of 800 MHz spectrum was reserved, because it would allow more options for how the 800 MHz spectrum was distributed between national wholesalers. However, this option would remain more restrictive than Option 4, given our conclusion that sub-1 GHz is unlikely to be necessary for credibility. For example, it would ensure that two national wholesalers who do not currently have sub-1 GHz spectrum each obtained at least 2x5 MHz. This may not be efficient if, for example, it would be more efficient for a fourth national wholesaler to obtain a reserved portfolio without sub-1 GHz spectrum.

A3.454 While some responses have advocated wholesale access obligations, we do not consider that new issues were raised in responses on imposing this now and hence our conclusion is unchanged from the provisional view we set out in the consultation. This is that even if fewer than four credible national wholesalers emerged from the Auction and competition was reduced, it may not be appropriate to impose regulated wholesale access obligations at that time. We could wait to see how the market evolved and use our competition or Communications Act powers if concerns arose. This might mean that wholesale access obligations could be introduced later, if justified following an investigation.³⁵¹

A3.455 In response to BT's arguments for clarifying, within the licences, that wholesale access obligations could be imposed in the future if necessary to promote competition, we do not consider this necessary. We have powers to impose wholesale access obligations which we could consider exercising as appropriate in the future, in light of the circumstances at the time.

Tight caps

A3.456 We considered a tight cap option in paragraphs 8.27 to 8.41 of Annex 6 of our January 2012 consultation (as 'Option 3'). The main option we considered was:

³⁵⁰ We have set out why we consider H3G would be capable of being credible with a portfolio of 2x5 MHz of 800 MHz and 2x15 MHz of 1800 MHz spectrum from paragraph A2.117 of Annex 2. We consider that the same arguments apply to Everything Everywhere but that it is much more certain that Everything Everywhere would be capable of being credible, given it has significantly more 1800 MHz spectrum.

³⁵¹ We considered this in paragraphs 6.22 to 6.34 of Annex 6 of the January 2012 consultation.

- 2x20 MHz cap on sub-1 GHz spectrum;
- 2x80 MHz cap on overall spectrum; and
- Reserve prices, set by reference to estimated market value with a discount.

A3.457 We noted if there were no successful new entrant bidders in the Auction, these caps effectively ensure that H3G has at least 2x15 MHz of 800 MHz spectrum, provided it was prepared to pay the reserve price. This was because, of the four existing national wholesalers, only Everything Everywhere and H3G would be eligible to obtain 800 MHz spectrum. And Everything Everywhere would be restricted to 2x15 MHz by the overall cap, which effectively means that H3G would be able to obtain 2x15 MHz of 800 MHz spectrum.

A3.458 As summarised in paragraphs 8.40 and 8.41 of Annex 6 of the January 2012 consultation, we considered that this option would be effective at addressing most of the competition concerns. In particular, we consider that if the caps were set sufficiently tightly this option would be highly effective at dealing with our most significant competition concern, namely ensuring that the fourth national wholesaler has sufficient spectrum to enable it to be credible. We also recognised that tight caps could be effective at addressing other competition concerns.

A3.459 However, this would come at a cost of very restrictive measures in the Auction. We said that very restrictive measures may not be in consumers' interests because they could cause spectrum inefficiency or other disadvantages such as unsold spectrum. We therefore did not consider tight caps be proportionate.³⁵²

A3.460 The following table summarises how well tight caps deals with the different competition concerns and spectrum efficiency risks we identified earlier. The reasons for the scoring of the effectiveness of the option against our different competition concerns are as in Figure 8.2 of Annex 6 of the January 2012 consultation. We do not consider these have changed in the light of responses.

³⁵² See paragraphs 8.168 to 8.177 of Annex 6 of the January 2012 consultation for more details on this, and especially paragraphs 8.171 and 8.172. We set out in paragraph 8.35 of Annex 6 an example of how tight caps might restrict the distribution of spectrum in a way that was not in consumers' interest.

Figure A3.7: Assessment of tight caps

Competition concerns		Effectiveness of option
Concern that fewer than four credible national wholesalers		
1. Fourth national wholesaler not credible because insufficient share of spectrum & no sub-1 GHz spectrum & no spectrum for early route to LTE or high peak data rates with early LTE	Assuming only four national wholesalers, this option ensures that a fourth national wholesaler would be able to obtain at least 2x15 MHz of sub-1 GHz spectrum (subject to paying the reserve price). We consider that a fourth national wholesaler would be likely to be credible with 2x15 MHz of 800 MHz spectrum, but some small risk it may not be. If a new entrant obtained spectrum this may increase competition further in the short term, with a route to at least four credible national wholesalers in the long term.	High
2. Everything Everywhere not credible because no sub-1 GHz spectrum	Assuming only four national wholesalers, this option ensures that Everything Everywhere would be able to obtain 2x15 MHz of sub-1 GHz spectrum. We consider that Everything Everywhere would very likely be credible if it obtained 2x15 MHz of 800 MHz spectrum.	High
3. Telefónica/Vodafone not credible because no spectrum for early route to LTE, high peak data rates with early LTE or greater capacity	Neither Telefónica nor Vodafone could obtain 800 MHz spectrum. But they would each be much more likely to be able to obtain 1800 MHz or 2.6 GHz spectrum due to the 2x80 MHz overall spectrum cap. And even if one of them did not obtain spectrum, their competitors would be capped in the amount of spectrum they had.	High
Concern that even if at least four credible national wholesalers one or more wholesalers is at a disadvantage in competing across a wide range of services and customers		
4. Weaker competition because one or more competitors does not have sub-1 GHz spectrum	This option ensures at least four national wholesalers with sub-1 GHz spectrum, and if there are only four it ensures they would each have at least 2x10 MHz of sub-1 GHz spectrum.	High
5. Weaker competition because one or more competitors does not have early route to LTE	This option ensures at least three national wholesalers have spectrum suitable for an early route to LTE, and makes it likely there would be four.	Medium to High
6. Weaker competition because one or more competitors does not have 2x15 or 2x20 contiguous block for LTE	This option makes it likely that a fourth national wholesaler would obtain 2x15 MHz of 800 MHz. The overall cap also makes it more likely that a number of national wholesalers would have large blocks of contiguous spectrum at some frequency.	Medium to High
7. Weaker competition because one or more competitors does not have enough spectrum for capacity and average data rates	If the Auction resulted in four national wholesalers, then the most uneven distribution of spectrum that can result from this option is three have 30% and one has 10%, so ensuring at least three have more than 20% of spectrum. The tight caps therefore contribute significantly to ensuring that competition is not weaker because some national wholesalers are capacity constrained.	Medium to High
8. Weaker competition because one competitor has a very large share of spectrum	Tight caps prevent any national wholesaler obtaining more than c30% of spectrum overall or of sub-1 GHz spectrum.	High

Spectrum inefficiency risks		Riskiness of option
Spectrum inefficiency resulting from complexity of Auction design (bidders bid incorrectly)	Tight caps are relatively easy to implement in the Auction.	Low risk

Spectrum inefficiency because fourth national wholesaler obtains more spectrum than necessary to be credible as a consequence of the intervention	Tight caps do not directly allow the fourth national wholesaler to leverage their advantage from intervention to gain more spectrum. However, tight caps might reduce the competition the fourth national wholesaler faces in obtaining more spectrum (compared to, say, the competition constraint) because some of the other three national wholesalers may be restricted in bidding for some spectrum because they have reached the cap.	Medium risk
Spectrum inefficiency resulting from excessively restrictive proposals	Tight caps are very restrictive in terms of the distribution between the three larger national wholesalers.	High risk

A3.461 Tight caps could result in spectrum inefficiency because they are excessively restrictive, even if subsequent trading has the potential to mitigate some of the largest inefficiencies. We consider this a significant disadvantage.

A3.462 With regard to Everything Everywhere’s argument that the risk of unsold spectrum as a result of tight caps could be eliminated through a ‘follow-up process’ in the Auction regulations, we accept that it might be possible to do something quickly that would significantly mitigate this risk (though this would add complexity such as avoiding incentives for gaming or specifying the exact rules how and to whom any type of unsold spectrum could be sold).

A3.463 We have also considered the specific proposal for a different set of tight caps suggested by Everything Everywhere, namely:

- 2x22.5 MHz cap on sub-1 GHz spectrum, and
- 2x15 MHz cap on 800 MHz spectrum.

A3.464 These caps would effectively ensure that a fourth national wholesaler would obtain at least 2x5 MHz of 800 MHz spectrum. This is because Vodafone and Telefónica would each be restricted to a maximum of 2x5 MHz of 800 MHz spectrum (due to the sub-1 GHz cap) and Everything Everywhere would be restricted to 2x15 MHz of 800 MHz spectrum (due to the 800 MHz cap).

A3.465 We consider that these caps are still restrictive. Vodafone and Telefónica would each be limited to 2x5 MHz of 800 MHz spectrum, which might result in spectrum inefficiencies.

A3.466 Moreover, these caps would only ensure the fourth national wholesaler had 2x5 MHz of 800 MHz spectrum. They would not, for example, ensure that it also had 2x15 MHz of 1800 MHz. On its own, these caps may provide low confidence that a fourth national wholesaler has sufficient spectrum to be credible. We are therefore concerned that these caps by themselves may not be effective in addressing our main competition concern. These caps might need to be supplemented by other caps to ensure that the fourth national wholesaler had sufficient spectrum to be credible, which would introduce further restrictions.

A3.467 Everything Everywhere also floats another tighter caps option:

- 2x20 MHz cap on sub-1 GHz spectrum, and

- 2x15 MHz cap on 800 MHz spectrum.

A3.468 If there were only four bidders, these tighter caps effectively ensure that a fourth national wholesaler is able to obtain 2x15 MHz of 800 MHz spectrum. We consider that this would be sufficient to ensure the fourth national wholesaler had enough spectrum to be credible. But this would come at the cost of being even more restrictive in terms of not allowing Vodafone or Telefónica to acquire any 800 MHz spectrum (as in the tight caps option considered in the January 2012 consultation).

A3.469 In general, we consider that it is difficult to relax the tight caps while still ensuring that a fourth national wholesaler obtains sufficient spectrum to be credible. We therefore consider that any set of caps that sufficiently address our main competition concerns is likely to be highly restrictive in terms of the distribution of spectrum.

Competition constraint and safeguard caps

A3.470 An important advantage with the competition constraint is that the Auction influences which portfolio is reserved for the fourth national wholesaler, leading to better spectrum efficiency.

A3.471 As described from paragraph A3.412 above, we have changed the score of this option for competition concern 2. The other scores are as in Figure 8.3 of Annex 6 of the January 2012 consultation, as we do not consider they have changed in the light of responses.

Figure A3.8: Assessment of competition constraint & safeguard caps

Competition concerns		Effectiveness of option
Concern that fewer than four credible national wholesalers		
1. Fourth national wholesaler not credible because insufficient share of spectrum & no sub-1 GHz spectrum & no spectrum for early route to LTE or high peak data rates with early LTE	The option is designed to address this concern directly through a reservation for a fourth national wholesaler. The safeguard caps also help to mitigate this concern (see Figure 8.1 of Annex 6 of January 2012 consultation). (However, the option may not eliminate the concern, because one of the portfolios may be insufficient to make a fourth national wholesaler credible. The effectiveness of this option for addressing this concern could be increased by increasing the spectrum reserved for a fourth national wholesaler. It is also possible that a fourth national wholesaler may not be prepared to pay the reserve price).	High
2. Everything Everywhere not credible because no sub-1 GHz spectrum	The sub-1 GHz spectrum cap tends to mitigate the concern that EE does not obtain sub-1 GHz spectrum. See from paragraph A3.412 above for more explanation.	Medium
3. Telefónica/Vodafone not credible because no spectrum for early route to LTE, high peak data rates with early LTE or greater capacity	There are effects in both directions, but on balance this option may worsen this concern. The overall spectrum cap limits what Everything Everywhere can obtain, tending to mitigate the concern. But the reservation for a fourth national wholesaler increases this concern, as it limits the amount of spectrum suitable for an early route to LTE they can compete for. (See Figure 8.3 of Annex 6 of January 2012 consultation for more details).	Low (may worsen)
Concern that even if at least four credible national wholesalers one or more wholesalers is at a disadvantage in competing across a wide range of services and customers		
4. Weaker competition because one or more competitors does not have sub-1 GHz spectrum	Possible reservation of sub-1 GHz spectrum for a fourth national wholesaler and sub-1 GHz spectrum cap mitigate concern, by ensuring at least three have sub-1 GHz spectrum. But this option does not ensure at least four national wholesalers have sub-1 GHz spectrum.	Medium
5. Weaker competition because one or more competitors does not have early route to LTE	Reservation for a fourth national wholesaler and safeguard caps mitigate to some extent.	Low to Medium
6. Weaker competition because one or more competitors does not have 2x15 or 2x20 contiguous block for LTE	Safeguard caps have ambiguous effect (see Figure 8.1 of Annex 6 of January 2012 consultation). Possible reservation for a fourth national wholesaler could make it easier for a fourth national wholesaler to obtain 2x15 MHz of some frequency.	Low
7. Weaker competition because one or more competitors does not have enough spectrum for capacity and average data rates	Mitigated to some extent by safeguard caps (as for Option 2) and by portfolio for a fourth national wholesaler, which boosts the spectrum holdings of the party with the smallest share.	Medium to High
8. Weaker competition because one competitor has a very large share of spectrum	Safeguard caps mitigate by preventing any national wholesaler obtaining more than c40% of spectrum overall or of sub-1 GHz spectrum.	High

Spectrum inefficiency risks		Riskiness of option
Spectrum inefficiency resulting from complexity of Auction design (bidders bid incorrectly)	The Auction design for the competition constraint is complex and novel, but has been subject to expert advice and thorough testing, and we plan a number of opportunities for potential bidders to become familiar with the design.	Low to Medium risk

Spectrum inefficiency because fourth national wholesaler obtains more spectrum than necessary to be credible as a consequence of the intervention	The fourth national wholesaler only has an advantage for the reserved spectrum (and not for unreserved spectrum).	Low risk
Spectrum inefficiency resulting from excessively restrictive proposals	The portfolio selected from the set of possible reserved portfolios will be the one that least reduces the value of bids from the Auction.	Low risk

Set aside and safeguard caps

A3.472 A set aside mechanism is similar in some ways to the competition constraint that we considered in Option 4 of the January 2012 consultation. The difference is that with the competition constraint there is a group of portfolios any one of which might be reserved for a fourth national wholesaler with the Auction determining which portfolio is acquired, whereas with set aside the portfolio for the fourth national wholesaler would be determined in advance.

A3.473 In the assessment in the table below we assume that 2x15 of 1800 MHz and 2x20 of 2.6 GHz is set aside for a fourth national wholesaler.³⁵³ If this were varied the effectiveness in addressing different competition concerns may change, but the risks to spectrum inefficiency would be broadly similar.

³⁵³ We make this assumption on the basis that this portfolio is likely to be the lowest value in terms of auction prices of the reserved spectrum portfolios in the competition constraint and so might be considered the least interventionist set-aside portfolio.

Figure A3.9: Assessment of set aside & safeguard caps

Competition concerns		Effectiveness of option
Concern that fewer than four credible national wholesalers		
1. Fourth national wholesaler not credible because insufficient share of spectrum & no sub-1 GHz spectrum & no spectrum for early route to LTE or high peak data rates with early LTE	The option is designed to address this concern directly through a set aside for a fourth national wholesaler. The safeguard caps also help to mitigate this concern. (However, the option may not eliminate the concern, for example, the set aside spectrum may be insufficient to make a fourth national wholesaler credible).	High
2. Everything Everywhere not credible because no sub-1 GHz spectrum	The sub-1 GHz spectrum cap tends to mitigate the concern that EE does not obtain sub-1 GHz spectrum and there is no sub-1 GHz in set aside spectrum. See from paragraph A3.417 above for more explanation.	Medium to High
3. Telefónica/Vodafone not credible because no spectrum for early route to LTE, high peak data rates with early LTE or greater capacity	There are effects in both directions, but on balance this option may worsen this concern. The overall spectrum cap limits what EE can obtain, tending to mitigate the concern. But the set aside may increase the concern because if the fourth national wholesaler obtained spectrum there would be less suitable spectrum for Vodafone and Telefónica.	Low (may worsen)
Concern that even if at least four credible national wholesalers one or more wholesalers is at a disadvantage in competing across a wide range of services and customers		
4. Weaker competition because one or more competitors does not have sub-1 GHz spectrum	The sub-1 GHz spectrum cap mitigates the concern. There would be at least three national wholesalers with sub-1 GHz spectrum, but this option does not ensure at least four national wholesalers.	Medium
5. Weaker competition because one or more competitors does not have early route to LTE	The set aside for a fourth national wholesaler and safeguard caps mitigate to some extent.	Low to Medium
6. Weaker competition because one or more competitors does not have 2x15 or 2x20 contiguous block for LTE	Safeguard caps have ambiguous effect (see Figure 8.1 of Annex 6 of January 2012 consultation). (The set aside does not help this concern because the divested 2x15 of 1800 MHz can only be acquired by a party other than EE in any event).	Low
7. Weaker competition because one or more competitors does not have enough spectrum for capacity and average data rates	Mitigated to some extent by safeguard caps (see Figure 8.1 of Annex 6 of January 2012 consultation) and by set aside for a fourth national wholesaler, which boosts the spectrum holdings of the party with the smallest share.	Medium to High
8. Weaker competition because one competitor has a very large share of spectrum	Safeguard caps mitigate by preventing any national wholesaler obtaining more than c40% of spectrum overall or of sub-1 GHz spectrum.	High

Spectrum inefficiency risks		Riskiness of option
Spectrum inefficiency resulting from complexity of Auction design (bidders bid incorrectly)	Set aside is relatively easy to implement in the Auction.	Low risk
Spectrum inefficiency because fourth national wholesaler obtains more spectrum than necessary to be credible as a consequence of the intervention	The fourth national wholesaler is only advantaged for the particular spectrum that is set aside.	Low risk

Spectrum inefficiency resulting from excessively restrictive proposals	The regulator selects the portfolio the fourth national wholesaler receives, with the Auction having no influence.	Medium to high risk
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Bidder credits and safeguard caps

A3.474 In paragraphs 6.17 to 6.21 of Annex 6 of our January 2012 consultation, we considered bidder credits.

A3.475 We said that in theory the size of the bidder credit could be set at an estimate of the benefits from competition, and whether or not it was in consumers' interests to have four credible national wholesalers would then be determined by the Auction. But accurately quantifying the benefits from greater competition is difficult. Furthermore we would need to take account of the threat of strategic investment in spectrum. The bidder credit would need to be set high enough to discourage strategic investment. It would be challenging to determine the appropriate level of the bidder credit, as it would depend on a detailed quantification of the costs and payoff of strategic investment. There would be significant scope for error in setting an appropriate bidder credit. For this reason, there might be a risk that the bidder credit is set too low and so insufficient to ensure four credible national wholesalers when this is in consumers' interests. Alternatively, if the bidder credit is very high, this option might effectively pre-determine the outcome and become similar to reservation (which would tend to undermine the rationale for using bidder credits).

A3.476 One of the arguments in favour of bidder credits over the competition constraint might be that it is less complex. However, developing bidder credits to be a targeted measure to address our concerns may result in some Auction complexity, even if it is less than the competition constraint.

A3.477 The simplest way to implement this approach would be for the bidder credit to be added to whatever amount the fourth national wholesaler bids for spectrum. A potential disadvantage of this is that, if the bidder credit is set too high, it may allow the fourth national wholesaler to obtain more spectrum than it needs to be credible as a result of the intervention, when it does not have the highest intrinsic value for the extra spectrum.

A3.478 A more complicated system could be developed that involved the bidder credit only applying for some spectrum portfolios. This would reduce the risk that the fourth national wholesaler was advantaged in obtaining more spectrum than it needed to be credible. This may help to reduce the risk of spectrum inefficiency, but could add complexity to the Auction design. Opted-in bidders would need to obtain bidder credits only on specific portfolios (when in a package auction they would be permitted to bid on strictly larger packages), and there should only be one winning package with the bidder credit.

A3.479 The following table summarises how well bidder credits deal with the different competition concerns and spectrum efficiency risks we identified earlier.

Figure A3.10: Assessment of bidder credits & safeguard caps

Competition concerns		Effectiveness of option
Concern that fewer than four credible national wholesalers		
1. Fourth national wholesaler not credible because insufficient share of spectrum & no sub-1 GHz spectrum & no spectrum for early route to LTE or high peak data rates with early LTE	The option is designed to address this concern directly by giving a bidder credit to fourth national wholesaler. The safeguard caps also help to mitigate this concern. However, setting the bidder credit would be challenging, and there would be a risk it was insufficient to ensure four credible national wholesalers, especially given the difficulty in accurately quantifying competition benefits and addressing the risk of strategic investment. This would depend on how high the bidder credit was set. ³⁵⁴	Medium
2. Everything Everywhere not credible because no sub-1 GHz spectrum	The sub-1 GHz spectrum cap tends to mitigate the concern that EE does not obtain sub-1 GHz spectrum. See from paragraph A3.412 above for more explanation.	Medium
3. Telefónica/Vodafone not credible because no spectrum for early route to LTE, high peak data rates with early LTE or greater capacity	There are effects in both directions, but on balance this option may worsen this concern. The overall spectrum cap limits what EE can obtain, tending to mitigate the concern. But the bidder credit may increase the concern because if the fourth national wholesaler obtained spectrum there would be less spectrum suitable for an early route to LTE for Vodafone and Telefónica.	Low (may worsen)
Concern that even if at least four credible national wholesalers one or more wholesalers is at a disadvantage in competing across a wide range of services and customers		
4. Weaker competition because one or more competitors does not have sub-1 GHz spectrum	The sub-1 GHz spectrum cap mitigates the concern, by ensuring at least three have sub-1 GHz spectrum and the bidder credit may help the fourth national wholesaler obtain sub-1 GHz spectrum. But this option does not ensure at least four national wholesalers.	Medium
5. Weaker competition because one or more competitors does not have early route to LTE	The bidder credit for a fourth national wholesaler and safeguard caps mitigate to some extent.	Low to Medium
6. Weaker competition because one or more competitors does not have 2x15 or 2x20 contiguous block for LTE	Safeguard caps have ambiguous effect (see Figure 8.1 of Annex 6 of January 2012 consultation). Bidder credit could make it easier for a fourth national wholesaler to obtain 2x15 MHz of some frequency.	Low
7. Weaker competition because one or more competitors does not have enough spectrum for capacity and average data rates	Mitigated to some extent by safeguard caps (see Figure 8.1 of Annex 6 of January 2012 consultation) and by bidder credit for a fourth national wholesaler, which boosts the spectrum holdings of the party with the smallest share.	Medium to High
8. Weaker competition because one competitor has a very large share of spectrum	Safeguard caps mitigate by preventing any national wholesaler obtaining more than c40% of spectrum overall or of sub-1 GHz spectrum.	High

Spectrum inefficiency risks		Riskiness of option
Spectrum inefficiency resulting from complexity of Auction design (bidders bid incorrectly)	The Auction design may need to be fairly complex if the bidder credit is limited to particular spectrum and if only a single bidder can obtain spectrum with it.	Low to Medium risk

³⁵⁴ We comment above on the concerns arising from setting the bidder credit too high.

Spectrum inefficiency because fourth national wholesaler obtains more spectrum than necessary to be credible as a consequence of the intervention	Depending on how complex the Auction design was, bidder credits might allow the fourth national wholesaler to obtain more spectrum than the minimum necessary to be credible as a result of the intervention.	Low to Medium risk
Spectrum inefficiency resulting from excessively restrictive proposals	Bidder credits would not dictate the distribution of spectrum between the three larger national wholesalers.	Low risk

Conclusion on choice of mechanism to promote fourth national wholesaler

A3.480 The table below brings together the assessments in the earlier tables.

Figure A3.11: Assessment of different options

Effectiveness in dealing with competition concerns and spectrum inefficiency risks

Competition concerns	Tight caps	Competition Constraint	Set aside	Bidder credit
Concern that fewer than four credible national wholesalers				
1. Fourth national wholesaler not credible because insufficient share of spectrum & no sub-1 GHz spectrum & no spectrum for early route to LTE or high peak data rates with early LTE	High	High	High	Medium
2. Everything Everywhere not credible because no sub-1 GHz spectrum	High	Medium	Medium to High	Medium
3. Telefónica/Vodafone not credible because no spectrum for early route to LTE, high peak data rates with early LTE or greater capacity	High	Low (may worsen)	Low (may worsen)	Low (may worsen)
Concern that even if at least four credible national wholesalers one or more wholesalers is at a disadvantage in competing across a wide range of services and customers				
4. Weaker competition because one or more competitors does not have sub-1 GHz spectrum	High	Medium	Medium	Medium
5. Weaker competition because one or more competitors does not have early route to LTE	Medium to High	Low to Medium	Low to Medium	Low to Medium
6. Weaker competition because one or more competitors does not have 2x15 or 2x20 contiguous block for LTE	Medium to High	Low	Low	Low
7. Weaker competition because one or more competitors does not have enough spectrum for capacity and average data rates	Medium to High	Medium to High	Medium to High	Medium to High
8. Weaker competition because one competitor has a very large share of spectrum	High	High	High	High

Spectrum inefficiency risks	Riskiness of option			
Spectrum inefficiency resulting from complexity of Auction design (bidders bid incorrectly)	Low risk	Low to Medium risk	Low risk	Low to Medium risk

Spectrum inefficiency because fourth national wholesaler obtains more spectrum than necessary to be credible as a consequence of the intervention	Medium risk	Low risk	Low risk	Low to Medium risk
Spectrum inefficiency resulting from excessively restrictive proposals	High risk	Low risk	Medium to high risk	Low risk

A3.481 We judge the first competition concern in Figure A3.11 (i.e. a fourth national wholesaler not being credible) as the single most significant competition concern relevant to our policy aim of promoting competition. For this concern, we consider that bidder credit scores weaker than the other options. We consider this is an important disadvantage of bidder credits compared to the other options.

A3.482 We also recognise that the different options address the other competition concerns to different extents. In particular, tight caps address all competition concerns reasonably well, and better than the other three options. However, we consider there is a greater risk of spectrum inefficiency with tight caps because they give little flexibility on how spectrum is distributed between Vodafone, Telefónica and Everything Everywhere.

A3.483 We do not agree with Telefónica’s argument that spectrum caps are better targeted than the competition constraint. We acknowledge that the competition constraint reduces the supply of spectrum available for other bidders (i.e. other than those opted in to bid for the spectrum reserved for a fourth national wholesaler). But to be effective in addressing our largest competition concern, spectrum caps would have to be tight, as discussed earlier. Tight caps place significant restrictions on the bids (i.e. the demand for spectrum) of those other bidders to whom they apply.

A3.484 In particular, with the other three options, there might be various spectrum distributions that would be consistent with the fourth national wholesaler having sufficient spectrum to be credible that would not be possible with tight caps.³⁵⁵ We recognise that the possibility of spectrum trading after the Auction may mitigate the largest inefficiencies from tight caps, but we have concerns about the extent to which such trading is likely to occur in practice (see from paragraph A3.425 above).

A3.485 We therefore regard tight caps as being potentially more effective but also more restrictive than the other three options. We see the risk of spectrum inefficiency as a significant disadvantage of tight caps.

A3.486 As we set out from paragraph 4.231 in Section 4, we favour a less interventionist approach that will allow competition in the Auction to determine the acquisition of spectrum to a large extent, constrained only by targeted measures such as to focus

³⁵⁵ A simple example may help to illustrate this. Suppose it were the case that a national wholesaler needed at least 10% of spectrum, abstracting from differences in frequency. It would be possible to ensure at least four national wholesalers by imposing caps of 30%. Assuming only four national wholesalers, this would limit the amount that three could obtain to 90% (=3x30%), leaving enough for the other national wholesaler to obtain 10%. However, this would be unnecessarily restrictive, compared to a reservation of 10% for the fourth national wholesaler. Such a reservation would mean that the remaining spectrum could be distributed between the other three national wholesalers without any restrictions (subject to each having at least 10%), which may tend to maximise spectrum efficiency. So, for example, the reservation would allow a distribution of 10%, 20%, 30%, 40%, which would not be possible with caps of 30%.

on the competition concern of greatest significance. This is because we are concerned that attempting to mitigate as many competition concerns as possible will lead to disproportionate intervention. Therefore, having regard to proportionality, we do not consider that tight caps would be an effective way of achieving our policy aim.

- A3.487 If we compare the effectiveness of the competition constraint, set aside and bidder credits, we are concerned that bidder credits may be less effective at meeting our main competition concern, without having any strong offsetting advantages. We therefore consider that the competition constraint and set aside are preferable to bidder credits.
- A3.488 Set aside and the competition constraint are broadly similar in addressing our main competition concern and in addressing our other competition concerns. However, they are different in terms of risks to spectrum inefficiency. The advantage of set aside over the competition constraint is that the design of the auction is much simpler. We agree with Everything Everywhere that the competition constraint is a novel approach, and that this carries risks with it. To mitigate these risks we will be giving prospective bidders a number of opportunities to become familiar with the design including mock auctions and have had the Auction design reviewed by external advisers, thoroughly tested, and we have consulted on it. Our judgement is that the residual risk is not large.
- A3.489 On the other hand, the disadvantage of set aside is that the regulator would have to determine a single unique portfolio for the fourth national wholesaler in advance, rather than allowing the Auction to influence this. There is a diverse range of potential portfolios that we consider would allow the fourth national wholesaler to be credible, and there is flexibility about which portfolio the fourth national wholesaler would obtain with the competition constraint. Different national wholesalers may value different spectrum very differently. We therefore consider that the risk of spectrum inefficiency from Ofcom selecting a single portfolio is material.
- A3.490 On balance, we consider the risks of spectrum inefficiency from the competition constraint are less than from set aside.

Choice of portfolios for fourth national wholesaler

Summary of our position in January 2012 consultation

- A3.491 In Figure 4.11 of the January 2012 consultation, we set out three alternative groups of portfolios that might be reserved for a fourth national wholesaler. These portfolios are shown in the table below.

Figure A3.12: Proposed alternative groups of portfolios in Option 4

	800 MHz	1800 MHz	2.6 GHz
Group 1 (Smaller portfolios)			
Portfolio 1	2 x10 MHz		
Portfolio 2		2x 15 MHz	
Group 2 (Medium portfolios)			
Portfolio 3	2 x15 MHz		
Portfolio 4	2x 10 MHz		2 x 10 MHz
Portfolio 5	2 x10 MHz	2x 15 MHz	
Portfolio 6		2x 15 MHz	2 x 10 MHz
Group 3 (Larger portfolios)			
Portfolio 7	2x20 MHz		
Portfolio 8	2 x15 MHz		2 x 10 MHz
Portfolio 9	2 x10 MHz		2x 20 MHz
Portfolio 10	2 x10 MHz	2 x 15 MHz	
Portfolio 11		2 x 15 MHz	2x 20 MHz

A3.492 As summarised in paragraph 1.32 of the January consultation, our provisional view was that group 2 was preferable. This was based on (i) the evidence available to us at that stage and our analysis thereof, and (ii) the inherent uncertainties surrounding some of that analysis. We considered that the increase in the benefits that might be realised from this compared to group 1 is considerable, as it would materially increase the probability that four entities would hold sufficient spectrum to be credible national wholesalers after the Auction. We considered there is a risk that the amount of reserved spectrum under group 1 may not be sufficient adequately to address our most significant competition concerns. By contrast we considered the comparative increase in cost as between groups 1 and 2 to be relatively small since group 2 still involves reservation of only a relatively small proportion of the available spectrum. Overall we considered that a spectrum reservation for a fourth national wholesaler as specified in group 2 is the least onerous way of achieving our policy aim of promoting national wholesale competition, given the uncertainties we have about the efficacy of group 1 in addressing our main concerns.

Summary of responses

A3.493 Responses were split on which group of portfolios was most appropriate. For example, H3G argued that the smaller portfolios would not be adequate to ensure the continued existence of a fourth credible national wholesaler (in line with Ofcom’s provisional conclusion).³⁵⁶ As discussed further below, H3G also considered we should amend the medium group of portfolios.

A3.494 However, other responses disagreed with this. For example, Vodafone³⁵⁷, Telefónica³⁵⁸ and Everything Everywhere³⁵⁹ argued that, if Ofcom were to reserve spectrum for a fourth national wholesaler, the spectrum portfolios in the smaller group are sufficient for a fourth operator to be credible. To support this, respondents referred to the strength of the justification (including risk of regulatory failure), inferences from international auctions, their own technical analysis, the merger

³⁵⁶ H3G’s non-confidential response, page 13.

³⁵⁷ Vodafone non-confidential response, page 1.

³⁵⁸ Telefónica non-confidential response, paragraph 171.

³⁵⁹ Everything Everywhere non-confidential response, answer to question 4.3, page 40.

decision of the EC, and their own assessments of outcomes under the analytical framework.

A3.495 Below, we have grouped discussion of responses under the following headings:

- Inferences from international auctions;
- Technical modelling of capacity;
- Consistency with EU merger decision;
- Adequacy of portfolio without sub-1 GHz spectrum;
- Medium sized portfolios and symmetry of risk; and
- Competition constraint and lower power 2.6 GHz spectrum.

Inferences from international auctions

Summary of responses

A3.496 In relation to international examples, Vodafone drew the following conclusions:³⁶⁰

- a) There is evidence from Belgium and Spain that the smaller portfolios provide enough spectrum for a fourth operator to be credible since neither Yoigo nor Telenet Tecteo Bidco bid for any 2.6 GHz spectrum (and so effectively they voluntarily accepted less than Ofcom's proposed floor for the fourth operator, as set out above).
- b) Similarly in Italy, Vodafone noted that Hutchison Whampoa's Group Managing Director stated that 3 Italia will be able to achieve "comparable performance" to the incumbent operators with only 2x15 MHz of additional spectrum, i.e. using its recently acquired 1800 MHz (2x5 MHz) and 2.6 GHz (2x10 MHz) spectrum.
- c) There is a risk of an inefficient outcome if 2.6 GHz is part of the minimum package but the fourth bidder does not actually want it. It again referred to Spain and Belgium where it argued both appeared to believe they did not require 2.6 GHz in addition to their other holdings to be credible.³⁶¹ Therefore it concluded that reserved spectrum which included 2.6 GHz would have meant that both would have ended up with 2.6 GHz spectrum without wanting it³⁶², and so deprived another operator who could have put it to better use and would have been willing to pay more. As a result, Vodafone argued that if a fourth operator acquired 2x15 MHz in 1800 MHz band, intervention in 2.6 GHz would not be justified and would be more likely to lead to an outcome where a scarce resource is held by an undertaking that will not wish to exploit it in a way that benefits mobile consumers. This, Vodafone argued, would lead to an inefficient outcome which was also

³⁶⁰ Vodafone's non-confidential response to the January 2012 consultation, pages 20-21.

³⁶¹ It argued that the relatively low price of £50m for 2x10 MHz suggests budget constraints were not an issue.

³⁶² Vodafone concludes that if each had been asked to opt in for a floor involving both 1800 MHz and 2.6 GHz we can assume that each would have done so, because neither would have wanted to compete openly for, or risk someone else opting in for, 1800 MHz in their place.

contrary to our duties under the WTA 2006 to promote efficient use of spectrum (section 3(2)(a)).³⁶³

A3.497 Therefore Vodafone argued that there is no case that 2.6 GHz should be included in any portfolio as experience from elsewhere casts serious doubt on whether smaller operators actually need 2.6 GHz (over and above an allocation of either sub-1 GHz or 1800 MHz). If they do, it argued, then they appear able to acquire it despite the alleged potential payoff to strategic investment on the part of other bidders.

A3.498 Telefónica also noted that with the smaller portfolios, the required volume of spectrum needed by H3G is reduced to a level lower than the volume it acquired in equivalent processes in Austria, Sweden and Italy. It argued that the processes in each of these countries were more prone to strategic behaviour (as discussed above), and so considered this to be strong evidence that any reservation beyond Portfolio 1 or Portfolio 2 is disproportionate. Further, it argued that it is unclear why Ofcom has not taken note of the fourth national wholesaler's performance in other EU auctions where they have often secured incremental capacity, i.e. reached a position equivalent to Ofcom's minimum portfolios, without the need for further reservations (as discussed above).³⁶⁴

Ofcom's response

A3.499 In general we are cautious of drawing strong conclusions from a small number of international examples because there may be particular reasons for the circumstances in those countries. However, we have considered what inferences can be drawn from the specific examples that Vodafone raised.

A3.500 In relation to whether 2.6 GHz is necessary to be credible, a key question is whether Yoigo in Spain and/or Telenet Tecteo in Belgium will be credible in the near and longer term with their respective spectrum holdings. If we were confident that Yoigo and Telenet Tecteo would each be a credible national wholesaler even in the longer term with their existing spectrum holdings, this might suggest that it would be more likely that it would be possible for a national wholesaler in the UK to be credible with just this holding. This would tend to support the smaller group of portfolios being sufficient to promote at least four national wholesalers. However, as discussed in paragraphs A3.390 to A3.391 above, we are cautious of drawing strong conclusions about whether Yoigo will be an effective constraint on its rivals in the near and longer term with its existing spectrum holdings. Further, in Belgium, we do not consider that any strong conclusions can be drawn from Telenet Tecteo about the likely outcome in the UK (or indeed what spectrum is needed to be credible in the timescales we are considering) since there are a range of reasons it may have decided not to bid in the 2.6 GHz auction, as discussed in paragraph A3.389.

A3.501 In relation to 3 Italia, we note it is also likely to be assigned 2x5 MHz of 900 MHz by 2013 and 2x10 MHz of 1800 MHz. In conjunction with its current holdings (2x5 MHz of 1800 MHz, 2x15 MHz of 2.1 GHz and 2x10 MHz of 2.6 GHz), this means its spectrum holdings would be greater than we consider likely to be sufficient to be able to be credible in the UK. Several financial analysts have expressed views on 3 Italia's position in the market, commenting on aspects such as share of spectrum and access to sub-1 GHz frequencies. Overall the views are mixed, though the majority

³⁶³ Vodafone's non-confidential response to the January 2012 consultation, pages 76-77.

³⁶⁴ Paragraph 169 of Telefónica's response to the January 2012 consultation.

tend to have a positive outlook for 3 Italia's future. These views are set out in more detail from paragraph A2.234.³⁶⁵

A3.502 We accept that there is a risk that we reserve more spectrum than is necessary for the fourth national wholesaler to be credible and that as a result there is spectrum inefficiency. However, we need to balance this risk with the concern that we do not reserve enough and the fourth national wholesaler has insufficient spectrum to be credible. Further, our consideration of the points raised by Vodafone and Telefónica about the risk of strategic investment are set out from paragraph A3.326 above (and strategic investment more generally in Section 4). Our judgement is that the portfolios we have reserved are appropriate and proportionate, given the uncertainties, as set out in Section 4.

Technical modelling of capacity

Summary of responses

A3.503 Vodafone argued that its technical analysis using Ofcom's data suggests that LTE networks operating with either of the smaller portfolios can provide a credible network in terms of coverage, speed and capacity, and that operating at 2x15 MHz at 1800 MHz has some advantages in terms of capacity.³⁶⁶ It argued this, combined with international experience, casts doubt on whether the smaller operators actually need 2.6 GHz. It included an example which showed that spectrum in the smaller portfolios augmented by either minimal (or manageable) site build in future years yields a network of sufficient capacity to be credible under reasonable demand forecasts for a network with current access to 3G spectrum. In particular, it shows an operator today facing congested sites and reasonable growth in data demand of over 60% p.a. over ten years could handle this growth with the smaller portfolios (i.e. 2x15 MHz of 1800 MHz or 2x10 MHz at 800 MHz) provided existing site numbers are augmented with minimal (or easily manageable) additional site rollout³⁶⁷ over a number of years. As such it argued that 2.6 GHz is not a requirement for capacity to be credible as assumed by Ofcom in its medium portfolios.

Ofcom's response

A3.504 We have explored Vodafone's technical modelling of capacity from paragraph A10.75 in Annex 10.

Consistency with EU merger decision

Summary of responses

A3.505 Vodafone argued that its analysis is consistent with the decision by the European Commission in its review of the T-Mobile and Orange merger which found that a divestment of 2x15 MHz of 1800 MHz spectrum was sufficient to create a credible LTE player.³⁶⁸ In particular, Vodafone argued that the Commission emphatically

³⁶⁵ Telefónica also refers to Austria. We take account of Austria in our analysis of the international experience earlier in this Annex. We recognise that the Austrian 2.6 GHz auction is an example of the fourth operator obtaining 2x20 MHz (but we also take account of the auctions in other countries in which the fourth operator acquired less 2.6 GHz spectrum). We also comment on the comparison between Austrian and UK circumstances from paragraph A3.372 above.

³⁶⁶ Vodafone non-confidential response, paragraph 56 and Annex 2.

³⁶⁷ Vodafone suggested an average minimum of 50 and a average maximum of 350 additional sites per annum, and referred to the fact that Ofcom assumed an operator can build 1.5k sites per annum.

³⁶⁸ Vodafone non-confidential response, pages 75ff.

noted that a divestment of a larger block of spectrum was not necessary to create effective competition (even though the divested amount was smaller than the retained amount). Equally significantly, Vodafone argued, was that the Commission did not find it was necessary for the acquirer to hold existing spectrum in order for the divestment to achieve its objective of creating a credible rival to Everything Everywhere. Vodafone argued it would therefore be disproportionate to include 2.6 GHz in any spectrum reservation.

Ofcom's response

- A3.506 As part of its assessment of the merger between T-Mobile and Orange, one of the European Commission's two key competition concerns was that the combined entity could be the only national wholesaler with a clear path to a full coverage maximum-speed network in the short to medium term, as against the counterfactual that there would be two national wholesalers in that position with 1800 MHz spectrum in absence of the merger.³⁶⁹ As a result, the parties submitted various commitments to address the Commission's concerns. As Vodafone says, this included a commitment to divest 2x15 MHz of 1800 MHz spectrum, which the European Commission considered sufficient to address this competition concern.
- A3.507 The Commission was therefore considering what spectrum was necessary to enable a full coverage near maximum speed LTE network in the short to medium term by reference to the counterfactual of no merger.
- A3.508 It does not follow from the Commission's decision that the Commission considered that 2x15 MHz of 1800 MHz spectrum would be sufficient *on its own* to allow a national wholesaler to be credible over the timescales, and taking into account all of the dimensions of capability, which we consider in our competition assessment. We are considering longer timescales of up to 5 to 10 years after the Auction. In addition our analysis includes but goes beyond the key considerations in the theory of harm in the Commission's merger decision. These differences arise from the different issues relevant to the Commission's merger decision and our competition assessment.
- A3.509 We therefore do not consider that our decision conflicts with the Commission's decision.

Adequacy of portfolio without sub-1 GHz spectrum

Summary of responses

- A3.510 H3G argued that Portfolio 6 (i.e. 2x15 of 1800 MHz spectrum and 2x10 of 2.6 GHz spectrum) would not be adequate to be a credible national wholesaler because it does not contain sub-1 GHz spectrum, and so should be removed. As an alternative to the removal of this portfolio, H3G argued that Ofcom should consider a new minimum spectrum portfolio which merges Portfolios 5 and 6, which would consist of 2x5 MHz of 800 MHz spectrum + 2x15 MHz of 1800 MHz + 2x5 MHz of 2.6 GHz. While it considered that this merged portfolio suffers some disadvantages, H3G argued it was nevertheless more likely than Portfolio 6 to allow a wholesaler to be credible. It also argued that it is much more likely to be sufficient than the portfolio

³⁶⁹ See from paragraph 122 of the Commission's decision dated 1 March 2010:

http://ec.europa.eu/competition/mergers/cases/decisions/M5650_20100301_20212_247214_EN.pdf

The Commission's other key concern related to the potential threat to H3G's position in the market, especially due to its RAN sharing arrangements with T-Mobile.

proposed in the March 2011 consultation of 2x5 MHz of 800 MHz paired with 2.6 GHz spectrum.³⁷⁰

- A3.511 H3G considered that Ofcom has analysed in detail the competitive position of Everything Everywhere and why it might have countervailing advantages which result in it not requiring protection in the Auction in order to acquire additional spectrum. However, it argued that Ofcom has erred in not conducting a similarly detailed analysis in relation to the fourth national wholesaler. Yet, it argued, the fourth national wholesaler is in a materially different position from Everything Everywhere and even with one of the proposed portfolios, would have a much greater need for additional spectrum.³⁷¹
- A3.512 In particular, H3G agreed that Everything Everywhere has a large number of advantages in relation to the credibility criteria, and that although it suffers a coverage disadvantage from a lack of sub-1 GHz spectrum, this is to some extent mitigated due to its capacity and average data rate advantages. In particular, it argued that Everything Everywhere has a much greater bandwidth than any other national wholesaler, which it will be able to use for LTE to give an additional capacity advantage, and it has a large number of base stations. All of these not only allow a capacity advantage, but H3G also argued that Everything Everywhere will be able to achieve significantly better coverage from its large holdings of contiguous 1800 MHz spectrum than a national wholesaler with fewer sites and less spectrum. In addition, it argued that Everything Everywhere will obtain competitive advantages in the highest peak data rates (in the short and long term) due to the bandwidth available for LTE, alongside the other LTE advantages, plus the size of its customer base gives further advantages (i.e. less likely to be victim to strategic investment).
- A3.513 In contrast, H3G argued, the fourth national wholesaler has few if any of these advantages. It argued that had Ofcom assessed the specific position of the fourth national wholesaler in a scenario where it held a portfolio with no 800 MHz spectrum, Ofcom should have drawn the following conclusions:
- Even with Portfolio 6 from the consultation, the fourth national wholesaler's *"spectrum holdings ... would still result in capacity constraints both in absolute terms (i.e. the proportion of available spectrum it holds) and in terms of its ability to increase capacity through the deployment of more efficient technologies."*³⁷² H3G therefore considered that the fourth national wholesaler (whether H3G or a new entrant) would suffer a significant capacity/average data rate disadvantage.
 - *"Second, the fourth national wholesaler will not be able to offer the same quality of coverage as EE" because (1) if it were a new entrant it would not have a network in place and (2) it "will have a significantly smaller holding of 1800MHz spectrum than EE. This means Everything Everywhere will be able to achieve better coverage from its 1800MHz holding."*³⁷³
 - *"Third, whether the fourth national wholesaler is Three or a new entrant, without sub-1GHz spectrum it will be disadvantaged by its more limited ability to offer the highest peak data rates in the near or longer term."* Specifically H3G said that Everything Everywhere would be able to deploy LTE much earlier. And Everything Everywhere would retain a peak data rates advantage in the longer term because

³⁷⁰ H3G's non-confidential response to the January 2012 consultation, section 6 and page 13.

³⁷¹ H3G's non-confidential response to the January 2012 consultation, section 5.

³⁷² H3G's non-confidential response to the January 2012 consultation, page 114.

³⁷³ H3G's non-confidential response to the January 2012 consultation, page 115.

of its broader bandwidth of LTE-suitable spectrum. H3G argued that Telefónica and Vodafone would also be able to match or exceed the fourth national wholesaler's peak data rates as they are able to clear up to around 2x17MHz each of 900MHz spectrum for LTE use.³⁷⁴

- The fourth national wholesaler will remain at a disadvantage because of its smaller customer base. In the same way that the large size of Everything Everywhere's business provides it with advantages, the substantially smaller size of H3G's or a new entrant's business creates a number of disadvantages, including frictions to growth and being less likely to be able to acquire sub-1 GHz in the Auction.

A3.514 As such, H3G argued that it should have been apparent that the fourth national wholesaler would be much less credible with a portfolio excluding 800 MHz spectrum, and is in a far more vulnerable position than Everything Everywhere. Therefore H3G concluded that the fourth national wholesaler needs new spectrum much more, including sub-1 GHz, to be a credible national wholesaler.

Ofcom's response

A3.515 We disagree with H3G that we did not conduct a detailed analysis in relation to the fourth national wholesaler. We assessed the position of both a new entrant³⁷⁵ and H3G³⁷⁶ under each portfolio in a similar way to Everything Everywhere. It was this analysis of the potential advantages and disadvantages, followed by an assessment of strategic risk and intrinsic value that led us to our provisional proposals.

A3.516 We also emphasise that while our assessment of credibility involves a relative assessment, as rivals need to be able to compete with one another for there to be strong competition, we consider that a national wholesaler may be credible even if it is disadvantaged in some dimensions relative to its rivals. This is provided the disadvantages are not too large or are compensated by sufficient strengths in other quality dimensions. A national wholesaler may even be credible if it is at a relative disadvantage to its competitors in all dimensions, provided these relative disadvantages are not too large. It is not in our view necessary that all companies are equally strong for them all to be credible.

A3.517 H3G's comments relate to the portfolio of 2x15 MHz of 1800 MHz and 2x10 MHz of 2.6 GHz spectrum. Partly as a result of H3G's response, we have reviewed this portfolio and on balance we now consider there is a material risk this portfolio does not have sufficient strengths to allow a fourth national wholesaler to be credible. To mitigate this risk, we have therefore considered a portfolio with 2x20 MHz of 2.6 GHz, combined with 2x15 MHz of 1800 MHz spectrum. We consider this larger portfolio, providing H3G with a share of spectrum in excess of 10-15%, would be likely to be sufficient to enable H3G to be credible.

A3.518 Here we review H3G's comments when considering both portfolios, that is, considering:

- 2x15 MHz of 1800 MHz and 2x10 MHz of 2.6 GHz spectrum; and
- 2x15 MHz of 1800 MHz and 2x20 MHz of 2.6 GHz spectrum.

³⁷⁴ H3G's non-confidential response to the January 2012 consultation, page 115 to 116.

³⁷⁵ See, in particular, paragraph 4.78 et seq. of Annex 6 of the January 2012 consultation.

³⁷⁶ See, in particular, paragraph 4.59 et seq. of Annex 6 of the January 2012 consultation.

- A3.519 In relation to capacity and average data rates, the smaller of the two portfolios above accounts for 15% of total paired spectrum if combined with H3G's 2x15 MHz of 2.1 GHz spectrum, and the larger portfolio accounts for 19%. We agree that 15% does not provide a particular strength, but we consider that a share of 19% is more than the minimum share of spectrum and does provide a contribution to sufficient spectrum to be credible.
- A3.520 In terms of coverage, for low data speeds we consider that it is the frequency that matters rather than the bandwidth, but we agree that for higher data speeds the bandwidth can affect coverage. We also agree that a new entrant would find it more challenging to deliver coverage quickly and that sub-1 GHz spectrum might be particularly valuable to a new entrant to assist it to roll out a network more quickly (see paragraph 4.151 in Section 4). However, because we consider that sub-1 GHz is unlikely to be necessary to be credible, we regard both these portfolios as likely to have the minimum necessary on coverage to be credible.
- A3.521 With the smaller of the two portfolios, we agree with H3G that the portfolio would not give a 2x15 MHz bandwidth until it acquired the second tranche of the divested 1800 MHz spectrum which may not be until September 2015. With the larger of the two portfolios, the fourth national wholesaler would have a 2x20 MHz carrier at 2.6 GHz. But we consider that high peak data rates are unlikely to be necessary for credibility.
- A3.522 While the fourth national wholesaler may start from a smaller customer base, it would have an opportunity to grow its customer base provided its spectrum portfolio is sufficient for it to be credible. We have taken the smaller customer base of the fourth national wholesaler into account in our analysis of the risk that it would fail to acquire in the Auction the spectrum it needs to be credible. But we do not consider its smaller customer base is an independent reason for it to need to have larger portfolios or sub-1 GHz spectrum to be credible.
- A3.523 Our assessment of these two portfolios is set out from paragraph A2.100 and from paragraph A2.127 in Annex 2, and our conclusion on whether sub-1 GHz spectrum is necessary to be credible is set out from paragraph 4.74 in Section 4.

Medium sized portfolios and symmetry of risk

Summary of responses

A3.524 Telefónica said that:

“We note that, in conducting its analysis in Section 4 (specifically §§4.87-4.91) Ofcom determines that it must act symmetrically and that medium portfolios are required by Hutchison (or a new entrant), Telefónica and Vodafone. It is only later in Section 5 that Ofcom determines that no measures are required to secure a medium portfolio for either Telefónica or Vodafone.

In particular, Ofcom refers to the “reduction of risk” as an important factor in choosing medium over smaller portfolios. We have shown above that if medium portfolios are required then the risks are symmetric between Hutchison, Vodafone and Telefónica. It is only if smaller portfolios are required that Hutchison is exposed to higher risks of becoming a credible fourth national wholesaler.”³⁷⁷

³⁷⁷ Telefónica's response to the January 2012 consultation, paragraphs 139 to 140.

A3.525 Telefónica argued that:³⁷⁸

- The “weakest” of Telefónica, Vodafone or H3G is exposed to a significant risk in acquiring sub-2 GHz spectrum (each requiring 40-60% of the residual spectrum available in the Auction), assuming stronger bidders secure their portfolios, so H3G is not unique.
- Reserving Portfolio 1 (2x10 MHz of 800 MHz) or Portfolio 2 (2x15 MHz of 1800 MHz) for H3G does little to the sub-2 GHz risk of Telefónica or Vodafone. However, including 2x10 MHz 2.6 GHz as well reduces supply to 2x60 MHz and increases Telefónica/Vodafone’s percentage of residual spectrum required to 50%. A further reduction in supply caused by any sub-national RAN reservation increases this further to 66%. Telefónica noted that both these percentages are comparable to the risk level (40-60%) used by Ofcom to justify a sub-2 GHz reservation.
- A divestment via private sale (to Telefónica or Vodafone) prior to the Auction reduces exposure in the 2.6 GHz band for all bidders whilst increasing the risks of strategic behaviour at sub-2 GHz as only one 900 MHz operator would be exposed.

A3.526 Telefónica also argued that Ofcom had not assessed the repercussions for the next weakest bidder when considering reservations. It argues that the smaller group of portfolios (2x10 MHz of 800 MHz or 2x15 MHz of 1800 MHz) would improve H3G’s position relative to Telefónica and Everything Everywhere:³⁷⁹

- Under either reservation H3G has a guaranteed route to LTE, Telefónica does not; and
- Under Portfolio 1, H3G is the only bidder with a guarantee of LTE with a sub-1 GHz carrier.

Ofcom’s response

A3.527 Telefónica uses percentages of residual spectrum in the Auction to compare the “task” facing each operator in achieving a portfolio of spectrum we consider they may need to be credible (if they needed additional spectrum). We do not agree with this approach to assessing and comparing the “risk” faced by itself, Vodafone and H3G to being credible.

A3.528 Firstly, we consider that the comparisons presented are potentially misleading, both for Telefónica itself and for H3G. In relation to Telefónica, it has presented percentages reflecting an artificial divide between sub 2 GHz and 2.6 GHz, even though, in our view, the spectrum it may need to be credible can be obtained from either of these categories, not both. In particular, Telefónica appears to assume that it and Vodafone need to acquire sub 2 GHz spectrum (i.e. 800 MHz or 1800 MHz spectrum) to be credible by presenting this category separately from 2.6 GHz. However, our view is that if they need more spectrum to be credible, it is likely to be sufficient for them to acquire 2x10 MHz of 800 MHz or 2.6 GHz bands or the 2x15 MHz of 1800 MHz³⁸⁰. As such, it is potentially misleading to present the “task” faced by Telefónica to obtain spectrum for both of these categories in this way. In relation to

³⁷⁸ Telefónica’s response to the January 2012 consultation, paragraphs 138.

³⁷⁹ Telefónica’s response to the January 2012 consultation, paragraph 126.

³⁸⁰ See, for example, paragraph 4.132 of Section 4.

H3G, Telefónica has maintained this artificial distinction between sub-2 GHz and 2.6 GHz, even though some of the portfolios identified for a fourth national wholesaler require spectrum from both of these categories. Therefore we consider that a comparison between the percentages that Telefónica derives for itself and for H3G is not informative about the relative risks of exposure to strategic investment.

- A3.529 For example, Telefónica set out the “task” it would face to acquire a minimum spectrum portfolio when H3G and Vodafone had each already acquired their respective minimum portfolios (i.e. what Telefónica may need as a percentage share of the remaining spectrum available in the Auction). It also set out a similar analysis for H3G, absent reservation, considering the share of residual spectrum it would need to acquire to obtain a minimum portfolio if Telefónica and Vodafone had each achieved one of their identified minimum portfolios. However, in our view Telefónica’s comparison of these two positions and concluding them to be equal is misleading due to the representation of minimum portfolios and artificial divide between sub-2 GHz and 2.6 GHz (as set out in the previous paragraph). Telefónica’s comparison also fails to reflect that Telefónica is likely to have a higher intrinsic value than a fourth national wholesaler if both need the same spectrum to be credible (see paragraph 4.214d) of Section 4).
- A3.530 Telefónica has also included “risk” values for the residual spectrum when all other operators have acquired what they need to meet their minimum portfolio, including the fourth national wholesaler via reserved spectrum. This also seems misleading if compared directly to the percentage faced by the fourth national wholesaler without spectrum reservation (particularly in light of the differing portfolios and artificial divide in analysis discussed above). For example, if the percentages are the same, this does not imply that the risks faced by each are the same. The fourth national wholesaler could be prevented from acquiring the spectrum it may need by three other national wholesalers. In comparison, the percentage for Telefónica would reflect the position after two other national wholesalers (Vodafone and a fourth national wholesaler) have been assumed to acquire the spectrum that they may need in the Auction³⁸¹.
- A3.531 Therefore in light of the above, we do not consider that Telefónica’s approach to assessing and comparing risk is appropriate, and so we do not draw conclusions based on this. Instead of seeking to use percentages of residual spectrum under various assumptions to assess the relative risk faced by different national wholesalers, we have considered:
- a) the likelihood of a fourth national wholesaler being able to become credible with different reservations (from paragraph 4.135 of Section 4);
 - b) the likelihood of a fourth national wholesaler not being able to obtain the spectrum they need to be credible, (from paragraph 4.169 of Section 4);
 - c) the likelihood of Telefónica, Vodafone and Everything Everywhere not being able to obtain spectrum in the event they need it to be credible, absent any measures in the Auction (from paragraph 4.203 of Section 4); and
 - d) the likelihood of Telefónica, Vodafone and Everything Everywhere not being able to obtain spectrum in the event they need it to be credible, after factoring in the measures we are taking for a fourth national wholesaler and safeguard caps (from paragraph 4.270 of Section 4).

³⁸¹ Telefónica ignores Everything Everywhere in its analysis as it assumes it already holds a minimum portfolio, and so does not need to win any additional spectrum in the auction.

A3.532 This includes considering whether a fourth national wholesaler would be likely to obtain what it may need to be credible if we only reserved smaller portfolios (from paragraph 4.246), and the implications for Telefónica and Vodafone of our measures (from paragraph 4.272).³⁸²

A3.533 Secondly, in response to the three main conclusions Telefónica drew from its analysis when there is no reservation for a fourth national wholesaler, we consider that:

- a) If Telefónica and Vodafone do need additional spectrum to be credible, it does not need to be sub-2 GHz as discussed above. Additionally, absent reservation, we do not consider that Telefónica, Vodafone and H3G face the same risk in the Auction, and our discussion of the risk of strategic investment for Telefónica and Vodafone relative to the fourth national wholesaler is set out from paragraph 4.205 of Section 4.
- b) We consider that Telefónica's inclusion of figures for "risk" when all other operators have achieved their respective portfolios are misleading when compared to the risk faced by the fourth national wholesaler without reservation, as discussed above.
- c) Again, we consider that if Telefónica needs additional spectrum to remain credible, it is likely to be sufficient for it to acquire one of 2x10 MHz of 800 MHz, 2x10 MHz of 2.6 GHz or the 2x15 MHz of 1800 MHz – it does not necessarily need to be sub-2 GHz.

A3.534 Finally, in response to the two main conclusions Telefónica drew from its analysis of the impact on Telefónica of reservation for a fourth national wholesaler, we note that:

- a) Our discussion of the importance of an early route to LTE is set out in Section 4, and our discussion of when different bands (including those already held by Telefónica) are likely to be used for LTE is set out from paragraph A2.59 of Annex 2; and
- b) The reserved portfolio obtained by the fourth national wholesaler (and the identity of that bidder) would be determined by bidding in the Auction, including the bids of other opted-in and non opted-in bidders. Therefore H3G will not be guaranteed a sub-1 GHz LTE carrier.

A3.535 In our view, Telefónica's arguments around the position of the next weakest bidder in light of reservation for the fourth national wholesaler boil down to the relative strength of its existing holdings compared to H3G with different sized reserved portfolios. We have not approached this in the same way as Telefónica in our main assessment in Section 4 (as discussed above). While having some similarities, our approach in Section 4 does not directly compare the relative strengths of Telefónica and H3G with different portfolios. However, to respond to Telefónica, below we consider the relative strength of Telefónica's existing spectrum holdings with H3G assuming H3G obtained one of the two smaller portfolios (i.e. with 2x10 MHz of 800 MHz or 2x15 MHz of 1800 MHz). We then go on to consider the portfolios we have reserved.

A3.536 The table below shows the relevant spectrum holdings for Telefónica and H3G with the two smaller portfolios.

³⁸² In the January 2012 consultation we explored the implications of our proposals for Telefónica and Vodafone in paragraph 8.64 in Annex 6.

Figure A3.13: H3G with small portfolios compared to Telefónica's existing holdings

	800 MHz	900 MHz	1800 MHz	2.1 GHz	2.6 GHz
H3G + 2x10 of 800 MHz	2 x 10			2 x 15	
H3G + 2x15 of 1800 MHz			2 x 15	2 x 15	
Telefónica		2 x 17.4	2 x 5.8	2 x 10	

A3.537 In the longer term, when there are devices for LTE900, Telefónica will have the option of using the 900 MHz spectrum for LTE if that is more profitable than using it for HSPA and 2G. In this case Telefónica's existing spectrum holdings look stronger than the two small portfolios for H3G:

- We make the simplifying assumption that Telefónica's holdings of 2x5.8 MHz of 1800 MHz and 2x10 MHz of 2.1 GHz spectrum are in combination broadly comparable to H3G's 2x15 MHz of 2.1 GHz spectrum. This is consistent with our technical modelling finding that 1800 MHz and 2.1 GHz spectrum have similar propagation characteristics.³⁸³ While the block of 2x15 MHz of 2.1 GHz is fractionally smaller overall, and may not be used for LTE for some time, it is contiguous, whereas the combination of 1800 MHz and 2.1 GHz spectrum is not. Overall, we think they are likely to be similarly useful in terms of adding to the credibility of a national wholesaler in the longer term.
- For the portfolio of H3G with 2x10 MHz of 800 MHz spectrum, the comparison becomes between Telefónica's holding of around 2x17 MHz at 900 MHz spectrum and 2x10 MHz of 800 MHz spectrum. Given that 2x10 MHz of 800 MHz is smaller, Telefónica's holdings are stronger. We consider the propagation characteristics of 800 MHz and 900 MHz spectrum are similar.³⁸⁴
- For the portfolio of H3G with 2x15 MHz of 1800 MHz spectrum, the comparison becomes between Telefónica's holding of around 2x17 MHz at 900 MHz spectrum and 2x15 MHz of 1800 MHz spectrum. Given the advantages of sub-1 GHz spectrum over higher frequencies, Telefónica's holdings are stronger. (We recognise that currently the standards do not include 2x15 MHz blocks of 900 MHz spectrum for LTE. However, in the longer term, we consider that standards are likely to become more flexible in their ability to aggregate blocks of spectrum in different bands for a single user and the total amount of spectrum will become more important for peak data rates than the particular bands).

A3.538 In the near term, it is not straightforward to compare the portfolios. The relative strengths depend on the weight that is placed on the different dimensions of capability, including the relative advantages of LTE versus HSPA, and the importance of more capacity and sub-1 GHz spectrum. The portfolio with 2x15 MHz of 1800 MHz spectrum enables high peak data rates and gives other LTE advantages, and while the portfolio with 2x10 MHz of 800 MHz spectrum does not enable high peak data rates it does give other LTE advantages. As we set out in from paragraph 4.98 we consider the importance of these advantages to be unclear. And if the advantages of LTE over HSPA were large, we would expect Telefónica to move to LTE900 more rapidly.³⁸⁵ Also, for a period, there could also be advantages of HSPA over LTE because of a larger range and stock of compatible devices.

³⁸³ See from paragraph A7.128 in Annex 7.

³⁸⁴ See from paragraph A7.128 in Annex 7.

³⁸⁵ See from paragraph A3.135 above for discussion of responses on refarming 900 MHz and 1800 MHz spectrum.

A3.539 While there is some ambiguity in the near term, in our view Telefónica’s existing holdings are stronger than the two smaller portfolios in the longer term.

A3.540 Turning to the comparison with the medium sized portfolios we have reserved, the table below sets out the relevant spectrum holdings to compare.

Figure A3.14: H3G with reserved portfolios compared to Telefónica’s existing holdings

	800 MHz	900 MHz	1800 MHz	2.1 GHz	2.6 GHz
H3G + Portfolio 1	2 x 15			2 x 15	
H3G + Portfolio 2	2 x 10			2 x 15	2 x 10
H3G + Portfolio 3	2 x 5		2 x 15	2 x 15	
H3G + Portfolio 4			2 x 15	2 x 15	2 x 20
Telefónica		2 x 17.4	2 x 5.8	2 x 10	

A3.541 In the longer term, we again make the simplifying assumption that Telefónica’s holdings of 2x5.8 MHz of 1800 MHz and 2x10 MHz of 2.1 GHz spectrum are broadly comparable to H3G’s 2x15 MHz of 2.1 GHz spectrum. The comparison with Portfolio 1 is then straightforward. One portfolio has 2x15 MHz of 800 MHz spectrum and the other has around 2x17 MHz at 900 MHz spectrum. We regard this as the most clear cut of the portfolios to compare and regard them as being similar, with Telefónica’s perhaps slightly stronger because it has a little more sub-1 GHz spectrum.

A3.542 If H3G obtained Portfolio 2, it would have around 2x7 MHz less sub-1 GHz spectrum, but would instead have 2x10 MHz more of 2.6 GHz spectrum. Because of the advantages of sub-1 GHz spectrum, we do not consider Portfolio 2 to be stronger than Telefónica’s existing spectrum.

A3.543 If H3G obtained Portfolio 3, it would have around 2x12 MHz less sub-1 GHz spectrum, but would instead have 2x15 of 1800 MHz spectrum. Again we do not consider Portfolio 3 is stronger than Telefónica’s existing spectrum, because of the advantages of sub-1 GHz spectrum.

A3.544 The comparison between Portfolio 4 and Telefónica’s existing holding is the most difficult because the two portfolios are very different in terms of the frequencies. Portfolio 4 is clearly materially larger in terms of total paired spectrum than Telefónica’s existing holding, but Telefónica’s holding has the advantage of sub-1 GHz spectrum. Our judgement is that Portfolio 4 is not clearly stronger than Telefónica’s existing holding in terms of the likelihood of ensuring credibility.

A3.545 In the near term, it is not straightforward to compare the portfolios. As with the comparison of the smaller portfolios, the relative strengths depend on the weight placed on the different dimensions of capability. Given the medium sized portfolios are larger than the smaller portfolios, it is more likely that H3G would be in a stronger position compared to Telefónica with the medium sized portfolios compared to the smaller portfolios. But it is still not clear that H3G’s portfolio would necessarily be stronger. Telefónica would have more sub-1 GHz spectrum (though only marginally so in the case of Portfolio 1), and the more weight that is placed on that, the stronger is its spectrum holding. On the other hand, the reserved portfolios can be used for early LTE which might give advantages, and some of the portfolios include 2x15 MHz bandwidths which enables high peak data rates. If LTE did give advantages over HSPA, then the portfolios for the fourth national wholesaler might be stronger in the near term. But if the advantages of LTE over HSPA were large, we would expect Telefónica to move to LTE900 more rapidly. And, for a period, there could also be

advantages of HSPA over LTE because of a larger range and stock of compatible devices.

A3.546 We therefore disagree with Telefónica that reserving the smaller portfolios for the fourth national wholesaler places the fourth national wholesaler in a similar position to Telefónica and Vodafone. We consider that the fourth national wholesaler would be in a weaker position than Telefónica and Vodafone with the smaller portfolios and, while there is some ambiguity in the near term, that it would not be in a clearly stronger position with the portfolios we have reserved. For the reasons explained from paragraph A2.134, we consider it appropriate to reserve the same portfolios for a new entrant as for H3G.

Competition constraint and low power 2.6 GHz spectrum

Summary of responses

A3.547 BT considered that Group 3 (larger portfolios) would not be appropriate. It considered Group 2 (medium portfolios) could be appropriate, although unless Ofcom excludes H3G from bidding for a low power 2.6 GHz licence it seems that these mostly offer little more than Group 1 (smaller portfolios) since, with multiple 2.6 GHz low power licences available, it may be relatively easy for the fourth national wholesaler to anyway obtain a low power licence for 2.6 GHz spectrum in addition to the minimum portfolio of Group 1. BT noted that the January 2012 consultation was not explicit whether or not the low power 2.6 GHz spectrum would count towards the minimum portfolios.³⁸⁶

Ofcom's response

A3.548 We do not consider that low power 2.6 GHz spectrum when combined with 2x10 MHz of 800 MHz or 2x15 MHz of 1800 MHz spectrum would be likely to be sufficient to enable the fourth national wholesaler to be credible. Low power 2.6 GHz spectrum cannot be used for conventional macrocell deployments, so is likely to be less useful to a national wholesaler. Our assessment of the portfolios needed to enable H3G to be credible (set out from paragraph A2.85) were on the basis that the spectrum could be used for conventional macrocell deployments (as well as for small cell deployments). We clarify that the low power 2.6 GHz spectrum will not count towards satisfying the competition constraint.

Impact of proposals on divestment of 1800 MHz spectrum

Summary of responses

A3.549 Vodafone argued that Ofcom's current proposals for annual licence fees (ALF) lack sufficient clarity for operators to be able to make well informed bids in the forthcoming Auction, or in any private sale of the 1800 MHz spectrum. Another respondent expressed a similar view and stated that Ofcom had made insufficient effort to reduce the uncertainty.

A3.550 One respondent commented that despite the uncertainty over ALF the orders of magnitude had been made clear, and that these were discriminatory against new entrants. It noted that incumbents had rolled out their 1800 MHz networks under licence fees that were "benevolent". It argued this gave incumbents a regulatory advantage which cannot be replicated by those that follow.

³⁸⁶ BT's non-confidential responses, answer to question 4.3, page 9.

Ofcom's response

- A3.551 We recognise that there is uncertainty over the level of ALF for 1800 MHz spectrum. We explain our current thinking on ALF for 1800 MHz spectrum in Section 12 and also from paragraph A12.58 onwards. However, we stress that this is only our provisional thinking and we will consult specifically on the revision of ALF for 1800 MHz (and 900 MHz) spectrum after the Auction. It is difficult to provide greater clarity because we intend to draw on a range of methodologies for setting ALF after the Auction and will consult at that time (see Section 12 for more details).
- A3.552 Moreover, our focus in this Statement is on the appropriate and proportionate measures to promote future competition in mobile services. By contrast, the Direction requires us to revise the 900 MHz and 1800 MHz licence fees *after* completion of the Auction, having particular regard to the sums bid for licences *in the Auction*. Given this, we do not consider that it is appropriate to go beyond setting out our current thinking on ALF in this Statement simply in order to aid the private sale process for the 1800 MHz spectrum.
- A3.553 In terms of reducing the uncertainty for bidders in the Auction as a result of ALF, we have considered this in Section 12.
- A3.554 We do not agree that our proposals relating to the setting of ALF are discriminatory. As set out in Section 12, the Direction requires us to set ALF for the 900 MHz and 1800 MHz spectrum after the Auction to reflect full market value, having particular regard to the sums bid for licences in the Auction. We have not yet made any decision as to the levels of ALF and will consult on our proposals to revise these fees after the Auction, taking account of all relevant circumstances at the time, before any such levels are decided upon. We note however that ALF will only apply to the 1800 MHz spectrum that Everything Everywhere has committed to divest if it is traded in advance of the Auction. If the spectrum falls to be included in the Auction, ALF will not apply to it for the initial period of 20 years, as the licence fee for the use of the spectrum in that period will be determined by bids in the Auction. To the extent that ALF is levied on any 1800 MHz purchased by a new entrant, it will apply on the same basis as equivalent spectrum held by a current incumbent.

Treatment of new entrant (including Addendum and related issues)

Summary of our position in January 2012 consultation and Addendum

- A3.555 As set out in the January 2012 consultation, our aim is to promote four national wholesalers, and part of this requires at least four operators to hold at least a minimum spectrum holding that would enable them to be a credible national wholesaler. We considered that the most proportionate approach to enable such an Auction outcome would be through the reservation of spectrum for a fourth national wholesaler (a new entrant or H3G). However, we also considered it important that any reserved spectrum was the minimum amount necessary to enable at least four national wholesalers to be credible in the longer term so the intervention remained proportionate. Therefore we considered the potential spectrum portfolios that H3G may require to be credible, and then considered a new entrant.
- A3.556 In the January 2012 consultation, we proposed to have the same reservation for H3G or a new entrant if 1800 MHz was in the Auction. This was despite H3G already holding 2x15 MHz of 2.1 GHz spectrum and the reserved portfolios leaving a new entrant (assuming it acquired no further spectrum) with a share of spectrum that is

below the range we considered as having an increased level of risk to credibility.³⁸⁷ There were several reasons for this:³⁸⁸

- a) Reserving a larger portfolio(s) for a new entrant would not necessarily make it easier for it to obtain any reserved spectrum in competition with H3G.
- b) When the amount of reserved spectrum is the same for H3G and a new entrant, then the new entrant can compete on equal terms for the reserved spectrum and has the option (and flexibility) of buying any additional spectrum it needs in the normal way in the Auction.
- c) If a new entrant bought one of the reserved portfolios, it may be possible for it to launch a competitive LTE service soon after the Auction (potentially leading to stronger competition in the near term).
- d) In the longer term, H3G and the new entrant may not each have sufficient spectrum to be credible. However, if necessary at that point, it might be possible for the two spectrum holdings to be brought together in some way, by network sharing, a trade or a merger, while still retaining at least four credible national wholesalers.³⁸⁹ We recognised that if spectrum holdings were more dispersed there is some risk that they do not come together to enable at least four credible national wholesalers in the longer term. However, the risk of unnecessary restrictions on spectrum outcomes leading to an inefficient spectrum allocation is higher if we reserve more than the minimum necessary to enable at least four national wholesalers to be credible in the longer term.

A3.557 Therefore, we considered that this does not preclude a new entrant obtaining sufficient spectrum in the Auction to be credible even in the longer term, but it may need to obtain more than the reserved spectrum (either in the Auction or subsequently). On balance, we therefore considered it likely to be sufficient for promoting at least four national wholesalers to set the same portfolios for H3G and a new entrant if 1800 MHz spectrum is in the Auction. However, if Everything Everywhere sold the 2x15 MHz of 1800 MHz spectrum that it is required to divest as part of its merger commitments before the Auction, the reserved portfolios will change depending on who acquires that spectrum.

A3.558 In the event that the 1800 MHz spectrum is bought by Vodafone or Telefónica, then we considered that the group of portfolios that would be reserved for a fourth national wholesaler would reduce to those that did not contain 1800 MHz.

A3.559 In our “Addendum to the second consultation”³⁹⁰, we set out two cases for how the reserved portfolios could change if a party other than Vodafone or Telefónica bought the 1800 MHz before the Auction. It seemed to us that the key issue in this situation was whether it would be sufficient to meet our objective that parties other than Everything Everywhere, Telefónica and Vodafone collectively held (at least) the

³⁸⁷ Paragraph 4.212 of the January 2012 consultation.

³⁸⁸ Paragraphs 4.213 to 4.217 of the January 2012 consultation.

³⁸⁹ We also recognised the potential risk of strategic incentives on Everything Everywhere, Telefónica or Vodafone to obtain one of these two spectrum holdings to prevent a fourth credible national wholesaler in the longer term, but if this were through a spectrum trade, it would be subject to a competition assessment at that time.

³⁹⁰ Addendum to second consultation on assessment of future mobile competition and proposals for the award of 800 MHz and 2.6 GHz spectrum and related issues of 12 January 2012”, 17th February 2012: <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/annexes/addendum.pdf>

spectrum in one of the spectrum portfolios we have identified, even if they do not do so individually (Case 1). Or whether it is necessary to meet our objective that there is at least one party who on its own holds (at least) one of the identified spectrum portfolios (Case 2).

- a) In Case 1, given that a party other than Everything Everywhere, Telefónica and Vodafone would already be holding the future rights to use the 2x15 MHz of 1800 MHz spectrum to be divested by Everything Everywhere, the spectrum portfolios in the Auction would be the same for all opted-in bidders, and would consist of the spectrum in excess of 2x15 MHz of 1800 MHz that we considered necessary to reserve to meet our objective, which we proposed at that time to be either 2x10 MHz of 800 MHz spectrum or 2x10 MHz of 2.6 GHz spectrum.
- b) In Case 2, the spectrum necessary to meet our objective would vary between bidders: in the case of the party that had acquired the 2x15 MHz of 1800 MHz spectrum the portfolios would be as in Case 1; in the case of other parties, the portfolios would be those that we judged necessary for them independently to acquire sufficient spectrum to further our objective, and, could not include the 1800 MHz spectrum already sold by Everything Everywhere, so would be 2x15 MHz of 800 MHz spectrum or 2x10 MHz of 800 MHz spectrum plus 2x10 MHz of 2.6 GHz spectrum.

A3.560 We did not express a preference in the consultation between Case 1 and Case 2.

Topics in responses

A3.561 A full discussion of the treatment of a new entrant is set out from paragraph A2.134 of Annex 2, which reflects responses received, and the implications of 1800 MHz spectrum being sold pre-Auction set out from paragraph A2.159 of Annex 2. Notwithstanding this, we now go through each issue raised by respondents individually.

A3.562 Below, we have grouped discussion of responses under the following headings:

- Reserved portfolios for a new entrant when 1800 MHz is in the Auction
- Reserved portfolios if 1800 MHz is sold pre-Auction to H3G or a new entrant

Reserved portfolios for a new entrant when 1800 MHz is in the Auction

Summary of responses

A3.563 One respondent raised concerns about the 800 MHz coverage obligation deterring a new entrant. This is discussed from paragraph 6.42 of Section 6.

A3.564 H3G argued that to be credible, a fourth national wholesaler needs to hold one of the minimum spectrum portfolios on its own, so Ofcom should not allow 'split MSPs' to count to there being a fourth national wholesaler. Further, it argued that if two operators each have half the minimum efficient scale, the two firms together do not achieve the minimum efficient scale.³⁹¹ In addition, H3G argued that there is no justification for Ofcom's suggestion that sub-scale operators would necessarily merge to form a fourth national wholesaler, and argued that Ofcom does not address the fact that O2 or Vodafone are far more likely to obtain the new entrant's spectrum via

³⁹¹ Page 132 of H3G's non-confidential response to the January 2012 consultation.

a merger (which would essentially amount to another form of strategic investment³⁹²).³⁹³

- A3.565 H3G also argued that by reserving the same portfolios for a new entrant as for H3G (despite a new entrant needing more than the reserved portfolio), Ofcom's approach appears to be focussed mainly on achieving a symmetric contest for becoming the winning opt-in bidder. However, it argued that this was at the cost of dispersing a minimum spectrum holding between at least two parties if a new entrant is successful in the Auction.³⁹⁴ The better approach, it argued, is for Ofcom to implement Auction rules that restore symmetry to the contest for becoming the winning opt-in bidder in scenarios where different opt-in bidders ought to receive reserved portfolios of different sizes (i.e. where at least one is a new entrant and one is not). In particular, H3G argued that this issue of a level playing field could be resolved with specific "handicap" measures to bring parties eligible to benefit from the competition constraint on equal terms without sacrificing its objectives.³⁹⁵
- A3.566 H3G suggested that its proposed handicap would provide an approximation of the difference in implicit subsidy (the difference between final clock prices and reserve prices) for opt-in bidders with smaller pre-Auction holdings (and so the larger reserved portfolio) and those with the largest pre-Auction holdings (and the smaller reserved portfolio). This difference would set the level of the handicap provided to the opted-in bidder who requires a larger reserved portfolio. The winning opted-in bidder would then be selected by maximising the total value of bid combinations, while taking account of the handicap in favour of opted-in bidders with smaller pre-Auction holdings.³⁹⁶ It argued this would ensure a fourth national wholesaler (on its own) held sufficient spectrum to be a credible national wholesaler at the end of the Auction.

Ofcom's response

- A3.567 In relation to H3G's point around split portfolios, we acknowledge that holding less than a minimum spectrum holding may increase the risk that a party is not a credible national wholesaler³⁹⁷, and so relying on subsequent coming together of spectrum may be more risky in achieving our objectives. However, it is also important that our proposals are appropriate and proportionate. As such, we set out a discussion of split holdings, the ability of spectrum holdings to come together, and concerns around the distribution of spectrum from paragraph A2.139 of Annex 2, reflecting this trade-off. In addition, we note that any merger would be subject to the relevant merger analysis which would consider the impact on competition in the market (and a spectrum trade would be subject to a competition assessment).
- A3.568 We consider there are several reasons for favouring the same size portfolios for a new entrant as for H3G, and not just that different portfolios may make it harder for a new entrant to win the reserved spectrum, as discussed from paragraph A2.137 of

³⁹² As Telefónica or Vodafone would extract greater value from foreclosing the possibility of a credible fourth national wholesaler than the value H3G or another entrant would obtain from becoming the credible fourth national wholesaler, and so could offer considerably better terms (including price) for the merger.

³⁹³ Page 134 of H3G's non-confidential response to the January 2012 consultation.

³⁹⁴ Page 135 of H3G's non-confidential response to the January 2012 consultation.

³⁹⁵ Page 136 of H3G's non-confidential response to the January 2012 consultation.

³⁹⁶ Annex B of H3G's non-confidential response to the January 2012 consultation.

³⁹⁷ H3G referred to minimum efficient scale, but this is not strictly the concept we are using in our analysis as discussed from paragraph A3.169 above, and so we continue to refer to credibility (and we draw no conclusions on its implications of the points raised for minimum efficient scale).

Annex 2. Our discussion of H3G's specific handicapping proposal, and bidder credits more generally in this context, is set out from paragraph A2.150 of Annex 2.

Reserved portfolios if 1800 MHz is sold pre-Auction to H3G or a new entrant

Summary of responses

- A3.569 If 1800 MHz spectrum is sold pre-Auction to H3G or a new entrant, H3G argued that the issue of no party holding a complete minimum spectrum holding (discussed above) is greatest under Case 1, but present under both Case 1 and Case 2.³⁹⁸
- A3.570 Several respondents argued against Case 2, for a range of reasons. Firstly, Vodafone³⁹⁹ and one other respondent argued that the logic of Ofcom's case for 2.1 GHz when 1800 MHz spectrum is in the Auction is that spectrum holdings for a fourth national wholesaler should apply collectively, and so Case 1 should be adopted if 1800 MHz spectrum is sold pre-Auction. This is because, Vodafone argued, if Ofcom is right about the amount of spectrum required to be credible, then the smaller operators who 'split' a minimum portfolio must get together if their individual holdings are not sufficient because both will need to do so in order to survive. Ofcom, by its own competition analysis it argued, must sanction such an arrangement in order to preserve competition.⁴⁰⁰ If Ofcom is wrong, as argued by Vodafone, then the purchaser of the divested spectrum will have sufficient spectrum to be a credible competitor.⁴⁰¹ Similarly, Telefónica argued that Ofcom does not need to be prescriptive as to the distribution of spectrum amongst players other than Vodafone, Telefónica and Everything Everywhere as the market will sort that out in the most efficient way.⁴⁰² As a result of this ability to combine holdings, and Ofcom's ability to seek to block mergers or spectrum trades with the components of the reserved portfolios if they were detrimental to competition, one respondent argued that there is no competition ground for Ofcom to choose Case 2 over Case 1.
- A1.106 In addition, Telefónica argued that if a new entrant purchased the divested spectrum, even with just 2x15 MHz of 1800 MHz the "fifth player" has a direct route to LTE, as much capacity as Hutchison today, and it can still bid in an open auction for further capacity (which it argued was not as prone to strategic behaviour as Ofcom's assertions suggest). Further, it argued that there would be a "four" or a "three plus two" outcome guaranteed under Case 1. If its interpretation of the DoJ's assessment is correct, it argued that the number of competitors is a more important factor than their individual spectrum holdings (which is distinct from Ofcom's case that both are as relevant). This, it argued, implies that "three plus two" would provide more intense competition than exists in today's market (the test set by Ofcom to justify intervention), irrespective of the outcome of the Auction process and so supports Case 1.⁴⁰³

³⁹⁸ Page 132 of H3G's non-confidential response to the January 2012 consultation.

³⁹⁹ Vodafone also argued for restricting any spectrum reservation to the small portfolios, and noted that this would avoid the problem identified in the addendum because if a 'new' operator bought the divested spectrum then there would be no need to reserve any spectrum for anyone. Similarly, Telefónica argued for reserving the smaller portfolios and stated that if H3G purchased the 1800 MHz pre-auction, this issue would disappear. The arguments they both put forward for the reserved portfolios are discussed in paragraphs A3.491 et seq.

⁴⁰⁰ Paragraphs 59-61 of Vodafone's non-confidential response to the January 2012 consultation.

⁴⁰¹ P1 of Vodafone's non-confidential response to the January 2012 consultation.

⁴⁰² Paragraph 291-4 of Telefónica's non-confidential response to the January 2012 consultation.

⁴⁰³ Paragraph 292-4 of Telefónica's non-confidential response to the January 2012 consultation.

- A3.571 Vodafone argued that there are also potentially very high costs associated with Case 2. For example, it stated that if the purchaser of the 1800 MHz pre-Auction decides not to participate in the Auction because it believes that it has sufficient spectrum to compete, another party will then enter the Auction and opt for the reserved portfolios which now must include a large block of 800 MHz spectrum (at the reserve price). Assuming that there are no other new bidders, Vodafone argued that this party is then guaranteed that spectrum, even though it may crowd out others who have a higher intrinsic value for the spectrum.⁴⁰⁴
- A3.572 Further, Vodafone argued that with Case 2 Ofcom would need to be wary of trading between the two lesser competitors after the Auction as the combined entity would have obtained an artificially large amount of spectrum at the reserve prices, purely by clever use of the floors.⁴⁰⁵ Similarly, another respondent argued that Case 2 introduces incentives on parties eligible to opt-in to collude in order to win collectively more spectrum at a lower price. For example, it referred to a scenario in which one party eligible to opt-in would agree with another party eligible to opt-in to buy the 1800 MHz divestment spectrum privately ahead of the Auction, and then not participate in the Auction on the agreement that the two parties would pool their spectrum holdings after the Auction. It argued that the result of this would be that the reserved portfolios for opted-in bidders would include 800 MHz spectrum (which is seen as particularly valuable), and the two colluding parties would have increased chances of jointly owning rights to a significant holding (in excess of the Group 3 larger portfolios)⁴⁰⁶.
- A3.573 One respondent raised concerns with Case 2 that a pre-Auction sale of the 1800 MHz spectrum to H3G or to a new entrant would cause significant differences in the position of opted-in bidders, and another argued that it would bias competition in favour of the buyer of 1800 MHz pre-Auction, making Case 2 pointless and potentially discriminatory. In particular, it argued that the Auction for reserved spectrum would be biased as whoever had not bought the 1800 MHz divestment would need to win a larger reserved portfolio (which includes 800 MHz) than the purchaser of the 1800 MHz divestment in order to be a credible national wholesaler. Further, the respondents argued that having different portfolios for different opted-in bidders was inconsistent with Ofcom's proposal to reserve the same portfolios for H3G and new entrants, despite H3G's existing 2.1 GHz holdings, in order for all opted-in bidders to compete on equal terms for reserved spectrum.
- A3.574 Finally, one respondent also argued that Ofcom should not, and is obliged to not, let Everything Everywhere influence the outcome. In particular, it stated that Ofcom's proposals allow Everything Everywhere to determine the future market structure, and it will do everything possible to find a new entrant to sell the 1800 MHz to. This is because, it argued, a new entrant would likely face delay and other barriers to becoming an effective competitor in the market, no fourth operator would hold at least 10% of spectrum, and it would reduce the likelihood of an opted-in bidder acquiring 800 MHz (and so increase the chance of Everything Everywhere obtaining such spectrum). Similarly, another respondent expressed concern that Everything Everywhere would have the incentive to target an outcome where either H3G or a new entrant obtained the divested spectrum as this would increase the probability of Everything Everywhere being able to win 800 MHz in the Auction. This is because, it argued, the opted-in bidder would be reserved either portfolio 5 or 6a (from the

⁴⁰⁴ Paragraphs 62-63 of Vodafone's non-confidential response to the January 2012 consultation.

⁴⁰⁵ Paragraph 64 of Vodafone's non-confidential response to the January 2012 consultation.

⁴⁰⁶ The respondent also referred to our use of a modified Vickrey pricing rule designed to avert collusion among smaller bidders as suggesting concern about collusion is merited.

January 2012 consultation), with the most likely outcome being a reservation of portfolio 6a (i.e. containing no 800 MHz) as this would minimise the opportunity cost.

- A3.575 Alternatively, one respondent argued, if a suitable (new entrant) buyer could not be found (particularly that satisfies the purchaser requirements), the next best option would be to not sell the 1800 MHz pre-Auction. This, it argued, would delay the point at which the eventual acquirer has certainty of ownership and so can make the necessary investment, and again makes it less likely for an opted-in bidder to acquire any 800 MHz which reduces competitive pressure on this spectrum band.
- A3.576 In either case, the respondent argued that the Auction creates a situation where Everything Everywhere is effectively able to determine whether the fourth operator does or does not obtain 800 MHz spectrum. Regardless of Ofcom's own views on the relative merits of 800 MHz and 1800 MHz spectrum, the respondent argued it cannot be consistent with an obligation to maintain a "non-discriminatory" process for the assignment of spectrum or the objectives to promote competition for the assignment to be swayed by Everything Everywhere given its incentives (to distort competition as much as possible).
- A3.577 Further, it argued that given the potential bias in the Auction among opted-in bidders towards the purchaser of the 1800 MHz, Everything Everywhere's decision on the sale of the 1800 MHz spectrum may effectively determine the winner of the Auction as well as the content of the winning reserved portfolios (i.e. no 800 MHz). It considered that such a result is not only discriminatory, but means the assignment will be largely controlled by the earlier sale process in which no party (other than Everything Everywhere) has any right to be involved, and where the decision on who wins (if anyone) need not be transparent or objectively fair as between potential purchasers. This, it argued, cannot be said to be an "open" or "transparent" Auction assignment, as required. To address this potential risk to future competition and the integrity of the Auction design, the respondent considered the key drivers for Everything Everywhere to use its divestment to bid strategically should be removed by protecting the opt-in bidder's ability to acquire sub-1 GHz spectrum by including some 800 MHz spectrum in all reserved portfolios.

Ofcom's response

- A3.578 A discussion of the issues around split portfolios if 1800 MHz is sold pre-Auction is set out from paragraph A2.164 in Annex 2.
- A3.579 We do not agree that our analysis means spectrum holdings should necessarily apply collectively if the 1800 MHz is sold pre-Auction, nor that we do not need to be concerned about the distribution of portfolios, for the reasons discussed in Annex 2. In particular, we consider it desirable to minimise the reliance on such subsequent coming together of spectrum to the extent it is appropriate and proportionate to do so, due to the potential difficulties and therefore the risks it may pose to furthering our objectives.
- A3.580 In relation to Telefónica's comments about Case 1, the assessment of a new entrant's position under the different portfolios is set out from paragraph 4.149 of Section 4, and as discussed, we consider that there is a material risk that a new entrant with only 2x15 MHz of 1800 MHz will not be credible in the longer term. The risks of strategic investment are discussed from paragraph 4.181 of Section 4 (with responses to the January 2012 consultation discussed from A3.326 of this Annex). The discussion of four national wholesalers and the DoJ decision is set out from paragraph A3.53 above, and we disagree with Telefónica's interpretation of the DoJ's

assessment. In addition, we do not agree that the number of competitors is more important than their individual spectrum holdings as suggested by Telefónica, as we consider both are relevant for competition. In particular, as discussed in Section 4, we consider that in order to be capable of being credible, an operator would need to hold at least a minimum spectrum holding that provides sufficient capability to be credible. If it holds less than this, we consider there to be a material risk to its ability to exert an effective constraint on their rivals. We do not consider that an outcome under Case 1 of “three plus two”, where the “two” may each have insufficient spectrum to be credible, is necessarily more competitive than an outcome with four credible national wholesalers.

- A3.581 With regard to Vodafone’s argument about the costs of Case 2, we consider there is a low level of confidence that a fourth national wholesaler would be capable of being credible if it only holds one of the smaller portfolios, for all the reasons discussed from paragraph A2.167 in Annex 2. As a result, we consider that if the purchaser of 1800 MHz pre-Auction adopted the approach suggested (i.e. not to participate in the Auction), it would present a significant risk to our objectives under Case 1. Therefore, we consider that Case 2 provides a way to further our objectives relative to Case 1 as it would ensure an opted-in bidder would hold at least a complete reserved portfolio. As a result, we consider that Vodafone has understated the net benefits of Case 2.
- A3.582 We accept Vodafone’s suggestion that such an outcome under Case 2 could result in more spectrum being reserved than under Case 1 and might displace others who have a higher intrinsic value for that spectrum. We take account of this possibility as a potential disadvantage of Case 2 in our assessment in Annex 2. We also note that the acquirer of reserved spectrum displacing others who may have a higher intrinsic value is a feature of the competition constraint more generally and we consider it promotes our objective in a proportionate way due to the likely competition benefits and the risks around intrinsic value and strategic investment, as discussed in Section 4. Furthermore, we also take account of the risk of spectrum inefficiency arising from this general feature of the competition constraint in determining our proposals on reserve prices.
- A3.583 With regards to the risk of a “clever use of the floors” and collusion, the qualification provisions and the activity rules in the Auction regulations give us the ability to exclude bidders from the Auction where there is collusion or attempted collusion with another person to distort the outcome of the award process. We consider that these provisions are sufficient to address the concerns identified. Further, we note that any coming together of spectrum through a trade would be subject to a competition assessment at that time by Ofcom.
- A3.584 We have considered whether having different portfolios for different opted-in bidders under Case 2 would favour the pre-Auction acquirer of the 1800 MHz spectrum. This is set out from paragraph A2.172 of Annex 2.
- A3.585 Some respondents suggested that it is inconsistent for there to be different portfolios between the acquirer of 1800 MHz pre-Auction and other opted-in bidders under Case 2 if 1800 MHz is acquired pre-Auction, whereas if 1800 MHz is in the Auction identical reserved portfolios apply for all opted-in bidders. However, we do not agree. As set out in Annex 2, we apply a consistent analytical framework to both issues and the difference in our conclusions reflects different circumstances between the two situations. We also note that in both situations our approach enables an opted-in bidder to acquire a complete reserved portfolio, consistent with promoting our overall aim.

- A3.586 Contrary to the respondents' arguments, we do not consider that Everything Everywhere has excessive power over who can buy the divested 1800 MHz spectrum, and therefore influence over the future market structure. The merger commitments contain terms to guard against this, and both the European Commission and Ofcom must approve the purchaser of the divested spectrum in accordance with the provisions of the commitments given to the European Commission by Everything Everywhere's parent companies.
- A3.587 Given this, and our view that the sale of 1800 MHz pre-Auction would not automatically bias the Auction towards the purchaser, we do not consider that the sale would prevent the Auction from being an open and transparent process. In addition, we do not consider that the sale necessarily affects whether the fourth national wholesaler wins 800 MHz, as the winning portfolio will depend on the bids of other opted-in and non opted-in bidders. Further, given our view that sub-1 GHz spectrum is unlikely to be necessary for credibility, we would not consider an outcome where one of the portfolios without 800 MHz was won by the opted-in bidder to be inconsistent with our objectives as we consider any of the reserved portfolios will enable an operator to be capable of being credible. Therefore given the sale would not affect the ability of an opted-in bidder to win a complete reserved portfolio, nor directly affect the openness or transparency of the Auction assignment process (both winning opted-in bidder and winning portfolio), we consider it consistent with our objectives.
- A3.588 Additionally, we are neutral as to the identity of the fourth national wholesaler, providing it is capable of being credible. Therefore since Everything Everywhere can only sell the 1800 MHz pre-Auction to a party that meets the requirements set out in the merger commitments (and in particular must have the financial resources, proven expertise and incentive to use the spectrum as a viable and active competitive force), we do not consider a sale to a new entrant that meets these criteria would be inconsistent with our objectives.

Obligations on reserved spectrum (including possible roll out obligation)

Summary of our position in January 2012 consultation

- A3.589 In paragraphs 7.14 to 7.19 of Annex 6 of the January 2012 consultation we recognised the risk that we might reserve spectrum for a fourth national wholesaler when it was not efficient to do so. We considered that this risk could be mitigated to some extent through a higher reserve price.

Summary of responses

- A3.590 Telefónica considered that any reservation in the 800 MHz band should attract an obligation to provide national coverage. This was because the reservation was predicated on a competition benefit from a national wholesaler, so it was not unreasonable to ensure that whoever obtained reserved 800 MHz spectrum offers a national service.⁴⁰⁷

⁴⁰⁷ Telefónica's non-confidential response, paragraph 229.

A3.591 Telefónica was also strongly of the view that any reservation of 800 MHz spectrum should automatically be assigned the coverage obligation, so as to secure value for money for the taxpayer.⁴⁰⁸

A3.592 H3G argued that Ofcom should impose a roll-out obligation on any bidder opting in to the minimum spectrum portfolios. This would minimise the risk of speculative entry, when a party acquiring spectrum has no credible plans of rolling out a network and competing effectively with the established operators.

A3.593 H3G proposed the following roll-out obligation:

- To provide 50% population coverage by 31 December 2015 with 80% probability that users in outdoor locations within that area can receive the service with a sustained downlink speed of not less than 768 kbps in a lightly loaded cell;
- To provide and thereafter maintain 80% population coverage by 31 December 2018 with 80% probability that users in outdoor locations within that area can receive the service with a sustained downlink speed of not less than 768 kbps in a lightly loaded cell; and
- To provide and thereafter maintain 90% population coverage by 31 December 2020 with 90% probability that users in outdoor locations within that area can receive the service with a sustained downlink speed of not less than 1.5 Mbps in a lightly loaded cell.

A3.594 H3G considered that there should be financial consequences if these obligations were not met and that these consequences would need to be specific and identified at the time of the Auction and sufficiently substantial to incentivise roll-out. H3G suggested an obligation to make additional licence payments equivalent to between 5% and 10% of the Auction price of the acquired spectrum if the roll-out obligations are not met.⁴⁰⁹

A3.595 One respondent raised concerns that the method of payment for spectrum obtained in the Auction may undermine Ofcom's objectives, disadvantage the fourth national wholesaler and increase the risk of successful legal challenge by some existing national wholesalers. It argued that these concerns could be reduced by changing the existing proposals to more closely align the payment obligations for portfolio spectrum with those for 900 MHz spectrum. It proposed:

- The 800 MHz spectrum included in a reserved portfolio would be subject to ALF at the same level as for an equivalent amount of 900 MHz spectrum (including during the initial term);
- No reserve price for the 800 MHz spectrum in the reserved portfolio; and
- Roll-out conditions on the 800 MHz spectrum included in the reserved portfolios to maximise the benefit to consumers and minimise the risk of a speculative acquisition by operators that might otherwise have been deterred by a higher up-front cost.

A3.596 The respondent argued that these adjustments would generate the following benefits:

⁴⁰⁸ Telefónica's non-confidential response, paragraph 231.

⁴⁰⁹ H3G's non-confidential response, pages 136-7.

- There would be no risk that the fourth national wholesaler had received state aid or, generally not paid enough as it will inevitably pay at least as much as the holders of 900 MHz spectrum. Any risk of successful challenge on this basis will therefore be diminished.
- Without the proposals, the fourth national wholesaler will have to pay 20 years' licence fees in one go and in advance for the 800 MHz licence while other national wholesalers pay year-by-year for their 900/1800 MHz licences that will be used to provide competing services. It argued this would be a significant and unfair advantage afforded to the other national wholesalers by 900/1800 MHz liberalisation, but could be reduced with its proposals.
- It removes the difficulty of trying to work out the right level for the reserve price and ensures that the Treasury will receive at least the same amount of revenue that it would have done otherwise (albeit spread over a number of years with a cost of funds built in).

Ofcom's response

A3.597 A roll out obligation on spectrum reserved for a fourth national wholesaler might ensure that it would only be acquired by a party that wanted to be a national wholesaler and actually did roll out a network. This could mitigate risks such as a company acquiring the spectrum even though its business plan was only for a niche market rather than providing a national wholesale service, or a financial company acquiring the spectrum for speculative reasons (for example, if it hoped that it would be able to sell the spectrum to one of the larger three national wholesalers in the future).

A3.598 While we can see some merit in the arguments for a roll out obligation, we have decided not to impose one for the following reasons.

A3.599 The risk of a party obtaining the reserved spectrum and not rolling out a network to be a national wholesaler appears low to us:

- H3G is likely to want to opt-in to bid on the reserved spectrum and to want to use it to remain a national wholesaler. Assuming that H3G bids, there will be at least one potential national wholesaler bidding. This means that any other opted-in bidder will need to at least out-bid H3G in order to acquire the reserved spectrum, and this seem unlikely if the other bidder had a business plan that involved serving only a niche market rather than providing a national wholesale service. (While it is also possible that a party may wish to buy the spectrum for an entirely different use, no such party has made itself known to Ofcom and hence the technical licence conditions are not designed for this. We think this is very low probability. We note it has not occurred elsewhere in Europe).
- It seems unlikely that a company would acquire the spectrum for speculative reasons. Assuming that H3G and/or a new entrant bids in the Auction, it would need to outbid them, and so would be unlikely to profit from selling to them at a later date. If it hoped to sell the spectrum to one of the larger three national wholesalers in the future, this would be a risky strategy because any such spectrum trade would be subject to a competition assessment at that time.⁴¹⁰ It is possible that this competition assessment would mean there could be no sale to

⁴¹⁰ See: <http://stakeholders.ofcom.org.uk/binaries/consultations/trading-900-1800-2100/statement/900-1800-2100-statement.pdf>

the larger three national wholesalers. We also note that such speculative acquisition of spectrum has not generally been experienced in other auctions (where it might have been undertaken to, for example, try to exploit the imposition of caps in auctions).

- If the acquirer of reserved spectrum obtains the 1800 MHz spectrum (whether in the Auction or before the Auction), then it would need to have met the terms for the divestment in the merger commitments. These include both the European Commission and Ofcom having the power to veto any proposed sale. Under the terms for the divestment, we can veto a purchaser unless we consider they have “the financial resources, proven expertise and incentive to use the Divestment Spectrum as a viable and active competitive force in competition with the Parties and other competitors”.⁴¹¹ A party intending to be a national wholesaler could satisfy this test, whereas a party with a niche business plan would have difficulty satisfying the test, and a financial speculator would not satisfy it.

A3.600 There are risks of unintended consequences from imposing a roll out obligation, including:

- The roll out obligation could disadvantage a potential new entrant, who is unable to build a network sufficiently quickly for the roll out obligation, even though a new entrant might be beneficial for competition and consumers. We could aim to set the roll out obligation in a relaxed way to mitigate this risk, but some risk would remain that we make new entry more risky as a result of the roll out obligation.
- The inflexibility in a roll out obligation could lead investment to be distorted in a way that disadvantages consumers, for example by the roll out obligation requiring the holder to prioritise roll out over a wide geographic area, when it may have been more in consumers’ interests to have more capacity added first in particular areas of high demand.

A3.601 We also do not agree with Telefónica that the fourth national wholesaler should automatically be assigned the coverage obligation. The fourth national wholesaler may not be best placed to meet the coverage obligation, so it would be inefficient to impose that obligation on that party if the same objective could be achieved more efficiently by another national wholesaler.

A3.602 As regards the concern raised about the method of payment, we consider that the merits of the proposal are limited. Firstly, we do not consider it necessary to make changes to our proposals for state aid reasons, as we do not consider that they give rise to the grant of a state aid.

A3.603 Secondly, we do not consider that the respondent has provided evidence to show that paying for substitutable spectrum (i.e. 800 MHz and 900 MHz) in different ways, would materially and differentially affect the market.

A3.604 We note that we will in any event be setting ALF on the 900 MHz spectrum to reflect full market value after the Auction. Further, the respondent’s proposals do not in fact avoid similar spectrum being subject to different payment terms as they would also result in closely substitutable spectrum being paid for differently, as the winning opted-in bidder would be paying for 800 MHz via ALF whereas the non-opted-in

⁴¹¹ See paragraph 18 of Section B of the commitments to the European Commission: http://ec.europa.eu/competition/mergers/cases/decisions/M5650_20100301_20212_247214_EN.pdf

bidders that bought 800 MHz in the Auction would be making upfront lump sum payments.

A3.605 Thirdly, we acknowledge that this proposal might help promote competition if the fourth national wholesaler was unable to afford the purchase of reserved spectrum if payment was in the form of a lump sum payment, but would be able to if there were annual payments. However, we consider that we have already developed a way of managing the risk that a potential fourth national wholesaler is unable to afford the reserved spectrum in the Auction. We are doing this through the choice of reserve prices – see the proposals in Section 8.

A3.606 We also note that the proposal only refers to 800MHz and no other bands, and makes no provision for competition between opted-in bidders, or for the choice of reserved spectrum portfolio to be determined through bids in the Auction.

A3.607 In light of the above, we do not agree with many of the concerns raised, and in any event do not consider that the proposals put forward necessarily address them.

Reservation and state aid

Summary of responses

A3.608 Telefónica considered that as the fourth national wholesaler may not pay the market price for its spectrum, there was an inherent risk of the grant of state aid, although it considered that this outcome was not certain. If there were a clear grant of state aid arising from any reservation, Telefónica said it was entitled to seek a court review and to secure a supplementary payment to the UK taxpayer from the recipient of the reserved spectrum.

Ofcom's response

A3.609 We do not consider that our decision to reserve some spectrum for a fourth national wholesaler will result in the grant of a state aid to the winning bidder for that spectrum. In designing the rules of this Auction, we have taken account of the regulatory requirements that it must satisfy under the general regulatory scheme set out in both domestic and European law. As set out elsewhere in this statement, we consider that our decisions are consistent with those requirements.

Shared low power use of spectrum

Summary of our position in January 2012 consultation

A3.610 Annex 6 of our January 2012 consultation noted (paragraph 9.60) that the evidence for reserving 2.6 GHz spectrum for low power use was mixed. We said that there was a reasonable likelihood that a reservation would lead to the introduction of new services based on low power use, but the extent and benefits of such services remained uncertain.

A3.611 We also noted (paragraphs 9.61-9.66) that the evidence as to whether entry by low power users would occur without spectrum reservation was not clear cut. However we said there was some risk that it might not, due to the potential for free riding between low power bidders, low power use having a lower intrinsic value, and strategic investment by national wholesalers.

A3.612 We said (paragraph 9.67) that we were minded to favour reservation of 2x10 MHz of 2.6 GHz spectrum for low power use, but we invited further evidence of the costs and benefits of such an action. We begin by setting out responses in support of, and against, reserving spectrum for low power use. We then set out our view of these comments. Next we report the comments we have received in relation to other potential measures, including the aggregation of bids for low power use, and our conclusions on each of these measures.

The case for and against reservation

Summary of responses

- A3.613 Two respondents who had expressed a commercial interest in low power use of 2.6 GHz spectrum continued to support reservation.
- A3.614 BT said it agreed with Ofcom's view that sub-national networks using low power shared 2.6 GHz paired spectrum would enable new entrants to bring innovation and further competition to the UK market. BT said that spectrum should be reserved to encourage this and ensure that the benefits of additional competition are secured, and that this was essential if Ofcom was serious about promoting competition and innovation.
- A3.615 BT urged Ofcom to provide sufficient bandwidth nationwide to enable such applications to flourish, with multiple operators able to provide the highest speed services to consumers that could be supported by widely available backhaul solutions. Accordingly BT proposed that 2x15 MHz would be appropriate as a compromise between the amount of 2x10 MHz that Ofcom appeared to recognise to be insufficient and the bandwidth of 2x20 MHz that Ofcom suggested was not proportionate. BT further suggested that the number of low power licences and power levels could be further optimised along the lines of BT's response to the previous consultation and welcomed Ofcom's willingness to consider any views on these from other players. The location of low power spectrum within the band also needs further consideration.
- A3.616 Another potential entrant argued that the Auction presented a prime opportunity to boost innovation and competition, and that new entry into the market must be facilitated and encouraged. It argued that low power users could provide enhanced services within homes, premises, and metro wireless installations. This would deliver greater speeds, enhanced interference characteristics and tailored connectivity solutions, as well as constituting a new source of competition to established players. It noted that the Government's planned Urban Broadband Fund had the potential to shape low-power use in large cities, as many of the services it would fund would be reliant on obtaining low-power spectrum on competitive terms.
- A3.617 The potential entrant argued that, given their inability to compete with established, scale players in the Auction, new entrants would likely be unable to acquire such spectrum absent reservation. It therefore strongly supported reservation, but considered that 2 x 20 MHz of this spectrum should be designated for exclusive use by low-power shared users, to allow the full potential of low power spectrum to be realised.
- A3.618 The potential entrant further argued that free riding effects, differences in intrinsic value, and strategic investment were a concern, and that in addition new entrants would also have no guarantee that they would get wholesale access on reasonable terms to enable national roaming after they have won spectrum and built sub-national

networks. Therefore, additional measures to facilitate low power shared usage were essential to help compensate for this and other barriers to market entry.

A3.619 Reservation for low power use was also supported by ZTE (UK) Ltd, a provider of products which facilitate LTE networks at both the macro and small cell levels. ZTE said that small cell in-building deployment in the 2.6 GHz band offered the potential for innovation and extended high speed network coverage.

A3.620 Arqiva commented that innovative business models based on low power use of 2.6 GHz spectrum were likely to provide significant benefits, but noted that these services were still emerging and that the industry was still working through the technical and business implications. It said that Ofcom should reserve spectrum at 2.6 GHz in order to stimulate these services and reduce the uncertainty they face.

A3.621 Vodafone argued that there was no evidence that low power use would create any significant benefits to consumers. It said that unpaired spectrum was the most appropriate location for low power shared use within the 2.6 GHz band, and this would have a lower opportunity cost than paired spectrum.

A3.622 Telefónica said that:⁴¹²

“A reservation for sub-national RANs would incur costs on all the bidders seeking to acquire spectrum to be credible national wholesalers, increasing strategic risks. The case for reserving spectrum for sub-national RANs is speculative, at best, its costs are clearly large and measurable, ie. increased foreclosure risks on MNOs. Ofcom must let the market decide whether an allocation to sub-national RANs is the economically efficient outcome and return to the contestable assignment process proposed in March 2011.”

A3.623 Everything Everywhere was strongly opposed to reservation for low power use and said that it could “accept as an absolute highest level of intervention, the aggregation of bids for concurrent low-power licences...”⁴¹³ It argued that:

- The proposed intervention was not technology neutral;
- Ofcom should have conducted a cost benefit analysis which “as a very first step” should take account of factors such as consumer demand and willingness to pay for low power-based services, and high power-based services respectively, the loss of consumer surplus if the spectrum were not put to high power use, and the net impact on producer surplus of a reservation.
- It did not believe that, if low power entry had a positive net benefit, this would not be reflected in the intrinsic value of low power entrants. This was because benefits which low power users could not internalise would have to be through increased competition, but the sector was already competitive and Ofcom had taken steps to ensure this continued after the Auction. “Hence by definition” it was not possible for significant competition benefits to be unaccounted for in low power bids.
- Strategic bidding against low power entry was near impossible, because the downstream market was already highly competitive so there was no value to bid solely to bar further market entry, and in any case there was no mechanism by which national wholesalers could conspire to exclude low power entry.

⁴¹² Telefónica’s response, paragraph 28.

⁴¹³ Everything Everywhere’s response, paragraphs 31-33.

- The DECT guard band was a relevant comparator which was not widely used, and Ofcom had not put forth any arguments why the business model might be more sustainable for data services. There was also a significant risk of fewer than ten bidders for low power licences.
- The technical viability of concurrent low power licences is unclear.

Ofcom's response

A3.624 We recognise the potential for entry by low power users to deliver substantial benefits through improved services, competition, and innovation as described by the two stakeholders who have expressed an interest in such entry, and supported by ZTE and Arqiva. We also recognise that the prospective nature of such entry means that it is difficult to provide evidence as to the likely extent of these benefits.

A3.625 In light of this, we remain of the view that the strength of the case for entry is a difficult judgement, which requires weighing the uncertain benefits of entry with the likely opportunity cost of reservation. However while we said in our January 2012 consultation that we were minded to reserve spectrum for low power use, we have decided, on balance – and given in particular the uncertainty of the scale of the benefits arising from reservation – that to do so would be disproportionate. As discussed in Section 4, we have concluded that, while there remains some risk that socially-beneficial entry by low power users may not occur without reservation, overall the benefits of reserving spectrum for low power entry are insufficiently clear when set against the opportunity cost of such an intervention.

A3.626 Regarding the arguments made by a potential entrant in paragraph A3.618:

- As to the specific point about wholesale access on reasonable terms to enable national roaming, we note that to date wholesale access has not been regulated, and MVNOs and existing sub-national RANs have been able to negotiate access to national wholesalers' networks and thus to compete in the market. We recognise that there may be a greater risk to low power entrants in securing access on reasonable terms, if national wholesalers saw them as a greater competitive threat than MVNOs. However, we do not consider that the possibility of such an outcome is itself a justification for reserving spectrum for low power entry. We do not have clear evidence that entrants will fail to secure access on reasonable terms. If national wholesalers were to restrict competition by failing to provide such access, it would be open to us to use our competition or Communications Act powers if concerns arose.
- As to the more general point about the need to facilitate entry, we note that the existence of barriers to entry is not in itself a sufficient basis for reserving spectrum in the Auction. It is also necessary to have sufficient evidence that entry will lead to improved consumer outcomes.

A3.627 We note Telefónica's suggestion that a reservation of spectrum for low power use could in principle have increased the risk of strategic investment between national wholesalers. However, as we have decided not to make such a reservation, for the reasons set out in Section 4, we have not sought to assess the extent of any increased risk.

A3.628 We do not agree that a detailed cost benefit analysis of the kind described by Everything Everywhere would have been necessary to support a reservation for low power use. Any estimate of consumers' willingness to pay, consumer surplus, and

producer surplus, from services which have not yet been introduced, would necessarily have been speculative. We therefore consider it is appropriate for us to make a judgement on the basis of the available qualitative evidence, without engaging in a quantification exercise which is unlikely to be reliable.

- A3.629 Everything Everywhere seems to argue that because the market is already competitive, there is no scope for market entry to deliver substantial consumer surplus which would be unaccounted for in low power bids. Similarly it argues that there is no incentive for standard power incumbents to behave strategically to prevent entry.
- A3.630 We consider that the UK market currently provides good outcomes for consumers, and our proposed measures in the Auction are intended to ensure that this continues to be the case. However, this does not rule out the possibility that more intense competition could deliver further benefits to consumers.
- A3.631 Moreover, Everything Everywhere's argument appears to be based on a static view of competition. Market entry could take the form of an innovation which delivered services not currently available to consumers, or the delivery of services at substantially lower cost (leading to lower retail prices). Such entry could potentially lead to substantial consumer benefits, and be disruptive of the business models of incumbents.
- A3.632 Our decision is based on the view that such benefits from entry are not sufficiently certain to justify the cost of reservation. However that does not rule out the possibility of such benefits arising from entry. This is consistent with our recognition that there is a risk of the intrinsic value of low power entry failing to reflect its wider social benefit, and that incumbents could have an incentive to prevent such entry.
- A3.633 As regards the mechanism through which strategic investment might occur, as we have discussed elsewhere this does not require a conspiracy between the four national wholesalers. Rather, individual national wholesalers could consider that, by acquiring 2.6 GHz spectrum, they will increase the risk that low power entrants will fail to acquire the spectrum they need to enter. If national wholesalers see the potential for such entry as a threat, they could potentially factor this consideration into the amount of 2.6 GHz spectrum they will bid for, and the amount they are willing to bid.
- A3.634 Furthermore, strategic investment by national wholesalers against other national wholesalers will tend to increase, not decrease, the risk that low power entry is excluded. This risk is increased if national wholesalers bid above their intrinsic value for 2.6 GHz spectrum, regardless of whether the primary intended victim is low power entry, or another national wholesaler.
- A3.635 Finally, as regards Everything Everywhere's argument relating to the DECT guard band, we noted in our January 2012 consultation (Annex 6, paragraph 9.24) that:
- Whilst the DECT guard band has in fact been used to deliver services,^[...] we do not consider that it is necessarily a good analogy to the present case, notwithstanding some technical similarities. The 2006 auction of the DECT guard band gave 12 licensees concurrent access to 2 x 3.3 MHz of spectrum, a much smaller bandwidth than we are considering here. Also, the DECT guard band is suited for GSM-based voice services. In contrast 2.6 GHz spectrum would allow the provision of LTE-based data services,^[...] allowing entrants to compete for a growing area of the market. It is by no means clear that the experience of the DECT guard band can be generalised to the present case.

A3.636 Everything Everywhere has repeated its earlier arguments (which we reported in the January 2012 consultation, Annex 6, paragraph 9.23), but has not responded to our rebuttal of that argument as set out above.

Aggregation of bids by low power users

A3.637 Our January 2012 consultation (Annex 6, paragraph 9.87) consulted on the option of aggregation of bids by low power users for 2.6 GHz spectrum. None of the consultation responses objected to aggregation of bids, and we conclude that it is appropriate to aggregate bids by low power users for 2x10 MHz and 2x20 MHz of 2.6 GHz spectrum (see Section 4, paragraph 4.308).

Summary of responses

A3.638 BT argued in favour of making low power 2.6 GHz spectrum available exclusively to new entrants. This argument was made in the context of a reservation, but remains relevant in the case of aggregation of bids for low power use. BT said:

“We further believe that there is a good case to exclusively reserve the low power 2.6GHz spectrum for new entrants. MNOs with high power spectrum can operate small cells on the same frequency. For LTE this can be relatively easily achieved as part of a single network in accordance with the latest standards and hence existing players would not have the same incentives to coordinate and cooperate in use of low power spectrum as new entrants and to reach agreement with other players on these aspects.”

Ofcom's response

A3.639 It is possible that national wholesalers may not have an incentive to cooperate with new entrants in sharing the spectrum.

A3.640 However, there are disadvantages in excluding them from bidding for low power licences. We do not consider we can rule out that shared access to low power use of additional spectrum will be of value to national wholesalers. On a related point, if we were to exclude national wholesalers in the context of aggregation of bids, this increases the likelihood that the spectrum will be won for standard power use. This could lead to an inefficiency if the value of the spectrum on a low power basis to entrants and national wholesalers combined is greater than the value to a single standard power bidder.

A3.641 Furthermore, we consider that there would be scope for Ofcom to intervene if there were evidence that national wholesalers were obstructing the development of low power services by entrants.

A3.642 We consider that there is not a strong basis for excluding national wholesalers from bidding for low power licences. We therefore conclude that it is appropriate to aggregate bids for shared low power use of spectrum, including from national wholesalers.

Reserving for low power use with a shorter initial licence term

A3.643 Subsequent to our consultation we considered whether, if we were to reserve spectrum for low power use, the opportunity cost of such a measure could be mitigated through the initial licence term. In particular we considered whether we

should award an indefinite licence for low power use with a ten-year initial term and a notice period of three years, and complete a review seven years into the licence term to assess whether low power entry had been successful. This could potentially allow a range of actions at the end of ten years, including possible revocation of all low power licences and making the spectrum available for standard power use. We invited views from BT and another prospective low power entrant.

Summary of responses

- A3.644 BT said that the proposal added risk to prospective entry. It commented that, whilst it might be confident in its ability to enter the market and deliver benefits to consumers, the degree of success of other licensees could potentially lead to revocation of BT's licence. It suggested that Ofcom could compensate successful licensees in the event that their licence was revoked because of failure of other licensees, and allowing existing deployments at the time of licence revocation.
- A3.645 BT also suggested a 15 year minimum term, reviewed after 12 years, on the grounds that that some licensees may roll out networks faster than others, and the fact that the success of small cells was dependent on the wider progress of the LTE market which might take time to establish.
- A3.646 Finally, BT noted that low power licences were proposed to be tradable and so it would be possible for a standard power operator to purchase all the low power licences and request a licence variation to create a single standard power licence.
- A3.647 The other prospective entrant commented that the proposed shorter licence period would represent an insufficient period of time upon which to base business plans – and thus to secure customer contracts and investment, and noted that:
- There would likely be a delay between any award of licences and the resulting services becoming available in the market, so a ten-year licence could mean a significantly shorter period of full commercial use. Business cases would need to be underpinned by certainty that spectrum rights would allow the full potential of the new services to be realised.
 - The need for certainty would also be a critical factor in downstream markets. Should, for example, a licensee decide to offer a wholesale service, any customer taking that service would equally require confidence around the minimum duration of the licence and the circumstances under which it may be revoked or amended.
 - Radar interference filtering equipment that would be needed should the low power portion of spectrum be positioned at the top end of the 2.6 GHz band, was not yet fully developed or readily available.
 - It might be appropriate to grant licences for a finite period of 20 years in the first instance, and a 'utilisation test' applied around 15 years after award – with amendment or revocation of usage rights applying on three years notice in the event that certain pre-determined criteria were not met. However the criteria for such a test should be established in advance of the Auction, and should be objective and realistic. They also should not constitute roll-out obligations, such as coverage and adoption targets.

Ofcom's response

- A3.648 In light of these responses, we considered that a shorter initial licence term would raise a number of difficulties. It appeared that, if offered on the basis we had suggested, shorter licences could substantially reduce the period over which low power entrants would have certainty of commercial use of the spectrum, and this could undermine business cases and the confidence of downstream markets.
- A3.649 We considered that extending the initial licence term from, for example, ten to fifteen years would defeat the purpose of having a shorter initial licence term, as it would not substantially reduce the opportunity cost of a reservation for low power use.
- A3.650 We also considered that the other suggestions made for limiting the impact of a shorter licence period were unlikely to be workable. For Ofcom to commit to compensating successful low power users, or defining the terms of successful entry, would require us to take a highly prescriptive view of the development of the market, rather than allowing revocation to be a matter of regulatory judgement.
- A3.651 As regards BT's comment that a standard power user could buy all the available low power licences and request a variation of licence conditions, we recognise that this possibility potentially mitigates the risk attached to reservation of spectrum for low power use. However it could still lead to an outcome of sub-optimal spectrum use – for example if one low power user introduced a moderately successful service and was unwilling to sell its licence because of the disruption to customers of closing down the service.⁴¹⁴ There could also be impediments from the cost of negotiation and the need to reach agreement with a number of licence holders.
- A3.652 Finally, we note that there is a risk that setting a shorter initial licence term may not be effective in significantly reducing the opportunity cost of a reservation. The reserved spectrum would still not be potentially available to standard power use for at least ten years, and its value at that point is uncertain. For example, if a national wholesaler wanted to use this spectrum as part of its introduction of LTE services, a delay of ten years or more could prevent that wholesaler from using the spectrum for LTE (or subsequent evolutions of the technology) within an acceptable timeframe.

Hybrid use of spectrum by low power and standard power bidders

- A3.653 In our March 2011 consultation⁴¹⁵ we set out two possible approaches to allowing hybrid use of spectrum by low power and standard power users (sensing and minimum separation). However, due to technical obstacles with such approaches, we provisionally decided not to proceed with either. We remain of the view that we should not proceed with this option.
- A3.654 In the January 2012 consultation (paragraphs A15.114 to A15.116), we reported BT's suggestion of creating three licences with a maximum permitted base station power of 30dBm EIRP, suitable for outdoor or indoor coverage, and seven licences with a maximum permitted base station power of 10dBm EIRP, proposed as suitable for indoor coverage. We consider this issue further in Annex 11 (paragraphs A11.57 to A11.67).

⁴¹⁴ This could be an inefficient outcome relative to one in which the standard power user acquired the spectrum in the award, and used it for a purpose with a higher economic value than the moderately successful low power service.

⁴¹⁵ See Annex 6, paragraphs 9.70 to 9.72 of our January consultation for details on the provenance of these proposals.

Geographically split licences

A3.655 Our January 2012 consultation (Annex 6, paragraphs 9.82 to 9.86) set out a proposal for geographically split licences (alongside a reservation of 2x10 MHz nationally for low power use), which would allow, for example, low power use in rural areas and standard power use in non-rural areas (or vice versa).

Summary of responses

A3.656 BT said that urban areas were more likely than rural areas to have several low power operators in the same location and hence additional low power shared spectrum would be most useful in urban areas, primarily to help manage interference between low power licensees and also to take advantage of high speed backhaul. It said Ofcom's proposal to increase the 2x10 MHz reserved for low power to 2x20 MHz in rural areas would not address the locations where there are likely to be multiple operators.

A3.657 However BT agreed that extra low power spectrum in rural areas would be useful for serving customers as a broadband delivery solution. However, on balance BT considered that it would be preferable and simpler if the 2x10 MHz reserved low power spectrum were increased to 2x15 MHz reserved spectrum on a national basis, available for urban applications as well as rural broadband solutions. This would avoid more complicated geographic sharing options, including the need to deal with boundary issues.

Ofcom's response

A3.658 As noted above, we suggested this measure in the January 2012 consultation as an addition to a reservation for low power spectrum, rather than as a stand-alone measure. In addition, consultation responses did not support the use of geographically split licences. We have concluded that we should not include such licences in the Auction.

Annex 4

Auction design – issues raised in responses to our January 2012 consultation

- A4.1 This Annex sets out a summary of issues raised in responses to the January 2012 consultation in respect of the auction design and our comments regarding these issues. Where appropriate, it refers to section 7 of the main document on auction design. Annex 5 provides a full description of the rules for the Auction.
- A4.2 In general, respondents were supportive of our proposals. However, some respondents noted the complexity of the rules and there were comments on a number of aspects of our proposals, often regarding detailed aspects, in particular the policy for providing information to bidders during the Auction. The comments related to the following aspects:
- a) the complexity of the auction rules;
 - b) the information provided to bidders during the Primary Bid Rounds;
 - c) the activity rules;
 - d) eligibility points for each lot category;
 - e) the pricing rule;
 - f) the Assignment Stage and approach to joint bidding; and
 - g) deposits.
- A4.3 Some comments related to the approach to the promotion of competition in the Auction as well as the auction design. We address these comments in Annex 3.

Complexity of the rules

Summary of our position in the January 2012 consultation

- A4.4 We proposed to use a combinatorial clock format, similar to that used for previous spectrum auctions that Ofcom decided to hold, with some modifications to reflect the circumstances of this Auction. The modifications include in particular two types of measures. The first type gives effect to our objectives for the promotion of competition, which we refer to as the competition constraint and associated elements (permissible packages, a competition credit for opted-in bidders, adaptations to the assessment of excess demand during the primary bid rounds and to winner and price determination). The second type may be used to help price discovery and incentives for truthful bidding (final price cap, relaxed activity rule and associated chain bids).

Summary of responses

- A4.5 Vodafone noted that the rules were complex but agreed that most of the complexity was necessary for truthful bidding and price discovery.

- A4.6 David Hall Systems considered that the rules appeared complex but noted that this was a consequence of the objectives for the Auction.
- A4.7 A confidential respondent argued that complexity of the proposals was so extreme that it threatened the practicability and integrity of the auction process. It thought that, under the proposals, it would find it difficult to devise an optimal bidding strategy, arguing that the auction rules do not produce clear incentives or a dominant strategy. The respondent referred to direct costs that result, in terms of time and resources, but also to potential costs from the risk that bidders make mistakes, which could produce an inefficient spectrum assignment. It was concerned about the scope for issues that it had not yet identified to arise under the proposed rules, as a result of their complexity. The respondent argued that a radical simplification was necessary.
- A4.8 Northern Ireland's Department of Enterprise, Trade and Investment (DETI) noted the complexity of the proposed auction process and expressed support for Ofcom's objective to deliver outcomes in the interests of consumers.
- A4.9 Intellect raised its continued concern that a complex auction procedure could cause delay to the delivery of the Auction.
- A4.10 Telefónica commented that the proposed design, whilst more efficient, was extremely complex when compared to other auctions Ofcom had conducted, or have been conducted elsewhere in Europe. It highlighted the importance for Ofcom to do everything it can to simplify this Auction in order to increase participation and efficiency.

Ofcom's response

- A4.11 We acknowledge that the auction rules proposed in the January 2012 consultation were fairly complex and we have decided on a number of simplifications to the design. These simplifications include a modified activity rule in the Primary Bid Rounds and a new method of calculating excess demand in the Primary Bid Rounds (and the associated stopping rule).
- A4.12 We also note that many of the complex aspects of the auction rules, such as the Vickrey-nearest pricing rule which we have used in previous auctions, are intended to promote straightforward bidding strategies that bidders ought to be able to implement without difficulty. Bidders have an incentive simply to bid on their most profitable package in each Primary Bid Round and to place a comprehensive set of bids in the Supplementary Bids Round. We also note that the software we will be using to run the Auction will be designed to be as helpful to bidders as possible to assist them in managing their bids.

Information provided to bidders including the Competition Credit and the stopping rule for the Primary Bid Rounds

Summary of our position in the January 2012 consultation

- A4.13 In the January 2012 consultation, we proposed to tell all bidders (a) at the end of the opt-in round, the number of opted-in bidders, and (b) at the end of each Primary Bid Round the level of total demand and of excess demand in each category, whether a further Primary Bid Round would take place given the level of demand and what the prices in that subsequent round would be (see A11.75-A11.79 in that document). The information on excess and total demand would take account of the effect of the competition constraint. We also proposed to give opted-in bidders, ahead of each

primary bid round, information about the likely effect of the competition constraint on the prices they might have to pay, in the form of a Competition Credit (see A11.66-A11.74). (Simplifications would apply in the absence of the competition constraint.)

Summary of responses

- A4.14 Telefónica said the information given to bidders during the Primary Bid Rounds was insufficient for effective price discovery. Under our proposals, bidders are informed about Total Demand in each lot category⁴¹⁶. This does not inform bidders about the bids made at current clock prices since it includes spectrum allocated to an opted-in bidder by the competition constraint and spectrum allocated to bids made in earlier rounds (at lower prices). Telefónica argued that this inhibits price discovery and also makes it less certain for each bidder by how much it needs to raise its bid on its Final Primary Package⁴¹⁷ in the Supplementary Bids Round to guarantee winning it.⁴¹⁸
- A4.15 Telefónica also noted that opted-in bidders would have more information in this respect because of the Competition Credit. Other bidders would have less certainty about whether they are likely to win a given package or the likely price they will pay.
- A4.16 Telefónica argued that we should reveal during the Primary Bid Round information on ‘Aggregate Demand’, defined as the total number of lots bid for in the current round. Telefónica noted that ComReg in Ireland has gone further and proposed to provide bidders with a software tool that informs them of the minimum bid necessary to guarantee that a bidder will win its Final Primary Package.
- A4.17 A confidential respondent expressed concerns about the specific rules by which reserved spectrum is allocated during the Auction, arguing that the current design conflicts with our stated objectives for the Auction. It claimed that the proposed Competition Credit provides an informational advantage to opted-in bidders that they can exploit to acquire more valuable or larger packages. It also claimed that this risk remained even without a Competition Credit if the number of opted-in bidders is revealed at the start of the Auction.
- A4.18 The confidential respondent argued that the Competition Credit allowed an opted-in bidder to deduce the minimum bid necessary to ensure it cannot lose Minimum Portfolio Packages (MPPs). It could therefore shade its bids on these packages without risk of losing them and thereby artificially increase the difference between its bid on MPPs and larger or more valuable packages. This would increase its chance of winning larger packages⁴¹⁹. Even without the Competition Credit, the revelation of the number of opted-in bidders before the first Primary Bid Round could have a similar effect in cases where there is only one opted-in bidder.
- A4.19 In the respondent’s view, other (i.e. non opted-in) bidders could attempt a similar strategy of shading bids on less valuable packages, which might restore the Auction outcome to what it would have been if no one pursued this strategy. However, it

⁴¹⁶ Total Demand is defined as the sum across all bidders in a lot category of the maximum out of a) the bidders’ bid in that round or b) the number of lots it is awarded by the Provisional Winner Determination.

⁴¹⁷ The Final Primary Package is the package a bidder bid on in the final Primary Bid Round.

⁴¹⁸ Telefónica provided an example in which Total Demand can equal supply in every lot category and yet a bidder is not guaranteed to win its Final Primary Package at final clock prices. See page 66 of Telefónica’s response.

⁴¹⁹ The respondent provided a numerical example of this scenario). It noted that a possible response is that this kind of bidding reduces profitability (in their example the strategy of Bidder 3 raises its payment from 150 to 285 and reduces profits from 50 to 15). However, it argued that bidders would seek to acquire more spectrum within bid limits if able to.

argued other bidders would instead withhold bids on lesser valued 2.6 GHz spectrum packages until bidding activity on 800 MHz had ended, effectively turning the Auction into a sequential one (i.e. where lot categories are sold in separate auctions held sequentially). This would be needlessly drawn out and reduce efficiency.

- A4.20 The respondent further argued that the Competition Credit does little to help opted-in bidders during the primary rounds since they can deduce from their own bids and price movements when they are the last opted-in bidder to drop out.
- A4.21 Given the Competition Credit and the revelation of the number of opted-in bidders, the respondent argued that an opted-in bidder could come to understand during the Primary Bid Rounds that it is in a position to benefit from low prices on prime spectrum. It can then pursue a strategy of over-bidding (i.e. bidding more than its willingness-to-pay) on prime spectrum to guarantee it acquires it while still paying low prices. The respondent argued that the risk to an opted-in bidder of miscalculating and paying a much higher price than anticipated is mitigated by its ability to sell the spectrum to the next highest bidder after the Auction.
- A4.22 A second confidential respondent made a similar argument referring to an “inflator” strategy that could lead an opted-in bidder to raise prices for its competitors but still win an MPP at reserve prices; it was opposed to the use of a competition credit and the opportunities it may create for an opted-in bidder to increase ALF for others. Instead it proposed that a competition credit should be granted up to a specified maximum, representing the maximum inefficiency acceptable for promoting competition.⁴²⁰ However, the respondent welcomed the proposal to provide bidders with information that reflects whether opted-in bidders are still competing.
- A4.23 BT agreed with the proposal to reveal the number of opted-in bidders at the start of the auction and welcomed our proposal to ban bids that cannot win under any circumstance because of the competition constraint. However, it asked for clarification that, in cases where there is more than one opted-in bidder, the list of permitted bids for opted-in bidders would be relaxed so that it is identical to all other bidders.
- A4.24 BT also agreed that the introduction of the Competition Credit and the updated stopping rule would be potentially helpful since they increase certainty regarding the outcome at the end of the Primary Bid Rounds.

Ofcom’s response

- A4.25 With regard to Telefónica’s comments on the usefulness of Total Demand, we note that our final design now reports to bidders the sum of bids made in each lot category in the previous round and therefore at current clock prices (what Telefónica calls Aggregate Demand). This change will aid price discovery by providing bidders with a clearer idea of what others are willing to pay (and in Telefónica’s view will also reduce informational asymmetry between opted-in bidders and others).
- A4.26 However, we also note that since we have decided to remove the Final Price Cap this information can no longer be used to calculate the supplementary bid necessary to guarantee winning a Final Primary Package. Instead the rules incentivise bidders to place a comprehensive set of supplementary bids equal to their full valuation for the relevant packages.⁴²¹ Providing bidders with information on the minimum bid

⁴²⁰ [See Annex 3 paragraph A3.474 for a discussion of this proposal.]

⁴²¹ See Section 7, paragraphs 7.7-7.11 for a discussion of our decision to remove the Final Price Cap.

necessary in the Supplementary Bids Round to be guaranteed of winning the package bid on in the Final Primary Bid Round, even if possible, would re-create the potential for bidders to make bids in the Supplementary Bids Round that cannot win but might increase the prices payable by competitors.

- A4.27 Telefónica also stated that in addition to Aggregate Demand information Ofcom should reveal the MPP that is assigned to opted-in bidders in the Final Primary Round.⁴²² Under our final design we have decided not to reveal the MPP that is used in the calculation of excess demand and the stopping rule.⁴²³ This is to prevent any strategic behaviour by other bidders aimed at ensuring an opted-in bidder wins a particular MPP.
- A4.28 With regard to the first confidential respondent's argument that the Competition Credit (and also revealing the number of opted-in bidders) provides an informational advantage to opted-in bidders we note that the respondent does not demonstrate clearly how this information can be exploited to increase the opted-in bidder's profits. The respondent provides numerical examples that it argues show that an opted-in bidder can more easily acquire larger packages by increasing the difference between its bids on small packages and larger ones. Specifically, since the opted-in bidder can identify the smallest bid necessary to guarantee winning an MPP, it can place aggressive bids on larger packages, increasing the chances of winning them while avoiding the risk of winning nothing.
- A4.29 However, even under the first confidential respondent's examples the strategy does not increase the profits of the opted-in firm (indeed in one example the respondent provides profits fall dramatically⁴²⁴). The respondent appears to acknowledge this point but argues that bidders will seek to acquire as much spectrum as they can within their budget. One interpretation of this point (though this is not clearly stated in the respondent's response) is that some or all bidders will face binding budget constraints that prevent them from placing bids equal to their full value on larger packages. The challenge for bidders is then to structure their bids so as to maximise the likelihood of winning larger packages while remaining within budget and reducing the risk of winning nothing. Under this interpretation of the respondent's argument, the objection would appear to be that because the winning opted-in bidder will not have to pay as much as its non opted-in competitors for the MPP part of its winning package it will be in a better position to manage its budget more effectively.
- A4.30 However, the respondent's solution is to deny opted-in bidders any information about the competition they face from other opted-in bidders. This would put opted-in bidders in a very different position from other bidders since the information on demand reported during the Primary Bid Rounds would do little to reveal the competition they face to secure an MPP. In our view it is therefore appropriate to provide opted-in bidders with information relevant to them during the Auction. Under the rules we have decided to adopt, instead of the Competition Credit, we provide the same information to all bidders by reporting at the start of each round whether there is more than one opted-in bidder that is still eligible to bid for an MPP-compatible package in the round, as described in section 7. This is in addition to revealing to all bidders the number of opted-in bidders after the conclusion of the Opted-in Round.
- A4.31 We do not agree with the respondent's argument that an opted-in bidder that knows it is alone might be willing to over-bid on prime spectrum. This would be a very risky

⁴²² See Telefónica's response paragraph 269

⁴²³ See Section 7, paragraphs 7.16-7.19.

⁴²⁴ Specifically in the example in section 4.2.1 of the response the strategy increases payments from 150 to 285 and reduces profits from 50 to 15 relative to truthful bidding.

strategy and the possibility of selling any spectrum purchased at high prices after the Auction, which is subject to a competition check by Ofcom, will not, in our view, mitigate the risk to any significant degree.

- A4.32 With regard to the second confidential respondent's concern about "inflator" strategies, we consider that the removal of the Final Price Cap addresses the scope to make riskless bids that raise the prices others pay. Any attempt by opted-in bidders to make bids on larger packages during the Primary Bid Rounds with the intention of increasing the prices others pay will risk winning large packages at high prices and will risk reducing profits. Opted-in bidders only receive a potential discount for reserved spectrum and will face the full cost of acquiring additional spectrum over and above an MPP.
- A4.33 With regards to BT's comments, we can confirm that, where there is more than one opted-in bidder, they will not be restricted only to place bids on MPP-compatible packages. It is only when there is a single opted-in bidder that it must place bids only on MPP-compatible packages in accordance with its Permissible Packages.

Activity rules including relaxation on eligibility and Final Price Cap

Summary of our position in the January 2012 consultation

- A4.34 In January 2012, we proposed to use eligibility point-based activity rules that included a requirement for eligibility of bids in primary rounds to stay the same or decrease and a 'relative cap' for the supplementary bids round, with additional provisions. The additional provisions were a relaxation of the requirement for primary bids to be on packages with the same or lesser eligibility than the bidder's eligibility limit in each round (subject to consistency with preferences expressed in previous rounds), and a Final Price Cap creating a constraint based on prices in the final primary bid round. We also proposed that, where relevant, the relaxation in the Primary Bid Rounds would lead to chain bids, i.e. additional bids to make in a Primary Bid Round to reflect the implications of a relaxed bid in light of preferences expressed through previous bids.

Summary of responses

- A4.35 Everything Everywhere expressed cautious support for the updated activity rules, though noted the increase in complexity.
- A4.36 BT thought that the changes proposed in the January 2012 consultation seemed reasonable.
- A4.37 A confidential respondent expressed concerns that the proposed Final Price Cap allowed bidders to make, without risk, supplementary bids aimed at raising the prices paid by other bidders (particularly given the link to ALF levels). The Final Price Cap, by making bidders certain or almost certain that they will win their Final Primary Package, has the effect of allowing supplementary bids to be made that cannot win and are driven solely by the impact on prices paid by others. A bidder that wants to raise prices for others will place bids on all larger packages up to or near the maximum bid allowed by the Relative Cap and Final Price Cap. A bidder that wants to keep prices low will only place supplementary bids on its Final Primary Package.
- A4.38 The respondent proposed eliminating the Supplementary Bids Round in those cases where there is no unsold spectrum at the end of the clock phase. If there is a slight shortfall of demand in some categories, it proposed a sequential procedure in which a

winning outcome are prices are calculated on the basis only of those bids made in the primary round and then a supplementary round is held only on lots that are not sold in the primary round.

- A4.39 A second confidential respondent referred to the outcome of the recent auction in Switzerland to question whether the proposed activity rules in that auction, together with spectrum caps and eligibility points, had been sufficient to prevent strategic behaviour with the effect of raising competitor costs. The concern related to the ability to hide (or “park”) demand on a category and, late on in the Auction, make a high value bid on another category using the parked eligibility. The respondent invited us to review the proposed rules against such risk of strategic bidding.

Ofcom’s response

- A4.40 We have made a number of changes to the activity rules proposed in the January 2012 consultation. Following the confidential response and after conducting further analysis we accept that the Final Price Cap can allow bidders to place bids in the Supplementary Bids Round that they know cannot win but that might raise the prices other bidders pay for spectrum.⁴²⁵ As discussed in section 7 (paragraphs 7.7- 7.11), we have decided not to include the Final Price Cap in the rules for the Auction.
- A4.41 As discussed in Section 7 paragraphs 7.13-7.15 of the Statement we have also simplified the activity rule by removing the ability to make Capped Bids in the Primary Bid Rounds under the relaxed activity rule.
- A4.42 Regarding the second confidential respondent’s point on strategic bidding, we have reviewed all aspects of the auction design and are satisfied that the risk of strategic bidding is low. The combination of the pricing rule and the activity rules (and our choice of eligibility points) provides a powerful incentive for bidders to bid in a straightforward manner that expresses their true value for packages. Since any bid can potentially win and since supplementary bids must be consistent with Primary Round Bids, any deviation from straightforward bidding risks winning a package that is unwanted or that is not the most profitable for the bidder.

Eligibility points for the different categories of lots

Summary of our position in the January 2012 consultation

- A4.43 In setting eligibility points, we proposed to take account of both likely values of different lot categories as well as of the scope for switching between categories of lots during the Auction as prices change. Noting that there were uncertainties, we proposed that a ratio of 6:1 between 800 MHz and 2.6 GHz (paired at standard powers) and a ratio of 3:2 between 800 MHz and 1800 MHz. We also proposed that the eligibility of 2.6 GHz concurrent low power lots should be sufficiently low to prevent switching to other lots and that it seemed appropriate to take account of the uncertainty regarding the relative value of 2.6 GHz unpaired spectrum by setting the eligibility by reference to an equivalent amount of 2.6 GHz spectrum or slightly less.

⁴²⁵ In particular, if there are no unsold lots at the end of the Primary Bid Round, Final Primary Packages are guaranteed regardless of the Supplementary Bids that are made. A bidder can then place Supplementary Bids on a whole range of packages that will subsequently form part of the calculation of prices other bidders pay.

Summary of responses on ratio of eligibility points between 800 MHz lots and the 1800 MHz lot

- A4.44 H3G disagreed with our proposal to set the same number of eligibility points for 2x10 MHz of 800 MHz spectrum and the 2x15 MHz lot in the 1800 MHz band (that might be available in the Auction). H3G considered that the outcomes from recent auctions of rights to use 800 MHz and 1800 MHz spectrum showed that the value of 2x15 MHz of 1800 MHz was not equivalent to that of 2x10 MHz of 800 MHz. H3G argued that the data showed that the relative value of the 1800 MHz lot was much less than that of 2x10 MHz of 800 MHz. H3G noted the view on relative values of different lots that is linked to the concept of eligibility points has a read-across to reserve prices. As a result, its proposal was to use the proposals set out in our March 2011 for eligibility points (i.e. 60 eligibility points for 2x10 MHz of 800 MHz; 15 points for 2x15 MHz of 1800 MHz; 10 points for 2x10 MHz of 2.6 GHz). H3G also submitted that the proposed relaxed activity rules created adequate opportunities for bidders to switch between the 1800 MHz lot and 2x20 MHz of 2.6 GHz spectrum.
- A4.45 Vodafone also argued that eligibility points should reflect roughly the relative values of different spectrum categories. It therefore questioned our proposal for the same eligibility for 2x10 MHz of 800 MHz and 2x15 MHz of 1800 MHz, which suggests a 3:2 value ratio between the two categories when it thought that previous auctions and our proposals for ALF suggested a 2:1 ratio.
- A4.46 A confidential respondent pointed to evidence from recent European auctions to question the similarity in value between 2x10 MHz of 800 MHz and 2x15 MHz of 1800 MHz. To its knowledge, the only example was this appeared to be the case was in Portugal, where all of the spectrum was sold at reserve prices, i.e. prices were not determined through a market process. A confidential respondent invited us to reconsider our proposals and to make the underlying reasons more transparent to stakeholders.
- A4.47 Vodafone noted that the proposals for eligibility points included fewer points per MHz for 2.6 GHz (0.5 points per MHz) than for 1800MHz (2 points per MHz). Vodafone argued that it conflicted with the proposal for using the price of 2x45 MHz of 2.6 GHz as one of the sources of information for the ALF on 1800 MHz spectrum. Vodafone proposed to address this by using a 2:1 eligibility (and reserve price) ratio between 800MHz and 1800MHz, so that the Category B lot receives 45 eligibility points.

Summary of responses on other issues

- A4.48 Everything Everywhere considered that it was not possible for it to comment on proposed eligibility points ahead of seeing proposals for reserve prices.
- A4.49 Vodafone noted that it was common practice to use integer numbers for eligibility points per lot but that we had proposed a fractional number for Category E (2.6 GHz unpaired).

Ofcom's response

- A4.50 In section 7, at paragraphs 7.58-7.59, we set out how we have decided to take account of likely relative values of different lot categories and of the prospect for switching between categories in response to price changes. This includes a change in the relative eligibility points for the 1800 MHz lot relative to 800 MHz spectrum.
- A4.51 The values for eligibility in this Statement are integers for each lot category.

A4.52 This Statement sets out our approach to reserve prices in section 8 as well as to eligibility points.

Pricing rules

Summary of our position in the January 2012 consultation

A4.53 We proposed two options for a minimum revenue core pricing rule, one that would break ties between core prices by minimising the distance to Vickrey prices (the Vickrey-nearest rule), the second that would break ties by minimising the distance to a set of single prices per lot category that is as close as possible to market-clearing prices (the linear reference rule).

Summary of responses

A4.54 Everything Everywhere expressed support for the linear reference pricing rule, with two arguments. The first was based on the linkage to Annual Licence Fees (ALFs) for 900 MHz and 1800 MHz spectrum that is not in the Auction. The linear reference price would likely help make those annual fees more transparent. The second argument was that linear prices could be more suitable when the competition constraint was in place and reflecting the competition constraint in the primary bid rounds could lead to large relative price increases in one band. Everything Everywhere argued that linking prices to clock prices would make them more consistent with the primary bid rounds and, in some sense, “fairer”.

A4.55 A confidential respondent argued that in a large number of plausible scenarios the existence of the competition constraint “effectively wrecks” the modified Vickrey rule used to calculate the payments of winning bidders. This pricing rule is based on the opportunity cost imposed by winning bidders on others. When this opportunity cost is calculated from among only those outcomes consistent with the competition constraint (rather than all possible allocations of spectrum) it can lead to very low prices for sought after spectrum even where losing bidders are willing to pay much more for winning packages.

A4.56 The respondent proposed that if opted-in bidders win a package of spectrum that is larger than one of the MPPs they should pay a price that reflects a broader opportunity cost that does require the Competition Constraint to hold. In other words, the opportunity cost would be the next highest value allocation of spectrum regardless of whether this meets the requirement of the Competition Constraint.

Ofcom’s response

A4.57 We have selected a Vickrey-nearest pricing rule because further analysis has shown that the prices set by a linear reference rule can be very sensitive to the reserve prices that are chosen and can lead to highly asymmetric allocations of core adjustments between bidders. We also note that linear reference prices can be calculated as part of the information used to set ALF payments whether or not these are used to determine auction payments.

A4.58 We discuss the confidential respondent’s proposed method of calculating prices for opted-in bidders in section 7 at paragraphs 7.32-7.34. We have decided to calculate prices for opted-in bidders in a way that ensures they pay an opportunity cost that reflects the need for the Competition Constraint to hold.

Assignment stage and joint bidding

Summary of our position in the January 2012 consultation

A4.59 In section 7 of the January 2012 consultation, we considered that joint bidding in the Auction could give rise to competition law questions and ultimately, as a result of its impact on timelines for the Auction, would risk affecting consumer benefits. We proposed not to facilitate joint bidding in the Auction and were minded to preclude joint applications from competitors. We proposed that an option potentially suitable to facilitate two bidders securing adjacent spectrum in the Auction may be contingent bidding in the Assignment Stage, subject to the associated complexity.

Summary of responses

A4.60 A confidential respondent commented on our proposed approach to joint bidding. It was concerned about the potential for differential treatment of certain types of bidders, in this case existing holders of mobile spectrum, as compared with other bidders. It questioned the case for distinguishing between a joint venture between two mobile licensees and, for example, a joint venture between a mobile licensee and a fixed network operator. It argued that Ofcom appeared not to have carried out any proper comparative analysis of the likely benefits and risks of facilitating joint bidding, compared with not doing so. In considering the issues, it argued that we should take account of a recent network joint venture between two mobile licensees in Denmark, noting that one of the commitments given by the parties to that JV to address concerns from national competition authorities was that they would only participate in future auctions through the JV.

A4.61 Everything Everywhere did not favour an approach that would facilitate spectrum sharing in the Auction. It also commented specifically on the option to allow bidders to make Assignment Stage bids contingent on which bidder would be next to them. It disagreed with this approach for two reasons. First, it considered that this risked harming the ability of some bidders to seek to achieve other efficiencies through network sharing. The reason was that Everything Everywhere believed that network sharing would be better supported with spectrum holdings in a given band that are not adjacent. Therefore bidders seeking to be next to each other to share spectrum could harm the prospect of other bidders seeking blocks of spectrum that are not adjacent so as to maximise the benefits of network sharing. The second reason was a concern regarding unnecessary complexity in the design and a pragmatic consideration of the likely assignment stage options in each band, given the supply and the likely demand. The limited set of options made any form of bidding contingent on the identity of a neighbour very likely unnecessary. Bidders seeking adjacent spectrum would naturally bid on spectrum in the middle of a band.

A4.62 Vodafone proposed that the Assignment Stage could provide the mechanism for allocating a coverage obligation, rather than identifying a separate lot category for the Primary Bid Rounds. Under this approach, winners of at least 2x10 MHz would be bidding for a combination of an assignment position with or without the coverage obligation. Vodafone believed that this would provide appropriate scope for bidders to reflect differences between blocks at 800 MHz, offer rich choices in the Assignment Stage and help simplify the Primary Bid Rounds.

Ofcom's response

A4.63 We have decided that it would not be appropriate to allow joint bidding by Principal Stage winners or bidding that is contingent on the identity of one or more neighbours

in the Assignment Stage. We are therefore not taking any measure to facilitate spectrum sharing through the auction rules and bidders will bid independently on their own position in a band, where they have several potential options, in the Assignment Stage. We are also not including any specific provisions as part of the qualification process in respect of joint ventures between competitors and competition issues they might raise. The qualification criteria apply to all potential applicants in the same way.

A4.64 We discuss this in more detail in section 7, at paragraphs 7.40-7.45.

A4.65 We explain in Section 6 at paragraph 6.43 why we will be using a specific category for the coverage lot at 800 MHz.

Deposits and their potential role in reducing incentives for strategic bidding

Summary of our position in the January 2012 consultation

A4.66 Our January 2012 proposals did not include specific proposals for the level of deposits. Previously, in March 2011, we set out when we expected to require deposits from applicants and bidders during the auction process. We also used the provisions on deposits in previous regulations as a starting point for considering deposit levels, whereby bidders were required to have on deposit a specified proportion (not required to be greater than 50%) of their highest bid at various points.

Summary of responses

A4.67 Vodafone suggested that Ofcom could use deposits covering 100% of bids made if there were signs of a bidder pursuing a strategy to inflate prices for competitors by exploiting the competition constraint. Vodafone considered that this would help in reducing the impact of any such strategy because of the bidder's budget and cash-flow constraints.

Ofcom's response

A4.68 This point relates to the activity rules which we discuss above at paragraphs A4.34 to A4.42 and in Section 7. We consider that the changes to the activity rules address the underlying concern and that it is not necessary to use deposits to address it. In addition, we have decided that it will be appropriate to have scope to require deposits of up to 50% of the highest bid made. This allows us to require deposits that are likely to be of a material amount.

A4.69 We also note that, if any bidder fails to pay the full amount of their licence fee at the end of the Auction (for example because they have bid more for a package than they can afford), then that bidder will not get a licence and will lose the whole of their deposit.

Annex 5

Auction rules

A5.1 This Annex sets out the detailed auction rules. It describes both the Principal Stage of the auction (which determines the number of Lots in each Lot Category won by bidders) and the Assignment Stage (which determines specific frequencies to be allocated to winners of Generic Lots from the Principal Stage).

Packaging of spectrum

A5.2 The packaging of spectrum into Lot Categories is summarised Table A5.1 below.

A5.3 There are two Lot Categories in the 800 MHz band:

- four A1 Lots, which are 2x5 MHz Generic Lots located within the bottom 2x20 MHz of the band (the specific frequencies for each of the A1 Lots will be determined in the Assignment Stage); and
- a single A2 Lot, which consists of the 2x10 MHz at the top of the 800 MHz and is subject to a coverage obligation (the A2 lot is thus available as a Specific Lot in the Principal Stage).

A5.4 The 1800 MHz B Lot will be available in the event that it is returned to Ofcom by Everything Everywhere pursuant to undertakings given to the European Commission relating the merger of Orange and T-Mobile. Therefore, if available, this Lot will be offered as a Specific Lot in the Principal Stage.

A5.5 Paired spectrum in the 2.6 GHz band is potentially available either as individual, standard-power use C Lots, or as concurrent, low-power use D1 or D2 Lots. D1 Lots allow concurrent use in 2x10 MHz, whereas D2 Lots allow concurrent use in 2x20 MHz. Therefore:

- if any D2 Lots are awarded, only ten C Lots will be available;
- if no D2 Lots are awarded, but some D1 Lots are awarded, then twelve C Lots will be available;
- if no D1 and no D2 Lots are awarded, then fourteen C Lots will be available.

No more than 10 Lots across Categories D1 and D2 will be awarded in total.

A5.6 Finally, Category E consists of unpaired 2.6 GHz Lots. Where a bidder wins n of these Lots, this will permit standard-power use of the $(n-1)$ 5 MHz blocks at the top of its allocation, with the lowest frequency block subject to usage restrictions to avoid interference with adjacent users.

Table A5.1: Lots available for award

Band	Lot Categories	No. of lots	Lot size (MHz)	Reserve price	Eligibility per lot
800 MHz	Lot Category A1: four 2x5 MHz Lots. The A1 Lots relate to generic frequencies: they can be in any of the four positions in the 800 MHz band below A2. A1 Lots have no coverage obligation attached.	4	2x5	£225m	2250
	Lot Category A2: a single Lot of 2x10 MHz at specific frequencies at the top of the 800 MHz band. A2 has a coverage obligation attached.	1	2x10	£250m	4500
1800 MHz	Lot Category B: single 2x15 MHz lot relating to specific frequencies.	1	2x15	£225m	2250
2.6 GHz paired	Lot Category C: paired lots for individual use at standard powers. Between ten and fourteen generic Lots will be available, depending on the number of Lots allocated in Lot Categories D1 and D2. If no Lots are allocated in either Lot Category D1 or D2, fourteen C Lots will be available. If any Lots are allocated in Lot Category D1, but not D2, twelve C Lots will be available. If any Lots are allocated in Lot Category D2, ten C Lots will be available.	10, 12 or 14	2x5	£15m	150
	Lot Category D1: 2x10 MHz Lots for concurrent low-power use (up to 10 users).	Up to 10	2x10	£3m	30
	Lot Category D2: 2x20 MHz Lots for concurrent low-power use (up to 10 users) A bidder may bid for a most one Lot in Lot Categories D1 and D2. At most 10 Lots across Lot Categories D1 or D2 will be awarded.	Up to 10	2x20	£6m	60
2.6 GHz unpaired	Lot Category E: unpaired Lots for individual use covering Lots at standard powers and any necessary Lot at restricted powers. A bid for n Lots includes n-1 Lots useable at standard powers and one Lot at restricted powers (located at the bottom of the contiguous frequency range that would be assigned). Any bid including any Lots in this Lot Category must include at least two Lots in this Lot Category.	9	5	£0.1m	(n-1) if bidding for n such lots

Key terminology

A5.7 The tables below provide a glossary of the most important terms used throughout subsequent sections when describing the auction rules. These terms are typically capitalised. We would suggest that the reader first read the description of the auction rules from paragraphs A5.8 onwards, as they include detailed discussion of these terms, and use the following tables as a reference aid.

Table A5.1: Key terms

Term	Explanation
Lot	Blocks of spectrum offered in the auction. Lots can be combined into Packages of Lots for the purpose of bidding.
Generic Lot	A spectrum block that is not linked to a specific frequency range, but rather to a given bandwidth within a larger frequency range. The specific frequency range that will be assigned to each winner of a Generic Lot is determined in the Assignment Stage.
Specific Lot	A spectrum block that is linked to a specific frequency range, known in advance of and fixed irrespective of the outcome of the Assignment Stage.
Lot Category	Each different type of Lot offered in the auction. Identical Generic Lots are grouped together within the same Lot Category. Each Specific Lot belongs to the trivial Lot Category consisting of just that Lot.
Package	A selection of Lots, specified as the number of Lots in each Lot Category included in the Package.
Zero Package	The Package containing zero Lots in each Lot Category.
Package Bid	A bid for a Package. A Package Bid has an associated Bid Amount, which is the amount the bidder offers to pay for the Package to which the Package Bid relates. Bids for a Package are considered in their entirety. Therefore, bidders are not exposed to any risk of winning only a subset of the Lots included in a Package, unless they have also bid for such a subset in a separate Package Bid.
Bid Amount	The amount the bidder offers to pay for a Package in a Package Bid.
Zero Bid	A bid for the Zero Package, with a Bid Amount of zero.
Principal Stage	The stage in which the number of Lots in each Lot Category allocated to each Winner is determined. The Principal Stage comprises the Opt-in Round, the Primary Bid Rounds and the Supplementary Bids Round.

Term	Explanation
Primary Bid Round	A round in the auction where the Auctioneer announces prices per Lot for each Lot Category and bidders are invited to submit a bid (a Primary Bid) for their preferred Package, with a Bid Amount equal to the sum of prices of all Lots included in the Package.
Supplementary Bids Round	A round in the auction that takes place after the Primary Bid Rounds. In the Supplementary Bids Round bidders may submit multiple mutually exclusive bids (Supplementary Bids) for different Packages, provided that these bids are consistent with the Activity Rules of the auction.
Round Prices	The price per Lot for each Lot Category specified by the auctioneer in a Primary Bid Round.
Package Price	The total price of a Package in a Primary Bid Round. The Package Price is calculated as the sum of Round Prices of all Lots included in the Package. The Package Price is the Bid Amount associated with a Primary Bid.
Permissible Package	<p>For a specific bidder, a Package for which the bidder may be permitted to bid, which:</p> <ul style="list-style-type: none"> (i) must satisfy the spectrum caps and other bidding constraints; (ii) have an associated eligibility that does not exceed the bidder's eligibility for the first Primary Bid Round; and (iii) could be allocated to this bidder in a feasible outcome where the Competition Constraint is met.
Package eligibility	For a Package of Lots, the eligibility points associated with the Lots included in the Package.
Bidder eligibility	<p>The bidder eligibility determines the Packages that a bidder may bid for in a Primary Bid Round.</p> <p>A bidder's eligibility in the first Primary Bid Round is determined before the first Primary Bid Round, by reference to the total amount of money that the bidder has on deposit with Ofcom at a specified point in time.</p> <p>For all subsequent rounds, the eligibility of the bidder in a Primary Bid Round will be equal to the eligibility associated with the Package the bidder bid for in the preceding Primary Bid Round (or zero if the bidder did not submit a Bid in the preceding Primary Bid Round).</p>
Primary Bid	A bid for a Package, with a Bid Amount determined by prevailing Round Prices, submitted in a Primary Bid Round.

Term	Explanation
Constraining Primary Bid	<p>A Primary Bid for a Package with eligibility <i>strictly smaller</i> than the bidder's eligibility in the round it is made. Submitting a Constraining Primary Bid will result in:</p> <ul style="list-style-type: none"> (i) a reduction in the bidder's eligibility in the following Primary Bid Round; and (ii) a Relative Cap on subsequent bids for Packages with eligibility <ul style="list-style-type: none"> • equal to or smaller than the eligibility of the bidder in the round in which it submits the Constraining Primary Bid; and • greater than the eligibility of the Package to which the Constraining Primary Bid relates.
Final Primary Bid Round	The last Primary Bid Round run, after which the auction proceeds to the Supplementary Bids Round.
Final Primary Package (FPP)	For each bidder, the Package of Lots for which the bidder submitted a Primary Bid in the Final Primary Bid Round. If the bidder does not submit a Primary Bid in the Final Primary Bid Round, the Final Primary Package will be the Zero Package.
Final Round Prices	The Round Price for each Lot Category applying in the Final Primary Bid Round.
Supplementary Bid	A bid for a Package of Lots made in the Supplementary Bids Round.
Activity Rules	<p>A collective term for the various rules governing:</p> <ul style="list-style-type: none"> (i) the ability of a bidder to make Primary Bids during the Primary Bid Rounds; and (ii) the Relative Caps that apply to Bid Amounts for Supplementary Bids <p>as a result of the Primary Bids submitted by the bidder.</p>

Term	Explanation
Relative Cap	<p>A cap applying to the Bid Amount for a Supplementary Bid. The Relative Cap limits the amount by which a Supplementary Bid for Package X may exceed the highest bid that the bidder submits for the Constraining Package determined for Package X.</p> <p>The Constraining Package for a Package X with eligibility greater than the bidder's eligibility in the Final Primary Bid Round is the Package for which the bidder submitted a Constraining Primary Bid in the last Primary Bid Round in which the bidder's eligibility was greater than or equal to the eligibility of Package X (the Constraining Round). The maximum difference is determined by the Round Prices that prevailed in the Constraining Round (see the definition of Revealed Differential below).</p> <p>The Constraining Package for a Package X that the bidder was eligible to bid for in the Final Primary Bid Round is the Final Primary Package. The maximum difference is determined by the Final Round Prices (see the definition of Revealed Differential below).</p>
Constraining Round	<p>For a given Package that the bidder does not have eligibility to bid for in the Final Primary Bid Round, the last Primary Bid Round in which the bidder's eligibility was greater than or equal to the eligibility of the Package subject to the Relative Cap.</p> <p>For a given Package that the bidder does have eligibility to bid for in the Final Primary Bid Round, the Final Primary Bid Round.</p>
Constraining Package	<p>For a given Package subject to a Relative Cap, the Package against which the Relative Cap is defined.</p> <p>For a given Package X with eligibility greater than the bidder's eligibility in the Final Primary Bid Round, the Constraining Package is the Package the bidder submitted a Constraining Primary Bid for in the last Primary Bid Round in which the bidder was eligible to bid for Package X.</p> <p>For a given Package X with eligibility equal to or smaller than the bidder's eligibility in the Final Primary Bid Round, the Constraining Package is the Final Primary Package.</p>
Revealed Differential	<p>The greatest permitted amount by which the Bid Amount for a Package subject to a Relative Cap may exceed the highest bid that the bidder submits for its Constraining Package.</p> <p>The Revealed Differential is equal to the difference in price between the Package subject to the Relative Cap and the Constraining Package at the Round Prices in the Constraining Round. Note that this differential may be positive or negative.</p>

Term	Explanation
Excess Demand	<p>There is Excess Demand at the end of a Primary Bid Round if it is not possible to accommodate the total Adjusted Demand for every Lot Category within the Lots available for award. This may occur because either:</p> <ul style="list-style-type: none"> (i) the total Adjusted Demand across all bidders in one or more Lot Categories exceeds the maximum number of lots available in that Lot Category; or (ii) It is impossible to accommodate the Adjusted Demands for individual standard-power use C Lots and concurrent low-power use D1 and D2 Lots within the available 2.6 unpaired spectrum. <p>The Primary Bid Rounds terminate if there is no Excess Demand at the end of a Primary Bid Round.</p>
Adjusted Demand	<p>A measure of demand for a Lot Category at the Round Prices in a given Primary Bid Round that takes account of:</p> <ul style="list-style-type: none"> • the demand expressed by bidders in their Primary Bids in that round; and • the potential need to substitute the Primary Bid submitted by an Opted-in Bidder for one of its MPP-compatible bids for the Competition Constraint to be met.
Key Bid	<p>The Key Bid is used in the calculation of Adjusted Demand in order to determine which Lots might be required for meeting the Competition Constraint. The bidder who has submitted the Key Bid is the Key Bidder, whose Primary Bid is replaced by the Key Bid for the purpose of calculating Adjusted Demand.</p> <p>The Key Bid is an MPP-compatible bid submitted by an Opted-in Bidder for which the difference between the current Package Price of the Package subject to the bid and its Bid Amount is minimal across all MPP-compatible Bids of all Opted-in Bidders. Where more than one bid meets this criterion for a given round, tie-breaking criteria are used to select one of these bids.</p>
Key Bidder	<p>The bidder who has submitted the Key Bid for a given Primary Bid Round. The Primary Bid submitted by this bidder is replaced by the Key Bid for the purpose of calculating Adjusted Demand.</p>

Term	Explanation
Winner Determination (WD)	The process of taking a set of bids and determining which of those become Winning Bids. The process uses an optimisation algorithm to identify acceptable combinations of Winning Bids, taking account of the Competition Constraint.
Feasible Allocation	<p>An allocation of Lots amongst bidders consisting of a selection of Bids such that:</p> <ul style="list-style-type: none"> • at most one bid is selected from each Bidder; • all the Lots included in the Bids selected can be awarded given the available spectrum; and • the Competition Constraint is met given this allocation of Lots (where this is active due to at least one MPP Bidder opting in).
Total Value	Defined for a feasible allocation of Lots amongst bidders where a bid is selected for each bidder and each bidder is allocated the Lots in the Package subject to the bid selected for the bidder. The Total Value of the allocation is the sum of the Bid Amounts of the bids selected, plus the reserve price of all unallocated Lots excluding D1 and D2 Lots and any C Lots which are not available given the D1 and D2 Lots allocated.
Winning Bid	A bid that has been selected to win in the Winner Determination.
Winner / Winning Bidder	A bidder who has submitted a Winning Bid.
Base Price	The price to be paid by Winners for the Lots they are allocated in the Principal Stage. Base Prices reflect the opportunity cost of allocating a Winner the Lots it has won (including the opportunity cost of each individual Winner and every possible group of Winners). When added to the Additional Price, this determines the Total Price to be paid by a Winner.
Additional Price	The price to be paid by Winners for the specific frequencies they are assigned in the Assignment Stage. Additional Prices are set to reflect the opportunity cost (as reflected in Assignment Stage bids) of allocating a specific frequency range to a Winner. When added to the Base Price, this determines the Total Price to be paid by a Winner.
Total Price	The price to be paid by a Winner for its Licence. The Total Price for a Winner is the sum of the Base Price and the Additional Price for that Winner.
Electronic Auction System (EAS)	The interface that enables bidders to participate in the auction and make bids over the internet.

Term	Explanation
Competition Constraint	The requirement that a certain minimum number of Opted-in bidders each win a certain minimum amount of spectrum (a Minimum Portfolio Package or MPP).
Minimum Portfolio Package (MPP)	For a specific bidder, a Package of Lots that, if won by the bidder, would be sufficient for the bidder to count towards satisfying the Competition Constraint (provided that the bidder has opted in and selected a set of MPPs that includes this particular MPP). A bidder may have more than one MPP, in which case the bidder counts towards satisfaction of the Competition Constraint if the bidder wins at least one of its MPPs. Note that MPPs are not defined for all bidders, but only for MPP Bidders.
MPP Bidder	A bidder having one or more non-zero MPPs. An MPP Bidder may become an Opted-in Bidder.
MPP Set	A set of MPPs that is available as a choice for an MPP Bidder in the Opt-in Round. An Opted-in Bidder may only choose between MPP Sets, and may not choose individual MPPs within a set.
Opt-in Round	<p>A single round in the auction, prior to the first Primary Bid Round, where MPP Bidders can choose to opt in to be eligible for being counted towards meeting the Competition Constraint.</p> <p>An MPP Bidder who opts in has a choice between two MPP Sets (but may only choose one of these MPP Sets, not individual MPPs within a set). The MPP Set chosen determines the MPPs applied for determining whether the bidder counts towards the Competition Constraint. Bids at reserve prices are required for all the MPPs in the chosen MPP Set (these are called Opt-in Bids).</p>
Opt-in Bids	For a specific bidder, bids at the reserve price for the bidder's MPPs.
Opted-in Bidder	An MPP bidder who has made Opt-in bids and who may therefore be awarded an MPP in order for the Competition Constraint to be met.
MPP-compatible Bid	A bid submitted by an Opted-in Bidder for a Package that includes at least as many Lots in every Lot Category as one of its MPPs. If an MPP-compatible Bid is selected as a Winning Bid the Competition Constraint is satisfied.

Stages of the Combinatorial Clock Auction

A5.8 Bidding in the Combinatorial Clock Auction progresses in two distinct stages:

- a) **The Principal Stage.** The function of the Principal Stage is to determine how many Lots in each Lot Category are allocated to bidders and a price for each winning bidder (its Base Price). The Principal Stage comprises:

- an **Opt-in Round**, in which MPP bidders may choose to opt in to be eligible for being counted towards meeting the Competition Constraint (in which case the bidder will be required to submit the corresponding Opt-in Bids);
 - one or more **Primary Bid Rounds**, during which bidders may bid for a Package at the Round Prices set by the auctioneer for that round; and
 - a **Supplementary Bids Round**, during which bidders may submit multiple mutually-exclusive bids for Packages of Lots, subject to constraints on the Bid Amounts determined by the activity rules and their Primary Bids.
- b) **The Assignment Stage.** Following the Principal Stage, the exact frequencies allocated to each one of the Winners of Generic Lots in the Principal Stage are determined in the Assignment Stage.
- A5.9 The purpose of the Primary Bid Rounds is to provide bidders with an opportunity to gather information about the demand for the Lots offered in the auction. The Primary Bid Rounds would typically last until the auction reaches prices at which there is no Excess Demand.
- A5.10 The Primary Bid Rounds allow bidders to update their estimates of likely market value and contribute to reducing common value uncertainty. Following the Primary Bid Rounds, bidders can then submit a fuller set of Supplementary Bids, subject to certain restrictions. The Activity Rules provide incentives for bidders to reveal their true demand during the Primary Bid Rounds. All bids submitted during the Principal Stage are then taken into account for determining the Winning Bids.
- A5.11 In addition, prior to the Primary Bid Rounds and the Supplementary Bids Round, the Principal Stage will include an **Opt-in Round**, where MPP Bidders may opt in to be eligible for being counted towards meeting the Competition Constraint. Bidders who opt in may select between two sets of MPPs (one set of MPPs includes MPPs that contain the A2 Lot, which is subject to a coverage obligation, the other set does not), but may not otherwise choose their applicable MPPs. Opted-in Bidders are required to place bids at reserve prices for *all* of their selected MPPs as part of the process of opting in.
- A5.12 If no bidders opt-in, then the Competition Constraint will not be applied.
- A5.13 After the Opt-in Round, but prior to the first Primary Bid Round, a list of **Permissible Packages** will be determined for each bidder. These are the packages that the bidder could possibly win; the Permissible Packages exclude those packages that the bidder could not win under any circumstances given the bidding restrictions and the Competition Constraint. Throughout the Primary Bid Rounds and the Supplementary Bids Round, bidders will only be allowed to bid for Permissible Packages.

The Competition Constraint

- A5.14 The Competition Constraint requires that one bidder other than Telefonica, Vodafone or Everything Everywhere wins an MPP. The relevant minimum amounts of spectrum that are sufficient for a winner to satisfy the Competition Constraint are summarised in Table A5.3 below. Only one of these four alternatives need be satisfied to satisfy the Competition Constraint.

Table A5.3: Minimum spectrum requirements for MPPs

Portfolio	800 MHz	1800 MHz	2.6 GHz
1	2 x 15 MHz		
2	2 x 10 MHz		2 x 10 MHz
3	2 x 5 MHz	2 x 15 MHz	
4		2 x 15 MHz	2 x 20 MHz

A5.15 The minimum number of Lots that a bidder needs to win in each Lot Category to achieve these requirements is summarised in Table A5.4 below. An Opted-in Bidder needs to win a package including at least as many Lots in every Lot Category as one of these MPPs.

Table A5.4: MPPs required to satisfy the Competition Constraint

Portfolio	MPPs excluding A2	Additional MPPs including A2
1	3xA1	1xA2 + 1xA1
2	2xA1 + 2xC	1xA2 + 2xC
3	1xA1 + B	1xA2 + B
4	B + 4xC	

A5.16 For the purposes of opting in, a bidder will be able to choose whether or not it wishes to include the MPPs that contain the A2 Lot (which is subject to a coverage obligation) amongst its MPPs. Therefore, an Opted-in Bidders MPPs may be one of two nested sets:

- i) 3xA1, 2xA1+2xC, A1+B and B+4xC only;
- ii) all of the MPPs listed in (i) above and also A2+A1, A2+2xC, A2+B.

The Opt-in Round

A5.17 The Opt-in Round consists of a single round, run at the start of the Principal Stage. During the Opt-in Round, MPP Bidders (i.e. bidders other than Telefonica, Vodafone and Everything Everywhere with non-zero MPPs) have the option to opt in for the purposes of counting towards meeting the Competition Constraint. Bidders who are not MPP Bidders will not participate in the Opt-in Round.

A5.18 A bidder who wishes to opt-in must choose one of the two nested MPP Sets listed in Table A5.4 above. The bidder may not select individual MPPs within a set, but only choose one set or the other. The bidder must have sufficient eligibility to bid for *all* the MPPs in a set, otherwise it is not possible for the bidder to choose that set. An MPP Bidder who chooses one of these MPP Sets in the Opt-in Round will be called an Opted-in Bidder.

A5.19 An Opted-in Bidder is required to make a bid at reserve price for each and every one of the MPPs in its chosen set. These are binding bids that will be considered in the eventual determination of Winning Bids at the end of the Principal Stage.

A5.20 Bidders who opt in will still be required to submit a Primary Bid in the first Primary Bid Round. For the avoidance of doubt, the bidder will not be restricted to bidding

only for an MPP in the first Primary Bid Round, but rather will be able to bid for any of the bidder's Permissible Packages (which could be larger than the MPPs).

- A5.21 Following the conclusion of the Opt-in Round, the number of Opted-in Bidders will be disclosed to all Bidders before the start of the first Primary Bid Round. Details on the choices of MPP Sets by Opted-in Bidders will not be disclosed.
- A5.22 If no MPP Bidder chooses to Opt-in, the Competition Constraint will not be applied to the Winner Determination at the end of the Principal Stage. If at least one MPP Bidder opts in, the Competition Constraint will be applied, with the requirement that at least one Opted-in Bidder secures an MPP-compatible package.
- A5.23 The Opt-in Round will be conducted through the Electronic Auction System (EAS). The Opt-in Round will have start and end times in a similar manner to a Primary Bid Round or the Supplementary Bids Round.

Permissible Packages

- A5.24 In this section, we describe the restrictions applying throughout the Primary Bid Rounds and Supplementary Bids Round to the Packages of Lots for which bidders may bid. The Permissible Packages for a given bidder are determined by:
- a) spectrum caps (in combination with existing spectrum holdings);
 - b) other bidding restrictions;
 - c) that bidder's initial eligibility; and
 - d) the feasibility of awarding a Package to that bidder and at the same time meeting the Competition Constraint.
- A5.25 In addition, the Primary Bid Rounds are governed by Activity Rules that affect the Packages a bidder may bid for in any particular round depending on previous Primary Bids submitted by the bidder. These Activity Rules are discussed subsequently in paragraphs A5.86 to A5.95.

Spectrum caps

- A5.26 All bids will be subject to two spectrum caps that limit the total amount of relevant spectrum that a bidder can acquire through the auction given their existing spectrum holdings. These caps are as follows:
- 2x27.5 MHz for spectrum under 1 GHz for all bidders, including existing spectrum holdings of the bidder (the "Sub-1 GHz Cap"); and
 - 2x105 MHz for spectrum in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz (paired) and 2.6 GHz (paired and unpaired) bands for all bidders, including existing spectrum holdings of the bidder (the "Overall Cap").
- A5.27 The spectrum subject to the Sub-1 GHz Cap includes all spectrum in the 800 MHz and 900 MHz bands.
- A5.28 The spectrum subject to the Overall Cap includes:

- a) all spectrum in the 800 MHz, 900 MHz, 1800 MHz, and 2.1 GHz (paired) bands; plus
- b) all individual, standard-power use paired spectrum in the 2.6 GHz band (offered in Lot Category C); plus
- c) the unpaired spectrum in the 2.6 GHz (Lot Category E) band but not including any restricted Lot, such that n E Lots count as equivalent to $(n-1)$ blocks of 2x2.5 MHz paired spectrum.

A5.29 No bidder will be able to submit any bid for a Package of spectrum that would result in them exceeding either spectrum cap if the bid were to be a Winning Bid.

Other bidding restrictions

A5.30 No bidder is permitted to bid for a Package containing more Lots in a Lot Category than the maximum number of Lots available in that Lot Category (given in Table A5.1).

Restriction on bidding for the 1800 MHz B Lot

A5.31 Everything Everywhere is not permitted to submit bids that include this Lot if it is available.

Restrictions related to Lots in Lot Categories D1 and D2 (2.6 GHz paired concurrent, low-power use)

A5.32 Bidders are not permitted to bid for Packages containing more than one Lot in total across Lot Categories D1 and D2.

A5.33 Bidders are not permitted to bid for Packages containing more than twelve Lots in Lot Category C plus one Lot in Lot Category D1.

A5.34 Bidders are not permitted to bid for Packages containing more than ten Lots in Lot Category C plus one Lot in Lot Category D2.

Restrictions related to Lots in Lot Category E (2.6 GHz unpaired)

A5.35 A bidder winning n Lots in the 2.6 GHz unpaired band will have additional usage restrictions on the lowest 5 MHz block, leaving $n-1$ blocks available at standard power. The purpose of this restriction is to create guard blocks to manage risks of interference between adjacent users within the band. Consequently, bidders are not allowed to bid for Packages that contain only a single Lot in Lot Category E. Therefore, any package containing Lots in Lot Category E will have to contain at least two such Lots.

Initial eligibility

A5.36 For a given bidder, the eligibility of any Permissible Package may not exceed that bidder's initial eligibility at the start of the first Primary Bid Round (which is determined prior to the start of the auction by reference to the total amount of money that the bidder has on deposit with Ofcom at a specified point in time).

Compatibility with the Competition Constraint

- A5.37 The Competition Constraint requires that a sufficient number of Opted-in Bidders win at least one of their MPPs. For this reason, it may be impossible for a bidder to win certain Packages, as those Packages might be incompatible with satisfaction of the Competition Constraint overall.
- A5.38 In the case that no MPP Bidder opts in, then the Competition Constraint will not be applied; the Permissible Packages will be determined solely by the spectrum caps, other bidding restrictions and initial eligibility, as described above.
- A5.39 If at least one MPP Bidder opts in, for a Package X to be a Permissible Package for a particular bidder, it is required that if Package X were awarded to that bidder, there is some hypothetical selection of Packages for other bidders (which might include the Zero Package in some cases) such that:
- a) The spectrum caps and bidding restrictions described above are respected for all bidders;
 - b) No Package selected for any bidder exceeds its initial eligibility to bid;
 - c) It would hypothetically be possible to award all the Packages (i.e. there would be no Excess Demand given these Packages); and
 - d) The Competition Constraint would be satisfied (given the choice of MPP Set by the Opted-in Bidders).
- A5.40 The Zero Package will be added to a bidder's set of Permissible Packages if not already present.
- A5.41 In the case that just a single MPP Bidder opts in, it would necessary for that bidder to win an MPP-compatible package for the Competition Constraint to be satisfied. Therefore, the Opted-in Bidder's Permissible Packages will all be required to be MPP-compatible Packages (or the Zero Package).
- A5.42 Conversely, in the case that more than one MPP bidder opts in, there is no requirement that a specific Opted-in Bidder's Permissible Packages only include MPP-compatible Packages.
- A5.43 Furthermore, the requirement that an Opted-in Bidder be able to acquire an MPP-compatible Package may limit the largest Packages that may be bid for by other bidders. For example, suppose that the 1800 MHz B Lot were not available for award and there was just one Opted-in Bidder who chose to bid for the MPP Set excluding the A2 Lot. In this case, if another bidder won a Package containing at least two A1 Lots, one D2 Lot and nine C Lots (which is possible within the spectrum caps), this would leave only two A1 Lots and one C lot available to the Opted-in Bidder, which is insufficient to achieve any of the MPPs. Therefore, any bidder other than the Opted-in Bidder bidding for this Package is incompatible with satisfaction of the Competition Constraint and so such a Package would not be a Permissible Package for such a bidder.
- A5.44 The Permissible Packages will be determined after the Opt-in Round and may depend on: (i) whether or not MPP Bidders opt in; (ii) the choice of MPP Set made by Opted-in Bidders and (iii) the availability of the B lot.

A5.45 After the Opt-in Round, but before the first Primary Bid Round, bidders will be notified of their Permissible Packages through the EAS.

Bidding in the remainder of the Principal Stage

A5.46 Bidding in the remainder of the Principal Stage takes place in two parts, the Primary Bid Rounds and the Supplementary Bids Round. At the end of the Supplementary Bids Round, the winning combination of bids will be determined amongst all bids received during the Principal Stage. Bidders may not withdraw any bids; therefore, any bid submitted during the Opt-in Round, the Primary Bid Rounds or the Supplementary Bids Round could potentially be selected as a Winning Bid.

A5.47 As explained above, prior to the first Primary Bid Round, each bidder will be provided with the list of Permissible Packages for which it may bid. Throughout the Primary Bid Rounds and Supplementary Bids Round, a bidder may only bid for its Permissible Packages.

A5.48 Bidding in the Principal Stage is subject to Activity Rules intended to prevent bidders from hiding their demand until late in the auction and thereby to promote price discovery and straightforward bidding behaviour. The Activity Rules constrain bidders when submitting bids in later rounds as a function of the Primary Bids submitted during earlier Primary Bid Rounds. The Activity Rules are discussed in detail in paragraphs A5.86 to A5.100 below.

Part 1 – The Primary Bid Rounds

A5.49 Bidding during the Primary Bid Rounds proceeds in discrete rounds, with all bidders being able to submit their bids for a round within the same fixed time window (subject to provisions for bidder-specific round extensions, details of which are provided in paragraphs A5.101 to A5.105).

A5.50 The Primary Bid Rounds follow a clock auction format. Before the start of each Primary Bid Round, the auctioneer announces a price per Lot for each Lot Category for that Primary Bid Round (the Round Prices). A bidder may submit a single Primary Bid in each Primary Bid Round.

A5.51 A Primary Bid consists of a Package of Lots selected by the bidder and a non-discretionary Bid Amount calculated automatically. The Bid Amount is the sum of the Round Prices of all the Lots included in the Package.

A5.52 In accordance with the Activity Rules, the Primary Bids submitted during the Primary Bid Rounds limit the possibilities available to bidders for submission of bids in subsequent Primary Bid Rounds and in the Supplementary Bids Round.

A5.53 The Primary Bid Rounds end when there is no Excess Demand. The auctioneer may also terminate the Primary Bid Rounds if there is Excess Demand in certain circumstances.

A5.54 In the case where the Competition Constraint is active, there is no Excess Demand when it is possible to accommodate, within the Lots available:

- an MPP-compatible bid from an Opted-in Bidder in order to satisfy the Competition Constraint (selected according to the procedures described below in paragraphs A5.58 to A5.60 for the calculation of Adjusted Demand); and

- the Primary Bids submitted by all other bidders in the most recent Primary Bid Round.

A5.55 In the case where the Competition Constraint is inactive, as a result of no MPP Bidders opting in, there is no Excess Demand if it is possible to accommodate all the Primary Bids submitted in the most recent Primary Bid Round within the available Lots.

A5.56 If there is Excess Demand, then a further Primary Bid Round may be run. In this case, the Round Price of one or more Lot Categories will be increased according to the procedures described at paragraphs A5.63 to A5.67.

Scheduling Primary Bid Rounds

A5.57 At the time at which the start time for a Primary Bid Round is notified to bidders, each bidder will also be given information about:

- the duration of the round;
- the Round Prices for each Lot Category that will prevail in that round;
- the bidder's eligibility for that Primary Bid Round (expressed as a number of eligibility points);
- The number of extension rights it has available for that and subsequent Primary Bid Rounds (discussed below); and
- Whether or not there is more than one Opted-in Bidders with sufficient eligibility to bid for at least one of their MPPs (but not the number of such Opted-in Bidders).

Determination of Excess Demand

A5.58 At the end of each Primary Bid Round, the auctioneer will determine if there is Excess Demand when considering:

- a) the requirement to accommodate an MPP-compatible bid (a 'Key Bid') from an Opted-in Bidder in order to meet the Competition Constraint (where this is active);
- b) the demand from the Primary Bids submitted in the most recent Primary Bid Round by any bidders other than the Opted-in Bidder whose MPP-compatible bid has been accommodated;
- c) the fungible nature of the 2.6 GHz paired spectrum, which may be used to provide concurrent, low-power use lots (i.e. Lot Categories D1 and D2) or individual standard-power use lots (i.e. Lot Category C).

A5.59 The MPP-compatible bid that may be selected in order to meet the Competition Constraint in a) must be such that the *difference* between

- the price of the Package subject to the bid at the Round Prices prevailing in the most recent Primary Bid Round and
- the Bid Amount of the bid

is minimal across all MPP-compatible bids made so far by Opted-in Bidders in any of the Primary Bid Rounds. We call this bid the Key Bid and the bidder that submitted this bid the Key Bidder. The process for identifying the Key Bid is detailed below.

Determination of the Key Bid

A5.60 In the case that there is at least one Opted-in Bidder, but no Opted-in Bidder has submitted an MPP-compatible bid in the current Primary Bid Round, the auctioneer will determine the Key Bid as follows:

- consider all MPP-compatible bids submitted by Opted-in Bidders (including all Opt-in Bids and Primary Bids submitted so far);
- for each one of the Packages subject to the MPP-compatible bids, calculate the difference between the price of the Package in the current Primary Bid Round and the highest bid received for the Package (we call this difference the discount over round prices);
- select the MPP-compatible bids submitted by Opted-in Bidders for which the discount over round prices is smallest.

If there is only one bid for which the discount over round prices is smallest, then this is the Key Bid. If there is more than one bid for which the discount over round prices is smallest, apply the following tie-breaking criteria in order to identify a single bid from this set.

A5.61 For each bid in the set of bids with minimal discount over round prices, let B denote the bidder who submitted the bid under consideration and M be the Package subject to the bid. Let P denote the Package for which bidder B submitted a Primary Bid in the current Primary Bid round. The tie-break criteria for selecting the Key Bid when there is more than one bid with minimal discount over round prices is as follows:

- a) consider only the bids in this set for which the value (at current Round Prices) of Lots which are included in M but not included in P is smallest;
- b) if multiple bids meet the previous criterion, consider only the bids that meet the first criterion and for which the value (at current Round Prices) of Lots which are included in P but not included in M is smallest;
- c) If there are multiple bids that meet the first two criteria, select one at random.

This process identifies a unique Key Bid for this round, with the Key Bidder being the bidder who submitted the Key Bid.

A5.62 Notice that in the case that one or more Opted-in Bidders makes an MPP-compatible Primary Bid in the current round, then the procedure above would in any case identify one of the MPP-compatible Primary Bids as the Key Bid, as such a bid would have a zero discount over round prices and minimise any value differences between M and P . Therefore, it is only necessary to identify a Key Bid in the case that no Opted-in Bidders make MPP-compatible bids in the current Primary Bid Round.

Adjusted Demand

A5.63 The Adjusted Demand takes into account:

- the demand expressed by bidders in the Primary Bid they submitted in the current Primary Bid Round; and
- the potential need to substitute the Primary Bid submitted by an Opted-in Bidder by one of its MPP-compatible bids for the Competition Constraint to be met (in particular the Key Bid identified previously).

A5.64 In the case that the Competition Constraint is not active (if there are no Opted-in Bidders) or where at least one Opted-in Bidder has submitted an MPP-compatible Primary Bid in the current Primary Round, the Adjusted Demand for each Lot Category is equal to the total demand for that Lot Category included in all the Primary Bids submitted by all bidders in the current Primary Bid Round.

A5.65 In the case that there is at least one Opted-in Bidder and no Opted-in Bidder has submitted an MPP-compatible Primary Bid in the current Primary Round, the Adjusted Demand for each Lot Category is equal to the total demand for that Lot Category included in:

- the Key Bid; and
- all the Primary Bids submitted by bidders other than the Key Bidder in the current Primary Bid Round.

Conditions for Excess Demand

A5.66 There is Excess Demand if and only if at least one of the following conditions occur:

- a) there is at least one Lot Category for which the Adjusted Demand exceeds the maximum number of Lots available in that Lot Category;
- b) the Adjusted Demand for Lot Categories D1 and D2 exceeds 10 in total;
- c) there is strictly positive Adjusted Demand in Lot Category D2 and the Adjusted Demand for Lot Category C is strictly greater than 10;
- d) there is strictly positive Adjusted Demand in Lot Category D1 and the Adjusted Demand for Lot Category C is strictly greater than 12.

A5.67 If there is Excess Demand, then a further Primary Bid Round may be run. In this case, Round Prices will be set that are greater than the Round Prices in the previous round in at least one Lot Category, as described in the next section below. For the avoidance of doubt, the Round Price shall not be reduced for any Lot Category.

Price increments

A5.68 The Round Price of a Lot Category will increase if the Adjusted Demand for that Lot Category is greater than the maximum number of Lots available in that Lot Category.

A5.69 The Round Price of C Lots will increase if:

- a) the Adjusted Demand for C Lots is greater than 14; or
- b) the Adjusted Demand for C Lots is greater than 12 and the Adjusted Demand for D1 Lots is strictly positive; or
- c) the Adjusted Demand for C Lots is greater than 10 and the Adjusted Demand for D2 Lots is strictly positive.

A5.70 The Round Price of both D1 and D2 lots will increase if the Adjusted Demand for D1 plus the Adjusted Demand for D2 is greater than 10.

A5.71 The Round Price of D2 Lots cannot be smaller than the Round Price of D1 Lots plus 1/5 of the Round Price of C Lots, therefore the Round Price of D2 Lots will increase if this is necessary to satisfy this constraint.

A5.72 The Round Price of D1 Lots cannot be smaller than 1/5 of the Round Price of C Lots if the Adjusted Demand for C Lots is greater than 12, therefore the Round Price of D1 Lots will increase if this is necessary to satisfy this constraint.

A5.73 Ofcom will not set Round Prices such that the increment relative to the Round Price for the relevant Lot Category in the previous round exceeds 100%, unless this were necessary in order to satisfy the constraints set out in paragraphs A5.66 and A5.67.

Information provided to bidders during Primary Bid Rounds

A5.74 At the end of each Primary Bid Round, each bidder will be notified of the following:

- whether there is Excess Demand;
- the aggregate demand in each Lot Category when considering all Primary Bids made in the most recent Primary Bid Round;
- the Primary Bid submitted by that bidder in the most recent Primary Bid Round;
- the eligibility of that bidder for the next round;
- the highest Bid Amount submitted by that bidder up to that point (which might be relevant for any deposit calls); and
- the number of extensions that bidder has remaining for the Primary Bid Rounds.

A5.75 Bidders will not receive any detailed information about the bids made by other bidders. Adjusted Demand (which is calculated to determine whether or not there is Excess Demand) will not be notified to bidders.

A5.76 If there is a need for a further Primary Bid Round, Ofcom will notify bidders of the Round Prices, and the start time and duration of this round.

A5.77 The EAS will include an auction history tool to allow bidders to view and download information about the results from previous Primary Bid Rounds, and about their own bids.

End of the Primary Bid Rounds

- A5.78 The Primary Bid Rounds terminate when there is no Excess Demand, or earlier if Ofcom decide in certain circumstances.
- A5.79 The last Primary Bid Round is called the Final Primary Bid Round, and the Round Prices prevailing in the Final Primary Bid Round are called the Final Round Prices. The Package subject to the Primary Bid submitted by a bidder in the Final Primary Bid Round is the Final Primary Package for that bidder. If a bidder did not submit a Primary Bid in the Final Primary Bid Round, then the Final Primary Package for such bidder is the Zero Package.
- A5.80 After the Final Primary Bid Round, the auction will proceed to the Supplementary Bids Round.

Part 2 - Supplementary Bids Round

- A5.81 The Principal Stage includes one further round of bidding, the Supplementary Bids Round, which occurs after the Final Primary Bid Round. During the Supplementary Bids Round bidders may bid for multiple mutually-exclusive Packages, including Packages that they may not have bid for in any of the Primary Bid Rounds. These are called Supplementary Bids. Bidders are not required to make Supplementary Bids if they do not wish to do so.
- A5.82 Bidders need to specify the Bid Amount for their Supplementary Bids. However, there are a number of constraints on the Bid Amounts that bidders can specify:
- Bid Amounts must be in whole thousands of pounds;
 - Bid Amounts cannot be below the reserve price for the Package;
 - the Bid Amount on any Package for which a bidder has already bid cannot be lower than the highest bid made so far for that Package by that bidder;
 - in addition, most Supplementary Bids will be subject to Relative Caps (all except the Supplementary Bid for the bidder's Final Primary Package in the event that this is not the Zero Package), which will establish a maximum on the Bid Amount that the bidder can specify relative to the Bid Amounts that the bidder submits for other Packages (these caps are set in accordance with the Activity Rules described in paragraphs A5.86 to A5.100 below).
- A5.83 All bids received from bidders in the Opt-in Round, the Primary Bid Rounds and the Supplementary Bids Round are considered for the determination of Winning Bidders, Winning Bids, and prices to be paid by Winning Bidders.

Scheduling the supplementary round

- A5.84 After the completion of the Primary Bid Rounds, Ofcom will announce the start time and duration of the Supplementary Bids Round.
- A5.85 Each bidder will be able to submit a single list of Supplementary Bids within the same fixed time window (subject to provisions for bidder-specific round extensions, details of which are provided in paragraphs A5.101 to A5.105).

Restrictions on Supplementary Bids

- A5.86 Bidders may only bid for Permissible Packages.
- A5.87 Bidders may not submit a Supplementary Bid for the Zero Package.
- A5.88 There is a limit on the total number of Packages for which the bidder may submit Supplementary Bids. The maximum number of Packages bid for by a bidder, including the Packages bid for during the Primary Bid Rounds, cannot exceed 3,000.
- A5.89 The Bid Amount for each Supplementary Bid must be no less than the higher of:
- the sum of the reserve prices for all Lots included in the Package; and
 - the bidder's highest bid for that Package (if the bidder has submitted a bid for the Package during the Opt-in Round or the Primary Bid Rounds).
- A5.90 Supplementary Bids must conform with any Relative Caps applicable to each Package. These are set in accordance with the Activity Rules, described in paragraphs A5.86 to A5.100 below.

Activity Rules for the Principal Stage

- A5.91 The proposed Activity Rules are intended to ensure that the preferences across different Packages expressed in the bids submitted by a bidder are consistent with the Primary Bids that the bidder has previously submitted during the clock stage. They also intended to discourage bidders from only revealing their demand late in the auction. As a result, the proposed mechanisms should strengthen incentives for straightforward bidding during the Primary Bid Rounds.
- A5.92 The Activity Rules are based on a metric of overall demand by a bidder across the various Lot Categories. This metric uses an eligibility points system:
- Each Package has an associated number of eligibility points.
 - Each bidder starts the auction with an initial eligibility, determined by the deposit lodged with Ofcom before bidding starts. The eligibility of each bidder in the first Primary Bid Round will be equal to the bidder's initial eligibility.
 - During the Primary Bid Rounds, the eligibility of the bidder will be reduced if the bidder submits a Primary Bid for a Package with eligibility smaller than the bidder's eligibility in the round – in this case, the eligibility of the bidder after this round will be set equal to the eligibility of the Package for which it has just submitted a Primary Bid (or zero if the bidder failed to submit a Primary Bid in the most recent Primary Bid Round).
 - Therefore, the eligibility of a bidder may stay the same or decrease over successive Primary Bid Rounds, but cannot increase.

Eligibility of a Package

- A5.93 Each Lot Category in the auction has an associated number of eligibility points per Lot. The eligibility of a Package is calculated as the sum of:

- the eligibility points of all the Lots included in the Package, except for Lots in Lot Category E; and
- if the Package includes a strictly positive number of Lots in Lot Category E, the eligibility points associated with $n-1$ Lots in Lot Category E, where n denotes the number of E Lots included in the Package.

A5.94 The special treatment of Lots in Lot Category E reflects the requirement that if a bidder wins n Lots in Lot Category E, then only $n-1$ of these Lots are available for use at standard powers, with one Lot having restricted usage conditions.

Eligibility dynamics

A5.95 In any Primary Bid Round, a bidder may submit a Primary Bid for any Permissible Package with eligibility equal to the bidder's eligibility in the round. The eligibility of a bidder will remain the same for the following round if the bidder submits such a Primary Bid.

A5.96 A bidder may also submit a Primary Bid for a Package with eligibility smaller than the bidder's eligibility, in which case the bidder's eligibility for the following round will be reduced to the eligibility of the Package subject to this Primary Bid. We call such bids Constraining Primary Bids.

A5.97 Bidders can submit a Zero Bid during the Primary Bid Rounds. In this case, the eligibility of the bidder will be set to zero for the following rounds. A bidder with zero eligibility will not be able to submit any further Primary Bids, but may still be able to submit Supplementary Bids.

A5.98 If a bidder fails to submit a Primary Bid during a Primary Bid Round, the bidder will be deemed to have submitted a Zero Bid during this Primary Bid Round, and its eligibility will be set to zero for any subsequent Primary Bid Rounds.

Relative caps

A5.99 Relative Caps arise from:

- bid choices in those Primary Bid Rounds in which the bidder drops eligibility; and
- the bid choice of the bidder in the Final Primary Bid Round.

A5.100 The rationale behind the Relative Caps is that bidder's bid choices at given Round Prices reveal information about the differences in value that the bidder places on different Packages. The Relative Cap limits the maximum difference between the Bid Amounts that the bidder can specify in its Supplementary Bids using this information.

A5.101 All Packages, except the Final Primary Package, are subject to a Relative Cap. The Relative Cap is defined in relation to the Round Prices and the bid choice of the bidder in the last Primary Bid Round in which the bidder could have bid for the Package subject to the Relative Cap. We use the following terminology:

- **Constraining Round:** the last Primary Bid Round in which the eligibility of the bidder was equal to or greater than the eligibility associated with the Package subject to the Relative Cap. (For Packages with eligibility equal to or smaller

than the eligibility of the bidder in the Final Primary Round, the Constraining Round is the Final Primary Round.)

- **Constraining Package:** the Package bid for by the bidder in the Constraining Round. (For Packages with eligibility equal to or smaller than the eligibility of the bidder in the Final Primary Round, the Constraining Package is the Final Primary Package.)
- **Revealed Differential:** the price difference between Package subject to the Relative Cap and the Constraining Package in the Constraining Round. (The Revealed Differential may be positive or negative. If the Constraining Package is the Zero Package, then the Revealed Differential is Simply the price of the Package subject to the Relative Cap at the Round Prices prevailing in the Constraining Round, as it is not possible for the bidder to specify a non-zero Bid Amount for the Zero Package.)

A5.102 The Relative Cap requires that the Bid Amount specified for a Package in the Supplementary Bids Round may not exceed:

- the highest bid that the bidder submits for its Constraining Package (which might be the highest Primary Bid submitted for the Constraining Package or the Supplementary Bid that the bidder may submit for the Constraining package); plus
- the Revealed Differential.

Bidding under the Caps in the Supplementary Bids Round

A5.103 Bidders may submit a Supplementary Bid for any Permissible Package other than the Zero Package, provided that these bids are consistent with the Relative Cap.

A5.104 During the Supplementary Bids Round, bidders must enter or upload their full list of Supplementary Bids to the EAS, which will check for consistency with the constraints on Supplementary Bids. The EAS will provide functionality to assist bidders in identifying the Constraining Package that applies to each Supplementary Bid, and in the calculation of the Relative Cap that applies given a set of Supplementary Bids.

A5.105 Bidders will also be able to enter and maintain a set of provisional Supplementary Bids during the Primary Bid Rounds if they wish to do so, so that they may assess the consequences of their decisions in the Primary Bid Rounds ahead of the Supplementary Bids Round. Such provisional list of Supplementary Bids would provide the starting point for them to edit their list of bids during the Supplementary Bids Round.

Extensions

A5.106 An extension right allows a bidder additional time in which to submit a decision in the event that the bidder has failed to do so before the scheduled end of round (provided that the bidder has extension rights left and that the bidder was eligible to submit a decision in the round).

A5.107 In the event that a bidder who is eligible to submit a decision and has one or more extension rights left fails to submit its decision during a round, the round will automatically be extended for that particular bidder and one of its remaining

extension rights will be deducted. The EAS will give that bidder a revised deadline for submitting its decision. The revised deadline will be 30 minutes later than the original round deadline.

A5.108 The extension period lasts at most 30 minutes, but may terminate earlier once all bidders for which the round has been extended have successfully submitted their decision. The extension period applies to individual bidders, although more than one bidder may trigger an extension simultaneously:

- bidders who are eligible to submit a decision during the round but have failed to do so and still have extension rights left will have an extension and one of their extension rights deducted for the following rounds;
- bidders who are eligible to submit a decision during the round but have failed to do so, but do not have any extension rights left, will not have an extension and they will be unable to take any further action during the extension period;
- bidders who are not eligible to submit a decision during the round will not have an extension and will not have any extension rights deducted in that round;
- bidders who have submitted a decision already during the round cannot take any further action during an extension period (they will be told that the round has been extended and that they should wait for the announcement that the extension period has ended) and will not have any extension rights deducted in that round.

A5.109 The endowment of extension rights is as follows:

- Each bidder has an extension right for the Opt-in Round.
- Each bidder will start the auction with two extension rights for the Primary Bid Rounds. Each time the bidder fails to submit a bid in a Primary Bid Round before the deadline and an extension period is triggered for that bidder, the number of extension rights available for that bidder in subsequent Primary Bid Rounds is reduced by one.
- Each bidder has an extension right for the Supplementary Bids Round.

A5.110 Additional extension rights may be granted either to all bidders or to individual bidders at Ofcom's absolute discretion. Additional extension rights can only be granted in the periods between rounds, and thus cannot be granted during a round.

Determining the winners of the Principal Stage

A5.111 Following the Supplementary Bids Round, all bids received throughout the Principal Stage will be considered to determine the winning bids. These include all bids submitted:

- in the Opt-in Round;
- in the Primary Bid Rounds; and
- in the Supplementary Bids Round.

Feasible Allocations

A5.112 A Feasible Allocation of Lots amongst bidders consists of a selection of Bids (the Selected Bids) such that:

- at most one bid is selected from each Bidder;
- all the Lots included in the Bids selected can be awarded given the available spectrum; and
- the Competition Constraint is met for this allocation of Lots (where the constraint is active due to at least one MPP Bidder opting in).

A5.113 The Competition Constraint, if active, will require that at least one Opted-in Bidder is awarded an MPP-compatible package (where the relevant MPPs are determined by the choice of MPP Set by the Opted-in Bidder). The possible fact that a bidder who has not Opted-in wins a MPP is irrelevant for determining whether the Competition Constraint is satisfied. Due to the presence of reserve price bids from the Opt-in Round, it will always be feasible to meet the Competition Constraint regardless of what other bids may be received over the course of the Principal Stage.

Total Value of an allocation

A5.114 The Total Value of an allocation is defined to be the sum of Bid Amounts of the Selected Bids plus the reserve price of all unallocated Lots excluding unsold D1 and D2 Lots. For the purposes of determining the number of unallocated C Lots, the number of available C lots shall be:

- 14 if no D1 or D2 Lots are allocated;
- 12 if any D1 Lots but no D2 Lots are allocated;
- 10 if any D2 Lots are allocated.

A5.115 The selection of Winning Bids is such that it maximises the Total Value across all Feasible Allocations. The process of selecting the Winning Bids on the basis of such an optimisation is called Winner Determination.

A5.116 The prices that Winning Bidders will need to pay (Base Prices) will then be determined using an algorithm that identifies the opportunity cost that each Winning Bidder and group of Winning Bidders impose on other Bidders who are denied spectrum by virtue of the available Lots being allocated to the Winning Bidders.

Winner determination

A5.117 The winner determination process will select at most one bid from each bidder in order to maximise the Total Value across all Feasible Allocations. If there is only one combination of bids that meet these criteria, this will be the winning outcome that determines the Winning Bids and Winning Bidders.

A5.118 In the event of any tie amongst multiple allocations of equal total value, the winning allocation will be selected amongst those for which the sum of eligibility points associated with the bids is greatest.

A5.119 If ties still remain after application of the above criteria, the winning outcome will be selected at random from amongst the remaining ties.

Determining Base Prices for Winning Bids in the Principal Stage

A5.120 Following the determination of Winning Bids in the Principal Stage, Ofcom will proceed to determine Base Prices. These will be the minimum prices to be paid by Winning Bidders for the Lots they will be allocated (subject to having an appropriate deposit).⁴²⁶ Base Prices are determined jointly for all Winners in a single calculation.

A5.121 A separate Base Price will be determined for each Winning Bid (and thus for each Winning Bidder). Note that the Base Prices relate to the overall Package of Lots won by Winning Bidders, not individual Lots within these Packages.

A5.122 Base Prices will reflect the individual and collective opportunity costs of bidders winning spectrum. However, subject to each Winner paying at least the reserve price for the Lots it has won and each subset of Winners paying at least the opportunity costs for the Lots they have jointly won, the total sum of Base Prices is minimised. Therefore, Base Prices are calculated such that if all Winners had specified a Bid Amount equal to the Base Price for their Winning Bid, and reduced the Bid Amount of all their other bids by the same extent, then:

- the outcome of the winner determination process with these reduced bid amounts would still be the same as the winning outcome of the Principal Stage; and
- no winner could have lowered their Winning Bid Amount any further without this resulting in the previous condition not being met.

A5.123 A unique set of Base Prices is found by applying the following conditions:

- **First condition:** the Base Price of a Winning Bid cannot be lower than the reserve price for the Package associated with that Winning Bid, and cannot exceed the Bid Amount of the Winning Bid.
- **Second condition:** the set of Base Prices must be sufficiently high that for each subset of Winners (including subsets including a single Winner), the sum of
 - Base Prices for Winners included in the subset; plus
 - Winning Bid Amounts for Winners not included in the subset; plus
 - the value associated with Lots unallocated in the winning outcome (as specified in paragraph A5.109),

is not smaller than the greatest Total Value that could be obtained as a Feasible Allocation when considering the set of bids that includes only:
 - all the bids submitted by the bidders not included in the subset;
 - the Opt-in Bids from Opted-in Bidders included in the subset;

⁴²⁶ These are minimum prices because bidders may have to pay an Additional Price in order to win particular frequencies through the Assignment Stage.

- **Third condition:** If there are many sets of Base Prices that fulfil the first and second condition, the set(s) of Base Prices that minimise(s) the sum of Base Prices across all Winning Bidders is selected.
- **Fourth condition:** If there are multiple sets of Base Prices that satisfy the first three conditions, the set of Base Prices that minimise the sum of squares of differences between the Base Price and the individual opportunity cost for each Winner is selected.⁴²⁷

A5.124 These conditions characterise a unique set of Base Prices for each Winner. Finally, the Base Prices are rounded up to the nearest thousand pounds.

The Assignment Stage

A5.125 The Principal Stage determines the number of generic lots won by each bidder in each Lot Category, but not the specific frequencies to be assigned to Winners. In cases where there are multiple ways of arranging Winners at specific frequencies within a band, the arrangement will be determined in the Assignment Stage.

A5.126 The Assignment Stage consists of a single round of bidding in which winners of generic lots may express their relative preferences for different frequencies in a band. If there are multiple lot categories in the Assignment Stage, bids are made simultaneously, but independently, for frequencies in different lot categories.

Assignment options

A5.127 Following the determination of Winners of the Principal Stage, Ofcom will determine the feasible frequency assignments possible in each band. These are subject to the general requirements that:

- each winner of generic lots in a given lot category be assigned a contiguous frequency range within the relevant band (but not necessarily contiguous with the frequencies assigned to them as a result of winning lots in a different lot category, even if in the same band);
- this contiguous frequency range corresponds in size to the number of relevant generic lots won in that lot category; and
- any unassigned lots in a band form a single contiguous frequency range.

In addition, there are additional specific rules that apply in each lot category, detailed below.

A5.128 A given bidder's assignment options in a lot category are those frequency ranges for that bidder that are compatible with a feasible frequency assignment for all the winners in that band.

⁴²⁷ The individual opportunity cost of a Winner is defined as (i) the maximum Total Value that could be achieved for a Feasible Allocation in the counterfactual where all of the Bids of this Winner except for its Opted-in Bids (if any) were excluded, minus (ii) the Total Value of the winning allocation net of this Winner's Winning Bid Amount.

800 MHz band

- A5.129 If the A2 lot is allocated to a winning bidder, it will be located at the top of the 800 MHz band (i.e. at 811-821 MHz paired with 852-862 MHz). If the A2 lot is unallocated, then these frequencies will be retained by Ofcom.
- A5.130 A bidder who wins A2 together with one or more A1 lots will be assigned frequencies for its A1 lots in a contiguous block directly below A2 (i.e. including frequency block 4 at 806-811 MHz paired with 847-852 MHz). This is necessary so that such a winner receives a single contiguous block of frequencies in the 800 MHz band. Therefore, such a bidder will not have a choice of frequency range.
- A5.131 If any A1 lots are unsold, then a corresponding amount of spectrum at the bottom of the 800 MHz band will be retained by Ofcom. Therefore, if there are one or more winners of A1 lots, these winners' frequency allocations will, taken together, form a single contiguous frequency range directly below the A2 lot (i.e. will include frequency block 4 at 806-811 MHz paired with 847-852 MHz).

1800 MHz band

- A5.132 As only a single lot may be available in the 1800 MHz band, this lot will not feature in the Assignment Stage. Any winner of the B lot will be directly assigned frequencies at 1721.7-1736.7 MHz paired with 1816.7-1831.7 MHz.

2.6 GHz paired spectrum

- A5.133 Any unallocated 2.6 GHz paired spectrum will be placed at the top of the 2.6 GHz paired band. Therefore, frequencies assigned to winning bidders will, taken together, form a single contiguous frequency range including the lowest frequency block available in the band.
- A5.134 The location of any concurrent low power assignment will be determined by the number of category C winners, the sizes of their winning bids, and category C winners' bids on their Assignment Stage options. Specifically, the location of category D lots will be:
- 5.134.1 If there are no winners of category C lots, the category D winners will be assigned 2x10 MHz and/or 2x20 MHz near the middle of the band, specifically lot 5 upwards.
- 5.134.2 If there is only one winner of category C lots that winner will be assigned lots at the bottom of the band and the category D winners will be assigned the 2x10 MHz and/or 2x20 MHz immediately above this;
- 5.134.3 If there are two winners of category C lots, one of whom has won only one lot, and there is at most 2x5 MHz of 2.6 GHz paired spectrum unsold, then the winner of the larger number of category C lots will be assigned lots at the bottom of the band, the category D winners will be assigned the 2x10 MHz and/or 2x20 MHz immediately above this, and the winner of the one category C lot the 2x5 MHz immediately above this.
- 5.134.4 Otherwise, winners of category C lots will have the option of bidding on assignment options compatible with each of them being assigned a contiguous block of frequencies that matches the number of lots in their winning principal stage bid, with any unsold lots at the top of the band, and

it being possible for the winners of category D lots to be assigned a contiguous block of 2x10 MHz and/or 2x20 MHz (as the case may be) that is at least 10 MHz away from both the top and bottom of the band. In this case the winners of category D lots will be assigned whichever 2x10 MHz and/or 2x20 MHz (as the case may be), that is at least 10 MHz away from both the top and the bottom of the band, that is not assigned to winners of category C lots in the winning combination of assignment stage bids.

5.134.5 In all cases, if there are winners of both category D1 lots and category D2 lots, the winners of category D1 lots will be licensed to use the lowest 2x10 MHz of the block of 2x20 MHz assigned to the category D2 winners.

2.6 GHz unpaired spectrum

A5.135 If any E lots are unallocated, then a corresponding amount of spectrum at the bottom of the 2.6 GHz unpaired band will be retained by Ofcom. Frequency allocations to winners of E lots will, taken together, form a single contiguous frequency range including the highest block in the band (frequency block 9).

Direct assignment

A5.136 Where every Winner in a given band has just one assignment option, the Winners will be assigned these frequency ranges directly. The band will not be included in the Assignment Round.

A5.137 Notice that as there is a single lot in the 1800 MHz, this can always be directly assigned. In any case where there is a single winner in a band, a frequency range can be directly assigned, as the rules above for generating the feasible assignment options uniquely fix where unsold lots in the band (if there are any) will be located.

A5.138 The Additional Price for any such directly assigned frequency ranges will be zero.

Assignment round

A5.139 After the declaration of the results of the Principal Stage, Ofcom will announce the start time and duration of the Assignment Round.

A5.140 Where a lot category has at least one winner with multiple assignment options, that lot category will be included in the Assignment Round. A bidder may submit bids for assignment options during the Assignment Round in each lot category where that bidder has multiple assignment options. Bid Amounts must be expressed in whole Pounds. For the avoidance of doubt, bids for options in different lot categories are *not* treated as a single package bid, but may win or lose independently of one another. Each Winner participating in the Assignment Round will be able to submit a single list of additional bids within the same fixed time window (subject to provisions for bidder-specific round extensions, details of which are provided in paragraphs A5.101 to A5.105).

A5.141 If a Winner does not submit bids for some or all assignment options, then it will be deemed to have submitted bids of zero for these options. There is no requirement for a Winner to submit any assignment bids in the Assignment Round, but in that case it will have been deemed to have made assignment bids for all assignment options with a Bid Amount of zero, thereby expressing no preference across its assignment options.

A5.142 A Winner will always win exactly one of its assignment options in each lot category where it won lots. Therefore, its assignment bids express its *relative* preferences across these options. For this reason, a Winner may, if it wishes, submit a bid of zero for its least preferred assignment option. (If all assignment bids in a lot category made by a bidder are increased by some common amount X, then this will not affect the determination of winning assignment bids or the additional prices).

Winner Determination

A5.143 The winner determination process will be conducted independently for each lot category included in the Assignment Round. For a given lot category, the winner determination process selects exactly one assignment option for each bidder in order to maximise the value of winning assignment bids and such that no frequency ranges assigned are overlapping.

A5.144 In the event of there being multiple tied combinations of winning assignment bids of equal value, one such combination will be selected at random.

Additional prices

A5.145 Following the determination of winning assignment bids in the Assignment Stage, Ofcom will proceed to determine Additional Prices.

A5.146 Additional Prices will reflect the individual and collective opportunity costs of bidders having preferences for specific assignment options. Additional Prices are determined simultaneously for all winners in a given lot category, but separately for different lot categories.

A5.147 A unique set of Additional Prices is found by applying the following conditions:

- **First condition:** the Additional Price of a winning additional bid cannot exceed the Bid Amount of that bid;
- **Second condition:** the set of Additional Prices must be sufficiently high that, for each subset of Winners (including subsets including a single Winner), the sum of:
 - Additional Prices for those Winners included in the subset; plus
 - Winning Assignment Bid Amounts for Winners not included in the subsetis not smaller than the greatest value that can be achieved by selecting exactly one assignment bid for each Winner from amongst:
 - all the bids submitted by the bidders not included in the subset; and
 - hypothetical bids of zero for all the assignment options of the bidders included in the subset;such that no selected assignment options overlap.
- **Third condition:** If there are many sets of Additional Prices that fulfil the first and second condition, the set(s) of Additional Prices that minimise(s) the sum of Additional Prices across all Winning Bidders is selected.
- **Fourth condition:** If there are multiple sets of Additional Prices that satisfy the first three conditions, the set of Additional Prices that minimise the sum of

squares of differences between the Additional Price and the individual opportunity cost for each Winner is selected.⁴²⁸

- A5.148 These conditions characterise a unique set of Additional Prices for each Winner. Finally, the Additional Prices are rounded up to the nearest pound.
- A5.149 The overall price payable by a Winner is the sum of its Base Price and the relevant Additional Prices for its winning assignment options.

⁴²⁸ The individual opportunity cost of a Winner is defined as (i) the maximum total value that could be achieved for an allocation in the counterfactual where all of the bids of this Winner set to zero, minus (ii) the total value of the winning allocation net of this Winner's Winning Bid Amount.

Annex 6

DTT Coexistence

Introduction

- A6.1 On 2 June 2011, we published a consultation setting out our initial proposals for managing coexistence between new mobile services in the 800 MHz band and existing DTT services⁴²⁹ (the June 2011 consultation). We noted that some decisions raised question of public policy and were for Government to take, rather than Ofcom.
- A6.2 Following this first consultation, we undertook a range of further work, including updating our technical and costing models and commissioning consumer research, and shared the results of our analysis with Government.
- A6.3 In February 2012, Government took decisions⁴³⁰ on a range of issues related to coexistence, including the level of support that would be provided to consumers of DTT services to mitigate the interference issue, the organisation ('MitCo') that should be set up to provide this support and the level of funding required to do this work. It also decided that an Oversight Board⁴³¹ should be set up to monitor MitCo's performance.
- A6.4 We published a second consultation on 23 February 2012⁴³² (the February 2012 consultation) which reported on decisions made by Government and set out options for implementing the Government decisions. In particular, the consultation covered:
- When and how MitCo should be established;
 - How the Oversight Board might be established;
 - How any underspend below the maximum funding level should be split among the 800 MHz licensees when MitCo is shut down;
 - Managing MitCo's performance via a set of key performance indicators (KPIs) to ensure MitCo delivers the level of consumer support requested by Government to a high standard;
 - A set of Operational Conditions that new licensees will automatically have to implement should they, through MitCo, breach any of the KPIs;
 - The process for closedown of MitCo and dealing with any interference that might occur after closedown.
- A6.5 We received 30 responses to our second consultation. The non-confidential responses are published on our website.⁴³³

⁴²⁹ <http://stakeholders.ofcom.org.uk/binaries/consultations/dtt/summary/dttcondoc.pdf>

⁴³⁰ http://www.culture.gov.uk/news/media_releases/8865.aspx

⁴³¹ Previously referred to as the Supervisory Board

⁴³² <http://stakeholders.ofcom.org.uk/binaries/consultations/949731/summary/condoc.pdf>

⁴³³ <http://stakeholders.ofcom.org.uk/consultations/coexistence-with-dtt/?showResponses=true>

A6.6 In this Annex we provide an update on further decisions made by Government and present our conclusions on the issues discussed in the February 2012 consultation. Where we refer to imposing certain licence conditions on licensees, this includes both conditions that appear in the licence itself, as well as conditions in the procedures for mitigating interference that Ofcom will notify to licensees and which licensees will be obliged to comply with by virtue of the terms of their licences⁴³⁴.

Update on Government decisions

A6.7 As noted, Government made a public statement on its decisions on coexistence in February 2012. This included decisions on:

- The level of, and eligibility for, support provided by DTT consumers;
- Additional support for vulnerable consumers based on particular eligibility criteria;
- Limits on the number of consumers losing DTT services and/or TV services;
- The ownership, operational responsibility and oversight of MitCo; and
- The funding of MitCo.

A6.8 These decisions were described in detail in Section 3 of our February 2012 consultation. We received several responses to that consultation that related directly to the Government decisions, and we have shared non-confidential responses with Government.

A6.9 Government has considered these responses and has made further supplementary decisions on coexistence. A letter from Government to Ofcom setting out these decisions has been published on DCMS' website⁴³⁵. Government has now decided that:

- Up to £12m of the £180m funding for managing coexistence should be used by MitCo to provide installation support in the form of vouchers (to a value of £50 + VAT) to households affected by interference whose TV installation comprises a mast-head amplifier;
- Any underspend of the £180m funding should be returned in full to the 800 MHz licensees⁴³⁶;
- MitCo should remain in existence until one year after the date for reaching the coverage obligation or network roll out completes⁴³⁷, whichever is earlier.

A6.10 We would also note that Government does not currently intend to establish MitCo as a legal entity in advance of the auction. Instead, it will be the responsibility of the 800 MHz licensees to establish the appropriate legal entity to discharge the mitigation activity defined in the licence conditions. In addition, following the

⁴³⁴ See "Notice of DTT interference mitigation procedures required under spectrum access licences for the 800 MHz band" <http://stakeholders.ofcom.org.uk/consultations/award-800mhz-2.6ghz/statement/>

⁴³⁵ <http://www.culture.gov.uk/images/publications/letter-dcms-ofcom-10072012.pdf>

⁴³⁶ This updates and replaces the February 2012 decision in which underspend was to be shared equally between licensees and the Government.

⁴³⁷ This updates and replaces the February 2012 decision in which the backstop date for closure was 2017.

publication of this Statement, Government intends to appoint a person or persons to carry out preparatory work in advance of the auction. We discuss this in more detail in paragraphs A6.26 to A6.29 below.

Summary of Ofcom's decisions

- A6.11 The policy decisions which we set out in this Annex build on the Government's decisions establishing the framework for managing coexistence between new mobile services and DTT. Our decisions relate to the establishment of MitCo, MitCo's operations (including the support it will provide to consumers), the KPI framework for managing MitCo's performance and how MitCo will be closed down. We also provide our conclusions on how the Oversight Board should be constituted and run, though we note that Government will have responsibility for taking final decisions in this area.
- A6.12 Some of the decisions we have taken confirm proposals we set out in the February 2012 consultation. However, there are a number of areas in which we have altered our approach or introduced new elements following consultation with stakeholders. We summarise these areas below:
- We have articulated a clear set of objectives for the arrangements to manage coexistence. We have borne these objectives in mind in making policy decisions set out in this Annex, and expect these objectives to guide further work leading up to the establishment of MitCo.
 - We have provided further detail on the Memorandum of Understanding that we envisage governing various interactions between MitCo and the OB.
 - We have made some minor adjustments to the parameters of the KPIs in the light of stakeholder comments, and have clarified and amended some of the detailed wording of KPIs. We have also made minor adjustments to the way in which KPIs can be modified in the light of real experience of MitCo operation.
 - We have made a substantive revision to KPI 5, which relates to the provision of platform changes to consumers where interference cannot be resolved using a filter. The revised KPI now includes both a diagnosis and delivery phase and the timeframe has been extended to reflect this.
 - We have introduced a requirement for licensees to establish a 'Code of Service' for MitCo. This Code will set out MitCo's service commitments to DTT consumers.
 - We have simplified our approach for dealing with interference after MitCo closes. We consider that existing licence conditions should provide sufficient basis for managing this issue.

Structure of this annex

- A6.13 In the remainder of this Annex, we:
- set out the objectives of the arrangements for managing coexistence (paragraphs A6.15 – A6.19);
 - describe how further work in preparation for MitCo will proceed (paragraphs A6.20 – A6.47);

- discuss the scope of work that MitCo will need to accomplish (paragraphs A6.48 – A6.95);
- present information on the Oversight Board and its role in managing MitCo's performance (paragraphs A6.96 – A6.144);
- set out decisions on the KPI and Operational Condition framework (paragraphs A6.145 – A6.241);
- present other licence conditions relating to MitCo's activities (paragraphs A6.242 – A6.281);
- discuss arrangements for MitCo closure (paragraphs A6.282 – A6.301);
- present the detailed KPIs (paragraphs A6.302 – A6.306).

A6.14 In presenting our final decisions in each of these areas, we note and respond to relevant comments made by consultation respondents and explain any amendments we have made to our original proposals in the light of these responses.

Objectives for managing coexistence

A6.15 In our second consultation, one of the key points made by respondents related to the objectives or principles which should guide the operation of MitCo. For example, Vodafone suggested four objectives for MitCo. In their joint response, broadcasters and multiplex operators⁴³⁸ put forward four overarching principles for the establishment of MitCo, while Arqiva listed ten priorities for MitCo.

A6.16 The objectives for MitCo are to a large extent defined and bounded by Government decisions on the level of support that should be offered to consumers. However, we agree that it is useful to clearly articulate the objectives of the arrangements put in place to manage potential interference, particularly with regard to how the arrangements take into account the needs of, and impact on, consumers.

A6.17 In setting objectives for the way in which arrangements for managing coexistence are designed and implemented, we have borne in mind the legal framework within which we operate as described in Section 3 of our June 2011 consultation and in Section 3 of this Statement.

A6.18 Based on this framework, and taking due account of responses to our second consultation, we have defined the following set of objectives.

Figure 1: Objectives for managing coexistence

The arrangements for managing coexistence between existing DTT services and new services in the 800 MHz band must:

- i) ensure that consumers of existing DTT services receive a high quality and timely service consistent with Government decisions, with a bias towards

⁴³⁸ Joint response from the BBC, ITV, Channel 4, Channel 5, Arqiva and SDN. For simplicity, in subsequent references, we refer to this group as “the Broadcasters”.

providing assistance in advance of interference being experienced;

- ii) ensure that 800 MHz licensees implement the arrangements in a way that seeks to safeguard and maintain the value of the DTT service for consumers, and treats all consumers in a fair and consistent manner;
- iii) ensure that 800 MHz licensees are able to roll out new networks in a way that is not unduly delayed or hindered, e.g. by strategic behaviour on the part of other licensees, and that licensees are able to make efficient decisions about the choice between mobile network and consumer based mitigation;
- iv) be sufficiently clear and certain that organisations can confidently bid for 800 MHz spectrum without undue concern as to potential costs or delays related to coexistence arrangements;
- v) be sufficiently flexible that they can be adapted to take account of evidence and experience gained as new networks are rolled out, and to enable 800 MHz licensees to use their commercial expertise to adopt the most cost-effective approaches to implementation where doing so is appropriate and in harmony with the above principles; and
- vi) enable fast and responsive application of Operational Conditions to 800 MHz licensees in the event that licensees fail to achieve KPIs.

A6.19 We have borne these objectives firmly in mind in finalising the implementation arrangements for DTT coexistence. These objectives will also guide the further detailed preparatory work for MitCo in advance of the spectrum award.

Establishing MitCo

A6.20 The February 2012 consultation explained that Government had decided that MitCo will be jointly owned and operated by the 800 MHz licensees. It left open the question of whether MitCo should be established in advance of, or following, the auction, and whether Government would retain a shareholding.

A6.21 The consultation set out two options around the timing of MitCo's establishment:

- Government establishes a limited company before the auction and 800 MHz licensees become shareholders/owners after the auction; or
- The establishment of MitCo is the responsibility of the new 800 MHz licensees after the auction.

A6.22 The provisional conclusion was to establish MitCo before the auction, on the basis that this would enable MitCo to become operational faster, and reduce the risk of MitCo gating the roll-out of new networks.

A6.23 There was broad agreement amongst respondents that MitCo should be established before the auction by Government and transferred to 800 MHz licensee ownership. However, most respondents agreed that operational decisions, such as contracts with service providers, should not be taken until after ownership is transferred to the licensees.

- A6.24 Since our consultation it has emerged during discussion with Government that if they were to establish MitCo in advance of the auction, there is a risk that MitCo could be classified as a public body and be subject to rules around public procurement and expenditure which could for example increase the time it might take MitCo to become fully operational with potential knock-on impacts for the roll out of 4G networks. In light of this, the Government does not currently intend to establish MitCo as a legal entity in advance of the auction. Instead, it will be the responsibility of the 800 MHz licensees to establish the appropriate legal entity to discharge the mitigation activity defined in the licence conditions. Government also proposes to have no shareholding in MitCo.
- A6.25 As set out in the third objective described in Figure 1, we recognise the need to ensure MitCo is operational at the scale required by licensees' rollout plans in the minimum time following the auction.
- A6.26 Following the publication of this Statement, Government intends to appoint a person or persons to carry out preparatory work in advance of the auction. The preparatory work will be conducted in an open manner, working with relevant stakeholders, specifically including potential bidders for the 800 MHz licences. Its purpose is to minimise the time that will be needed for MitCo to become operational at scale, i.e. to be in a position to provide consumer support in line with KPIs over a sufficiently large geographical area to fit in with licensee roll-out plans. DCMS will publish contact information for anyone interested in being involved in this process.
- A6.27 This preparatory work undertaken by or on behalf of Government will not establish a legal entity. It will produce a package of documents which will be made available to the 800 MHz licensees to use if they wish. It will include:
- Draft governance documentation that could be used by the 800 MHz licensees for setting up MitCo, which may include a Memorandum and Articles of Association;
 - Rules for governance of MitCo, including membership of any decision making board; and
 - Research into, and early scoping of, operational aspects of MitCo's potential work.
- A6.28 This preparatory work will be handed over to licensees following the auction to inform Licensee's collective decisions around the establishment and operation of MitCo.
- A6.29 The licensees will have the option of cooperating together to agree their own approach to establishing MitCo and a different set of rules for owning and operating it, if they see fit, subject to any such alternative approach and rules being agreed by all licensees within six weeks of the date of 800 MHz licences being granted. The licensees may make a request to Ofcom to extend this timescale if they unanimously agree to do so, and Ofcom will consider any such application and make a decision on extension as soon as practicable after any request is made. If either (i) the licensees have not requested an extension, or (ii) MitCo has not been set up by this date, the licensees will be required to use the approach and rules prepared in advance. In any event and within the same timescale, MitCo must be able to nominate a senior responsible person to represent MitCo on the Oversight Board.

- A6.30 Several respondents highlighted the importance of the Chair of the MitCo board, and potentially the CEO, being independent of each of the licensee's parent companies to preserve neutrality. Arqiva suggested that the Chair be appointed by the Oversight Board while the Broadcasters thought the Chair should be appointed by Government. Freeview suggested that the Oversight Board should recruit both the Chair and Chief Executive of MitCo.
- A6.31 As MitCo will be owned entirely by the licensees it is up to them who they appoint as Chair and CEO. As they will need to collectively agree any appointee between themselves this should also deal with the issue of the Chair and CEO being independent of the licensee's parent company.
- A6.32 As noted, Government will be commissioning further work to develop detailed proposals for the governance of MitCo. This work will look to produce recommendations that are in line with best practice for governance arrangements, such as the UK Corporate Governance Code. This will include advice on the composition of MitCo's Board and the number and role of independent members.

A MitCo pilot

- A6.33 Arqiva, Freeview and the Broadcasters in their joint response suggested that MitCo's initial activities should include a pilot in a small area of the UK prior to a nationwide roll out to ensure that MitCo's operations are fit for purpose.
- A6.34 We consider that the requirements on licensees to comply with a robust KPI framework as described later in this Annex, with Operational Conditions automatically applied in the event that KPIs are not met, mean that licensees are already likely to adopt a cautious approach in the initial phases of network roll-out and MitCo operation. We also note that our duties as described in Section 3 of this Statement, in particular those contained in Section 3(3) of the Communications Act, mean that we need to apply the least restrictive measures which we consider are reasonably capable of meeting our objectives. We therefore consider that it should be for MitCo to define if and how it will undertake any pilot activities in advance of full operational activity. However, we consider that it would be appropriate for MitCo to provide some assurance to the Oversight Board in this regard. Later in this Annex, in paragraphs A6.138 to A6.144, we have suggested that a provision be included in the MoU between MitCo and the Oversight Board in relation to MitCo's initial phase of activity.

Funding

- A6.35 The policy choices made by Government in February included a decision that MitCo should receive a fixed amount of funding of £180m. Government decided that the funding would be sourced from the licensees, but as noted in our February 2012 consultation, full details of the funding mechanism remained to be agreed with HM Treasury.
- A6.36 The consultation noted that the funding amount required from each new licensee would be determined in proportion to the quantity of 800 MHz spectrum that they win in the auction. A licensee winning 2x10 MHz of spectrum (from a total of 2x30 MHz) would, for example, pay £60m of the total £180m. We did not receive any views from stakeholders proposing an alternative methodology.
- A6.37 We have now discussed the funding mechanism further with HM Treasury. Each licensee in the 800 MHz band will be required to pay an amount totalling £30million

per 2x5 MHz of paired 800 MHz spectrum to such bank accounts as notified to it by Ofcom. The payments shall be made as follows:

- £20million per 2x5 MHz of paired 800MHz spectrum held must be paid within 14 days of MitCo being set up as a legal entity;
- £5million per 2x5 MHz of paired 800MHz spectrum must be paid one year after the first payment is made;
- £5million per 2x5 MHz of paired 800MHz spectrum must be paid two years after the first payment is made.

A6.38 Ofcom may direct that different yearly sums be payable if the circumstances at the time mean that it is appropriate for us to do so. However the total amount payable will not alter.

A6.39 These sums will be used to fund both the consumer help scheme operated by MitCo and the work of the Oversight Board (OB). The funding that licensees will be required to provide for the work of the OB will be a total of £1.2m per annum. We discuss funding for the OB in more detail later in paragraphs A6.108 to A6.110.

A6.40 The Communications Consumer Panel (CCP) requested clarity on the level of funding that would be used to provide support to vulnerable consumers. Government has decided that £20m should be set aside for additional support for households including elderly or disabled people using the same definitions as for the Switchover Help Scheme. We note, however, that the amount of MitCo's budget that will be used to deliver support to vulnerable consumers will not be "ring-fenced". Rather, the amount MitCo spends on providing support to vulnerable consumers will be determined by the work it needs to do to meet its KPIs and to deliver outreach support in line with the Code of Service.

A6.41 Telefónica thought that it would be important for funding arrangements for MitCo to be specified in a way that meant that it was either not liable to pay VAT or so that it could recoup VAT on its costs. As noted earlier, it is now unlikely that MitCo will be established as a legal entity in advance of the licence award. We expect to consider how best to manage the VAT liability issue in further preparatory work for MitCo.

Gainshare

A6.42 In February 2012, the Government decided that, if MitCo's outturn expenditure is less than £180m, the residual funds would be subject to a "gainshare" mechanism, with 50% of the gainshare returning to Government and 50% being shared between the 800 MHz licensees in proportion to their spectrum holdings.

A6.43 Several respondents to our February 2012 consultation thought that this gainshare arrangement did not provide sufficient incentive to licensees to implement network-based mitigation and thereby reduce impact on consumers.

A6.44 Government has now made a further decision modifying its previous position. It has decided that the residual funds should be returned in full to 800 MHz licensees, with no Government claim to gainshare receipts. This will sharpen the incentives on licensees to carry out network-based mitigation.

A6.45 In our February 2012 consultation, we considered how the gainshare should be split between the new licensees and whether this split could be changed after MitCo has

been set up. We proposed that the gainshare should be split between the 800 MHz licensees based on the quantity of spectrum they hold in the band. We indicated that this should be used as a starting point; however we would allow licensees to seek to negotiate an alternative split, for example if one licensee bore a disproportionate share of network mitigation costs.

- A6.46 Most respondents that commented on this issue agreed with this proposal. Telefónica UK thought that there should be a facility for MNOs to negotiate an alternative split, but also thought that it would be hard to envisage what incentives would lead to a unanimous agreement on an alternative approach.
- A6.47 We continue to consider that as a starting point, the gainshare should be divided in proportion to each licensee's 800 MHz spectrum holdings. Licensees may seek to negotiate an alternative split but this would require unanimous agreement between licensees.

Scope of MitCo's work

- A6.48 Government's February 2012 decisions on consumer support broadly define the scope of MitCo's work⁴³⁹. Government decided that MitCo would need to provide the following level of support:
- Support should only be offered to mitigate interference into primary sets (but not additional sets) as follows:
 - Information and advice to potentially affected households;
 - DTT receiver filters, provided both proactively and reactively;
 - Platform changes (to a broadly equivalent cable or satellite TV service) where a filter does not solve the interference problem;
 - Support for vulnerable consumers to assist with the installation of filters, with the eligibility criteria for support mirroring those used by the Digital Switchover Help Scheme;
 - For those households who require a platform change but are unable to receive TV using an alternative platform, the provision of bespoke mitigation up to a limit of £10,000 per household.
 - No support for interference issues that result from problems with set-top aerials, cable TV equipment or local TV services;
 - No support for any interference caused by mobile handsets. However, wherever possible, MitCo would be expected to provide suitable information on possible impacts from handsets and things affected consumers could do to help themselves.
- A6.49 In their responses, a number of stakeholders expressed concern at the level of support specified in Government's decisions. Some thought that support for the installation of receiver filters should be extended to all consumers rather than just

⁴³⁹ Where we refer to obligations on or requirements of MitCo, those obligations and/or requirements will be placed on each 800 MHz licensee, who will collectively be required to fulfil them through the joint operation of MitCo.

for vulnerable consumers. Several respondents also commented on the lack of support for secondary sets.

- A6.50 Government has considered these representations and decided that installation support should additionally be provided to affected households that use a mast-head (or roof-top aerial) amplifier to assist with their reception of DTT services and who do not already have access to an alternative television platform. The letter setting out Government decisions on these matters is published on DCMS's website⁴⁴⁰. Government has decided that the additional support should be implemented using a voucher scheme, whereby affected households could request a voucher (to the value of £50+VAT) which could be redeemed with a reputable installer. Up to £12m of the £180m allocated for MitCo's work would be used to pay for this voucher scheme. Government has not provided further details on how this scheme will work at this stage. We expect that preparatory work for MitCo will investigate further. A condition has been included in the draft 800 MHz licences requiring licensees to provide such a scheme.
- A6.51 In addition to the responses on the level of support, several respondents made detailed comments, or had questions, on how the various consumer support elements would be delivered. We provide clarification on these issues in the following paragraphs.

Information and advice to DTT consumers

- A6.52 The Broadcasters, Freeview, Arqiva and Digital UK thought that all written communication between MitCo and consumers should include the names and company branding of the 800 MHz licensees. Broadcasters and Digital UK noted the reputational incentive that this would place on licensees to ensure a high level of service delivery by MitCo.
- A6.53 RNIB highlighted the importance of accessibility issues. This included not only the design and presentation of written information, but also the level of training that contact centre staff should receive and the accessibility standards of information provided online.
- A6.54 On the issue of branding, we agree that this would provide a very direct reputational incentive on licensees. We also note however that there is already strong stakeholder and media awareness of this issue such that, if MitCo were to fail to deliver a good service to consumers, it is highly likely to result in negative reputational impacts on licensees. Rather than include a condition in licences on this matter, we have included this issue as a suggested element of MitCo's Code of Service for consumers. We provide more detail on this Code later in this annex in paragraphs A6.242 to A6.248. We have also suggested that this Code should cover accessibility issues.
- A6.55 In addition, as we set out later in paragraphs A6.138 to A6.144 of this annex, 800 MHz licensees will be required to establish a Memorandum of Understanding (MoU) between MitCo and the Oversight Board. We expect this MoU to include details of the interactions that will take place between MitCo and the OB, and that these will include a role for the OB in scrutinising the content and design of consumer information.

⁴⁴⁰ <http://www.culture.gov.uk/images/publications/letter-dcms-ofcom-10072012.pdf>

- A6.56 Arqiva and the CCP highlighted the need for information provided by MitCo to assist consumers to whom MitCo is not required to provide a service directly but who may nevertheless benefit from information about interference issues, for example those that are affected by interference from handsets.
- A6.57 It is highly unlikely for MitCo to be able to accurately target in advance only those consumers who meet the eligibility criteria associated with Government decisions. This means that many consumers will receive information and advice from MitCo even if they are not directly eligible, e.g. if they are not a primary DTT household, but are in an area where DTT households are likely to suffer interference.
- A6.58 We also consider that it would be mutually beneficial for MitCo to cooperate closely with other TV service providers, e.g. cable or satellite TV providers, in planning communications with consumers. Indeed this could be especially beneficial in situations where other TV platform providers have direct and ongoing relationships with their customers.
- A6.59 This cooperation could involve agreeing protocols for dealing with telephone enquiries that come to MitCo that are more appropriately dealt with by another TV service provider (or vice versa). It could also involve other TV service providers suggesting, or contributing to, the key messages for their customers within the information that MitCo sends to consumers. We have included a point on how such consumers should be dealt with in the Code of Service presented later in this annex. We also expect that part of the preparatory work for MitCo would involve discussions with other TV service providers to discuss possible approaches to managing consumer communications and would encourage MitCo to set up such arrangements.

Provision of DTT receiver filters

- A6.60 Broadcasters and Freeview noted that MitCo would need to ensure that filters meet the required technical standard to mitigate interference effectively. The Digital Television Group (DTG) suggested that some level of performance testing should take place to ensure appropriate standards are met.
- A6.61 We agree that it is important that filters meet reasonable technical standards and levels of quality. For example, it will be important to ensure that filters installed externally are weatherproof. We would note that licensees should have an incentive to ensure that the filters they use are of a good technical standard. This is because using lower performance filters is likely to result in a greater need for expensive platform changes, or bespoke mitigation where platform changes are not available. We do not therefore think it is necessary for MitCo to be required to obtain approval for the type of filter they use in each situation. However, to ensure transparency and provide some reassurance to stakeholders with an interest in this process, we consider that it would be desirable for licensees to, via MitCo, provide information to the OB on the product specifications and technical standards of filters they plan to use and provide the OB with an opportunity to comment on these. We suggest that this could be dealt with as one of the elements in the MoU between MitCo and the OB as described later in paragraphs A6.138 to A6.144 of this annex.
- A6.62 The Communications Consumer Panel, Definitive Direction and Sony also commented on the need to make additional filters available for purchase by consumers, for example where more than one TV in the household requires mitigation. Definitive Direction suggested that consumers should be able to drop off filters which are unwanted (for example, where MitCo has proactively sent a filter to

a household without DTT) at licensees' retail premises. Sony stated that an accreditation scheme should be introduced to provide consumers with a guarantee of quality when purchasing additional filters.

- A6.63 In its February 2012 decisions, Government asked that consideration be given to how it could be made easier for affected viewers to acquire additional filters and said that it is important that affected viewers should have a clear and straightforward route to any additional filters required. As noted in paragraph A6.26, Government will lead preparatory work for MitCo in advance of the auction. We expect that this work will look at ways to ensure that additional filters are readily available. The work could also consider the need or otherwise for an accreditation scheme and possible ways to deal with unused filters, possibly including the use of licensee's retail premises where appropriate.
- A6.64 Freeview also asked whether, in addition to private households, MitCo would be required to provide filters to the public estate, e.g. hospitals, local authority care homes and other public buildings, or private companies and voluntary sector organisations providing accommodation.
- A6.65 We can confirm that filters will be provided to the public estate.

Support for DTT consumers in communal dwellings

- A6.66 For communal dwellings (e.g. blocks of flats etc) using a communal aerial system, it should be possible in most cases for a single receiver filter to be used to mitigate interference. This filter is likely to need to be installed close to the launch amplifier used in these systems. In some cases where DTT transmissions received by the dwelling are using DTT channels at the top end of the spectrum band used for DTT, a large professional-grade filter will be required. The installation of filters in communal aerial systems is likely to require the services of a professional installer.
- A6.67 A number of stakeholders, including the Broadcasters, Freeview and Digital UK, highlighted the challenges associated with identifying homes in communal dwellings as well as identifying the party responsible for managing the TV installation in these dwellings – normally the public or private landlord.
- A6.68 MitCo will be required to provide information in advance to all potentially affected households including those in communal dwellings. We would expect that, where MitCo can be certain that a household is part of a communal dwelling, it would send information to these households which is tailored to the circumstances of communal households. We also expect that the information that MitCo sends out to households in general will include instructions on steps to take if the household receives its DTT services via a communal aerial system. This should help MitCo to identify the responsible person for installing the filter in the communal aerials system.
- A6.69 We expect that the preparatory work for MitCo would involve discussions with organisations such as Digital UK who have experience with the challenges of accurately identifying and communicating with landlords of communal dwellings, and this may help to inform the detailed approach that MitCo will take to dealing with this issue.
- A6.70 For the provision of filters, we have decided that, where MitCo can be reasonably certain that a household is part of a communal dwelling, MitCo will not be required to provide filters to these individual households in advance. This is reflected in the

revised version of KPI 2 (see Table 10 at the end of this Annex) and is because, as set out above, the correct location for these filters is near the launch amplifier used in these systems rather than in the individual dwellings. In addition, as also noted above, it may be necessary to use expensive professional grade filters in these systems and it would be expensive and potentially wasteful to pay for such a filter and the installation of such a filter before it is clear that this is necessary (i.e. in advance of interference occurring).

- A6.71 However, where MitCo is able to obtain the contact details of the person responsible for the communal aerial system in advance, and where it is also likely that a standard filter could be used to resolve any interference, we expect that MitCo should aim to deliver the filter in advance. It would be for the responsible person (e.g. the landlord) to decide when to install the filter, i.e. in advance of, or after, any interference occurs. We have included a suggested element in the Code of Service relating to this point.
- A6.72 Digital UK also noted that interference might be picked up on the in-building distribution system after the filter (e.g. through the cabling) and that filters might additionally need to be provided to individual households within a communal dwelling.
- A6.73 In its July 2012 letter to Ofcom, Government noted that it is the responsibility of landlords to ensure that cabling used within the communal aerial system is of sufficient quality.

Vulnerable consumer support

- A6.74 Government has decided that support for vulnerable consumers should be based on the same criteria applied under the Digital Switchover (DSO) Help Scheme. To be eligible for support, the consumer must be:
- Aged 75 or over;
 - Eligible for any of the following: Disability Living Allowance; Attendance Allowance; Constant Attendance Allowance; or Mobility Supplement;
 - Registered blind or partially sighted; or
 - Have lived in a care home for six months or more.
- A6.75 In the July 2012 letter, the Government said that extra support, including installation support, should be offered to vulnerable consumers. This means that the extra support for vulnerable consumers could include more than just installation support although the Government has not specified what it should include. In our initial work looking at the costs of providing extra support for vulnerable consumers⁴⁴¹, we estimated the costs of providing outreach support to 'hard to reach' consumers. We expect MitCo to investigate and implement ways of providing 'outreach' to consumers who would particularly benefit from assistance with installations, for example by working with charities and local authorities. We would envisage these activities providing access to a network of community members who can assist those who lack confidence installing filters themselves. We have included an element related to outreach support in the suggested elements for a Code of Service for MitCo, described later in paragraphs A6.242 to A6.248.

⁴⁴¹ insert link to page 80 of Deloitte report (Nov 2011)

- A6.76 For the DSO Help Scheme, primary legislation was produced to enable the Help Scheme providers to identify consumers meeting the eligibility criteria. Digital UK noted that further primary legislation might be needed to allow MitCo to access this data.
- A6.77 We understand that the Government does not propose to produce primary legislation for MitCo. Rather, the information sent in advance to consumers by MitCo would provide clear instructions for consumers on how to inform MitCo of their requirement for installation support. MitCo should include some elements in its Code of Service (discussed later in paragraphs A6.242 to A6.248) in relation to the type of information it will provide to vulnerable consumers and the approaches it will use to communicate with them.

Platform changes

- A6.78 MitCo will provide platform changes to eligible households for which the installation of a DTT receiver filter does not restore DTT reception.
- A6.79 Government has signalled its intent to set a limit on the number of platform changes that may be provided by MitCo. It proposes to make a decision on the limit once MitCo is operational and there is more certainty as to the number of households that are likely to require a platform change. The policy intention of the limit will be to encourage a bias towards restoring DTT reception rather than allowing the provision of platform changes to be MitCo's default response to interference complaints. We have included a licence condition in licences to ensure that the total number of platform changes provided does not exceed a certain number as may be notified to it by Ofcom if Government decides to set a limit. To provide context on this, we note that our technical modelling estimated that approximately 15,000 primary DTT households might require a platform change if licensees choose not to use any mobile network-based mitigation.
- A6.80 The OB will keep the number of platform changes under review and advise Government in the light of practical experience once the consumer help scheme is operational. As such, licensees will be required to ensure that MitCo reports to the OB on a monthly basis in relation to the number of platform changes that have been provided to consumers.
- A6.81 In the February 2012 consultation, we considered whether the platform change cap should be capable of adjustment, i.e. whether it should be a "hard" or a "soft" limit. Several responses supported the use of a soft cap. Digital UK, Freeview and Arqiva indicated their support for a cap that was "challenging" or "binding", though it was not explicitly clear from the responses that it should be a hard cap, i.e. not capable of alteration.
- A6.82 We note the responses on this issue and have shared these with the Government. It will be for the Government to make the final decision on whether the cap (if one is introduced) should be soft or binding.
- A6.83 The Broadcasters and Digital UK suggested that there could be scope for licensees to circumvent the platform change cap, for example by independently funding platform changes outside of MitCo or agreeing commercial deals with other platform operators.
- A6.84 We have included a specific obligation in licences to require licensees to provide filters to households that are predicted to be affected by interference. It would be in

the interests of licensees to ensure that the filters provided effectively resolve interference so that further action on the part of MitCo, and therefore further cost, is limited. Our technical modelling shows that filters will resolve interference for the majority of households and the number of platform changes required after filters have been supplied is likely to be small. We therefore consider that the risk of licensees making commercial arrangements with alternative platform providers, or of directly funding platform changes outside of MitCo, is small.

- A6.85 In the February 2012 consultation, we also considered the process by which MitCo would identify when to provide a platform change. We noted that MitCo would require a robust diagnostic function to enable contact centre staff to accurately determine a household's requirements and eligibility for platform changes.
- A6.86 Various respondents, including Freeview, Digital UK, BT and Mandercom highlighted the need for MitCo to consider alternative mitigation solutions before providing a platform change. Respondents also queried the length of time it would take MitCo to confirm a platform change requirement after a consumer reports that a filter has not restored their DTT services.
- A6.87 In the consultation, we proposed a KPI that was intended to drive the delivery of platform changes in a timely manner. We have now made a number of adjustments to this KPI to address the concerns raised by stakeholders and we outline the revised KPI in paragraphs A6.178 to A6.189.

Support for loss of TV services

- A6.88 Among those households for whom a filter does not restore DTT services, a small number may be unable to receive TV services using an alternative platform.⁴⁴² For these households, MitCo will be required to provide bespoke mitigation assistance to restore some form of TV service. Additional assistance up to the value of £10,000 will be provided to each affected household.
- A6.89 The Communications Consumer Panel queried what additional options might be available for households requiring bespoke mitigation. There are likely to be a number of options open to MitCo including, for example, small DTT repeaters, mobile network-based mitigation, extension of cable networks or satellite redistribution. It will be for MitCo to investigate available options and determine the most cost-efficient solution.
- A6.90 Some media reports on our consultation interpreted this Government decision as a compensation scheme, whereby affected households would receive up to £10,000 compensation if MitCo is unable to restore TV services.
- A6.91 For the avoidance of doubt, bespoke mitigation will *not* consist of a compensation payment being made directly to consumers. Instead, MitCo will need to spend up to £10,000 per affected household to help the household maintain a broadly equivalent TV service. This allocation can be aggregated so for example if five houses are all affected in the same place then we would expect MitCo to spend up to £50,000 on a single solution that fixes the problem for all five houses. A condition will be included in 800 MHz licences to require licensees to provide this

⁴⁴² Some households may not be able to access satellite or cable services. In the February 2012 consultation we estimated that this could account for approximately 3% of those households that require a platform change.

support. We also expect that the MoU between the OB and MitCo will set out how MitCo will report to the OB in relation to the provision of bespoke mitigation.

- A6.92 The Broadcasters said in their response that they did not agree with Ofcom's position, set out in the February 2012 consultation, that there is no legitimate expectation that the 98.5% coverage level will be maintained. They have stated that, in their view, Government and Ofcom statements issued to date have created an expectation that the coverage level of 98.5% will be maintained and that it would be inappropriate and potentially unlawful for Ofcom to now make a policy decision that would impact on that expectation. The Broadcasters also included an annex to their response, setting out a number of statements from Ofcom and Government referring to DTT coverage.
- A6.93 We have carefully reviewed the Broadcasters' comments, including the statements made by Ofcom and the Government as contained in the annex to their response. Our view continues to be that which we set out in paragraphs 4.14 – 4.16 of the February 2012 consultation, namely that there is no legitimate expectation that a coverage level of 98.5% will be maintained.

Providing support additional to that required by Government

- A6.94 Vodafone queried whether MitCo would need to seek approval in order to undertake additional mitigation tasks in addition to those prescribed in Government decisions and reflected in KPIs.
- A6.95 We consider that in general the licensees should be free to provide additional support to consumers if they unanimously agree to do so, and we have therefore not proposed any requirements for licensees to seek approval to provide additional support. However, we expect licensees to seek to provide support to consumers in a cost-effective manner and the gainshare arrangement should provide incentives to do this. Government will not bear the costs of MitCo in excess of £180m which are result from the licensees choosing to provide help not required or approved by government.

The Oversight Board

- A6.96 The Government has decided that it will establish a group to oversee the activities and performance of MitCo, referred to for the purposes of this document as the Oversight Board (previously known as the 'Supervisory Board').
- A6.97 In the February consultation, we presented our initial views on the purpose of and constitution of the Oversight Board (OB) and noted that we expected to use the outcome of the consultation to provide information to assist Government when it establishes the Oversight Board.
- A6.98 It will be for Government to make final decisions in relation to all features of the Oversight Board. Notwithstanding this, we have discussed the content of this section with Government and while the material presented here represents our view on these matters, we note that this is broadly aligned with the views of government too.

Purpose and remit of the Oversight Board

- A6.99 Whilst there was general agreement amongst respondents regarding the requirement for an Oversight Board that would, among other things, monitor MitCo's

performance against the KPIs, a number of respondents including Digital UK, Arqiva and the Broadcasters, suggested its remit should be broader than the key functions presented in the February 2012 consultation. In reviewing responses, we have identified a number of areas where respondents, largely from the broadcaster and DTT community, suggested that the Oversight Board should have an increased or altered role:

- *Strategic direction* – Arqiva and Intellect suggested that the OB should have the power to set and modify MitCo’s strategic and policy objectives under the overall objective of providing mitigation support.
- *Monitoring and control of operations* – Arqiva also suggested that the OB should have greater responsibilities to monitor MitCo’s internal operations in addition to its proposed monitoring of its output metrics through the KPIs and a range of other outputs that directly support KPI delivery. Broadcasters thought that the employment terms and bonus arrangements for MitCo management should be subject to OB approval.
- *Approval of one-off aspects of MitCo’s work* – Broadcasters noted that one of the core functions of the OB as set out in our February 2012 consultation would be to accredit significant one-off aspects of MitCo’s service, e.g. the information campaign, the online portal etc, but thought that the OB should be given a stronger approval role.
- *Enhanced technical expertise* – The DTG suggested that OB would need broader technical expertise than that suggested in the consultation document. For example, it would need to have expertise related to interoperability problems with reception problems. They also suggested OB would need full-time engineering staff. They offered to provide industry representation and to coordinate reception equipment aspects of the technical advice needed by the OB.
- *Consumer research* – Arqiva, Digital UK, Freeview and the Broadcasters in their joint response suggested that the OB should undertake or commission its own research to verify actual interference encountered by consumers. In addition, the Broadcasters and Freeview thought that the OB should undertake extra research to understand the impact on customer behaviours in response to interference.
- *Consumer disputes* – Broadcasters and Digital UK suggested that the Oversight Board should provide the escalation path for disputes that arise between MitCo and consumers.

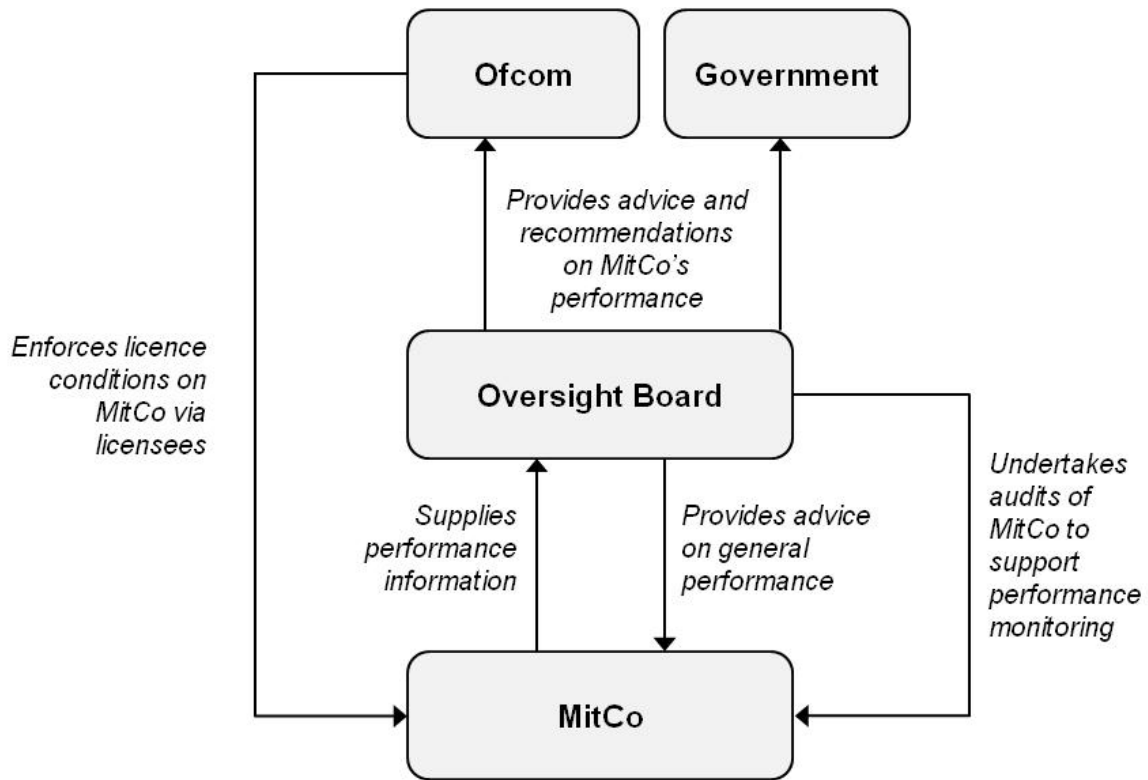
A6.100 We recognise that the use of the term ‘Supervisory Board’ in the February 2012 consultation may have contributed to some misconception as to the purpose of this board, e.g. by suggesting that the board would have powers to direct MitCo in some manner. This was explicitly not the intention of the proposals. We consider that the new title that we use here, the Oversight Board, provides a more accurate description of the intention and purpose of the board. Government has informed us that it intends to establish the Oversight Board as an informal advisory group sponsored by DCMS, but independent of both Government and MitCo. As such, it is intended that it would not have statutory powers nor would it have any authority delegated to it by Ofcom. Rather, it would make recommendations to Ofcom and it would be for Ofcom to make final decisions on how Ofcom would enact its statutory powers in the light of the available evidence.

- A6.101 In light of this, we do not agree that the OB should have the powers to, for example, set and modify the strategic objectives of MitCo, or for it to police MitCo's internal operations, e.g. by approving the employment terms and bonuses provided to MitCo management. In our February 2012 consultation, we suggested that the OB would need to 'accredit' significant one-off aspects of MitCo's service. In view of the above however, we no longer propose that OB would formally accredit or approve aspects of MitCo's service and, rather, these powers would remain with Ofcom. We have now included conditions in the 800 MHz licences to require licensees to take certain actions in relation to those aspects of MitCo's work which we consider to be especially important. We discuss these aspects later in this annex. We have further decided to amend the core functions of the OB to reflect this approach and describe these below.
- A6.102 On technical expertise, we proposed in the February consultation that the OB would need to have a technical modelling function to provide it with sufficient capability to assess and potentially challenge MitCo's performance. It will be for Government, in their preparations for establishment of the OB, to further define what technical expert resources will be needed by the OB
- A6.103 On consumer research, our proposals in relation to the audit function of the Oversight Board (in paragraph 7.50 of the February 2012 consultation) already envisaged OB undertaking consumer surveys. It would be for OB to decide how best to use its budget in undertaking such research. On consumer disputes, we have decided that MitCo will need to define a complaints-handling procedure in consultation with the OB; we discuss this in more detail in paragraphs A6.267 to A6.277.

Core functions of the Oversight Board

- A6.104 In view of the above, we have reviewed the core functions of the OB set out in the February 2012 consultation and consider that OB should have the following three revised core functions:
- monitor MitCo's performance on an ongoing basis against the KPIs, Code of Service and other conditions in the 800 MHz licences;
 - advise and make recommendations to MitCo in relation to MitCo's performance against its KPIs, Code of Service and other licence conditions;
 - advise, report to, and make recommendations to Ofcom in relation to MitCo's performance against its KPIs, Code of Service and other licence conditions.
- A6.105 The terms of reference for the OB will be drafted by Government as the OB is formally established. We understand that these will be based upon the core functions outlined above and the principles of interaction set out in Figure 2 below.

Figure 2: Oversight Board interactions



Establishing the Oversight Board

A6.106 Digital UK suggested that the Oversight Board should be established in advance of the auction in order to direct the establishment of MitCo. Vodafone expressed concern that doing so would be difficult without a mechanism to ensure the potential 800 MHz licensees were represented.

A6.107 Government intends to make preparations for the establishment of the OB in advance of the auction, for example, by appointing the Chair and independent members. However, formal constitution will occur only after the auction when the number and identify of 800 MHz licensees is confirmed. This is to ensure that the balance between licensees and broadcasting representatives is appropriate, as discussed in more detail in paragraphs A6.116 to A6.120.

Funding of the Oversight Board

A6.108 The February 2012 consultation set out the Government decision that the Oversight Board would be funded from within the overall allocation of £180m. It was expected that the annual running costs would be around £1.2m.

A6.109 The Broadcasters, Freeview and Digital UK expressed concerns that the funding for the OB would be insufficient for it to deliver the broader remit they believed was required. The Broadcasters and Digital UK added that the OB should have the ability to control the size of its budget in order to ensure it had sufficient resources to deliver its remit.

A6.110 As discussed earlier, we consider that the remit of the OB should not be expanded and as such the budget for the OB will remain at £1.2m per annum.

Membership

- A6.111 In the February 2012 consultation, we set out proposals for the composition of the Oversight Board's membership. We proposed that the OB should comprise the 800 MHz licensees, broadcaster representatives and independent advisors with consumer and technical / audit perspectives. We suggested that the role of chairing the OB could be taken on by an independent appointee or a Government official.
- A6.112 We also proposed that MitCo, Ofcom and Government should have observer status on the OB without the voting rights held by full members. The key principle that we suggested should govern the composition of the OB's membership was that there should be a balance between 800 MHz licensee and broadcaster representatives.
- A6.113 We received a wide range of comments from respondents relating to the membership of the OB, which we address in the following paragraphs.

Chairperson and Government / Ofcom representation

- A6.114 Arqiva, Intellect, Telefónica and the Broadcasters in their joint response supported the appointment of a Government official rather than an independent appointee. David Hall Systems Ltd and one confidential response supported the appointment of an independent person as Chair. Digital UK suggested that, if Ofcom or Government own the OB, they should have voting rights as members. Broadcasters noted that it would be for Government to resolve any deadlock within the OB. Both the Broadcasters and Telefónica noted that a Government appointee would give Government an opportunity to keep an eye on MitCo's costs with the gainshare and overspend issues in mind.
- A6.115 We have discussed this issue further with Government in addition to reviewing responses. We consider that it will be important for the OB Chair to be in a position to give independent advice to Government and Ofcom, and as such, the appointment of a Government official in this role could result in a conflict of interest. We therefore expect that Government will appoint an independent person to carry out this role. We do not consider it necessary for Government or Ofcom to have voting status on the OB.

Balance of members

- A6.116 Various respondents commented on the issue of ensuring balance between the different interests held by members of the Oversight Board.
- A6.117 Intellect noted that, in the event that more than three parties are awarded 800 MHz licences, the OB membership proposals should be adjusted to provide for the same number of broadcasting representatives. Both Arqiva and the Broadcasters in their joint response commented that our proposed broadcast industry representation should be amended so that all three members are drawn from DTT multiplex operators.
- A6.118 In our February 2012 consultation, in paragraph 7.49, we noted that a different award outcome (other than three licensees) would result in the need to adjust the number of broadcasting representatives accordingly. We note the comments on the broadcast representatives and agree with them. It will be for Government to discuss these appointments in more detail with broadcasters and multiplex operators when establishing the OB. To clarify matters, we have included a revised table below which sets out the need for a number of broadcast representatives, the number of

which will be defined once the award is complete and the number of licensees is known.

- A6.119 Telefónica expressed reservations with our approach, noting that the licensees would be in a one third minority and saying that the proposed membership structure creates a major control risk for licensees. They noted that the interests of the PSB, COM and MuxCo representatives would be likely to be aligned in a voting block against licensees and that this could place intolerable pressure on the independent members of the OB.
- A6.120 Telefónica's concerns appear to be based on an understanding that the OB will be able to put the brakes on MitCo's work thereby delaying network roll-out. In practice, we think that our proposals for the remit of the OB, as clarified earlier, mean that OB will only have limited indirect influence over MitCo's day to day operations. We have also included provisions in licence conditions so that, if agreement between MitCo and the OB is not reached on certain issues within a reasonable time period, Ofcom may intervene to break the deadlock. On the pressure from independent members, it will be important to ensure that these independent members are truly independent and do not have a bias towards either broadcast or new licensee interests. We would expect that these members would be given a clear remit in this regard and one which is in line with the objectives for coexistence described earlier in this annex.

Independent appointees

- A6.121 We received a number of other comments from respondents on our proposal to include two independent appointees with voting rights to the OB, who would hold expertise as consumer and technical / audit representatives respectively.
- A6.122 Telefónica thought that these members should act in an advisory capacity rather than holding voting rights. Similarly, Arqiva and the Broadcasters in their joint response stated that the technical / audit representatives' seat should instead be taken by the individual responsible for the OB's secretariat. Vodafone and Intellect both thought that two additional independent voting members should be included.
- A6.123 In our view, the purposes of the independent members are twofold – first, to be independent voices on the OB so as to assist with balanced decision making and avoid placing too much emphasis on the casting vote of the Chairperson, and second, to ensure there is expert understanding of consumer and technical/audit issues in OB's management group.
- A6.124 We consider that the first element of this role is somewhat more important and as such, we have clarified the titles of these independent members in the revised OB core membership table below.
- A6.125 In line with the second part of this purpose, we consider that retaining an independent member with technical or audit-related expertise would be more valuable than including the head of the OB's secretariat.

Consumer representation

- A6.126 With regard to the independent consumer representative, the Communications Consumer Panel commented that two consumer interest advisors would provide a better balance of representation on the board. RNIB noted that the consumer representative should have a track record of expertise in issues affecting vulnerable

consumers, or that a second representative with this specific remit should be added. Voice of the Listener and Viewer stated that a separate consumer monitoring group should be established.

A6.127 The role of the OB will be strongly focused on ensuring good outcomes for consumers. We expect that this is likely to be enshrined in any terms of reference for the OB, in line with the objectives for coexistence described earlier in this annex. In addition, the brief for the Chair of the OB is likely to include similar requirements. On balance, therefore, we do not think it is necessary to include additional consumer representation in the OB's core membership.

A6.128 We agree with the RNIB that it would be desirable for one of the independent representatives to have experience and understanding of the needs of vulnerable consumers and we would expect this to be among the characteristics sought when this member is appointed.

Appointments and voting arrangements

A6.129 Arqiva suggested that the representatives nominated by licensees should be UK board members or UK-registered company officials. It also thought that all stakeholders involved in the OB should be consulted when developing the board's voting protocol.

A6.130 It will be for Government to appoint the members of the OB. We expect that this will involve engagement with stakeholders to discuss nominees before final appointments are made. At this point, it will be for Government to ensure it is satisfied with the qualities and characteristics of the individuals it appoints.

A6.131 With regard to the voting arrangements of the OB, we believe it is important to provide as much certainty as possible to stakeholders as to our views on the arrangements that the OB should adopt. Voting amongst the OB membership should be on an equal basis with one vote per representative, with a casting vote exercised by the Chairperson. Advice to Ofcom on the basis of OB deliberations should be determined by simple majority voting.

A6.132 The Oversight Board will meet when key decisions are required, probably on a monthly basis or as otherwise called by the Chairperson, for example based on advice from the expert-level function (detailed below).

MitCo and wider stakeholder representation

A6.133 Digital UK suggested that the Chair of MitCo should be an OB member, while MitCo's CEO should also attend OB meetings. We expect that the interests of MitCo should be closely aligned with its licensee owners, and these will already be voting members of the OB. However, we continue to consider that one senior responsible person from MitCo should sit on the OB as a non-voting observer.

A6.134 Various respondents, including Sony, Digital UK and the Confederation of Aerial Industries, made recommendations for the inclusion of a number of additional observers to the OB, including:

- PMSE representatives;
- Digital UK;

- TV industry/manufacturer representatives;
- Aerial installation industry; and
- Alternative platform providers.

A6.135 We agree that all of these groups have important contributions to make to the work of MitCo. It is however important to keep the core membership of the OB to a relatively small size to enable quick and effective decision making. This is especially important in view of the key principle for OB membership of achieving a balance between broadcast and licensee interests. Notwithstanding this, we propose that the OB Chair will reserve the right to invite additional relevant stakeholders to attend Board meetings in an observer role as required, or to convene a separate meeting with a wider group of stakeholders as necessary.

A6.136 We also consider it more appropriate for the TV and aerial industry and alternative platform provider communities in particular to seek a close working relationship with MitCo where they could provide experience and advice on the operational aspects of MitCo.

Table 1. Membership of the Oversight Board

Membership	Role	Voting
Chairperson (independent appointee)	Independent chair of the Oversight Board	Casting Vote
Senior responsible person from MitCo, e.g. the Chief Executive Officer	Represents the management of MitCo	Non-voting status, information provider
Government (DCMS)	Represents Government wide interests as the responsible department for policy	Non-voting status, observer
Ofcom	Represents the authority with responsibility for managing the spectrum and enforcing the licence conditions	Non-voting status, observer
Independent 1	Provides constructive challenge to help develop the Oversight Board's recommendations with regards to technical and performance aspects	Voting status

Independent 2	Provides constructive challenge to help develop the Oversight Board's recommendations with regards to protecting consumer interests	Voting status
Broadcasting Representatives (<i>number to be determined by Government</i>)	Represent the interests of the broadcasting industry	Voting status for each representative
800 MHz Licensees (<i>number to be determined by Government</i>)	Represent the 800 MHz licensees	Voting status for each representative

Expert resources

A6.137 In the February 2012 consultation, we proposed that the OB would be supported by additional resources collectively referred to as the expert level function. As explained above, we consider that the remit of the OB should not be increased from that set out in the consultation. We continue to consider that the OB will need to be supported by broadly similar expert resources to those described in the consultation, i.e. a secretariat, and technical and audit capabilities. However, we would note that it will be for Government to decide on the exact resources that will be required.

MitCo and licensees' relationship with the Oversight Board

A6.138 The flow of information between MitCo and the OB will be a fundamental driver of the ability of the OB to carry out its core functions. The suite of reporting requirements in the KPI framework described later set out at a high level the key information MitCo will need to provide to the OB and how this should be provided. It will however be important for MitCo and the OB to build on this by agreeing the detail and protocols surrounding the transfer of this information.

A6.139 There is also likely to be a need for MitCo to provide a range of other information to the OB, e.g. in relation to the Code of Service, in relation to OB's input to the design of information that will be sent to consumers, etc.

A6.140 In addition to the information flow between the two bodies, it will also be necessary for the two bodies to agree principles that govern the working relationship between them.

A6.141 The 800 MHz licensees will therefore be required to establish a Memorandum of Understanding (MoU) between MitCo and the OB before MitCo commences operation, i.e. before it starts communicating with, and providing support to, consumers. This MoU must cover expected interactions between MitCo and the OB and agreed ways of working.

A6.142 If licensees have not agreed a MoU among themselves and with the OB within 6 weeks of the date of 800 MHz licences being granted, licensees will be required to

adopt a MoU notified to them by Ofcom. However, the licensees may make a request to Ofcom to extend this timescale if they unanimously agree to do so, and Ofcom will consider any such application and make a decision on extension as soon as practicable after any request is made.

A6.143 In the table below, we list some suggested elements for inclusion in the MoU. We expect that a draft MoU would be produced in the MitCo preparatory work for licensees to use as a basis (if they wish) for discussion and agreement with the OB. As noted, it will be for MitCo and the OB to reach final agreement on the exact content of the MoU.

Table 2: Suggested framework for MitCo’s interaction with the OB to be formalised within a Memorandum of Understanding

Elements of operation	Possible interaction with the OB
Initial phase of operation	<ul style="list-style-type: none"> • MitCo will consult with the OB on the approach it proposes to adopt in the initial phase of operation to reduce the risk of negative consumer impacts
Information provision / sharing	<ul style="list-style-type: none"> • The OB may provide guidelines on the content and design of information materials • MitCo will consult with the OB on the design of information for, and methods of communication with, vulnerable consumers • MitCo will share information with the OB in a way that provides sufficient anonymity of individual licensees’ network strategies
Online portal	<ul style="list-style-type: none"> • The OB may review and make recommendations on the content and design of online materials • The OB may review and make recommendations on the design and functionality of the online portal prior to start of MitCo’s activities
Diagnostic processes	<ul style="list-style-type: none"> • The OB may review and make recommendations on the diagnostic processes used to identify customer needs and required services (e.g. types of filter, type of mitigation) and their effectiveness within three months of the tool being established by MitCo • The OB may review and make recommendations on MitCo’s proposed approach to managing the diagnosis and delivery of platform changes (in relation to KPI 5) • The OB may and make recommendations on other diagnostic processes to support KPI delivery, as appropriate
Contact centre	<ul style="list-style-type: none"> • The OB may review and make recommendations on contact centre specific management information during audits based on information provided by MitCo in the following areas: average call waiting times; average call times; the management of customer queries by call centre operatives, call recordings. • The OB may review and make recommendations on telephone support processes

Filter standards	<ul style="list-style-type: none"> • MitCo will, in advance of sending filters to consumers, provide information on the product specifications and technical standards of the filters, as well as the specifications and standards for any other equipment used to mitigate interference at consumer premises, to the OB and provide OB with opportunity to comment on this information.
Bespoke mitigation	<ul style="list-style-type: none"> • In the event that MitCo considers that it would cost more than £10,000 to maintain a TV service for an affected household and proposes not to assist the household, MitCo will provide evidence to the OB to support this proposal, provide opportunity for the OB to comment on this proposal and take due account of OB recommendations on what other measures should be considered.
Targets	<ul style="list-style-type: none"> • The OB may discuss with MitCo the scope for further targets, in addition to the standards associated with KPIs, that support the delivery of MitCo's service requirements as defined by the KPIs
Format of KPIs	<ul style="list-style-type: none"> • The format of MitCo's reporting will be agreed with the OB ahead of the start of MitCo's operation. This process may be facilitated by the OB issuing a proposal to MitCo on format and reporting issues

A6.144 The list of suggested elements above is not comprehensive. The final list is likely to include a number of other elements. For example, it may include issues relating to the interference model or to the complaints procedure. As we set out later, licensees will already be subject to licence conditions which require them to cooperate with the OB in relation to these matters, but the MoU may set out additional factors which are not specifically covered in the licence conditions.

Key Performance Indicators

A6.145 In the February 2012 consultation, we proposed a set of Key Performance Indicators (KPIs) which 800 MHz licensees, via MitCo would be required to meet in delivering support to consumers. These were designed to ensure that the 800 MHz licensees deliver the level of consumer support determined in Government decisions to a high standard. They were based on the activities and services that MitCo will be required to deliver to achieve this level of support.

A6.146 In this subsection we discuss stakeholder responses to our February 2012 consultation on KPIs and describe some amendments that we have made in the light of stakeholder comments and our further analysis. An amended set of KPIs is set out at the end of this annex.

The KPI framework

A6.147 Digital UK and Sony thought that the proposed KPI framework was too focused on MitCo's activities and outputs, rather than on broader outcomes it was trying to achieve, and that an 'outcome-based' KPI regime would provide MitCo with greater flexibility in delivery. Digital UK thought that, in view of this, the OB should approve the final version of the KPIs and the design of the mitigation. Sony suggested that a KPI relating to maintaining DTT coverage should be introduced.

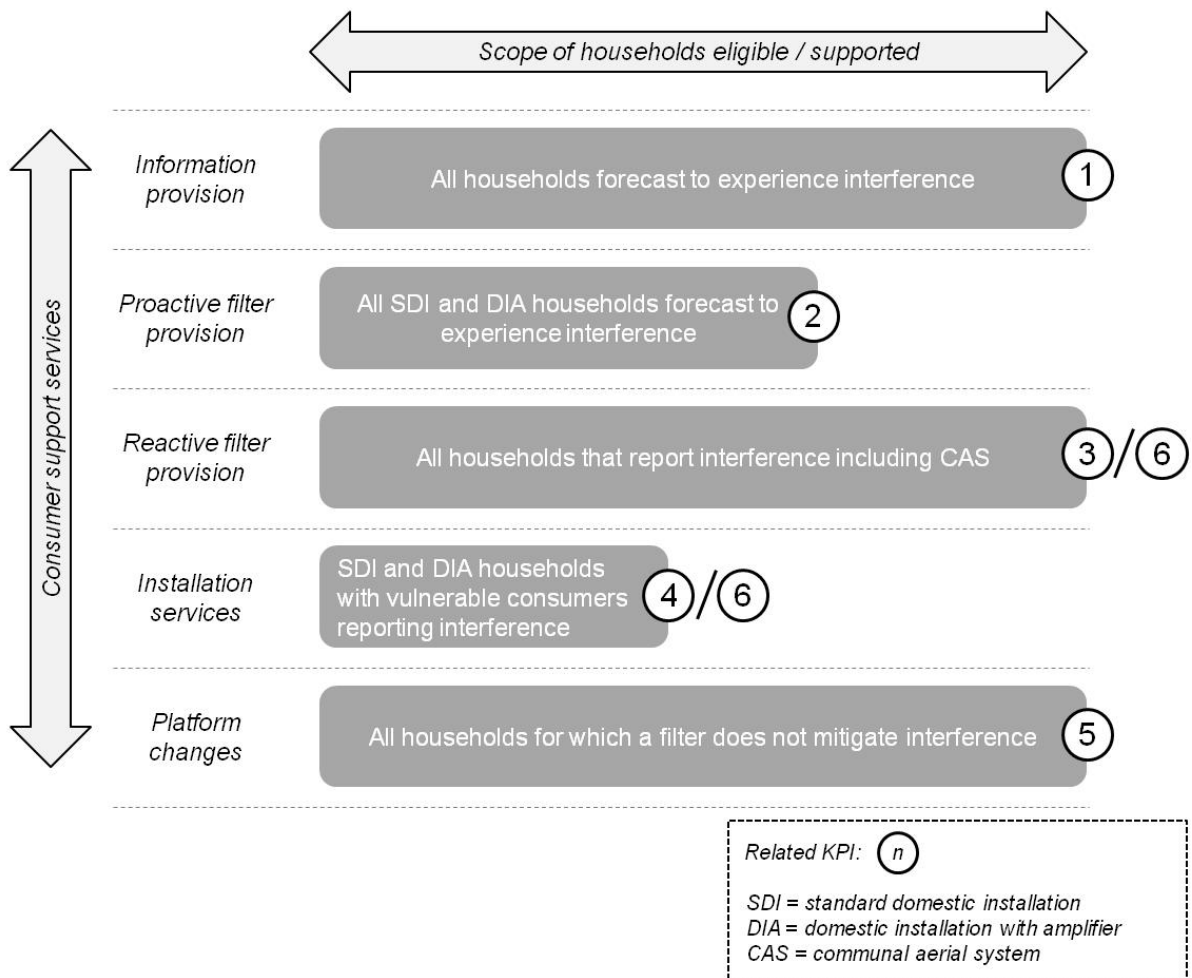
A6.148 The KPIs we proposed were designed in the context of Government decisions on consumer support. Government decisions focused on the specific services that MitCo would need to deliver to consumers rather than on more general outcomes.

A6.149 As noted previously in discussing the remit of the OB, the OB will not formally approve or accredit MitCo’s services. In addition, it is important that certainty is provided for licensees in advance of the licence award as to what they will be expected to achieve. The OB will therefore not be expected to approve a final version of the KPIs.

A6.150 We would note that including a KPI on DTT coverage would extend the scope of MitCo’s work beyond that set for it by Government decisions. As such, we have not added a KPI on DTT coverage.

A6.151 Figure 3 below illustrates and clarifies how the KPI framework relates to the services MitCo will be required to deliver.

Figure 3: Services MitCo will provide and related KPIs



A6.152 Vodafone suggested adding a KPI that covered the accuracy of the interference forecasting, recognising this as a key capability for MitCo. We agree that the ability to accurately predict levels of interference to DTT receivers will be critical for MitCo. We consider that interference forecasting is best addressed in a separate licence

condition rather than in a KPI and discuss this later in paragraphs A6.253 to A6.266.

Detailed comments on KPIs

A6.153 We received detailed responses to the consultation in relation to the individual KPIs. The following section discusses each KPI individually, comments received and revisions to some areas of detail.

A6.154 In addition, we have made a number of drafting changes to the KPIs presented in the February 2012 consultation. Some of these have been simply to make the KPIs clearer. In other cases, we have sought to provide certainty as to the meaning of KPI standards and how they apply to households. For example, reporting timeframes have been standardised, where relevant, into the use of ‘calendar months’, ‘weeks’ and ‘working days’. Where percentages are used with respect to the proportion of households served under a KPI standard, we have noted for clarification that these should be rounded up to the nearest household.

A6.155 A general provision has now been added in KPI reporting requirements requiring licensees, through MitCo, to report on whether they consider that KPIs have been met or not, in addition to providing the reporting evidence that supports their considerations. This requirement is intended to aid the performance monitoring carried out by the Oversight Board.

A6.156 Vodafone requested greater clarity over the terminology used in KPIs. Among others, this referred to the term ‘sent’ in relation to the provision of filters and information. In the February 2012 consultation, we intended that timeframes for the provision of items should include the time taken for items to be delivered to consumers and not simply the time taken for MitCo to despatch items. We have therefore used the term ‘delivered’ in this statement and provided an explanatory definition at paragraph A6.305. It is expected that MitCo will provide reasonable evidence that it has been able to deliver items to the standards set in the KPIs. For example, this might include information from the postal agent used by licensees relating to the proportion of completed deliveries within the prescribed delivery timescales.

Table 3: Summary of KPIs and their objectives

KPI	Service objective
1. Information provision	Affected households supplied with sufficient information in good time before interference occurs to enable them to make appropriate mitigation decisions
2. Proactive filter provision	A proportion of households forecast to be affected by DTT interference receive a filter to mitigate interference before it occurs
3. Reactive filter provision	Households experiencing interference receive a filter in a timely manner
4. Installation support to vulnerable consumers	Households with eligible vulnerable consumers, who are unable to self-install filters receive installation support in a timely manner with minimal disruption

5. Platform change supply	Households where filters are ineffective receive a platform change in a timely manner
6. Consumer complaints	MitCo seeks to minimise the occurrence of consumer complaints and responds promptly to issues

KPI 1: Information Provision

- A6.157 The purpose of this KPI is to ensure that households affected by DTT interference are supplied with information in good time before interference occurs.
- A6.158 Freeview and Digital UK commented on the need for further information to be provided closer to the time of base station activation than the one month point defined in the KPI. In addition, various respondents including RNIB and Broadcasters, commented on the characteristics of the information provided by MitCo, particularly to vulnerable people, suggesting a more prescriptive approach on how MitCo should undertake this activity.
- A6.159 The intention of this KPI is to ensure that households forecast to be affected by interference receive adequate notice of the issue, the necessary information on the support they will receive and any preparations they may need to take. Whilst this KPI focuses on ensuring this initial information gives adequate notice of possible interference to potentially affected households, we expect that MitCo will provide additional information or reminders, through the channel it deems most appropriate, closer to the point of base station activation, e.g. its website and alongside proactive filter provision.
- A6.160 It will be the responsibility of MitCo to design an information campaign which appropriately takes into account the needs of consumers, including vulnerable consumers. As noted previously, we would expect the MoU between MitCo and the OB to set out an agreed position on how the OB will contribute to the design of this information. This will be a key activity for MitCo, not only for the purposes of KPI 1, but for the whole KPI framework which will rely on timely and well-targeted information provision.
- A6.161 Intellect noted that the 99.9% target set for this KPI exceeded the likely accuracy of any address databases used as part of the interference model. We would stress that this KPI focuses on the population defined by MitCo's interference model and excludes any potential inaccuracy in the address database. We also consider that such a high standard is important because informing consumers is a vital first step in MitCo's delivery; if information is not received, consumers will be unaware of support available to them if they suffer interference. We believe therefore that this performance level and threshold is both appropriate and achievable.

KPI 2: Proactive Filter Provision

- A6.162 The purpose of this KPI is to ensure a high proportion of households receive filters before experiencing any interference to their DTT reception. Arqiva, the Broadcasters and Digital UK suggested that MitCo should be required to provide filters proactively to a 100% of households forecast to experience interference.
- A6.163 Our February 2012 consultation proposed a 90% level of proactive provision. This reflects an objective to balance the need for MitCo to act early and pre-emptively

supply filters before interference occurs versus limiting the risk of wastage and thus poor value for money.

- A6.164 If interference forecasts were accurate to the level of individual households, it would be reasonable to require that 100% of affected households received filters proactively. However, in practice, this level of forecasting accuracy is very unlikely to be possible. The UK Planning Model (UKPM), which is used by broadcasters in planning the DTT network and the output of which is likely to be a key input to the interference forecast model, produces outputs at a granularity of 100m by 100m. The UKPM represents the best available data and no other model is likely to be able to provide a higher level of local granularity. This means that even if, for example, a 100m square contains 20 households of which only one household is predicted to be affected, the only way to ensure that the potentially affected household receives a filter in advance would be to send a filter to all 20 households within the square. This would equate to wasting 19 filters. There therefore needs to be a balance between the benefit to consumers of proactive provision and the potential costs incurred in sending unnecessary filters. We continue to believe that this balance is best achieved by setting a target of 90% of households to receive a filter proactively.
- A6.165 With regards to how the proactive KPI is specified, the February 2012 consultation set out two approaches to measuring performance against this objective:
1. Setting the activities MitCo should undertake to produce the desired outcome in terms of the proportion of households affected by DTT interference receiving filters proactively; or
 2. Setting the outcome as the absence of reactive filter requests, thus allowing MitCo discretion in how it acts proactively to meet its service standards.
- A6.166 The preferred approach in the consultation was to adopt the second option and to establish a KPI that provided MitCo with greater flexibility in how it delivered proactive mitigation. The Broadcasters suggested that the approach outlined in the first point was preferable, whereas a number of other respondents, including BT, Definitive Direction and one confidential respondent, preferred the second approach.
- A6.167 We have decided to retain the second of the two approaches set out above, because it allows MitCo to explore innovative methods of delivering filters to households ahead of them experiencing interference, e.g. through retail networks, outreach activities and local amenities. We believe this approach avoids restricting the method of proactive support provided by MitCo and so allows for effective and efficient methods to be explored. This is the case because MitCo is judged to be sufficiently proactive in its approach if the proportion of reactive requests it gets is strictly limited - in this case "no more than 10% of households forecast to experience interference".
- A6.168 The joint response from Broadcasters raised a concern that consumers may under-report interference. We believe this risk is minimised through the requirement (under KPI 1) that MitCo must provide information to a very high proportion of households predicted to be affected by interference, clearly setting out MitCo's responsibilities in relation to providing support. Indeed this is one of the reasons why we have set such a high standard for KPI 1.

A6.169 As discussed earlier, we would note that we have amended the wording of the Standard in KPI 2 to clarify that it does not cover communal households.

KPI 3: Reactive Filter Provision

A6.170 The purpose of this KPI is to ensure that households experiencing interference receive filters in a timely manner.

A6.171 Three commented that the standard set for this KPI was too demanding in terms of the proportion of households served given likely service provider delivery timelines.

A6.172 The proposed KPI set out in the February 2012 consultation was based upon analysis of a representative delivery organisation's average delivery success rates. We acknowledge that the proposed thresholds in terms of the proportion of households served allowed for limited variability in delivery success rates from these averages.

A6.173 In view of this, we have decided to reduce the performance threshold for this KPI, in terms of the proportion of households served, to a level commensurate with the worst quarter of performance out of the last five quarters for the Royal Mail benchmark used⁴⁴³. Additional time (ranging from one to two days) has also been added to each limit to compensate for the time taken for dispatch. If it is shown that these delivery times are either too demanding or insufficiently demanding after MitCo begins to deliver its services, the Oversight Board can recommend to Ofcom changes to the standards to better align with stakeholders' expectations about what MitCo can and should reasonably achieve.

KPI 4: Installation Support to Vulnerable Consumers

A6.174 The aim of this KPI is to ensure that MitCo provides eligible households who are unable to self-install filters with installation support, in a timely manner and with minimal disruption.

A6.175 Three and Vodafone commented that the target set, of 99.9% of installations for eligible vulnerable households completed within 8 working days, was too demanding. Vodafone argued that it was likely that greater than 0.1% of vulnerable households may not want or be able to make an appointment within 8 days. In contrast, the Communications Consumer Panel suggested that the resolution time for vulnerable people should be shorter than proposed.

A6.176 In response to respondents' comments, we are introducing a tiered approach to the KPI where Licensees, through MitCo, must ensure that, where it is arranging the installation of filters for vulnerable consumers:

- 50% of such installations, within the relevant reporting region, are completed within eight working days; and
- 99% of such installations, within the relevant reporting region, are completed within twelve working days.

A6.177 This reflects our analysis of the sales to activation time for field force businesses, placing the 50% target at a level approximately equal to the average time of the

⁴⁴³ These figures are publically available from <http://www.royalmailgroup.com/how-were-performing/quality-service-reports>.

median performer, which is eight working days. We believe that placing any stricter requirement on MitCo, as suggested by some respondents, would be inappropriate given the difficulty of achieving this level of service against the consequence of failure, i.e. the Operational Condition. We have set the minimum standard, i.e. 99%, of households eligible for the service, at twelve working days, which is beyond that of the worst performers examined at approximately ten working days. We consider that this KPI is demanding but achievable for MitCo.

KPI 5: Platform Change Provision

A6.178 The objective of this KPI is to ensure that where a filter is ineffective in mitigating interference, MitCo considers the case for platform changes and provides such installations in a timely manner.

A6.179 There are two stages required in completing a platform change:

- *Diagnosis* – assessing whether a platform change is required or other alternatives available to MitCo should be pursued, most likely through a triage process with the consumer and MitCo’s contact centre or online function; and
- *Delivery* – MitCo, having acknowledged the requirement for a platform change, agreeing a time with the consumer and completing a platform change, subject to an on-site confirmation that it is, indeed, necessary.

A6.180 The proposed KPI detailed in the February 2012 consultation focused on the length of the “delivery” phase only, with the associated target time being eight working days. This was because we considered that MitCo should have the flexibility to assess various approaches under the “diagnosis” phase, including possible network mitigation measures in discussion with licensees, before confirming a requirement for platform change. Given this, a clear timeframe for such “diagnosis” would be challenging to define in all circumstances and this phase was therefore not brought within scope of the KPI presented in the consultation.

A6.181 DUK and CCP commented that the time taken to confirm a platform change requirement, i.e. the “diagnosis” phase, should be defined and included within the scope of the KPI in order to provide a minimum standard of service for the consumer from the moment they report that their filter is ineffective in mitigating interference.

A6.182 Having reviewed comments and having considered the high likelihood that licensees would have explored opportunities for network mitigation ahead of base station activation, we consider that this KPI can and should drive MitCo towards the rapid completion of both phases outlined above. Therefore, we have extended the scope of the KPI to cover “diagnosis” and “delivery” and, consequently, extended the overall timeframe for the KPI.

A6.183 With regard to the appropriate length of time for the “diagnosis” phase, we expect that this would involve a triage process (either online or over the telephone) that sought to establish a genuine request from a consumer. This triage process would, among other things, check that the filter had been fitted correctly, the type of interference experienced, and the consumer’s channel area and proximity to a base station based on their address. In view of the complexity of the issue, we consider that it would be appropriate to allow MitCo three working days within which to action this diagnosis phase, although it can (and should where possible) choose to

complete this phase more quickly. This would provide the opportunity to check that the interference is more than just a one-off occurrence.

- A6.184 After the “diagnosis” phase, MitCo would make a decision regarding whether it needs to provide a platform change or whether alternative courses of action are necessary to restore the consumer’s DTT services. This would trigger the start of the “delivery” phase.
- A6.185 Intellect, Telefónica, Three and Vodafone expressed concerns that the proposed target for completing a platform change in this phase was too demanding, with third party suppliers unlikely to provide the service within the eight working day time limit that had been set in the February consultation.
- A6.186 Having considered respondents’ view, the timeline for the “delivery” phase will be extended in line with the supporting analysis for KPI 4 (presented above) to twelve working days.
- A6.187 Therefore, combining the times for both phases, we consider that there should be an overall time period of fifteen working days for MitCo to complete a platform change from the date the household reports that its filter does not work. Licensees would be tied to the end-to-end timeframe of fifteen working days, rather than two separate times for each of the “diagnosis” and “delivery” phases. This is to ensure that MitCo has sufficient flexibility in the approach it adopts to deliver a platform change, but equally ensures that it delivers it within a timeline commensurate with other similar industries.
- A6.188 DTG raised the issue that an on-site inspection should be required in order to make accurate decisions on platform changes. We expect that MitCo could arrange for such checks to be carried out during the “delivery” phase. MitCo should have good incentives to do this to guard against false claims and to ensure it remains within any platform change cap.
- A6.189 In addition, two stakeholders (Intellect and Vodafone) commented that the 99.9% target was statistically impossible in situations where there were fewer than 1,000 platform changes a month in a reporting region. To reflect this, we have reduced the target to 99% (as for all KPIs, except KPI 1) and specified that for the purpose of interpreting the KPI threshold, the number of households should be rounded up to the nearest household.

KPI 6: Consumer Complaints

- A6.190 Through this KPI, we aim to ensure that MitCo minimises the occurrence of consumer complaints relating to specific areas of service delivery and responds promptly to issues where it fails or risks failing its KPIs.
- A6.191 The purpose of KPI 6 is to ensure that MitCo operates with sufficient diligence when delivering filters and providing installations in line with the timeframes specified in KPIs 3 and 4 and that there is a second source of information directly from consumers in addition to that from distribution logs and installation records that MitCo is performing as expected. In principle, this KPI should not be breached if KPIs 3 and 4 relating to reactive filter provision and installation support respectively are met.
- A6.192 In the February 2012 consultation, we proposed that licensees report on their performance against this KPI by base station every two weeks for an indefinite

period. Telefónica and Vodafone raised concerns about the burden of compliance and reporting. We consider that these concerns are reasonable. To reduce the reporting and compliance burden on licensees, we have changed the requirement to a four week reporting cycle over a total compliance period of twelve weeks. If after twelve weeks the KPI has not been breached, no further reporting is required for that base station. We consider that this change does not reduce the effectiveness of the KPI given that twelve weeks of compliance and reporting represents a significant period of time after base station activation and sufficient time in which to receive and address consumer requests. Moreover, we would expect MitCo and licensees to monitor internally their performance against this KPI (and all others) on a more frequent basis to predict and correct potential future under-performance before it emerges in its KPI reporting to the Oversight Board.

- A6.193 In response to concerns raised by Vodafone, Everything Everywhere and DUK over definition, we have clarified (under the detail of the KPIs and related terminology – see paragraph A6.305) the meaning of “complaint” for the purpose of interpreting this KPI. This is narrowly defined to ensure licensees are not held accountable against a vague requirement. A “complaint” under this KPI means that a consumer has not received the service (receipt of a filter or installation support) within the timeframes specified by the KPI. It does not relate to the general quality of the service provided – this will be managed through MitCo’s compliance with its complaints handling procedures established by MitCo after consultation with the Oversight Board.
- A6.194 Three and Vodafone expressed concern that the KPI performance target could be breached as a result of a large number of consumers trying to ‘game’ the system as part of a mass campaign. We have sought to address this concern by ensuring the definition of “complaint” under the KPI is clearly defined and relates to a consumer eligible for a specific service from MitCo (e.g. filter or installation) having been promised a service but not in fact receiving it in the specified timeframes. In addition, we expect that MitCo could use the evidence it gathers in relation to reporting on KPIs 3 and 4 to help identify ‘false’ complaints and to present this information to the OB.
- A6.195 DTG, Freeview and CCP raised concerns that there may be a tendency for consumers to “under-report” on issues and possible complaints they may have. CCP and Digital UK also thought that complaints relating to call centre performance and the speed of enquiry response should be considered.
- A6.196 We respond to these comments and discuss MitCo’s general complaints handling procedure later in this annex in paragraphs A6.267 to A6.277.

KPI change process

- A6.197 In the February 2012 consultation, we proposed that it would be necessary for Ofcom or Government to retain the right to modify the KPIs placed on MitCo. Principally, this was to enable Ofcom to adjust targets so as to reflect changes in performance requirements and the consumer environment over the life of MitCo’s operations. The proposed degrees of freedom in the KPIs were limited to changing the performance target; relaxation of that target and not tightening of it; and any modifications to take place no more than once every 6 months.
- A6.198 The Broadcasters and Arqiva argued that the process for altering KPIs must allow for KPIs to be strengthened as well as relaxed, with flexibility in the process to deal with real world experiences.

A6.199 Whilst we agree with the principle of adjusting performance targets over time to reflect better information, this needs to be balanced with a need to provide certainty to the 800 MHz licensees and MitCo, in terms of the capabilities and resilience they will need to deliver performance outputs. Fundamentally altering the structure of the performance framework may make the measurement of MitCo’s performance problematic and could place a significant administrative burden on MitCo, in terms of evidence and reporting requirements.

A6.200 Based upon respondents’ comments, we have reassessed the mechanism for modifying KPIs to allow for modification within a set of defined limits.

A6.201 We consider that it should be possible for MitCo or the OB, or members of the OB, to propose changes to KPIs and/or Operational Conditions. Modification proposals in respect of the KPIs will generally be limited to:

- Changes to threshold values either upwards or downwards, e.g. changes to timeframes for service delivery or the proportion of the population served by the KPI; and
- Changes will be limited to the ranges specified in Table 4 below under simple majority voting by the Oversight Board. For the avoidance of doubt the ranges specified represent the maximum total change possible for the KPI and not the maximum change possible at each review.

A6.202 When changes to KPIs of the type described above are proposed by MitCo, sufficient evidence will need to be provided to the OB in order for it to be able to consider the proposal and, as appropriate, make an informed recommendation to Ofcom on KPI or Operational Condition modification. The OB would make a recommendation on the basis of a simple majority in favour of its voting (non-observer) members.

A6.203 Ofcom will be responsible for making any decisions to modify any of the KPIs, subject first to any procedural requirements being met.

Table 4: Limits to proposed changes in KPIs based on majority voting by the Oversight Board

KPI	Parameters	Value	Range limit for changes
KPI 1: Information provision	Radial distance from base station	2 km	+/- 0.5 km
	% of forecast households served	99.9%	+/- 10 percentage points
	Timeframe ahead of base station activation	4 weeks	+/- 1 week
	Reporting cycle to base station activation	Every 2 weeks	+/- 2 weeks
	Time period for reporting before base station activation	For 12 weeks	+/- 3 weeks
KPI 2: Proactive filter	Radial distance from	1.5 km	+/- 0.25 km

provision	base station		
	% of forecast households served	10%	+/- 10 percentage points
	Timeframe after base station activation	4 weeks	+/- 1 week
KPI 3: Reactive filter provision	% of households served	Various: 86%, 94% and 99%	+/- 10 percentage points
	Timeframes for service delivery	Various: 3 working days; 4 working days; and 6 working days	+/- 2 working days
	Reporting and compliance cycle	Every calendar month	+/- calendar month
KPI 4: Installation support to vulnerable consumers	% of households served	Various: 50%; 99%	+/- 10 percentage points
	Timeframes for service delivery	Various: 8 working days; 12 working days	+/- 5 working days
	Reporting and compliance cycle	Every calendar month	+/- calendar month
KPI 5: Platform change	% of households served	99%	+/- 10 percentage points
	Timeframes for service delivery	15 working days	+/- 5 working days
KPI 6: Consumer complaints	% of households requesting a service	5%	+/- 5 percentage points
	Timeframes for service delivery	Various: 6 working days; 12 working days	+/- 5 working days
	Reporting and compliance cycle	Every 4 weeks	+/- 1 week
	Time period for reporting and compliance	For 12 weeks	+/- 3 weeks

Reporting and compliance by base station area for KPIs 1, 2 and 6

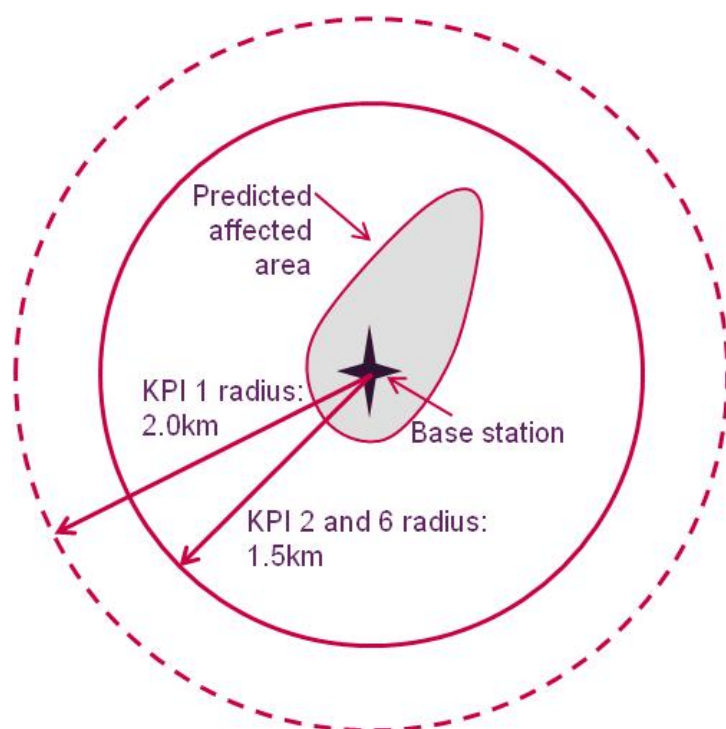
A6.204 In the February 2012 consultation, we proposed that MitCo should be required to report on its performance against KPI 1 for a 2km radius around each base station and against KPIs 2 and 6 for a 1.5km radius around each base station. Our proposals also required compliance with KPIs 1, 2 and 6 to be measured against their respective reporting radii.

A6.205 Intellect stated that the rationale for the specified radius around a base station within which information must be provided appeared arbitrary. As set out in the consultation, the 2km radius around a base station for KPI 1 is based on analysis of Ofcom interference modelling that indicates that more than 99.9% of households that are predicted to experience interference will be within this radial distance from base stations. For the purposes of information provision (KPI 1), we believe that this

radius is appropriate to ensure that virtually all potentially impacted households are informed. (For KPIs 2 and 6, we have used a slightly smaller 1.5km radius. Our modelling indicates that 99.8% of potentially affected households will be within this radial distance.)

- A6.206 In line with Government decisions, MitCo must provide consumer information and proactive filters to households forecast to be affected by interference in advance of base stations being activated. In order to ensure that consumers receive these services within a consistent timeframe, the starting time for the measurement of the KPI needs to be anchored to the activation date of the individual base station. For this reason, for KPIs involving a proactive service element (KPIs 1 and 2) and for the consumer complaint KPI (6), we think it is appropriate for MitCo to demonstrate that it has carried out these activities on a base station by base station basis.
- A6.207 We would expect MitCo to be able to compile performance data relating to specific base stations from a combination of its own interference forecasts, postal distribution records and consumer contacts with MitCo. To report accurately on these KPIs, MitCo will need the ability to identify which base station area a given household falls within, most likely based on the postcode of that household. We would note that many households are likely to sit within more than one reporting area – these households would count towards the measurement of all reporting areas within which they sit.
- A6.208 The requirement to report on KPIs 1, 2 and 6 for each base station is likely to generate a considerable volume of data. However, the KPIs have been formulated so as to avoid placing an 'open-ended' reporting requirement on Licensees. The reporting requirement for KPI 1 will be discharged once the base station has been activated and the KPI can be shown to have been met. Similarly, the requirements for KPIs 2 and 6 are limited to one and three months from base station activation date respectively, after which further reporting is not required.
- A6.209 The figure below shows the reporting and compliance radii for KPIs 1, 2 and 6. As illustrated, for most base stations, the predicted affected area will be within the 1.5km radius.

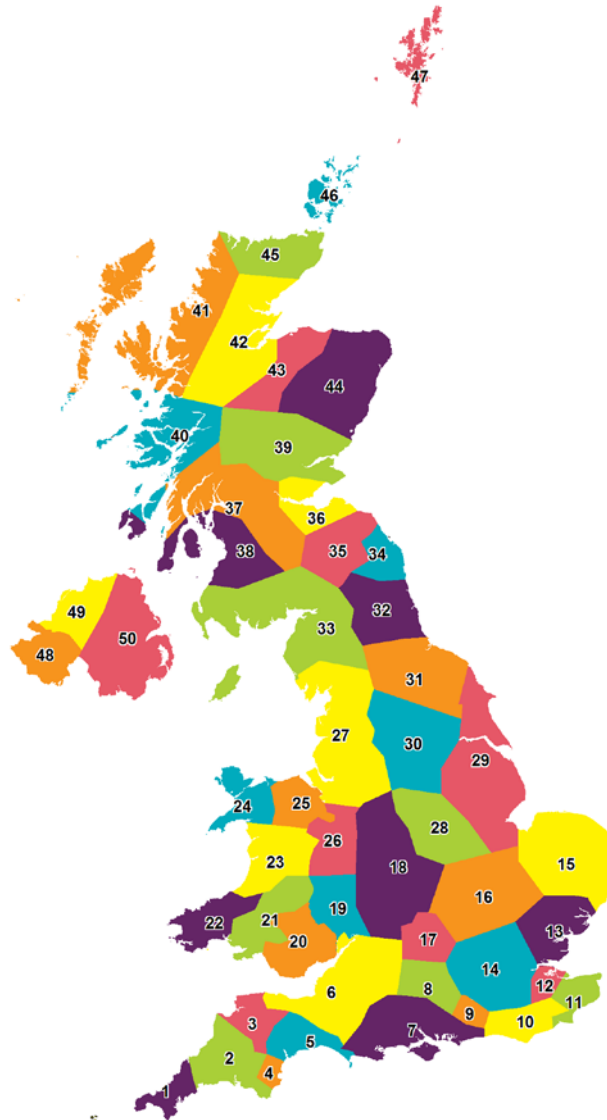
Figure 4: Reporting and compliance radii for KPIs 1, 2 and 6



Reporting and compliance by region for KPIs 3, 4 and 5

- A6.210 The February 2012 consultation proposed that MitCo would be required to report on its performance against KPIs 3, 4 and 5 in geographical areas defined by Ofcom. Compliance with KPIs would also be measured against these areas. We proposed that, where it failed to comply with KPIs, 3, 4 and 5, a 'test condition' Operational Condition would apply to the future rollout of base stations in the relevant area.
- A6.211 We did not receive any specific comments on this proposal and we have maintained this approach in this Statement. The regions against which MitCo will report will be aligned with main DTT transmitter areas as indicated in Figure 5 below. The areas shown in this map are indicative and Ofcom will produce the final map, which will define the reporting regions down to postcode level, in due course. We will seek to align these areas with DTT coverage areas, though inevitably the process of defining areas will have to take account of instances in which boundaries between coverage areas are not clearly delineated.

Figure 5: DTT transmitter areas for KPI reporting and the application of the ‘test condition’ Operational Condition



Ref	DTT transmitter area
1	Redruth
2	Caradon Hill
3	Huntshaw Cross
4	Beacon Hill
5	Stockland Hill
6	Mendip
7	Rowridge
8	Hannington
9	Midhurst
10	Heathfield
11	Dover
12	Bluebell Hill
13	Sudbury
14	Crystal Palace
15	Tacolneston
16	Sandy Heath

17	Oxford
18	Sutton Coldfield
19	Ridge Hill
20	Wenvoe
21	Carmel
22	Preseli
23	Blaenplwyf
24	Llanddona
25	Moel y Parc
26	The Wrekin
27	Winter Hill
28	Waltham
29	Belmont
30	Emley Moor
31	Bilsdale
32	Pontop Pike
33	Caldbeck

34	Chatton
35	Selkirk
36	Craigkelly
37	Black Hill
38	Darvel
39	Angus
40	Torosay
41	Eitshal
42	Rosemarkie
43	Knockmore
44	Durris
45	Rumster Forest
46	Keelylang Hill
47	Bressay
48	Brougher Mountain
49	Limavady
50	Divis

Source: Ofcom

- A6.212 The primary reason for requiring reporting and compliance with these KPIs to take place regionally is to ensure that MitCo provides a consistent service across regions, in line with our second objective for coexistence (see Figure 1 in this Annex). If performance reporting were to be aggregated across the whole of the UK, instances where MitCo underperforms in particular areas could be concealed. It also
- A6.213 We consider that, in most cases, DTT transmitter areas are an appropriate size on which to base these reporting regions because they strike a balance between giving an accurate picture of MitCo's performance while limiting the reporting burden.
- A6.214 In addition, the effects of interference are likely to be broadly consistent within a given region. We expect that aligning regions with DTT channel areas will make it easier for MitCo to focus on regions where consumer support is likely to be in greater demand (some DTT transmitter areas may be more affected by interference than others due to the frequency in use), while enabling licensees to proceed more rapidly with network roll out in other areas.
- A6.215 However, some DTT transmitter areas have particularly high, or low, population density. For example, the Crystal Palace reporting area contains millions of households while other areas contain just hundreds of households. While we are confident that the KPIs are sufficiently robust to apply effectively across areas varying in population, we recognise that there are some regions where the extremes of size warrant an altered approach.
- A6.216 We therefore propose to split the largest areas into smaller, manageable sizes: Crystal Palace split into four areas; Sutton Coldfield split into two areas; and Winter Hill split into three areas.
- A6.217 The following sparsely populated DTT transmitter coverage areas will be combined for the purposes of assessing KPIs in order to provide larger household population numbers: Eitshal combined with Torosay; and Keelylang Hill combined with Bressay.
- A6.218 Elsewhere in this Statement, we address the process and scope for the modification of KPIs and OCs. In order to preserve the overall integrity of the KPI and OC framework and prevent the KPI reporting process becoming overly complex, we have decided that modifications to KPIs should not result in different KPI standards being applied in different regions. Any changes to KPI or OC parameters would need to apply to all regions.

Performance reporting and monitoring

- A6.219 As discussed above, MitCo will be required to demonstrate its performance against KPI targets through regular reporting to the OB. The February 2012 consultation envisaged that it would be appropriate for the details of this performance reporting process to be agreed in an MoU between MitCo and the OB.
- A6.220 We did not receive any responses to the consultation which suggested altering this approach. In the suggested MoU presented in Table 2, we have therefore included a provision for the process and precise content of MitCo's performance reporting to be agreed with the OB prior to the start of MitCo's operations

- A6.221 The aim of this agreement would be to define the practical aspects of how licensees will meet their obligations to report to the OB on MitCo's performance against KPI Standards, in line with the reporting requirements set out in the draft licence conditions.
- A6.222 In addition, the OB may arrange for audits of MitCo's actual performance based on access to MitCo databases and random sampling of consumer service activities.
- A6.223 The OB will report to Ofcom where MitCo exhibits persistent failure against its KPIs or there is evidence, through the audit process, that Licensees have not complied with the KPI and OC regime as a whole.

Operational conditions

- A6.224 The February 2012 consultation presented a set of Operational Conditions (OCs) that would apply in the event that MitCo fails to achieve the performance standard set in a KPI.
- A6.225 Each KPI has an associated OC which would automatically apply with respect to that particular KPI. The 800 MHz licensees will be jointly responsible for meeting KPIs via MitCo and, therefore, Operational Conditions attached to the KPIs will apply to each 800 MHz licensee equally and all licensees will be required to implement them.
- A6.226 Vodafone disagreed with our proposal that OCs should be imposed on all licensees for problems caused by one licensee's base station. Three also believed that an unscrupulous licensee could act in a way that caused KPIs (in particular, KPI 2) to be breached resulting in all licensees being subject to OCs.
- A6.227 We would note that, subject to the correct information being provided to MitCo, it will be MitCo that will have control over its day to day operation and whether or not it achieves KPI standards rather than licensees. Since licensees will be jointly responsible for MitCo, failure to meet a KPI standard is a collective failure on the part of licensees. Collective responsibility for MitCo's actions on the part of licensees is an important principle underpinning the KPI framework.
- A6.228 Whilst it could be possible for a licensee to cause a breach of a KPI by deliberately providing inaccurate information to MitCo, we consider that this would be likely to constitute a breach of the licence condition requiring the licensee to provide information to MitCo for the purposes of forecasting interference, and could result in enforcement action being taken against that licensee.
- A6.229 Vodafone also thought that, rather than OCs applying automatically, the OB should have a role in deciding whether or not they should apply. OCs have been designed to be highly responsive to situations in which performance failure takes place. Failure to meet KPIs could result in immediate or widespread loss of consumers' DTT reception, making it imperative that the conditions take effect quickly and incentivise a timely response to remedy the interference being suffered. It is for this reason that, should one (or more) of the KPIs not be met, licensees will be required automatically to act in accordance with the requirements specified in the relevant OC.
- A6.230 Vodafone also suggested that discretion should be allowed in the application of OCs relating to the failure of KPI 3 (in relation to reactive filter provision) where there is a *force majeure* event or exceptional circumstances that would justifiably

free MitCo of its obligations under the KPIs. We consider that the Oversight Board, which in turn advises Ofcom on licensees' performance against the licence conditions, provides an informed forum for considering the legitimacy of instances where a *force majeure* event may have arisen.

- A6.231 Vodafone thought that applying a testing phase in response to a breach of KPI 3 would be disproportionate to the level of performance failure. On the other hand, the Broadcasters and one confidential response thought that a 'testing phase' OC was not a robust response to the breach of KPIs. They commented that the base station(s) that causes the KPI standards to be missed should be subject to a power reduction rather than just applying a 'testing phase' OC to future base station activation. The CCP also noted that this OC does not acknowledge or seek to resolve the situation of those consumers who may still be suffering harm as a result of lost service/interference.
- A6.232 In response to Vodafone's first point, we have as noted previously relaxed some of the targets in KPIs in the light of stakeholder responses. We also note that it will be possible to amend KPI and OC thresholds in the light of real experience of MitCo operation.
- A6.233 We consider that the testing phase OC is a relatively stringent response to the breach of a KPI. For example, a failure to meet KPI 2 (in relation to proactive filters) for just one base station will result in a delay to the ability of licensees to roll-out base stations in a large geographical area, and this is likely to be costly for licensees. We therefore consider that the 'testing phase' OC is sufficiently onerous that licensees will be incentivised to avoid breaching the KPIs that can trigger this OC and thereby avoid negative impacts on consumers. At the same time, we consider that it is a proportionate response to the failure to meet KPI standards that should be well within MitCo's ability to achieve.
- A6.234 With respect to the transmission limit for the 'testing phase', Vodafone and Intellect noted that not all base stations will be capable of transmitting at 64dBm. We have amended the limit in the operational condition to "64dBm (or maximum transmitting power if less than 64dBm)", to reflect this comment.
- A6.235 In the February 2012 consultation, we said that the 'power reduction' operational condition under KPI 6 would continue until "such time as the Supervisory (now Oversight) Board is satisfied that the Licensee is able, for the time being, to meet the required Standard". On further reflection, we have decided against allowing this condition to be 'open-ended'. We have instead decided that the condition should apply for a defined period and have decided that three weeks is an appropriate length of time. We have done this as given the disruptive nature of a power reduction for a base station that has been operating for some time, we consider that the time period for a 'power reduction' operational condition on a currently active base station due to failure to comply with KPI 6 should be shorter than that used for the 'test conditions' operational condition (applied to future base station activations triggered by failures under KPIs 2, 3, 4 and 5). Furthermore, the provision for changes in the KPI thresholds will allow adjustment of this condition if it is found during rollout that the condition is too stringent or weak.

Operational conditions change process

- A6.236 We did not receive any views from respondents on the issue of modifications to OCs. However, having reviewed the overall KPI framework, we believe it is

appropriate to allow OCs to be modified within certain limits to ensure they remain appropriate and proportionate in light of MitCo’s real-world experience.

A6.237 In line with the modification procedure for KPIs, the modification of OCs will be limited to changes to threshold values either upwards or downwards, e.g. changes to timeframes over which OCs apply. The scope of changes will be limited to the ranges specified in Table 5 below.

A6.238 The governance and decision-making arrangements for modifying OCs will mirror those for KPIs, described at paragraph A6.197 to A6.203.

Table 5: Limits to changes in OCs based on majority voting by the Oversight Board

KPI	Parameters	Value	Range limit for change
Operational Condition in relation to ‘delayed base station switch-on’ applicable to OC 1	N/a	N/a	N/a
Operational Condition in relation to ‘test conditions’ applicable to OCs 2, 3, 4 and 5	Radial distance from Base Station	1.5 km	+/- 0.25 km
	% of households served	99%	+/- 10 percentage points
	Transmission power limit	64dBm (or maximum transmitting power if less than 64dBm)	+/- 3 dB
	‘Test condition’ duration	For 4 weeks	+/- two weeks
	Reporting during ‘test conditions’	Every 2 weeks	+/- two weeks
Operational Condition in relation to ‘power reduction’ applicable to OC 6	Transmission power reduction	6 dB	+/- 6 dB
	Timeframe of power reduction	3 weeks	+/- 1 week

Enforcement

A6.239 In the February 2012 consultation, we set out our proposals for how MitCo’s performance would be managed, including the KPIs it would be required to meet and the Operational Conditions that would apply to licensees if it does not do so. We noted that this framework would be underpinned by enforcement powers held by Ofcom under the Wireless Telegraphy Act 2006, which could enable it to vary or revoke 800 MHz licences.

A6.240 The Broadcasters commented that further clarity was needed on when Ofcom would be willing to exercise its enforcement powers. Our view is that Ofcom will consider carefully the use of its enforcement powers in the event of any breach of licence being committed. As we noted in the consultation (paragraph 7.181), this will include consideration of enforcement action if individual 800 MHz licensees fail

to comply with Operational Conditions, which they will be required to comply with under the terms of 800 MHz licences.

A6.241 Digital UK suggested that a strong “backstop” power was lacking from Ofcom’s proposals, and that MitCo would lack an incentive to meet its KPIs as a result. Our view is that the requirements placed on licensees through Operational Conditions place a direct incentive on them to ensure MitCo meets its KPIs. Ofcom will take failure to comply with the Operational Conditions (or any other conditions of the licences) very seriously, and will consider using its statutory enforcement powers as appropriate.

A ‘Code of Service’ for MitCo

A6.242 A number of respondents to the February 2012 consultation suggested that the KPI framework and the scope of the Oversight Board’s remit provided insufficient control over operational aspects of MitCo’s service and that MitCo’s performance in relation to other elements of service delivery needed to be managed.

A6.243 Digital UK suggested that these aspects of MitCo’s service should be formalised in a ‘Code of Service’, which would set out the overarching principles of how MitCo will provide viewer mitigation and the service level it is seeking to achieve. They said that the Code of Service should be MitCo’s ‘promise’ to DTT viewers.

A6.244 We agree that there is a clear benefit for consumers in MitCo setting a clear and public expectation of the way it will engage with consumers across its various elements of service delivery.

A6.245 We have therefore decided that the 800 MHz licensees will be required to produce a Code of Service which sets out MitCo’s service commitments to its consumers.

A6.246 Specifically, the licensees will be required to do the following in advance of commencing communications with consumers:

- jointly prepare and agree a Code of Service among themselves;
- ensure that MitCo consults with the OB on the Code of Service and takes due account of the OB’s advice and views on the content of the Code of Service;
- ensure that the Code of Service is published openly, for example in MitCo’s key communications and on its website.

A6.247 If the 800 MHz licensees have been unable to agree on a Code of Service within 6 weeks of the date of the 800 MHz licences being granted, they will be required to adopt a Code of Service notified to them by Ofcom. However, the licensees may make a request to Ofcom to extend this timescale if they unanimously agree to do so, and Ofcom will consider any such application and make a decision on extension as soon as practicable after any request is made.

A6.248 We expect that part of the preparatory work for MitCo will include the preparation of a draft Code of Service which licensees can use as the basis of the Code they adopt for MitCo. We expect that the draft Code would likely include the elements set out in Table 6 below. Good practice that may also be useful for MitCo to draw upon

in the area of television would include, for example, the BBC’s “The Switchover Help Scheme: Code of Service Standards Booklet”.⁴⁴⁴

Table 6: Suggested possible model ‘Code of Service’ elements for MitCo

Elements of service	Code of Service commitments
Branding	<ul style="list-style-type: none"> • All MitCo written communications in the form of posted information or that provided on the internet, will clearly present the brand logo of the MNOs responsible for MitCo’s services
Information and filter provision	<ul style="list-style-type: none"> • MitCo will offer various alternative ways of contacting it or of getting information, including online and through telephone support • MitCo’s information will be clear and easily interpreted with a focus on raising awareness of the problem including when it may occur for particular areas • MitCo will inform consumers of the services they are eligible to receive and how and when these will be provided • Where MitCo is not required or not able to provide a service to consumers e.g. interference to cable services, MitCo will ensure that consumers understand what alternative courses of action are available to them • MitCo will provide accurate and up-to-date information • MitCo will provide information that is accessible for vulnerable consumers (e.g. blind or partially sighted) and provide clear instructions for vulnerable consumers on how to receive additional support • MitCo will explore innovative ways of making filters available to consumers before consumers experience interference, possibly using other organisations with sufficient networks and infrastructure to reach consumers effectively. This will also include managing and mitigating interference that could be felt by large numbers of consumers in public institutions, e.g. hospitals and schools • MitCo will demonstrate it is providing a high quality service to consumers by commissioning independent consumer research in specific areas of its activity as necessary • For communal households, MitCo will seek to identify the person responsible for the management of the communal aerial system and provide information and, where appropriate, a filter, in advance of interference occurring.
Online portal	<ul style="list-style-type: none"> • MitCo’s online presence will provide information, advice and offer services in a clear manner, following good practice in industry and establishing accessibility standards
Contact centre	<ul style="list-style-type: none"> • MitCo will provide telephone customer contact centre support, following good practice in the customer contact industry and

⁴⁴⁴ <http://www.helpscheme.co.uk/files/helpscheme/downloads/english/COSSBK%20V1%2006-11.pdf>

	<p>establishing accessibility standards</p> <ul style="list-style-type: none"> • MitCo will establish and use a diagnostic tool to identify the different needs of customers either through its online portal or the contact centre or both • MitCo will make sure that it has sufficient trained personnel able to give consumers the help and advice they need in a timely manner • Where a consumer enquiry falls beyond the scope of the service MitCo can provide, it will ensure that such consumers are treated in a courteous manner and are directed to the most appropriate alternative service provider • MitCo will keep its services open during all advertised hours and will give a reasonable period of notice when they make changes to services or hours of contact centre availability • MitCo will aim to be as responsive to consumer needs as is practicable • MitCo will hold consumer personal information for no purpose other than providing mitigation to interference for DTT consumers • MitCo will hold consumer personal information in confidence and in accordance with the Data Protection Act
<p>Complaints</p>	<ul style="list-style-type: none"> • MitCo will ensure that consumer complaints are handled professionally and in a responsive, polite and attentive manner • MitCo will ensure that its written communications to consumers clearly set out how they can complain to MitCo and the options that are open to them if they are unhappy with MitCo's decisions • MitCo will give priority to rectifying problems that result from an error on the part of MitCo or a MitCo employee
<p>Installation services and bespoke mitigation</p>	<ul style="list-style-type: none"> • MitCo's installation services will be conducted to a standard of quality as seen in the field force industry • MitCo will pay due care and attention to the needs of customers, particularly vulnerable consumers in all interactions with them (e.g. blind or partially sighted) • MitCo will ensure its trained personnel have sufficient awareness of those issues important to vulnerable consumers • MitCo personnel will have clear identification material so that consumers know who they are • MitCo will explore methods of reaching out to vulnerable consumers, working with other organisations and exploring ways to ensure the service is fit-for-purpose and meets these particular consumers' needs • MitCo will ensure it can provide consumers with details of reputable aerial installers with whom a voucher towards the

	cost of installation services can be redeemed.
KPIs and other targets	<ul style="list-style-type: none"> • MitCo will publish its KPIs (and any other targets) and record a summary of its performance against KPIs on its website • MitCo will make clear the targets for its service standard that arise from its obligations under KPIs • MitCo may establish and openly communicate further targets it will meet for its service standards • MitCo will commission independent consumer research from time to time to demonstrate its services are being delivered to a quality expected by consumers

Additional performance management areas

A6.249 In our February 2012 consultation, we described several additional performance management areas which were not captured in KPIs but which we suggested should also be subject to accreditation by the Oversight Board.

A6.250 As discussed earlier in relation to the Oversight Board, the OB will not have a formal approval or accreditation role. Instead, some of these additional areas will be dealt with directly in licence conditions while others will be dealt with in the MoU between MitCo and the OB and/or in the Code of Service.

A6.251 In the table below, we list the additional performance management areas discussed in our February 2012 consultation and explain how these will be dealt with going forward. We have added one additional area to this table: complaint escalation.

Table 7: Additional performance management areas

MitCo activity	How managed
Filter technical standards	MoU (between MitCo and the OB)
Interference forecasting	Licence condition (see footnote 434)
Information materials / online platform	MoU and the Code of Service
Contact centre	MoU and the Code of Service
Bespoke mitigation	Licence condition
Reporting	Licence conditions and MoU (for detailed issues)
Complaint escalation	Licence condition

A6.252 We discuss interference forecasting and complaint escalation in more detail below.

Interference forecasting

- A6.253 MitCo will need to forecast the interference to DTT caused by LTE in the 800 MHz band.
- A6.254 Accurate forecasting is likely to be a key factor in enabling the efficient delivery of mitigation to consumers for three reasons:
- i) it underpins MitCo's performance against its KPIs and ensures that all, or the vast majority, of households likely to be affected receive information and filters in advance of experiencing interference;
 - ii) it will allow MitCo to plan its strategy for the delivery of mitigation services; and
 - iii) it should enable licensees to make informed trade-offs between the costs of consumer- and network-based mitigation.
- A6.255 The February 2012 consultation noted that, in order for interference forecasting to take place, MitCo would require a technical model capable of predicting interference. We suggested that it would be appropriate for this model to be procured by or provided to MitCo at the outset of its activities.
- A6.256 As MitCo's performance against KPIs will be based on this model, it is important that the model is as accurate as possible, is independently verified and that all parties use the same model. 800 MHz licensees will be required, via MitCo, to consult with the OB and agree with Ofcom the underlying algorithms and input parameters used in the model before the model is used for the purposes of interference modelling.
- A6.257 The 800 MHz licensees, via MitCo, will also be required to consult with the OB and obtain the agreement of Ofcom before making any amendments to the forecasting model which involve adjustments to the algorithms or input parameters used. They must also make arrangements so that the OB technical function can audit the model and make recommendations to Ofcom accordingly. This would include providing access to the software, input parameters and underlying algorithms used within the model as and when required.
- A6.258 The Broadcasters and Arqiva suggested that, to fulfil MitCo's requirements, it would be appropriate to use the same modelling tool used by Ofcom to produce the interference predictions presented in our technical reports of June 2011 and February 2012.
- A6.259 We agree that this model, or a similar model, is likely to be appropriate to MitCo's requirements, while noting that it will be for licensees, via MitCo, to take the final decision on procurement of such a model. We also recognise that it is important for a model to be ready within a reasonable timeframe following licence award so as not to delay any licensee's roll-out plans. We expect that the preparatory work for MitCo in advance of licence award will include discussion with potential suppliers of the model and potential licensees so that MitCo can finalise the procurement of the model as soon as possible following licence award.

Information for interference forecasting

A6.260 The consultation set out a range of parameters that we proposed would be needed to enable DTT interference to be forecast accurately. The parameters we identified were principally concerned with:

- Mobile and broadcast network parameters needed to produce interference forecasts using a modelling tool as described above;
- Demographic data required to determine accurately the profile of dwellings in areas forecast to be affected by interference; and
- UK household address data against which the geographical interference forecasts will be mapped for the purpose of establishing a set of address points to which information and proactive filters would be provided and, thus, acting as the baseline for KPIs 1 and 2.

A6.261 Several stakeholders commented on these parameters, including Three, Digital UK and the Confederation of Aerial Industries. Comments related to the mobile and broadcast network data parameters and consisted broadly of additional information which respondents suggested would be required in order for MitCo to forecast interference accurately.

A6.262 As discussed above, further preparatory work in relation to the model will be carried out in advance of the licence award and we do not consider it necessary to specify the final list of parameters at this stage. These will be finally agreed between licensees and Ofcom shortly following the licence award. However we expect that the parameters that will be used in the interference model will be broadly similar to those set out in Annex 5 of our February 2012 consultation.

A6.263 Vodafone suggested that households not holding a TV licence should not have the expectation of receiving any support to mitigate interference. We agree that MitCo should not be required to offer support to DTT households that are not in possession of a TV licence. However, unless MitCo is given access to data on TV licences, our view is that it should operate under a presumption that a household does hold a valid licence.

A6.264 Digital UK thought that it, or any successor DTT platform management company, should be given access to MitCo's analysis of households predicted to be affected by interference. One confidential respondent also noted the importance of having visibility of MitCo's interference forecasts.

A6.265 We agree that it will be important for other bodies involved in providing related services to consumers, e.g. Digital UK, the BBC's Radio and TV Interference Service etc, to know in advance the areas where MitCo will be communicating with consumers. We expect that MitCo will need to agree working arrangements with relevant bodies, e.g. to agree protocols for passing consumer queries to the most appropriate body, in order to provide a good service to consumers. Table 6 in this Annex, presented earlier, which sets out the suggested elements for a Code of Service, includes a suggested commitment for MitCo to ensure that consumers whose enquiry or request falls outwith the scope of MitCo's remit are directed to the most appropriate alternative service provider.

A6.266 Finally, Arqiva and one other respondent suggested that proactive research or "real world" feedback should be used to refine MitCo's interference modelling. We have set out above the means by which MitCo will be able to modify the interference model. In addition, we have noted that the Oversight Board will have a key role in

scrutinising the accuracy of MitCo's interference model. It will be within the scope of the OB's remit to conduct or commission proactive research to assist with this scrutiny if needed.

Consumer complaints

- A6.267 In this subsection we discuss the procedure for handling all consumer complaints, including those which fit the definition of complaints as defined under KPI 6.
- A6.268 The February 2012 consultation included proposals for how MitCo should manage complaints from consumers who are dissatisfied with the service they have received.
- A6.269 We proposed that MitCo should be given freedom to define an appropriate procedure for resolving complaints, but that this procedure should require approval by the Oversight Board before being formally adopted. We also suggested that MitCo must have concluded this process within six months of ownership transferring to the new licensees (if MitCo is established before the auction), or six months from the point the new licensees establish MitCo (if established after the auction).
- A6.270 The CCP suggested that, where complaints become "deadlocked" between MitCo and the consumer, these could be resolved through an existing Alternative Dispute Resolution scheme⁴⁴⁵. The Broadcasters and Digital UK suggested that the Oversight Board should provide the escalation path for these complaints.
- A6.271 Our view remains that MitCo should be given freedom to choose the most appropriate approach to handling complaints and resolving disputes. However, we think that it is essential that MitCo has a complaints procedure, including a complaints escalation process, in place before MitCo commences communications or interactions with consumers.
- A6.272 We have therefore included conditions in the draft licences in relation to managing complaints. The 800 MHz licensees will be required, via MitCo, to consult with, and take due account of the views of, the OB in relation to establishing a complaint-handling procedure, and put this procedure in place in advance of commencing communications with consumers.
- A6.273 The procedure will need to set out how MitCo will act to resolve the generality of complaints it receives. It will also need to set out how complaints which cannot be resolved to the consumer's satisfaction within a specified time period would be escalated to a separate body, e.g. an Alternative Dispute Resolution scheme.
- A6.274 The procedure will need to specify what actions MitCo would commit to take if the separate body found that MitCo had failed to respond to or deal with the consumer complaint in an appropriate manner. Licensees will further be required to make clear to consumers what options are available to them (for example, by publishing information on MitCo's website) to escalate complaints that have not been resolved satisfactorily.

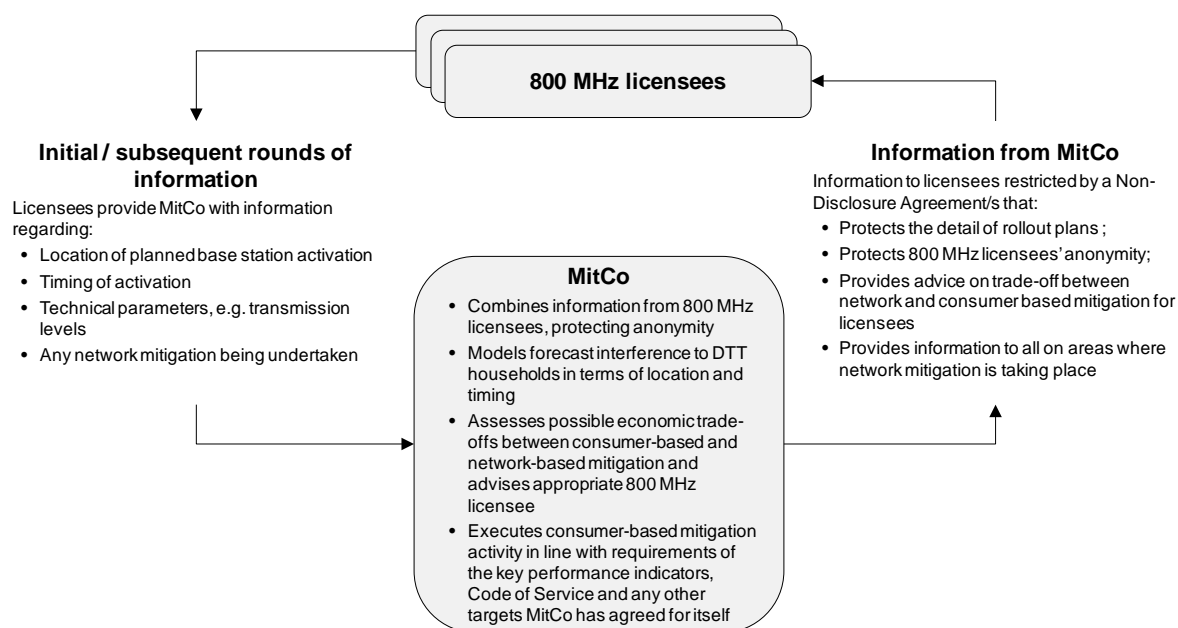
⁴⁴⁵ Two organisations, Ombudsman Services and CEDR (which runs the CISAS scheme), currently operate Alternative Dispute Resolution schemes for communications providers. Communications providers are required to implement and comply with one of these schemes under General Condition 14.5.

- A6.275 DTG, Freeview and CCP raised concerns that there may be a tendency for consumers to “under-report” on issues and possible complaints they may have. CCP and Digital UK also thought that complaints relating to call centre performance and the speed of enquiry response should be considered.
- A6.276 We accept that the tendency to under-report is a general problem with regards to consumer complaints but believe that it can be mitigated to some extent by the obligation on MitCo to provide an extensive proactive information campaign under KPI 1. It would also be mitigated by the obligation on MitCo, outlined above, to have a robust complaints procedure in place which has been subject to consultation with the OB and which makes it relatively easy for consumers to complain.
- A6.277 On call centre performance and response times, we believe licensees should have reasonable incentives to resolve complaints quickly and satisfactorily in order to reduce inefficiency. For example, long waiting times for consumers on hold with a telephone contact centre and repeat enquires would put pressure on contact centre resources and slow MitCo’s general delivery against other KPIs. We consider however that it would be appropriate for MitCo to make commitments to consumers in this regard. We have included some points on consumer complaints in Table 6, which sets out the suggested elements for MitCo’s Code of Service

Information sharing arrangements between MitCo and licensees

- A6.278 The obligation on 800 MHz licensees to deliver mitigation services jointly through MitCo using the process described above presents potential challenges around protecting individual licensees’ commercially sensitive information. Everything Everywhere expressed concern that working arrangements for handling this information were not defined clearly in the consultation. Telefonica suggested that existing network sharing arrangements between MNOs offer lessons for how MitCo should handle commercially sensitive information.
- A6.279 Figure 6 below describes what we consider will be the key information flows between MitCo and the licensees. This includes the mobile network data that will pass from licensees to MitCo and the advice on the location of sites where network mitigation is cost-efficient that MitCo will give to licensees.

Figure 6: Information-sharing between MitCo and 800 MHz licensees



A6.280 There are a number of potential risks that may occur as a result of information moving between MitCo and 800 MHz licensees, if the sharing of this information is not appropriately defined and limited. Primarily, these are:

- the risk of coordinated actions between licensees that undermines competition; and/or
- the risk of unilateral action by a particular licensee that gain information regarding the strategies and plans of other licensees.

A6.281 We note licensees will be subject to Competition Act prohibitions regarding anti-competitive behaviour, including illegal information exchange. To mitigate the risks noted above, we expect that licensees will need to seek to limit information exchange between licensees and MitCo to that needed to achieve MitCo's functions. However, it will be for licensees to ensure that they act lawfully and to decide how to do so.

Closure arrangements for MitCo

Timing and features of closure

A6.282 In this sub-section, we set out our conclusions relating to the closure of MitCo. The consultation described our proposed approach to:

- Closing down MitCo;
- Dealing with interference after MitCo closes.

A6.283 We expand on each of these areas below.

Timing of closure

- A6.284 As set out in paragraph A6.9, Government has revised its decision on the timing of MitCo's closure. Government has decided that MitCo should continue to operate for one year after either the date for meeting the coverage obligation, or network rollout completes, whichever is earlier. This decision overrides the previously proposed back-stop date of 2017.
- A6.285 In practice, this means that 800 MHz licensees will be required to operate MitCo until the earlier of the following two dates:
- the end of 2018 (which is one year after the coverage obligation target date), or;
 - 12 months after all licensees have completed network roll-out.
- A6.286 This is based on an expectation that licensees will in any event have completed network roll-out in the 800 MHz band before the end of 2018.
- A6.287 If the latter of the two bullets above applies, licensees would all need to be able to demonstrate to the OB that their network roll-out was complete. The final decision on whether MitCo could cease operation would rest with Ofcom.
- A6.288 Licensees would also be able to make a request to the OB that MitCo should close earlier if they can make a clear case for doing so. This request would have to have the unanimous support of licensees, with the final decision resting with Ofcom.
- A6.289 In our February 2012 consultation, we suggested that any request to close MitCo early would need to be made unanimously by licensees. Telefonica suggested that this proposal should be amended to allow MitCo to close after a specified threshold of activity has been passed. They suggested that our proposed approach, requiring joint action between licensees, could have implications for compliance with competition rules.
- A6.290 We consider that licensees could choose to request MitCo to set an activity threshold if they wished, with a closure request to the OB being made once this threshold is reached. However, the principle that licensees need to be unanimously in support of MitCo closing still applies, and the final decision would remain with Ofcom. In any case, licensees will be able to extend their networks further even after they have made a closure request subject to a requirement not to cause undue interference (discussed further in paragraphs A6.296 to A6.301).
- A6.291 Everything Everywhere, Arqiva and Intellect suggested that licensees should be able to continue with MitCo if they wished to do so. In Government's letter to Ofcom, published on 10 July 2012, Government said that "we should start on the premise that MitCo should exist for one year after either meeting the coverage obligation, or network roll-out completes, whichever is earlier. However, this is something I would expect the Oversight Board to keep under review". We note that this wording provides some flexibility for a different approach, e.g. if real experience of MitCo indicates that this would be beneficial and licensees wish to continue MitCo operation for a longer period.

Features of closure

- A6.292 The consultation set out a number of events we expect to be involved in closing down MitCo:

- Operation of the gain share mechanism;
- Government may independently audit MitCo;
- Oversight Board disbanded;
- Licensees' ownership of MitCo ceases;
- Ownership of certain elements of MitCo's Intellectual Property (IP) rights reverts to Government.

A6.293 Government has now decided that all of any underspend should be returned to the licensees, and an independent Government audit is no longer required.

A6.294 In addition, Government does not intend to hold any share in MitCo and has not expressed an interest in obtaining MitCo's IP rights. Rather, the owners of MitCo will be free to reach agreement among themselves as to how these rights should be dealt with at the cessation of MitCo's activities.

A6.295 Our position on the other features of closure listed above remains unchanged from that set out in the February 2012 consultation, i.e. we still expect the following events to occur at MitCo closedown:

- Operation of the gain share mechanism;
- Oversight Board disbanded;
- Licensees' ownership of MitCo ceases.

Dealing with interference after MitCo closes

A6.296 The February 2012 consultation noted that, although we expect the vast majority of occurrences of interference to be mitigated during MitCo's lifetime, interference may still occur after MitCo closes. This could arise from, for example, new base stations being built or power levels being increased at existing base stations. We proposed various requirements that could be placed on licensees to take account of this potential for further interference.

A6.297 Vodafone, Three, BT and Definitive Direction supported our proposed requirements. Several respondents, including Freeview, Arqiva, the Communications Consumer Panel and the Confederation of Aerial Industries, stated that the proposals would offer insufficient protection to DTT viewers. Everything Everywhere said that standard licence terms would be sufficient to protect viewers, providing they mirrored those in existing 2G and 3G licences.

A6.298 Having reviewed our proposals in light of these responses, we have concluded that the approach set out in our February 2012 consultation was overly prescriptive and likely to place an unnecessary administrative burden on licensees and Ofcom. We also consider that there would be practical difficulties in Ofcom relying on licensees providing prompt and transparent information on any network mitigation carried out.

A6.299 Rather, we consider that standard licence terms already confer on us the ability to require licensees to make adjustments to their network in the event that they cause undue interference to reception of DTT services. For example, we can require that

radio equipment is “modified or restricted in use, or temporarily or permanently closed down immediately”.

- A6.300 Some respondents, including Freeview, Arqiva and representatives of the aerial installer industry, queried the arrangements that will be put in place to support DTT consumers after MitCo closes.
- A6.301 Where licensees seek to make changes to their networks after MitCo closes, we will expect them to take account of the impact on surrounding DTT reception. We anticipate this could involve the use of similar network or consumer based mitigation measures as will be used when MitCo is operational. It will be for licensees to decide how to do this. Where licensees fail to take sufficient steps to mitigate interference or if Ofcom considers that consumer harm is occurring, Ofcom would expect to take appropriate steps in line with its enforcement powers to deal with this issue.

KPI tables

A6.302 This subsection presents the detailed KPIs against which MitCo’s performance will be measured and the Operational Conditions that will apply if MitCo fails to meet the required KPI standards.

Scope of the KPIs and treatment of households

A6.303 For the purposes of judging performance success or failure against KPIs standards, the following table highlights which households are eligible for services and therefore covered by the scope of which particular KPIs.

A6.304 A “communal household” is defined as a number of individual dwellings, each with a separate address, served by a single DTT receiver aerial with the signal boosted through an amplifier and distributed to each dwelling. The treatment of communal households, as with others, is presented in Table 8 below.

Table 8: Scope of KPIs and treatment of communal households

KPI	Scope of households covered by KPI	Treatment of communal households
KPI 1: information provision	Applies to all households	Each dwelling within a communal household is treated as a discrete household for KPI 1 only, with one item of information to be sent to each, i.e. every dwelling for which there is an individual address is sent information.
KPI 2: proactive filter provision	Applies to households with standard and amplified domestic installations only. Excludes communal households	Not applicable – communal households are excluded
KPI 3: reactive filter provision	Applies to all households	Each communal block of dwellings is treated as one household with one reactive filter provided against the KPI standard
KPI 4: installation support to vulnerable consumers	Applies to households with standard and amplified domestic installations only. Excludes communal households	Not applicable – communal households are excluded
KPI 5: platform change provision	Applies to all households	Each communal block of dwellings is treated as one household with one platform change provided against the KPI standard

Terminology

A6.305 In interpreting the meaning of the KPIs there are a number of issues of terminology to be clarified:

- *“Households forecast to experience interference”*: For the purposes of interpreting KPIs 1 and 2, “households forecasts to experience interference” means that population of addresses within either a 2km radius of a base station (KPI 1) or a 1.5km radius of a base station (KPI 2), produced by MitCo through its comparison and correlation of address data (e.g. Royal Mail Address Point) with its interference forecasting map. It is against the resulting population of address points that MitCo will provide information and filters in the timeframes specified under KPIs 1 and 2, respectively. The suitability of the analytical methodology in producing a reasonably accurate population of addresses forecast to experience interference will be discussed with the Oversight Board at the outset of MitCo’s operations and as defined in the licence conditions.
- *“Delivered”* means the relevant item (e.g. information or filter) has been provided to the consumer or reasonable efforts have been made to provide to the consumer (e.g. an attempted delivery to their address). It does not mean that MitCo has simply “despatched” an item from its warehouses within the time period.
- *“Information”*: For the purposes of interpreting KPI 1, “information” means information that: a) is clear and easily interpreted by consumers with a focus on raising awareness of the possibility of interference and when it may occur in their area; b) informs consumers of the services they are eligible to receive from MitCo and how and when these will be provided; how they can contact MitCo; and c) informs of other courses of action open to them where MitCo is not required to provide a service to them.
- *“Within x km of that base station”*: For the purposes of counting households where base station coverage areas overlap, households within the coverage of two or more base stations are considered relevant to each base station and therefore success or failure against a KPI standard is counted against all relevant base stations.
- *“Complaint”*: For the purposes of interpreting KPI 6, a “complaint” relates to a report from a consumer as to whether or not MitCo has delivered on a service requirement defined under that KPI. It does not relate to whether or not the customer is satisfied with the service more generally, the latter issue being addressed through MitCo’s adherence to its Code of Service.

Individual KPIs

A6.306 Set out below are the individual KPIs that will apply, in particular the specific Standards, performance Reporting Requirements on MitCo and the Operational Conditions that will take effect in the event of a failure to comply with the Standards set out in each individual KPI.

Table 9: KPI 1 – Information Provision

Objective of the KPI		
<ul style="list-style-type: none"> To ensure that households affected by DTT interference are supplied with information in good time before interference occurs. 		
Standards	Reporting Requirement(s)	Operational Condition(s)
<p>S1. The Licensee must ensure that 99.9% of households forecast⁴⁴⁶ to experience interference to their reception of DTT services within a 2 km radius of a base station⁴⁴⁷ have information⁴⁴⁸ delivered⁴⁴⁹ to them at least four weeks, and no earlier than twelve weeks, in advance of that base station being activated. For the purpose of interpreting KPI thresholds, these should be applied by rounding up to the nearest household.</p>	<p>RR1. The Licensee must report its progress against the Standard S1 of this KPI to the Oversight Board at fortnightly intervals during the twelve week period immediately prior to the date on which the Licensee intends to activate its base station. The Licensee must report whether it considers the KPI in relation to the activation of a base station has been met or not.</p>	<p>OC1. The Licensee must, in the event that it has not complied with the Standard S1 of this KPI by the date on which it intends to activate its base station, delay activation of that base station until such time as it can satisfy the Oversight Board that that Standard has been met. The Licensee must ensure that it reports to the Oversight Board at a time when it considers that Standard S1 of this KPI has been met.</p>

⁴⁴⁶ For the purposes of KPIs 1 and 2, the term “households forecast to experience interference” means the population of addresses within either a 2km radius of a base station (KPI 1) or a 1.5km radius of a base station (KPI 2), produced by MitCo through its comparison and correlation of address data (e.g. Royal Mail Address Point) with its interference forecasting map.

⁴⁴⁷ For the purposes of counting households where base station coverage areas overlap, households within the coverage of two or more base stations are considered relevant to each base station and therefore success or failure against a KPI standard is counted against all relevant base stations.

⁴⁴⁸ This means information that: a) is clear and easily interpreted by consumers with a focus on raising awareness of the possibility of interference and when it may occur in their area; b) informs consumers of the services they are eligible to receive from MitCo and how and when these will be provided; how they can contact MitCo; and c) informs of other courses of action open to them where MitCo is not required to provide a service to them.

⁴⁴⁹ For the purpose of these KPIs, the term “delivered” means that the relevant item (e.g. information or filter) has been provided to the consumer or reasonable efforts have been made to provide to the consumer (e.g. an attempted delivery to their address). It does not mean that MitCo has simply “despatched” an item from its warehouses within the time period.

Table 10: KPI 2 – Proactive Filter Provision

Objective of the KPI		
<ul style="list-style-type: none"> To ensure a significant proportion of households receive filters before experiencing any interference to their DTT reception. 		
Standards	Reporting Requirement(s)	Operational Condition(s)
<p>S2. Where a Licensee activates a base station, it must ensure that no more than 10% of households (not including communal households) forecast to experience interference⁴⁵⁰ to their reception of DTT services within a 1.5 km radius of that base station⁴⁵¹ request that a filter be delivered⁴⁵² to them within four weeks following the activation of the base station. For the purpose of interpreting KPI thresholds, these should be rounded up to the nearest household.</p>	<p>RR2. The Licensee must report to the Oversight Board four weeks after the activation of a base station, indicating whether or not it considers that it has complied with the Standard S2 of this KPI. The Licensee must provide evidence of:</p> <ol style="list-style-type: none"> The number of requests for a filter that it has received from households within 1.5 km of the relevant base station; The number of households forecast to experience interference to their DTT services within the 1.5 km radius of the relevant base station; and The number of households reported under point (a) expressed as a percentage of the number reported under point (b). 	<p>OC2. In the event that the Licensee has not complied with the Standard S2 of this KPI, it must ensure that any further base stations activated in the relevant reporting region within four weeks from the point at which the Licensee reports to the Oversight Board that Standard S2 of this KPI has not been met comply with “test conditions”. The purpose of test conditions is to test for interference. For the purposes of this Operational Condition OC2, “test conditions” means that the Licensee must:</p> <ol style="list-style-type: none"> Activate further base stations at the transmission limit of 64dBm (or maximum transmitting power if less than 64dBm) for a period of fifteen minutes each day, commencing at a time chosen by the Licensee during the hours of 7am – 6pm; Ensure that prior to a further base station being activated under point (a), written information has been delivered to 99% of households forecast to experience interference to their reception of DTT services within a 1.5 km

⁴⁵⁰ See footnote 1.

⁴⁵¹ See footnote 2

⁴⁵² See footnote 4.

		<p>radius of that base station;</p> <p>c) Ensure that the written information under point (b):</p> <ul style="list-style-type: none"> i. Informs consumers of the date, time, duration and purpose of the test conditions; ii. Informs consumers of appropriate actions to take in the event that they experience interference to their DTT equipment during the test conditions; and iii. Includes contact details for the Licensee’s mitigation services. <p>The requirement to comply with test conditions will cease four weeks from the date on which the Licensee reported to the Oversight Board that the Standard S2 of this KPI had not been met. After the requirement under this Operational Condition OC2 to comply with test conditions ceases, the Licensee may resume normal operation of any base stations that have been operating under test conditions, in accordance with the Licence.</p> <p>The Licensee must report to the Oversight Board its compliance with this Operational Condition OC2 on a fortnightly basis while the required test conditions are in operation.</p> <p>The application of test conditions to a base station required by this Operational Condition OC2 does not preclude it from being subject to the rest of the KPI</p>
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		framework set out in the Notice.
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Table 11: KPI 3 – Reactive Filter Provision

Objective of the KPI		
<ul style="list-style-type: none"> To ensure that households experiencing interference receive filters in a timely manner and in accordance with standard practice in the market for delivery / postal services. 		
Standards	Reporting Requirement(s)	Operational Condition(s)
<p>S3. The Licensee must ensure that where households contact Licensees or the Entity reporting interference to their DTT services:</p> <p>a) At least 86% of filters are delivered to the households within the relevant reporting region within three working days of households notifying the Licensee of the interference;</p> <p>b) At least 94% of filters are delivered to the households within the relevant reporting region within four working days of households notifying the Licensee or the Entity of the interference; and</p> <p>c) At least 99% of filters are delivered to the households within the relevant reporting region within six working days of households notifying the Licensee or the Entity of the interference.</p> <p>For the purpose of interpreting KPI thresholds, these should be rounded up to the nearest household.</p>	<p>RR3. The Licensee must report to the Oversight Board at the end of each calendar month, by each reporting region, as to whether it considers that it has complied with the Standard S3 of this KPI, and provide evidence as to the proportion of households within the relevant reporting region that it reasonably considers have had filters delivered within the following timeframes:</p> <p>a) Within three working days of having reported interference;</p> <p>b) Within four working days of having reported interference;</p> <p>c) Within six working days of having reported interference; and</p> <p>d) more than six working days after having reported interference.</p> <p>For the purpose of reporting against the Standard S3 of this KPI, evidence may also include:</p> <p>a) Information from the postal agent used by the Licensee relating to the proportion of completed deliveries within the prescribed delivery timescales; or</p> <p>b) A reasonable level of random sampling of households within particular DTT</p>	<p>OC3. In the event that the Licensee has not complied with the Standard S3 of this KPI, it must ensure that any further base stations activated in the relevant reporting region within four weeks from the point at which the Licensee reports to the Oversight Board that Standard S3 of this KPI has not been met comply with “test conditions”. The purpose of test conditions is to test for interference. For the purposes of this Operational Condition OC3, “test conditions” means that the Licensee must:</p> <p>a) Activate further base stations at the transmission limit of 64dBm (or maximum transmitting power if less than 64dBm) for a period of fifteen minutes each day, commencing at a time chosen by the Licensee during the hours of 7am – 6pm;</p> <p>b) Ensure that prior to a further base station being activated under point (a), written information has been delivered to 99% of households forecast to experience interference to their reception of DTT services within a 1.5 km radius of that base station;</p> <p>c) Ensure that the written</p>

	<p>transmitter areas to ascertain delivery times.</p>	<p>information under point (b):</p> <ul style="list-style-type: none"> i. Informs consumers of the date, time, duration and purpose of the test conditions; ii. Informs consumers of appropriate actions to take in the event that they experience interference to their DTT equipment during the test conditions; and iii. Includes contact details for the Licensee’s mitigation services. <p>The requirement to comply with test conditions will cease four weeks from the date on which the Licensee reported to the Oversight Board that the Standard S3 of this KPI had not been met. After the requirement under this Operational Condition OC3 to comply with test conditions ceases, the Licensee may resume normal operation of any base stations that have been operating under test conditions, in accordance with the Licence.</p> <p>The Licensee must report to the Oversight Board its compliance with this Operational Condition OC3 on a fortnightly basis while the required test conditions are in operation.</p> <p>The application of test conditions to a base station required by this Operational Condition OC3 does not preclude it from being subject to the rest of the KPI framework set out in the Notice.</p>
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Table 12: KPI 4 – Installation Support to Vulnerable Consumers

Objective of the KPI		
<ul style="list-style-type: none"> To ensure that consumers who are eligible for additional support receive installation services from Licensees in a timely manner and in accordance with standard practice in the marketplace. 		
Standards	Reporting Requirement(s)	Operational Condition(s)
<p>S4. The Licensee must ensure that, where it is arranging the installation of filters for vulnerable households (where the vulnerable household is not a communal household):</p> <ol style="list-style-type: none"> 50% of such installations within the relevant reporting region are completed within eight working days from the date on which a vulnerable household makes a request; and 99% of such installations within the relevant reporting region are completed within twelve working days from the date on which a vulnerable household makes a request. <p>For the purpose of interpreting KPI thresholds, these should be rounded up to the nearest household.</p>	<p>RR4. The Licensee must report to the Oversight Board at the end of each calendar month as to whether it considers that it has complied with Standard S4 of this KPI for the relevant reporting region in that calendar month. The Licensee must provide evidence as to:</p> <ol style="list-style-type: none"> The number of instances that calendar month where a vulnerable consumer has requested the installation of a filter; The date on which the request was made; The date on which the filter was installed; The percentage of filter installations completed within eight working days from the date of the consumer request; and The percentage of filter installations completed within twelve working days from the date of the consumer request. 	<p>OC4. In the event that the Licensee has not complied with the Standard S4 of this KPI, it must ensure that any further base stations activated in the relevant reporting region within four weeks from the point at which the Licensee reports to the Oversight Board that Standard S4 of this KPI has not been met comply with “test conditions”. The purpose of “test conditions” is to test for interference. For the purposes of this Operational Condition OC4, “test conditions” means that the Licensee must:</p> <ol style="list-style-type: none"> Activate further base stations at the transmission limit of 64dBm (or maximum transmitting power if less than 64dBm) for a period of fifteen minutes each day, commencing at a time chosen by the Licensee during the hours of 7am – 6pm; Ensure that prior to a further base station being activated under point (a), written information has been delivered to 99% of households forecast to experience interference to their reception of DTT services within a 1.5 km radius of that base station;

		<p>c) Ensure that the written information under point (b):</p> <ul style="list-style-type: none"> i. Informs consumers of the date, time, duration and purpose of the test conditions; ii. Informs consumers of appropriate actions to take in the event that they experience interference to their DTT equipment during the test conditions; and iii. Includes contact details for the Licensee’s mitigation services. <p>The requirement to comply with test conditions will cease four weeks from the date on which the Licensee reported to the Oversight Board that the Standard S4 of this KPI had not been met. After the requirement under this Operational Condition OC4 to comply with test conditions ceases, the Licensee may resume normal operation of any base stations that have been operating under test conditions, in accordance with the Licence.</p> <p>The Licensee must report to the Oversight Board its compliance with this Operational Condition OC4 on a fortnightly basis while the required test conditions are in operation.</p> <p>The application of test conditions to a base station required by this Operational Condition OC4 does not preclude it from being subject to the rest of the KPI framework set out in the Notice.</p>
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Table 13: KPI 5 – Platform Change Provision

Objective of the KPI		
<ul style="list-style-type: none"> To ensure that for households where filters are ineffective, Licensees consider the case for platform changes and provide such installations, as appropriate, in a timely manner. 		
Standards	Reporting Requirement(s)	Operational Condition(s)
<p>S5. The Licensee must ensure that, where a household reports that a filter does not work effectively to mitigate interference caused to its DTT services and, consequently, it is arranging for households to have a platform change in accordance with paragraph 3.15 of this Notice:</p> <p>a) 99% of such platform changes, within the relevant reporting region, are completed within fifteen working days from the date on which the household reported its filter was not working.</p> <p>For the purpose of interpreting KPI thresholds, these should be rounded up to the nearest household.</p>	<p>RR5. The Licensee must report to the Oversight Board at the end of each calendar month as to whether it considers that it has complied with Standard S5 of this KPI for the relevant reporting region in that calendar month. The Licensee must provide evidence as to:</p> <p>a) The number of instances during that calendar month where a household has requested a platform change;</p> <p>b) The number of instances during that calendar month where the Licensee has agreed to provide a platform change;</p> <p>c) The date on which the household for which the requirement for a platform change was established originally reported that its filter was not working;</p> <p>d) The date on which the platform change was completed; and</p> <p>e) The percentage of households for which the platform change was completed within fifteen working days from the date of the consumer request.</p>	<p>OC5. In the event that the Licensee has not complied with the Standard S5 of this KPI, it must ensure that any further base stations activated in the relevant reporting region within four weeks from the point at which the Licensee reports to the Oversight Board that Standard S5 of this KPI has not been met comply with “test conditions”. The purpose of test conditions is to test for interference. For the purposes of this Operational Condition OC4, “test conditions” means that the Licensee must:</p> <p>a) Activate further base stations at the transmission limit of 64dBm (or maximum transmitting power if less than 64dBm) for a period of fifteen minutes each day, commencing at a time chosen by the Licensee during the hours of 7am – 6pm;</p> <p>b) Ensure that prior to a further base station being activated under point (a), written information has been delivered to 99% of households forecast to experience interference to their reception of DTT services within a 1.5 km radius of that base station;</p> <p>c) Ensure that the written</p>

		<p>information under point (b):</p> <ul style="list-style-type: none"> i. Informs consumers of the date, time, duration and purpose of the test conditions; ii. Informs consumers of appropriate actions to take in the event that they experience interference to their DTT equipment during the test conditions; and iii. Includes contact details for the Licensee’s mitigation services. <p>The requirement to comply with test conditions will cease four weeks from the date on which the Licensee reported to the Oversight Board that the Standard S5 of this KPI had not been met. After the requirement under this Operational Condition OC5 to comply with test conditions ceases, the Licensee may resume normal operation of any base stations that have been operating under test conditions, in accordance with the Licence.</p> <p>The Licensee must report to the Oversight Board its compliance with this Operational Condition OC5 on a fortnightly basis while the required test conditions are in operation.</p> <p>The application of test conditions to a base station required by this Operational Condition OC5 does not preclude it from being subject to the rest of the KPI framework set out in the Notice.</p>
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Table 14: KPI 6 – Consumer Complaints

Objective of the KPI		
<p>• To ensure Licensees minimise the occurrence of consumer complaints⁴⁵³ regarding their required service standards (defined in other KPIs) and respond promptly to issues where they fail or risk failing to meet the requirements of the KPIs set out in this Notice.</p>		
Standards	Reporting Requirement(s)	Operational Condition(s)
<p>S6. The Licensee must ensure that it has put in place adequate arrangements with regards to the provision of filters and platform changes, such that, for each base station: Over a twelve week period from the activation of a base station:</p> <p>a) No more than 5% of households within 1.5 km of the relevant base station, who have requested a filter under paragraph 3.11.2 (“Provision of filters”) complain to the Licensee or the Entity that they have not received a filter within six working days of making their request; and</p> <p>b) No more than 5% of vulnerable households within 1.5 km of the relevant base station who have requested the installation of a filter under paragraph 3.12 (“Installation support”) complain that they have not received the installation within twelve working days of making their request.</p> <p>For the purpose of interpreting KPI thresholds, these should be rounded up to the nearest</p>	<p>RR6. For each base station, once activated, the Licensee must report to the Oversight Board every four weeks over a twelve week period as to whether it considers that it has complied with Standard S6 of this KPI for the relevant base station. The Licensee must provide evidence as to:</p> <p>a) The number and nature of the complaints regarding reactive filter provision and installation support that have been made to date; and</p> <p>b) The number of those complaints as a percentage of the total number of households that are potentially within the scope of KPI S6(a).</p> <p>If, at the end of the twelve week period for the relevant base station, Standard S6 set out at S6(a) and S6(b) has not been breached, then the Licensee will no longer be required to report to the Oversight Board on the standard for the relevant base station.</p>	<p>OC6. The Licensee must, in the event that it has not complied with the Standard S6 of this KPI:</p> <p>a) Reduce the in-block transmission level of the relevant base station by 6 dB for three weeks, or until such time as the Oversight Board is satisfied that the Licensee is able to meet the Standard S6, whichever is shorter.</p> <p>b) Provide, or arrange to be provided, a written apology to each consumer that has been eligible for installation support and who has had to wait longer than twelve working days before a technician first attended their house.</p> <p>The Licensee must report to the Oversight Board at a time when it considers that the Standard S6 of this KPI has been met.</p>

⁴⁵³ For the purposes of interpreting KPI 6, a “complaint” relates to a report from a consumer as to whether or not the Entity has delivered on a service requirement under this KPI. It does not relate to whether or not the customer is satisfied with the service more generally.

household.		
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