

Award of the 2.3 and 3.4 GHz spectrum bands

Competition issues and Auction Regulations

Statement

Publication date:

11 July 2017

About this document

This document sets out our decisions on competition issues for the forthcoming Auction of spectrum in the 2.3 and 3.4 GHz bands. The document also sets out our decisions on outstanding aspects of our proposed Regulations for the Auction.

The 2.3 and 3.4 GHz spectrum is needed to provide additional capacity to meet growing consumer demand for mobile broadband. It is important that the frequencies are made available as quickly as possible for the benefit of consumers and industry.

In parallel we are publishing an Information Memorandum for prospective bidders and a consultation document on the Auction Regulations. We intend to publish a statement making the Auction Regulations in August with a view to commencing the Auction in September.

Contents

Section		Page
1	Executive summary	3
2	Introduction	10
3	Previous decisions on the award	17
4	Our November 2016 consultation proposals	20
5	Developments since our consultation document	24
6	Competition assessment	34
7	Measures to address our competition concerns	55
8	Auction design and Regulations	67
9	Next steps	85

Section 1

Executive summary

- 1.1 This statement sets out Ofcom's decisions for the award of wireless telegraphy licences for use of the 2.3 GHz band (2350-2390 MHz) and the 3.4 GHz band (3410-3480 MHz and 3500-3580 MHz). In particular, we set out our final decisions on competition issues and the Auction Regulations which give effect to our decisions for this award.
- 1.2 The 2.3 and 3.4 GHz spectrum is likely to be used by mobile network operators to deliver additional capacity for mobile broadband. The 3.4 GHz spectrum may be used for 5G services. We will award the spectrum by auction.
- 1.3 In light of concerns that the Auction could give rise to a very asymmetric distribution of spectrum, we have decided to apply two separate caps on the amount a single operator may hold:
 - A cap of 255 MHz on the amount of mobile spectrum that is immediately useable after the Auction.
 - A cap of 340 MHz per operator on mobile spectrum *overall* after the Auction. This overall cap represents 37% of all the mobile spectrum that we expect to be useable within similar timeframes to the 3.4 GHz band.
- 1.4 These two caps will have the effect of preventing BT/EE from bidding for spectrum in the 2.3 GHz band. They will also restrict BT/EE to winning no more than 85 MHz in the 3.4 GHz band and restrict Vodafone to winning no more than 160 MHz across the 2.3 GHz and 3.4 GHz bands together.

Background

- 1.5 Demand for mobile data has increased substantially in recent years, driven by the rapid take-up of smartphones and tablets and the ability of these devices to deliver ever more services. Over the last five years, demand has grown at a cumulative annual rate of more than 50%, and we expect this sort of increase in demand to continue.
- 1.6 Although projections of future growth are uncertain, there is a broad consensus that mobile data consumption will increase sharply over the next decade – potentially by a factor of 10 to 100. Such a rapid growth in demand places pressure on mobile network operators (MNOs) to increase their capacity in order to meet growing consumer expectations.
- 1.7 There are several ways for MNOs to increase network capacity. One important means is by deploying additional radio spectrum. Because radio spectrum is a scarce and finite resource, its allocation has important implications for users of mobile communications services and the UK economy.
- 1.8 In this Auction, we will be awarding 190 MHz of additional spectrum, increasing the total amount of mobile spectrum available to operators from 647 MHz to 837 MHz – an increase of 29%.

Our approach to this award

- 1.9 Our principal statutory duties under the 2003 Communications Act are to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition. In doing so, we have a duty to secure the optimal use of spectrum.
- 1.10 In light of these duties, we have identified two main policy objectives for the 2.3 and 3.4 GHz award: first, to make the spectrum available in a timely manner to meet consumer demand; and second, to ensure that consumers and businesses continue to benefit from a competitive market in the provision of mobile services. We believe securing competition in the mobile market means there should be at least four credible MNOs in order to ensure good outcomes for consumers. In pursuing our objectives, we believe the award process should be simple where possible, without unduly compromising an efficient outcome, and that participants should have confidence in the fairness of the process and the final outcome.
- 1.11 Our general approach to awarding spectrum in circumstances where - as here - demand is likely to be greater than the amount of spectrum available, is to allow the market to determine the best allocation, often through means of an auction. This is because the operator with the highest value for the spectrum will normally be the one most likely to use the frequencies to deliver the services consumers most want.
- 1.12 However, there may be circumstances in which an unfettered market approach may be detrimental to consumers, even if an auction outcome helps to deliver the most valuable services. For example, if an auction left one or more operators with insufficient spectrum to compete strongly, consumers could face higher prices - and other operators might have reduced incentives to innovate and invest.
- 1.13 In those circumstances, in order to promote competition, we consider we should find an appropriate balance between the benefits of spectrum being won by the operators with the highest value and the aim of ensuring strong competition between operators.
- 1.14 At present, we consider that the UK mobile market is generally working well with four MNOs competing strongly. Prices remain relatively low compared with other countries and there is a significant level of investment in new products and services. However, we would be concerned if the results of this Auction risked a reduction in competition.
- 1.15 We have assessed the likely effects on competition of awarding the 2.3 and 3.4 GHz bands, and have identified two potential concerns: the risk that the outcome of the Auction means there will no longer be four credible MNOs in the UK market; and the risk that very asymmetric spectrum shares might weaken competition – even if there remain four credible MNOs.
- 1.16 We consulted in November 2016 on proposals to address these competition concerns. We had already taken a large number of other decisions about the Auction, which we summarise in this document for ease of reference.

Our consultation proposals on competition issues

- 1.17 In our November 2016 consultation document, we said there was a risk that the current level of competition in the UK market could reduce as consumer demand for mobile services increased.

- 1.18 We said asymmetry in the amount of spectrum held by different operators meant some operators might be in a stronger position to respond to increased demand than others. In this context, BT/EE held 45% of all the mobile spectrum that was currently useable; Vodafone held 28%; O2 held 15%; and H3G held 12%. We considered that, absent competition measures in the Auction, this asymmetry could become even more pronounced.
- 1.19 We were more concerned about the consequences of spectrum asymmetry in respect of the 2.3 GHz band than the 3.4 GHz band. The 2.3 GHz band will be useable immediately after the Auction because it is already supported by mainstream mobile devices. The 3.4 GHz spectrum is not currently supported – and by the time it becomes useable, we said we expected other spectrum would be available at 700 MHz and potentially at 3.6-3.8 GHz. We said the award of these spectrum bands could address any competition issues, if this was necessary.
- 1.20 We noted that if BT/EE won all the 2.3 GHz frequencies being auctioned it would hold nearly half of the UK's immediately useable mobile spectrum (49%, excluding the 1400 MHz band).
- 1.21 We explained that MNOs with smaller shares of spectrum would have an opportunity to bid for the 2.3 GHz spectrum themselves, and that they might well place a high valuation on that spectrum. However, we also said that an operator with a large spectrum share might have an even higher valuation, potentially not because it would use the spectrum more effectively, but because it would benefit from competition in the mobile market being weaker if it won the spectrum.
- 1.22 Our judgement was that these factors taken together resulted in a significant risk to competition. In light of our statutory duties, we said we considered it was appropriate for us to consider intervention in the market to address these concerns.
- 1.23 As always in considering market intervention, we sought to ensure that the level of intervention should be the minimum necessary to achieve our policy objectives effectively.
- 1.24 We therefore proposed to set a cap of 255 MHz on the amount of immediately useable spectrum any operator could hold – the level of BT/EE's current mobile spectrum holdings. Consequently, BT/EE would not be able to bid for the 2.3 GHz spectrum, making it more likely that the operators with the smallest shares of spectrum – O2 and H3G – could win the spectrum if they needed it.
- 1.25 We proposed no restriction on the 3.4 GHz band. Noting that it was not immediately useable, we said that in addition to its potential for delivering 4G services, it was likely to be used in future to launch new 5G services. We said we would not want to hinder innovation and the development of high quality 5G services if operators needed large contiguous blocks of spectrum.
- 1.26 We set out some alternative means by which operators could adapt their strategies to meet consumer demand in the longer term, including the wider use of 'small cells' which can enable an operator to make more intensive use of spectrum. We also identified the availability and useability of alternative spectrum on similar timescales to the 3.4 GHz spectrum – such as in the 700 MHz and potentially in the 3.6-3.8 GHz bands – to address any issues of very asymmetric spectrum holdings arising from the 2.3 and 3.4 GHz award.

- 1.27 However, we said it might be appropriate to impose competition measures in addition to those affecting the 2.3 GHz band if the 3.6-3.8 GHz band was likely to be useable materially later than the 3.4 GHz spectrum.

Developments since our November 2016 consultation

- 1.28 We received 30 responses to the November 2016 consultation document,¹ and we have considered these carefully. Since we published the document, there have also been some important changes affecting the UK market. Our assessment in some areas has evolved in light of responses and because of these changes:
- H3G has acquired UK Broadband. The acquisition gives H3G access to 40 MHz of mobile spectrum in the 3.4 GHz band plus 84 MHz in the 3.6-3.8 GHz band. This means that H3G has a significantly increased share of overall mobile spectrum which will be useable in future. This greatly reduces any concerns we may have had about the effect on competition of H3G's medium to long-term capacity.
 - It now appears that the 1400 MHz band will be useable for mobile earlier than we had anticipated (e.g. commercial deployment of the band has started in Italy). H3G and Vodafone each hold 20 MHz of spectrum in this band. We now consider that H3G may be able to use these frequencies from 2018 i.e. in the transitional period before the 3.4GHz band is useable. This reduces to some extent our concerns about the effect on competition of H3G's capacity in the short term.
 - We are now less confident about the 3.6-3.8 GHz band being fully useable on an equivalent timeframe to the 3.4 GHz band than we thought at the time of our November 2016 consultation. We have consulted on the 3.6-3.8 GHz band and will publish a statement shortly. That statement will confirm our intention to make the band available for mobile and will set out our proposed approach. Under our proposed approach, it is likely that it will be possible for operators to launch mobile services in the 3.6-3.8 GHz band in many areas from around 2020 – but not necessarily nationwide before 2022. This affects our analysis of the extent to which we can rely on the 3.6-3.8 GHz band to address any future competition concerns that might arise as a result of this award. It is therefore relevant to our assessment of the competition measures appropriate for the Auction.
 - We have seen credible evidence that MNOs may be less able than we thought to adapt networks to increase capacity without additional spectrum. This means we have slightly greater concerns about the effect on competition of very asymmetric spectrum shares – although we do consider there is a low risk that the credibility of any MNO is threatened.
- 1.29 We have taken account of these developments in reaching the conclusions set out in this statement. We now identify three distinct time periods for our analysis:
- A **first transitional period** from immediately after the 2.3 and 3.4 GHz Auction until the time at which the 3.4 GHz spectrum is useable (which we expect to be

¹ In addition to responses submitted directly to Ofcom in response to the consultation, more than 140,000 pro-forma submissions were made through a campaign called 'Make The Air Fair', organised by H3G (Three).

2019-20). During this first transitional period the 2.3 GHz spectrum will be useable but the 3.4 GHz spectrum will not.

- A **second transitional period** starting once the 3.4 GHz is useable (2019-20) and finishing when the 3.6-3.8 GHz is fully useable (potentially 2022). We expect the 700 MHz band to be useable in this period.
- A **longer term period** from after the 3.6-3.8 GHz becomes useable until up to 5-10 years in the future.

Our revised assessment of competition issues

- 1.30 We consider that the risk of any of the four MNOs ceasing to be a credible competitor in the market because of their spectrum holdings is low. We believe this conclusion holds true for the first and second transitional periods, and also for the longer term. MNOs with smaller holdings may need to win more spectrum, but alternative spectrum will be available (noting, in light of our duties, that we may take measures to promote competition in future spectrum awards).
- 1.31 However, we continue to consider that a very asymmetric distribution of immediately useable spectrum represents a significant risk to competition. Even though all the MNOs are in our view likely to remain credible competitors after the Auction, those with smaller spectrum holdings may not be able to compete so strongly in future as those with much larger spectrum holdings.
- 1.32 We acknowledge it is by no means certain that the Auction will result in very asymmetric holdings but, if competition were weakened in this way, it could lead to significant consumer harm. In the last major auction of mobile spectrum (in 2013) we included a 37% overall spectrum cap as one of the competition measures to address concerns about asymmetry in spectrum holdings. The acquisition of EE by BT took the spectrum share of the combined BT/EE entity above this level. It means that BT/EE now has a share of 42% of immediately useable spectrum, excluding the 2.3 GHz band but now including the 1400 MHz band (including the latter band reduces the figure from the 45% quoted in our November consultation).
- 1.33 Consistent with our decision for the 2013 award, we remain of the view that very asymmetric spectrum holdings – for example, a single operator having more than around 37% of useable mobile spectrum for a sustained period – could pose a risk to competition and hence to consumer outcomes.
- 1.34 Given BT/EE's current spectrum holdings, we remain concerned about spectrum asymmetry in respect of immediately useable spectrum in the first transitional period (before the 3.4 GHz spectrum becomes useable). This concern relates specifically to the 2.3 GHz band. Absent intervention, if BT/EE were to win all of the 2.3 GHz spectrum, its share of immediately useable spectrum (including the 1400 MHz band) would increase to 46%.
- 1.35 We are also concerned about spectrum asymmetry in the second transitional period. Although we expect an additional 80 MHz of spectrum in the 700 MHz band to be useable in this period, we consider the risk to competition is now increased compared to when we published the November 2016 consultation. This is because we are now less confident that the 3.6-3.8 GHz spectrum will be useable with few constraints by 2020. If that band is not useable on the same timescales as the 3.4 GHz spectrum, it would be possible for BT/EE to build a spectrum share of more than 44% by winning all of the 3.4 GHz spectrum.

Our decisions on competition measures for this Auction

- 1.36 In light of our concern about asymmetry in immediately useable spectrum – and following both detailed consideration of stakeholder responses and our own assessment of market developments – we continue to believe it is necessary to intervene in respect of the 2.3 GHz band to promote competition.
- 1.37 In line with the proposals in our November 2016 consultation, we have therefore decided to set a cap in the Auction on immediately useable spectrum of 255 MHz. This cap is at the level of BT/EE's current mobile spectrum holdings, and so has the effect of preventing BT/EE from bidding for spectrum in the 2.3 GHz band. The cap will reduce the current extent of asymmetry in immediately useable spectrum by bringing BT/EE's share of immediately useable spectrum down to 39% after the Auction.
- 1.38 In addition, we have decided to set a cap of 340 MHz in the Auction on the *overall* amount of mobile spectrum a single operator may hold. This represents 37% of the mobile spectrum that we expect to be useable within the same timescales as the 3.4 GHz band, including the 190 MHz available in this Auction plus the 80 MHz in the 700 MHz band that we plan to award in 2019. It is also consistent with the overall cap for our 2013 auction of mobile spectrum, which was set at 37% of the relevant mobile spectrum at that time.
- 1.39 We consider the overall cap to be an appropriate and proportionate response to the competition concern we identified with respect to spectrum asymmetry in the second transitional period. We consider it is capable of effectively addressing that concern, and is the least onerous means of doing so.
- 1.40 The cap has the effect of limiting BT/EE to winning a maximum of 85 MHz of new spectrum (all of it in the 3.4 GHz band). Vodafone could win an additional 160 MHz (in either the 2.3 or 3.4 GHz bands). There will be no restriction of the amount of spectrum H3G, O2 or any other bidder could win in this Auction.

Auction design and regulations

- 1.41 In addition to the competition issues, this document also sets out some further decisions with respect to the Auction Regulations, and recaps the decisions we have already taken and published regarding other aspects of this award. The November 2016 consultation proposed changes to rules set out in draft regulations published in October 2015. In particular, we proposed to amend the rules governing the withdrawal of bids made during the principal stage of the Auction
- 1.42 Having considered consultation responses, we have decided to proceed with our revised proposals about bid withdrawals.
- 1.43 Additionally, the inclusion of an overall cap on spectrum means we need to make further amendments to the Auction Regulations that give effect to this decision. We are today publishing a statutory consultation document on the proposed Auction Regulations as amended, in respect of which we invite representations.²

² https://www.ofcom.org.uk/_data/assets/pdf_file/0021/103827/Notice-of-proposal-to-make-regulations-in-connection-with-the-award-of-2.3-GHz-and-3.4-GHz-spectrum.pdf

Next steps

- 1.44 Having made our final policy decisions on the Auction, and in light of the fact that a significant part of the spectrum which is the subject of this award is immediately useable for the provision of mobile services, we consider it important to proceed to hold the award and issue licences to the winning bidders as soon as possible.
- 1.45 Our next steps are therefore as follows (approximate timetable):
- **14 August 2017**– Our consultation on the Auction Regulations closes and we will begin considering responses.
 - **Late August to early September 2017**– We anticipate being able to publish our final statement on the making of Auction Regulations.
 - **Mid to late September 2017** – The Auction Regulations will come into force.
 - **Late September to early October 2017** – We will invite applications from potential bidders in the auction.
 - **Late October to November 2017** – Bidding begins.
- 1.46 We are aware that in the course of our consultation process, a number of stakeholders have indicated that they might consider seeking judicial review of our final decisions, depending on their nature.
- 1.47 In light of the fact that a significant part of this spectrum could be used now to provide services, we consider that any claim for judicial review should be brought promptly, with a request that the courts expedite the matter.
- 1.48 As noted above, we are today consulting on the Auction Regulations which give effect to our decisions. That consultation period runs for one month. Subject to our consideration of the responses we receive, we intend to make the Auction Regulations within two weeks of the close of that consultation. We therefore consider that promptness in this case means that any claim for judicial review should be brought within six weeks of the date of this statement.

Section 2

Introduction

- 2.1 This statement sets out Ofcom's decisions for the auction of wireless telegraphy licences for use of the 2.3 GHz band (2350 to 2390 MHz) and the 3.4 GHz band (3410 to 3480 MHz and 3500 to 3580 MHz) (the Auction). It follows our consultation of November 2016 on competition issues and some aspects of auction design.
- 2.2 We have already consulted on other aspects of the 2.3 and 3.4 GHz award through a series of consultation documents published between 2013 and 2015. As a result, we have already taken decisions with respect to a number of issues, including other uses of the award bands; coexistence between mobile services and other services in neighbouring bands (including Wi-Fi); the technical and non-technical licence conditions we will apply to the 2.3 and 3.4 GHz licences; and on other aspects of the Auction design.
- 2.3 These decisions are summarised in section 3 of this document, so that stakeholders can see all our conclusions relating to the Auction in one place.
- 2.4 The outstanding issues determined in this statement relate to competition matters and to further rules for conducting the Auction, as set out in the November 2016 consultation. The bulk of this document therefore focuses on these areas.
- 2.5 All the decisions in relation to the Auction (including those set out in this statement and those which we have already taken in previous documents) directly concern our functions under the legal framework to manage the radio spectrum in the UK, including allocating and authorising spectrum use. They will be given effect to by Auction Regulations made under section 14 of the Wireless Telegraphy Act 2006.
- 2.6 In reaching our decisions in respect of the Auction, we have acted in accordance with our statutory duties, including our principal duty to further the interests of citizens in relation to communications matters and of consumers in relevant markets, where appropriate by promoting competition.

The importance of radio spectrum

- 2.7 The radio spectrum comprises one part of the wider electro-magnetic spectrum, which includes all forms of electro-magnetic waves (such as visible light, infrared and X-rays). The significance of the radio spectrum is that it includes waves that can travel over significant distances, and in some cases through objects such as walls and over hills.
- 2.8 Radio waves can be modified by human action so that they can carry information. This allows people to communicate with each other reliably without the need for wires. The radio waves are defined by their frequency, which is the number of times that the wave oscillates per second.³

³ The unit of frequency is a hertz (Hz), which is one oscillation per second. A thousand oscillations per second is referred to as a kilohertz (kHz), a million as a megahertz (MHz), and a thousand million as a gigahertz (GHz). Other types of electro-magnetic wave, such as light, have frequencies that are many orders of magnitude higher than radio. A group of radio frequencies that is contiguous is often referred to as a spectrum or frequency 'band'.

- 2.9 Radio spectrum is a scarce and finite resource. The spectrum itself is a major asset to the UK economy and society because it is the means by which all wireless communications devices operate. It is critical to areas such as mobile telephony and multimedia, radio and television broadcasting, satellite communications, air travel, emergency services, and public utilities.

The spectrum to be awarded

- 2.10 Within the radio spectrum, different frequencies have different physical properties. The properties of the 2.3 and 3.4 GHz bands mean they are suitable for the provision of mobile communication services, including mobile data services. The characteristics of these frequencies mean they are best suited to adding additional capacity to existing mobile networks, rather than providing broader network coverage.⁴
- 2.11 The Auction will comprise 190 MHz of spectrum which has been released to Ofcom by the Ministry of Defence as part of the Government's Public Sector Spectrum Release (PSSR) programme. The Auction is likely to attract the interest of mobile network operators (MNOs)⁵ and other providers looking to increase their capacity to meet growing demand for mobile data from consumers and industry. However, alternative uses will not be precluded if winning bidders have other plans (subject to compliance with technical parameters and consequent licence conditions).
- 2.12 The award bands are made up of 40 MHz of spectrum within the 2.3 GHz band (2350-2390 MHz) and 150 MHz of spectrum within the 3.4 GHz band (at 3410-3480 MHz and 3500-3580 MHz).
- 2.13 Access to a further 40 MHz of spectrum in the 3.4 GHz band (3480-3500 MHz and 3580-3600 MHz) is currently licensed to UK Broadband Limited. On 31 May 2017 H3G completed the acquisition of UK Broadband Limited, including its spectrum holdings. H3G has the option of applying for a replacement licence in respect of the current 3.4 GHz holdings of UK Broadband. This means it would allow its 3.4 GHz frequencies to be included in the assignment stage of the Auction, thereby enabling all users of the 3.4 GHz band to have contiguous spectrum holdings after the Auction.
- 2.14 The 2.3 GHz spectrum will be made available for new uses throughout Great Britain (i.e. in England, Scotland⁶ and Wales, but not in Northern Ireland). The 3.4 GHz spectrum will be made available throughout the whole of the UK.
- 2.15 The frequencies we are making available will increase the total amount of spectrum available to mobile operators by 190 MHz, from 647 MHz to 837 MHz – an increase of 29% in the total mobile spectrum available. However, the 2.3 and 3.4 GHz

⁴ Broadly speaking, at lower frequencies, signals travel further and are generally better at going round hills and at penetrating objects such as buildings. This is referred to as having better "propagation", such that lower frequencies are typically better suited to providing wider coverage of services. However, the capacity (also known as 'bandwidth') available at these frequencies to carry information is limited. At higher frequencies (such as those available in this award), signals may only travel a short distance from a transmitter and may not be able to penetrate obstacles such as buildings, trees or even in some cases rain. However, there is high capacity available to carry information.

⁵ In our July 2012 statement we used the term 'national wholesaler' to mean what we here refer to as MNO. The way we use MNO in this consultation excludes those operators that have mobile networks covering only specific areas rather than providing national coverage.

⁶ There are restrictions to availability in the Outer Hebrides, the Isle of Skye and the Small Isles.

spectrum bands are different from one another, and are likely to be important for increasing mobile capacity at different points in time:

- a) The 40MHz of spectrum in the **2.3 GHz band** can be used immediately, because it is already supported by mainstream mobile devices such as the Apple iPhone;
 - b) The 150 MHz of spectrum in the **3.4 GHz band** is *not* currently supported by most devices, but is likely to become useful in around two or three years. Additionally, the 3.4 GHz band is one of the bands likely to support the initial deployment of 5G mobile services. For example, we note that the Radio Spectrum Policy Group (RSPG), the high-level advisory group that assists the EC in the development of radio spectrum policy,⁷ recently identified the wider 3.4-3.8 GHz band as the “*primary band suitable for the introduction of 5G use in Europe even before 2020*”.
- 2.16 Both bands are harmonised throughout Europe for mobile services. Although high power mobile services seem the most likely use of the spectrum, alternative uses will not be precluded if winning bidders have other plans (subject to compliance with technical parameters and licence conditions).
- 2.17 We have considered whether this spectrum could be used to improve the geographic availability of mobile services in the UK i.e. by increasing the level of coverage. However, as identified above, the technical characteristics of the spectrum mean it is best suited to adding capacity to existing networks, and is not an effective means of extending existing levels of mobile coverage.

Legal framework

- 2.18 The legal framework for the Auction derives from our duties under both European and domestic legislation, specifically from:
- a) The Common Regulatory Framework⁸ for electronic communications networks and services, in particular, the Framework Directive and the Authorisation Directive;
 - b) Any relevant Decisions of the European Commission which bind the UK as to the use of the spectrum to be awarded; and
 - c) The Communications Act 2003 (the “Communications Act”) and the Wireless Telegraphy Act 2006 (the “Wireless Telegraphy Act”) which transpose the provisions of the directives referred to above into national law.

European Regulatory Framework

- 2.19 Article 8 of the Framework Directive sets out the objectives which national regulatory authorities must take all reasonable steps to achieve. These include:

⁷ <http://rspg-spectrum.eu/>

⁸ The Common Regulatory Framework comprises the Framework Directive (Directive 2002/21/EC), the Authorisation Directive (Directive 2002/20/EC), the Access Directive (Directive 2002/19/EC), the Universal Service Directive (Directive 2002/22/EC) and the Directive on privacy and electronic communications (Directive 2002/58/EC), as amended by the Better Regulation Directive (Directive 2009/140/EC).

- The promotion of competition in the provision of electronic communications networks and services by, amongst other things ensuring there is no distortion or restriction of competition in the electronic communications sector and encouraging efficient use of radio frequencies; Contributing to the development of the internal market by, amongst other things, removing obstacles to the provision of electronic communications networks and services at a European level, encouraging the interoperability of pan-European services.
- 2.20 In pursuit of these policy objectives, Article 8 requires national regulatory authorities to apply objective, transparent, non-discriminatory and proportionate regulatory principles by, among others:
- a) Ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services; and
 - b) Promoting efficient investment and innovation in new and enhanced infrastructures.
- 2.21 Article 8 also requires Member States to ensure that in carrying out their regulatory tasks, national regulatory authorities take the utmost account of the desirability of making regulations technologically neutral.
- 2.22 Article 9 of the Framework Directive requires Member States to ensure the effective management of radio frequencies for electronic communications services in accordance with Article 8, and to ensure that spectrum allocation used for electronic communication services and issuing general authorisations or individual rights of use of such radio frequencies are based on objective, transparent, non-discriminatory and proportionate criteria. Article 9 also requires Member States to promote the harmonisation of use of radio frequencies across the Community, consistent with the need to ensure effective and efficient use of frequencies. It further requires Member States to ensure technology and service neutrality.
- 2.23 Article 5 of the Authorisation Directive provides that where it is necessary to grant individual rights of use of radio frequencies, Member States must grant such rights through open, objective, transparent, non-discriminatory and proportionate procedures, and in accordance with the provisions of Article 9 of the Framework Directive. When granting those rights, Member States are required to specify whether they can be transferred by the holder, and if so, under which conditions.
- 2.24 Article 7 of the Authorisation Directive provides that where Member States decide to limit the number of rights of use to be granted for radio frequencies, they must, among others, give due weight to the need to maximise benefits for users and to facilitate the development of competition.
- 2.25 The legal duties imposed on the UK by the Framework and Authorisation Directives are transposed into UK law and given effect to by the Communications Act and the Wireless Telegraphy Act (see below).

European Commission decisions relevant to the 2.3 GHz and 3.4 GHz spectrum

- 2.26 On 21 May 2008, the European Commission adopted a decision (Decision 2008/411/EC) which sought to harmonise the conditions for the availability and

efficient use of the 3400-3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the EU. On 2 May 2014, the European Commission adopted Decision 2014/276/EU12, which amended Commission Decision 2008/411/EC, primarily in relation to the technical conditions in compliance with which the band should be made available. Any award of the 3.4 GHz band has to be compliant with the Commission Decision.

- 2.27 In relation to the 2.3 GHz band, ECC Decision (14)02 sets out harmonised technical and regulatory conditions for the use of the band 2300-2400 MHz for Mobile/Fixed Communications Networks. The ECC Decision is not mandatory, but in awarding the 2350-2390 MHz frequencies we are following the technical parameters agreed at the European Conference of Postal and Telecommunications Administrations (CEPT).

The duties imposed by the Communications Act

- 2.28 Ofcom's principal duties under Section 3 of the Communications Act 2003 are:

- a) To further the interests of citizens in relation to communications matters; and
- b) To further the interests of consumers in relevant markets, where appropriate, by promoting competition.

- 2.29 In doing so, we have a duty to secure, amongst other things, the optimal use of spectrum (Section 3(2)(a)); the availability throughout the UK of a wide range of electronic communication services and a duty to take account of the different needs and interests of all current or potential users of the frequencies (Section 3(4)(f)).

- 2.30 In performing our duties, we are also required under Section 3(3) to have regard in all cases to the principles under which regulatory activities should be transparent, accountable, proportionate, consistent and targeted only at cases in which action is needed.

- 2.31 Section 4 of the Communications Act requires Ofcom to act in accordance with the six Community requirements, which give effect to the requirements of Article 8 of the Framework Directive.

The duties imposed by the Wireless Telegraphy Act

- 2.32 The Wireless Telegraphy Act 2006 (WTA) also sets out a number of core statutory duties for Ofcom relating to spectrum management. These include the duty to have regard in carrying out our radio spectrum functions, to the extent to which spectrum is available, to the demand for use of the spectrum for wireless telegraphy, and the demand that is likely to arise in future for the use of the spectrum for wireless telegraphy (Sections 3(1)(b) and (c)).

- 2.33 Section 3 of the Wireless Telegraphy Act also requires Ofcom to have regard to the desirability of promoting the development of innovative services and competition in the provision of electronic communications services.

Application of our duties to the Auction

- 2.34 Taking into account each of the above duties and the relevant facts and circumstances, we consider that our principal duty to further the interests of citizens, and the interests of consumers where appropriate by promoting competition, is of particular importance to the Auction.

- 2.35 We also consider that our duties relating to:
- a) The optimal use for wireless telegraphy of the electro-magnetic spectrum;
 - b) The desirability of encouraging investment and innovation;
 - c) The desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom; and
 - d) Having regard to the interests of consumers in respect of choice, price, quality of service and value for money;

are particularly relevant.

- 2.36 In carrying out our competition assessment, in particular, we have taken account of the need for our proposals to be objectively justifiable; not unduly discriminatory; transparent; and proportionate.
- 2.37 As we set out in this document, there are uncertainties surrounding a number of key factors which are relevant to our competition assessment. In light of those uncertainties, we have sought to explain why we consider the decisions that we make are appropriate in light of our aims and duties, and comprise the least restrictive measures which we consider are reasonably capable of meeting the aims that we have identified as being of most importance.

Our objectives for the Auction

- 2.38 In light of our duties, our objective is to design the Auction in a way that enables the allocation of the spectrum to those bidders most likely to put it to the most efficient use and deliver the highest possible value to society. In so doing, we consider that it should be designed in a manner that promotes competition. We consider that this should fulfil our duty to secure the optimal use of the spectrum and enable us to achieve our wider policy objective that everyone in the UK can enjoy fast and reliable mobile broadband services.
- 2.39 In addition, we consider that the Auction should be simple where possible, without unduly compromising an efficient outcome, and that participants should have confidence in the fairness of the process and the final outcome.

Structure of the document

- 2.40 The rest of this document is set out as follows:
- **Section 3** summarises the decisions relating to the 2.3 and 3.4 GHz award that that have already been taken.
 - **Section 4** summarises the proposals we set out in our November 2016 consultation in relation to our competition assessment and its implications for potential competition-related measures in the Auction.
 - **Section 5** describes the developments that have taken place since the November 2016 consultation was published, and additional factual evidence presented in response to the consultation. We have taken these into account in finalising our decisions on competition measures in the Auction.

- **Section 6** identifies and assesses potential competition concerns arising from the Auction.
 - **Section 7** explains the competition measures we have decided to implement to address the competition concerns we have identified.
 - **Section 8** notes the decisions we have already taken with respect to auction design and regulations. It then sets out our further decisions following the November 2016 consultation, including those necessary to implement the conclusions of our competition assessment.
 - **Section 9** details the next steps for the award.
- 2.41 More detailed analysis of the key factors that have helped to inform our conclusions are set out in the annexes to this statement. In some places in this document and in the annexes we draw on commercially sensitive evidence supplied to us in confidence. This evidence is redacted in the published version of this document. Where we have redacted passages of text or illustrations it is indicated by the ¶ symbol.
- 2.42 This document is published alongside two further documents: an Information Memorandum setting out details relating to the 2.3 and 3.4 GHz band which may be of relevance to potential bidders,⁹ and a Notice of Ofcom's proposal to make regulations in connection with the award of 2.3 GHz and 3.4 GHz spectrum. The latter is a consultation on the Auction Regulations which will give effect to the decisions set out in this document in relation to the Auction design.¹⁰

⁹ https://www.ofcom.org.uk/_data/assets/pdf_file/0030/81579/info-memorandum.pdf

¹⁰ https://www.ofcom.org.uk/_data/assets/pdf_file/0021/103827/Notice-of-proposal-to-make-regulations-in-connection-with-the-award-of-2.3-GHz-and-3.4-GHz-spectrum.pdf

Section 3

Previous decisions on the award

- 3.1 This statement sets out our final decisions on competition issues and on auction design and regulations, building on a large body of pre-existing work. We have already taken decisions on a number of other matters connected to the 2.3 and 3.4 GHz award. The publications in which our earlier decisions are set out are as follows:
- **In February 2014** we published a document¹¹ confirming that band plans for both the 2.3 and 3.4 GHz spectrum would be consistent with time division duplex (TDD) arrangements.¹² The same document served as a consultation on proposals for addressing the coexistence of LTE with users of adjacent spectrum bands. The technical analysis supporting our proposals was updated in a further document published in December 2014.¹³
 - **In April 2014** we published a statement¹⁴ setting out our approach to use by amateur radio enthusiasts of the 2.3 and 3.4 GHz spectrum, and neighbouring spectrum. We decided that amateur radio should not have continued access to the award bands after April 2015.
 - **In June 2014** we published a document which set out our decision *not* to proceed with proposals to consolidate UK Broadband's spectrum holding in the 3.4 GHz band (3480-3500 MHz and 3580-3600 MHz) into a single contiguous block at 3560-3600 MHz.¹⁵ The document nevertheless proposed granting UK Broadband's application of an extension of the licence beyond its original expiry date of July 2018. The application was granted in a subsequent statement published in October 2014.¹⁶
 - **In October 2014** we published a statement setting out our strategy for Programme Making and Special Events (PMSE).¹⁷ The document addressed issues around the impact of the 2.3 and 3.4 GHz award on the amount of spectrum available for PMSE use, particularly for television coverage of sporting and other events, and identified the circumstances in which limited on-going access to the award bands might be permitted.
 - **In May 2015** we published decisions on a wide-range of issues.¹⁸ The same document also served as a consultation on certain competition issues. The decisions we took were as follows:
 - **Auction design:** We decided to conduct the 2.3 and 3.4 GHz award using a Simultaneous Multi-Round Ascending (SMRA) auction format.

¹¹ <http://stakeholders.ofcom.org.uk/binaries/consultations/pssr-2014/summary/pssr.pdf>

¹² Time division duplex is used to separate the outward and return mobile signals in the same frequency channel by time, rather than by use of different frequencies (frequency division duplex).

¹³ <http://stakeholders.ofcom.org.uk/consultations/pssr-2014/updated-analysis/>

¹⁴ <http://stakeholders.ofcom.org.uk/consultations/public-sector-spectrum-release/statement>

¹⁵ https://www.ofcom.org.uk/_data/assets/pdf_file/0026/55583/condoc.pdf

¹⁶ https://www.ofcom.org.uk/_data/assets/pdf_file/0018/74610/uk_broadband_statement.pdf

¹⁷ https://www.ofcom.org.uk/_data/assets/pdf_file/0031/68953/statement_on_camera_strategy.pdf

¹⁸

https://www.ofcom.org.uk/_data/assets/pdf_file/0027/68337/Public_Sector_Spectrum_Release_statement.pdf

We determined that the 40 MHz of spectrum available in the 2.3 GHz band should be awarded in 10 MHz lots. We said the 150 MHz of spectrum available in the 3.4 GHz band should be awarded in 5 MHz lots. We also finalised decisions on a range of more detailed aspects, which are set out in section 8 of this document.

- **Pre-existing licence holder:** We decided that if the existing holder of 40 MHz in the 3.4 GHz band (UK Broadband) wished to take part in the Auction it would have the option of applying for a replacement licence for the frequencies it held. Those frequencies would then be included in the assignment stage of the Auction, and so allow all allocations in the 3.4 GHz band to be contiguous following the Auction.
- **Coexistence issues:** We took decisions on a range of issues connected to the co-existence of mobile broadband in the 2.3 GHz band with services in the nearby licence exempt band (2400 to 2483.5 MHz). Those services included domestic and commercial **Wi-Fi**, **Bluetooth**, **ZigBee**, some medical monitoring equipment and **Assistive Listening Devices (ALDs)**. In all cases we concluded that the likelihood of interference was low and no intervention in the market was necessary or justified to protect devices. We also set out decisions with respect to **civil maritime radar** and **aeronautical radar** close to the 3.4 GHz band; and with respect to coexistence with **satellite services**. We said coordination was needed between 3.4 GHz LTE and aeronautical radar, but not with civil maritime radar or satellite services. We said coexistence with **naval systems** would require coordination zones around key military locations.
- **Technical licence conditions:** We set out decisions on coordination to avoid interference between neighbouring users *within* the 2.3 and 3.4 GHz bands. We decided there should be a different approach for the different bands. For the 3.4 GHz band we said there should be a flexible approach to synchronisation between users to allow for innovation. For the 2.3 GHz band, because there is less available spectrum, we decided to mandate full synchronisation.
- **Non-technical licence conditions:** We decided licences in the 2.3 and 3.4 GHz band would be issued for an indefinite period with an initial term of 20 years and on a non-exclusive basis; the 2.3 GHz licences would cover Great Britain (i.e. England, Scotland and Wales, but not Northern Ireland),¹⁹ the 3.4 GHz licences would cover the whole of the UK; the 2.3 and 3.4 GHz licences would exclude territorial seas and areas of adjacent internal waters, although individual requests would be considered; the spectrum would be tradable under the provisions of the Mobile Trading Regulations; and there would be no coverage obligations or ‘use-it-or-lose-it’ obligations placed on licensees.

¹⁹ Exclusion zones will apply in The Hebrides, Isle of Skye and The Small Isles.

- **In October 2015** we published a statement²⁰ setting out our decision to set a reserve price of £10m for each 10 MHz 2.3 GHz lot and £1m for each 5 MHz 3.4 GHz lot.

3.2 Our previous decisions on auction design and regulations are discussed in more detail in section 8 of this document, which also sets out our final decisions on other aspects of the auction design.

20

<http://webarchive.nationalarchives.gov.uk/20110207093142/http://stakeholders.ofcom.org.uk/binaries/consultations/2.3-3.4-ghz-auction-design/statement/pssr-statement.pdf>

Section 4

Our November 2016 consultation proposals

- 4.1 In our November 2016 consultation²¹ we explained our principal duties under the Communications Act 2003: to further the interests of citizens in relation to communications matters; to further the interests of consumers in relevant markets, where appropriate by promoting competition; and to secure the optimal use of spectrum.
- 4.2 We also set out our key objectives which would enable us to fulfil these duties. First, we wanted to make the 2.3 and 3.4 GHz spectrum available in a timely fashion, in order to meet consumer demand for mobile broadband services with higher speeds and greater capacity. Second, we wanted to ensure that consumers and businesses continued to benefit from a competitive market in the provision of mobile services.
- 4.3 Our general approach to awarding spectrum in circumstances where, as here, demand for the spectrum is likely to be greater than the amount of spectrum which is available, is to allow the market to determine the best allocation, often through means of an auction. This is because we consider that the operator with the highest value for the spectrum will normally be the one most likely to use the frequencies to deliver the services consumers most want.
- 4.4 However, there may be circumstances in which the outcome of an auction may be detrimental to competition and hence to consumers, even if it would help to deliver the most valuable services. For example, if the auction left one or more operators with insufficient spectrum to compete strongly, consumers could face higher prices and other operators might have reduced incentives to innovate and invest.
- 4.5 Our consultation document analysed the potential risks to competition and set out a range of potential competition concerns. It explained our view that some of these concerns were sufficient to justify intervention and we set out proposals for competition measures to mitigate our concerns. We also set out some proposed changes to the Auction Regulations which we discuss further in Section 8.

Our competition concerns

- 4.6 There are currently four MNOs serving the market – BT/EE, H3G (operating as Three), O2 (owned by Telefónica) and Vodafone. These are supplemented by a number of Mobile Virtual Network Operators (MVNOs) which each have access to an MNO's network through a commercial agreement, and offer their own mix of services to end customers.
- 4.7 In our consultation document, we explained our view that the UK mobile market was working well for consumers and businesses, with strong competition between mobile network operators (MNOs). We set out evidence that the UK enjoys relatively low prices, whilst at the same time seeing significant levels of investment in new products and services.

²¹ https://www.ofcom.org.uk/_data/assets/pdf_file/0026/93545/award-of-the-spectrum-bands-consultation.pdf

- 4.8 However, we also described a risk that the current level of competition may reduce as consumer demand for mobile services increases. This was because of an asymmetry in the amount of spectrum held by different operators. We considered that the asymmetry meant that some operators may be better placed to respond to increased demand than others.
- 4.9 Of the total amount of mobile spectrum that we said was currently useable, BT/EE held 45%; Vodafone held 28%; O2 held 15%; and H3G held 12%. We noted that if BT/EE were to win all the 2.3 GHz spectrum available in the Auction, that would increase its share of immediately useable spectrum from 45% to nearly half (49%, excluding the 1400 MHz band). In other words, this one operator would have almost the same amount of spectrum as all the other operators put together.
- 4.10 In our November 2016 consultation, our judgement was that this would create a significant risk to competition; we considered potential competition concerns from two perspectives:
- a) First, we considered whether the outcome of the Auction might result in any of the existing operators no longer being credible as a national supplier of mobile services.
 - b) Second, we considered whether competition amongst the four national operators might be weakened, even if they remained credible MNOs, because they had very asymmetric spectrum holdings.
- 4.11 Our analysis suggested it was unlikely that any of the existing MNOs would be left with insufficient spectrum to remain credible suppliers after the Auction. However, we considered that, a *very* asymmetric distribution of spectrum might allow an operator with a large amount of spectrum to offer a range or quality of services that could not be matched by credible competitors with smaller holdings. Conversely, we considered that an operator that was a credible competitor but had a small spectrum holding might struggle to compete in some segments of the market or in the provision of some services.
- 4.12 We considered whether these concerns about asymmetry might warrant intervention in the market. We assessed asymmetry and its impact on competition from three perspectives:
- a) Asymmetry in immediately useable spectrum (i.e. including the 2.3 GHz band but excluding the 3.4 GHz frequencies);
 - b) Asymmetry in the distribution of 3.4 GHz spectrum following the Auction; and
 - c) Asymmetry in the overall distribution of spectrum shares immediately after the Auction.
- 4.13 We considered that asymmetry in the 3.4 GHz band and asymmetry in the overall distribution of spectrum were less likely to result in competition concerns than asymmetry in the 2.3 GHz band. We based this view on our assessment that other mobile spectrum would become available in roughly the same timeframe as the 3.4 GHz band so that any competition concerns could be addressed at that time, if we assessed that doing so was necessary.

- 4.14 However, we remained concerned that very asymmetric spectrum holdings in immediately useable spectrum could adversely affect competition in the period before the 3.4 GHz band became useable.
- 4.15 We also considered how likely it was that very asymmetric holdings would arise after the Auction. We said there may be some incentive for operators who do not actually need additional spectrum immediately nonetheless to win it to weaken the competition they face in the mobile market. We considered that it would be easier to succeed in this kind of strategic investment in the 2.3 GHz band because of the relatively small amount of spectrum available. However, it is also possible that very asymmetric distribution of spectrum could arise even if bidding was not for strategic reasons.

Our proposed competition measures

- 4.16 Taking all these factors into account, we proposed a cap on immediately useable spectrum (i.e. spectrum useable now and in the transitional period before the 3.4 GHz frequencies are brought into use). We defined the immediately useable spectrum as frequencies in the 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2.3 GHz and 2.6 GHz, adding up to a total of 607 MHz. We proposed to set the cap at 255 MHz - the level of BT/EE's current mobile spectrum holdings. We said the cap would prevent an increase in the current extent of asymmetry in immediately useable spectrum.
- 4.17 We proposed no cap on the 3.4 GHz spectrum because we were less concerned about the risks associated with this band. We noted it was not immediately useable, and by the time it was, we expected other spectrum to be available. Additionally, we said the 3.4 GHz band was likely to be an enabler of 5G deployment - which might require access to large blocks of contiguous spectrum. Placing restrictions on the purchase of 3.4 GHz spectrum could put early development of 5G at risk.
- 4.18 However, we also explained that if the 3.6-3.8 GHz spectrum were likely to be available for mobile services materially later than the 3.4 GHz spectrum, then we would be more concerned about a large degree of asymmetry in total mobile spectrum holdings immediately after the Auction. In those circumstances, there would be a stronger case for an additional constraint on overall spectrum holdings and we identified an overall cap of 340 MHz as an intervention that might be proportionate.

Auction design

- 4.19 In addition to the competition issues, the November 2016 consultation also addressed some matters concerning the Auction design and regulations. In particular, it proposed changes to the rules set out in our October 2015 draft regulations governing the withdrawal of bids made during the principal stage of the Auction. These matters are discussed in detail in section 8 of this statement.

Consultation responses

- 4.20 We received 30 responses to our consultation. Four of those responses were submitted in both confidential and non-confidential versions. A further two responses were entirely confidential, and one response was confidential in part. Eight responses were submitted by individuals, of which seven responses were non-confidential. All

non-confidential responses - and non-confidential versions of confidential responses - are published on our website.²²

- 4.21 In addition to responses submitted directly to Ofcom in response to the consultation, a large number of submissions were made through a campaign called 'Make The Air Fair'. The campaign was launched by H3G (Three) with the stated aim of generating public support for tighter competition measures than we had proposed in the consultation. We have provided further details of the campaign and responses on our website.²³
- 4.22 In reaching the decisions set out in this statement, we have taken account of all submissions received in response to our consultation.

²² <https://www.ofcom.org.uk/consultations-and-statements/category-1/award-of-the-spectrum-bands>

²³ https://www.ofcom.org.uk/_data/assets/pdf_file/0028/98128/Make-The-Air-Fair.pdf

Section 5

Developments since our consultation document

- 5.1 The proposals we set out in the November 2016 consultation were informed by our understanding of the mobile market at that time. It is appropriate for us to take account of any changes in the market since then which might be relevant to our view of the competition concerns we identified.
- 5.2 We consider developments since the November 2016 consultation below under the following headings:
- a) **H3G's acquisition of UK Broadband.** This very significantly reduces any concerns we may have had about H3G's capacity in the period after the 3.4 GHz spectrum becomes useable.
 - b) **The availability and useability of additional spectrum.** We now expect that the 1400 MHz band will be useable in the period before the 3.4 GHz spectrum becomes useable. This is earlier than we previously thought. However, we have less confidence that the 3.6-3.8 GHz band will be useable within similar timeframes to the 3.4 GHz spectrum across the UK.
 - c) **Ability of MNOs to add capacity without additional spectrum.** We have seen additional credible evidence that suggests MNOs may be less able than we thought to adapt their networks to increase capacity without additional spectrum.
- 5.3 We discuss each of the developments we have identified in turn, and assess how they affect the analysis and conclusions set out in the November 2016 consultation. In section 6 we then go on to consider the competition issues for the Auction more widely, taking account of these new developments alongside other relevant factors.

a) H3G acquisition of UK Broadband

- 5.4 On 6 February 2017, H3G announced it had reached agreement to acquire UK Broadband Limited, including its spectrum holdings. The agreement was cleared by the Competition and Mergers Authority on 3 May 2017²⁴ and was completed on 31 May 2017.²⁵
- 5.5 As a result of the acquisition, and through licences currently held by UK Broadband Limited, H3G has gained access to 40 MHz of spectrum within the 3.4 GHz band (at 3480-3500 MHz and 3580-3600 MHz); 84 MHz in the 3.6-3.8 GHz band, which has been identified as a priority band for 5G mobile services, along with the 3.4 GHz band; plus the DECT guard band and spectrum suitable for high-capacity point-to-point and point-to-multipoint services in the 3.9 GHz, 28 GHz and 40 GHz bands. Even though UK Broadband is still the licensee for access to the above spectrum bands, we will, for the rest of this statement, consider these as being held by H3G.

²⁴ <https://www.gov.uk/cma-cases/hutchison-3g-uk-transvision-investments-merger-inquiry>

²⁵ <http://www.threemediacentre.co.uk/news/2017/ukb-completion.aspx>

Thus, where we refer to H3G's overall holdings, we include licences currently held by UK Broadband.

- 5.6 The acquisition of UK Broadband's 3.4 and 3.6-3.8 GHz spectrum licences increases H3G's overall holdings of spectrum that we expect to be useable for mobile in the future from 89.5 MHz to 213.5 MHz. This is a significant increase. However, because the 3.4 and 3.6-3.8 GHz bands are not currently supported by UK mobile devices, the acquisition does not have any impact on H3G's holdings of *immediately useable* frequencies.
- 5.7 Figure 5.1 below shows the current allocation of all the spectrum held by MNOs that we anticipate being useable for mobile services either now or in the next 5 to 10 years.

Figure 5.1: Current holdings of allocated mobile spectrum²⁶

Spectrum Band	Type	BT/EE	Vodafone	O2	H3G	Total
800 MHz	FDD	10	20	20	10	60.0
900MHz	FDD	0	34.8	34.8	0	69.6
1452-1492 MHz	SDL	0	20	0	20	40.0
1800 MHz	FDD	90	11.6	11.6	30	143.2
2100 MHz	FDD	40	29.6	20	29.5	119.1
2.6 GHz (paired)	FDD	100	40	0	0	140.0
2.6 GHz (unpaired)	TDD	15	20	0	0	35.0
3.4 GHz	TDD	0	0	0	40	40.0
3.6-3.8 GHz	TDD	0	0	0	84	84.0
Total holdings		255.0	176.0	86.4	213.5	730.9
Share of spectrum		35%	24%	12%	29%	

- 5.8 Even if H3G won no further spectrum in this Auction or subsequent anticipated awards, its current holdings would still amount to a share of 19% of the expanded pool of spectrum (i.e. those frequencies currently allocated - as shown above - plus those we plan to make available).²⁷

Implications for competition assessment

- 5.9 As a result of H3G's acquisition of UK Broadband, any concerns we may have had about the effect on competition of H3G's capacity in the period after the 3.4 GHz band becomes useable are now very greatly reduced.

b) The availability and useability of additional spectrum

- 5.10 The availability and useability of spectrum bands for mobile is of direct relevance to the assessment of potential competition concerns and associated competition measures set out in the November 2016 consultation.
- 5.11 In the consultation, we considered that only the 2.3 GHz band would be useable for mobile immediately, with the 3.4 GHz band not expected to become useable for at least two to three years after the Auction (suggesting 2019-2020 or later). In the transitional period before the 3.4 GHz spectrum became useable, we expected other bands also to become available. We said we intended to award the 700 MHz band in 2018/19 for mobile use from mid-2020 onwards, and we were in the process of

²⁶ We describe why we regard these bands as relevant and not others in annex 3. This includes describing why we do not include all 50 MHz of the unpaired 2.6 GHz spectrum in the table, or in our analysis.

²⁷ The pool of mobile spectrum increases to 1,116.9 MHz if we add spectrum yet to be awarded in the 700 MHz, 2.3 GHz, 3.4 GHz and 3.6-3.8 GHz bands.

consulting on making the 3.6-3.8 GHz band available for mobile, potentially on a similar timescale.

- 5.12 We also considered that other spectrum held by the MNOs – particularly the 1400 MHz band – was not immediately useable, but we expected it to be useable in a similar timeframe to the 3.4 GHz band.
- 5.13 Responses we received from the current operators focused on the timelines for development of a device ecosystem for bands; the potential obstacles to meeting Ofcom’s timelines for clearance and award of the 700 MHz and 3.6-3.8 GHz bands; and the requirements to be able to consider a band as useable.²⁸ We have reviewed what bands may be useable in what timeframes, in light of responses and market developments.
- 5.14 In making our assessment of useability for the Auction, we regard mobile spectrum as being useable once it satisfies all of the following three conditions:
- **Allocation:** The spectrum has been allocated, for example by auction, and the licences allow it to be used for mobile services. There should also be sufficient time to allow for the network to be rolled out after the spectrum has been awarded.
 - **No major constraints on use:** To the extent there are constraints on the use of the spectrum for mobile (e.g. due to a clearance programme of previous users or on-going requirements to address co-existence with other users) they must not be so significant that they undermine the substitutability of the band for adding capacity relative to the auctioned bands, 2.3 GHz and 3.4 GHz.
 - **Ecosystem:** There is a sufficiently developed ecosystem for the spectrum for mobile services. In this regard, we see user devices (e.g. smartphones, tablets etc.) as the key constraint rather than network equipment. We also consider that spectrum can be useful for adding capacity even when it is supported in only a minority of user devices. This is because traffic can be offloaded to the proportion of devices that can use the new spectrum band, freeing up other bands on the remaining devices that cannot use the new band.
- 5.15 We summarise below our updated assessment with respect to bands where there have been relevant developments since the November 2016 consultation, namely the 3.4 GHz, 1400 MHz and 3.6-3.8 GHz. We present a much fuller assessment of these and other bands in annex 3.

3.4 GHz spectrum

- 5.16 In the November 2016 consultation we said that we expected the 3.4 GHz band would not be useable for at least two to three years after the Auction.
- 5.17 While at present there are no UK mobile devices that can use the 3.4 GHz spectrum,²⁹ some of the responses we received in the consultation suggested that these devices could start coming into the market as early as 2018. We have now also

²⁸ We provide details of the responses in annex 3.

²⁹ Other than one model, which was developed for the Japanese market, as we discuss in annex 3. In addition, the Essential PH-1 (due for release in Q3 2017) will support this band.

received indications from manufacturers that suggest the device ecosystem may develop more quickly than we originally envisaged.³⁰

Conclusions in respect of the 3.4 GHz band

5.18 We now consider that there is greater certainty that this band will be useable in the period 2019 to 2020. This band already meets the other two criteria for useability - i.e. there will be no material constraints on its use and it will be allocated as part of this Auction.

1400 MHz spectrum

5.19 In our November 2016 consultation we said we expected the 1400 MHz spectrum to be supported by mobile devices on a similar timescale to the 3.4 GHz spectrum. We also said we were not aware of any devices currently available that could use 1400 MHz, but we expected these to become available in the near future.

5.20 We now understand that the 1400 MHz band can already be used by several popular handsets³¹ and we have been told by < [REDACTED] . Furthermore, Telecom Italia has already deployed the 1400 MHz frequencies commercially in a number of cities in Italy, and we understand that Vodafone Germany is also trialling the band. As a result, we now expect that the 1452-1492 MHz frequencies will become useable spectrum during 2018.

5.21 Vodafone and H3G each hold 20 MHz of 1400 MHz spectrum and could reasonably expect to be able to use this band in the UK from 2018 i.e. in the transitional period before the 3.4 GHz band is useable. The 1400 MHz spectrum has already been allocated and there are no material constraints on its use which undermine its useability. Indeed, Vodafone is planning to deploy sites using the 1400 MHz band in 2017/18 < [REDACTED] and < [REDACTED] . Therefore, we now include the 1400 MHz band in the pool of immediately useable spectrum. As a result this pool now includes the 800 MHz, 900 MHz, 1400 MHz, 1800 MHz, 2100 MHz, 2.3 GHz and 2.6 GHz (paired and unpaired), adding up to a total of 647 MHz.

Conclusions in respect of the 1400 MHz band

5.22 Our view on the earlier useability of the 1400 MHz spectrum reduces to some extent our concerns about the effect on competition of any constraints on H3G's capacity in the period before the 3.4 GHz spectrum become useable.

3.6-3.8 GHz spectrum

5.23 In our November 2016 consultation, we noted there was some uncertainty about the future useability of the 3.6-3.8 GHz band. However, we judged it sufficiently likely that the 3.6-3.8 GHz frequencies could be available and useable across the UK on similar timescales to the 3.4 GHz band to support our proposal for no overall cap on spectrum holdings. We also explained that the case for an overall spectrum cap would be stronger if the 3.6-3.8 GHz band were not likely to be useable on those timescales.

³⁰ The Essential PH-1 due to be released later this year will support the 3.4 GHz band. Additionally, < [REDACTED]

³¹ Including the Samsung S8, Google Pixel, HTC 10 and Sony Xperia XZ.

- 5.24 In responses, H3G, Vodafone, O2, UK Broadband and a confidential respondent questioned the likelihood of this spectrum being available on a similar timescale. We have summarised what those stakeholders said and have responded to their views in annex 3.
- 5.25 A total of 84 MHz of spectrum in the 3.6-3.8 GHz band is licensed to UK Broadband (recently acquired by H3G). The full 3.6-3.8 GHz band is also used by a number of receiving satellite earth stations and fixed links. Under Ofcom's current approach to managing this band, we coordinate access on a first come first served basis, ensuring a defined benchmark spectrum quality for existing fixed link licences, and satellite receiver components specified within Permanent Earth Station licences and grants of Recognised Spectrum Access for these frequencies. We consider that continuation of the current approach would limit mobile deployment in some densely populated areas such as greater London.
- 5.26 In October 2016, we published a consultation³² setting out our proposals to make the band available for mobile and identifying options for doing so. In light of responses to that consultation and our subsequent analysis, we now have less confidence that we will be able to make the band available for mobile on an equivalent basis to the 3.4 GHz band across the UK within the same timescales as the 3.4 GHz spectrum becomes useable.
- 5.27 We will shortly be publishing a further document on the 3.6-3.8 GHz band confirming our intention to make the band available for mobile as soon as practicable, and setting out our proposed approach. Under our proposed approach, it is likely that it will be possible for operators to launch mobile services in the 3.6-3.8 GHz band in many areas from around 2020 - but not necessarily nationwide before 2022. For example, the band may not be fully useable in some highly populated areas where we consider there to be a significant likelihood of capacity constraints (including greater London) until 2022. The consequence is that there could be material constraints on mobile deployment in the 3.6-3.8 GHz band beyond the stage at which we expect the 3.4 GHz spectrum to become useable (i.e. from 2020).³³
- 5.28 With regards to the device ecosystem, we are aware of only one mobile handset that will be able to use this band in the near future: the Essential PH-1 due to be released later this year. However, < [REDACTED] . It is therefore possible that the ecosystem will develop at a similar pace as the 3.4 GHz band.

Conclusions in respect to 3.6-3.8 GHz band

- 5.29 Although our aim remains to allocate the 3.6-3.8 GHz spectrum for mobile as soon as is practicable, we do not have certainty that this will be possible within a similar timeframe as the 3.4 GHz spectrum across the UK. We now have less confidence that the band will be useable (as measured by the specific criteria in paragraph 5.14 above) than we did when we published our consultation document in November

³² <https://www.ofcom.org.uk/consultations-and-statements/category-1/future-use-at-3.6-3.8-ghz>

³³ We recognise that H3G's 84 MHz is near the bottom of the 3.6-3.8 GHz band and faces fewer restrictions than the top of the band. This is because there are no fixed links at the bottom of the band, there is less extensive use by sites with satellite earth stations and because < [REDACTED] . Nevertheless, there currently remain significant constraints on the extent to which H3G could deploy its 3.6-3.8 GHz spectrum for mobile services. For example, H3G's operational flexibility is limited by the obligation in the 3605–3689 MHz licence to co-ordinate each deployment with Ofcom for assessment against its technical frequency assignment criteria. Hence, we treat this part of the 3.6-3.8 GHz band in line with the rest of the 3.6-3.8 GHz band in terms of its usability.

2016. This affects our analysis of the extent to which we can rely upon the useability of the 3.6-3.8 GHz band to address any future competition concerns that might arise as a result of the Auction.³⁴

Implications for competition assessment

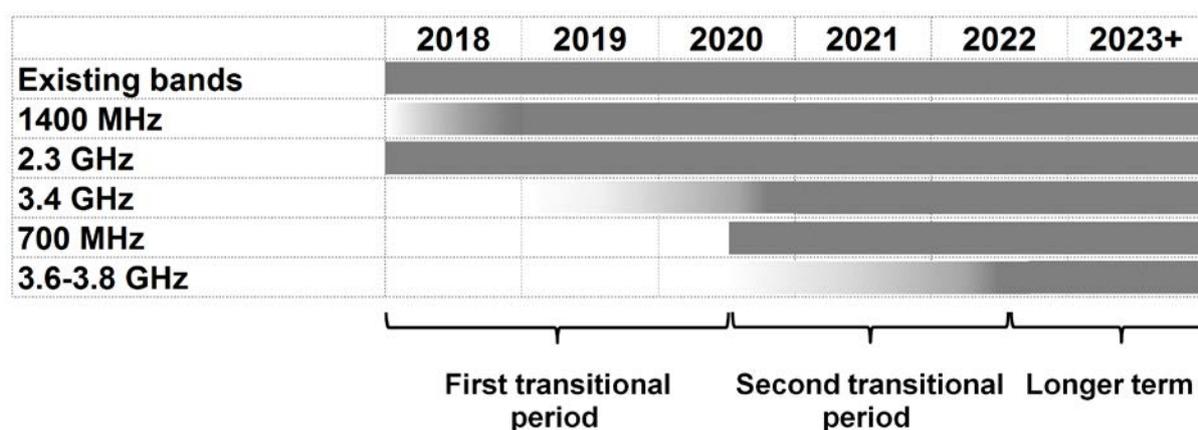
- 5.30 The developments affecting the availability and useability of spectrum bands, as discussed above, mean we have revised our view about relevant timeframes for the development of the mobile market.
- 5.31 We now expect that different spectrum bands will be available and useable at different times from those identified in the November 2016 consultations. As a result, we now distinguish three distinct periods:
- a) The **first transitional period** is from immediately after the 2.3 and 3.4 GHz Auction until the time at which the 3.4 GHz spectrum is useable. During this first transitional period we expect that the 2.3 GHz and 1400 MHz spectrum will be useable but the 3.4 GHz spectrum will not. We now expect the first transitional period to last for around two to three years.³⁵
 - b) The **second transitional period** begins when the 3.4 GHz is useable and lasts until the 3.6-3.8 GHz will be useable.³⁶ We also expect 80 MHz in the 700 MHz band to be useable in this period.
 - c) The **longer term** refers to the period after the 3.6-3.8 GHz is useable until up to 5-10 years in the future (the limit of our timeframe for the purpose of the competition assessment for the Auction).
- 5.32 These different time periods are shown in Figure 5.2 below along with an indication of when we expect the different spectrum bands to be useable. The faded nature of the bars is intended to illustrate the uncertainty. While Figure 5.2 also shows the timing of the first and second transitional periods, the start and end points of these periods is only illustrative. For example, the end of the first transitional period will be when the 3.4 GHz spectrum becomes useable, which we expect to be during 2019-2020, rather than being precisely at mid-2020 as illustrated in Figure 5.2.

³⁴ In the remainder of this document and in the annexes, when we refer to the ‘usability’ of the 3.6-3.8 GHz band, the definition of usability always relates to the criteria in paragraph 5.14 unless otherwise stated.

³⁵ In the November 2016 consultation, we referred to this simply as the transitional period, but we now refer to this as the first transitional period because we identify a second transitional period.

³⁶ If the 3.6-3.8 GHz spectrum becomes useable at a similar time to the 3.4 GHz spectrum, this second transitional period will not exist.

Figure 5.2: Time periods for our competition assessment



c) Ability of MNOs to add capacity without additional spectrum

- 5.33 In our November 2016 consultation we noted there were ways for MNOs to add capacity to their networks other than by deploying more spectrum. These include: ‘refarming’ spectrum currently used for one purpose to make it useable more efficiently for another; the use of smaller mobile cells so that existing spectrum can be used more intensively; the use of more advanced technology (such as enhanced MIMO); and the use of Wi-Fi to offload some mobile traffic.
- 5.34 If these means of adding capacity can be used effectively, it lessens our degree of concern that MNOs with relatively small spectrum holdings may be at a competitive disadvantage due to having insufficient capacity to offer the same speeds as rivals.
- 5.35 In the November 2016 consultation we focussed on the ability of O2 and H3G to add capacity without additional spectrum, as they are the MNOs with the smallest shares of relevant spectrum. We considered that those operators with a relatively small share of spectrum were more likely to face capacity constraints in future.
- 5.36 We said that **O2** was currently offering a good quality of service & [REDACTED] . We said it was not straightforward in the short term (i.e. before the 3.4 GHz band became useable) to deploy the techniques we identified to increase capacity. But we said there was likely to be scope for adding additional capacity after that (i.e. in the time we now define as the second transitional period).
- 5.37 For **H3G**, we referred to the EC assessment of the company’s proposed acquisition of O2 which said: “based on the available evidence in its file, it could not be reasonably predicted that H3G’s ability to compete would materially deteriorate due to capacity constraints in the next two to three years.”³⁷ We therefore did not undertake such a detailed assessment of whether H3G might be able to add capacity without additional spectrum.

Our further assessment

- 5.38 Since the November 2016 consultation we have considered extensive submissions from both O2 and H3G about their ability to add capacity.

³⁷ Recital 775, EC merger decision on the O2/Three merger, available online at http://ec.europa.eu/competition/mergers/cases/decisions/m7612_6415_10.pdf.

- 5.39 Having considered these submissions, we believe both O2 and H3G have overstated the difficulty of substituting sites for additional spectrum, especially in the longer term. Nevertheless, we agree that it can be technically challenging to keep adding sites to substitute for spectrum and that the marginal costs of doing so may be higher than for rivals with more spectrum.
- 5.40 Documents submitted alongside **H3G's** consultation response were focussed mainly on supporting broader arguments for a reservation of spectrum to allow it to increase its capacity. We have considered these submissions in detail and our analysis is set out in annex 6. In summary, we believe H3G has presented an overly pessimistic view of its own position.
- 5.41 We also note that H3G has continued to gain retail customers, and that it concluded a significant new MVNO partnership deal with Carphone Warehouse, which launched services in May 2015 (marketed as iD). On 5 July 2017 it launched a new offer called 'Go Binge', allowing customers on certain price plans to gain access to four streaming services, including Netflix, without this counting against their data allowances.³⁸
- 5.42 For the **first transitional period**, we acknowledge there could be limits on the extent to which H3G could grow the capacity of its network through technical improvements and densification. However, as noted above, we consider the 1400 MHz spectrum will provide an alternative means of addressing capacity constraints – and that devices capable of using the band will be available earlier than H3G maintains. Additionally, we consider that some demand assumptions in H3G's demand and capacity model are unduly unrealistic: we find that < [REDACTED] .
- 5.43 In the **second transitional period**, as already discussed, H3G's ability to increase network capacity has been enhanced materially by its potential to use 3.4 GHz spectrum. < [REDACTED]
- 5.44 Our assessment of **O2's** position - and its ability to increase capacity - has changed. We have now seen additional evidence suggesting that the scope for MNOs to add network capacity without additional spectrum after the first transitional period and beyond is more limited than we originally considered. This is because the obstacles to adopting alternative techniques in the first transitional period are likely to persist into the second transitional period too.
- 5.45 We have therefore reviewed our earlier analysis in the light of this additional evidence. As with H3G our assessment and conclusions with respect to O2 are addressed in detail in annex 6. However, they are summarised here in light of the fact that our conclusions have changed.
- 5.46 We continue to believe there is a risk that < [REDACTED].
- 5.47 We note that O2 has announced plans since the November 2016 consultation for 1,400 small cells³⁹ and a new Wi-Fi network⁴⁰ in the City of London. But details of how this might increase O2's capacity in this one area were not included in O2's response to the November 2016 consultation. We note that small cells and Wi-Fi

³⁸ See news release titled "Three removes data charges so Brits can infinitely binge watch on the go with 'Go Binge' launch" at <http://www.threemediacentre.co.uk/news/2017/go-binge-launch.aspx>.

³⁹ <http://www.mobileeurope.co.uk/press-wire/o2-uk-launches-small-cell-blitz-to-improve-its-london-coverage>

⁴⁰ <http://www.mobileeurope.co.uk/press-wire/o2-is-cornerstone-of-new-public-wi-fi-network-for-the-city-of-london>

might help to boost capacity in particular locations, but increases overall may be modest and, as we describe in the paragraphs below on the second transitional period, Wi-Fi cannot substitute for mobile networks in all scenarios.

- 5.48 Nevertheless, O2 is continuing to compete strongly in the market. It has the biggest customer base of all the MNOs, taking account of its own network and that of hosted MVNOs, and continues to acquire retail post-pay subscribers. It also experiences the lowest customer churn rate. We also note it has acquired major new wholesale customers through MVNO agreements, such as TalkTalk (November 2014) and Sky (January 2015).
- 5.49 ✂ [REDACTED]
- 5.50 Although we believe that mobile operators (including O2) may have more options to increase their network capacity without additional spectrum than in the first transitional period, these options may not be possible at all sites.
- 5.51 For example, ultra-dense indoor picocell deployments may give greater capacity gains than small cells, but there are uncertainties around the scale of these gains when taking account of practicalities such as site acquisition and backhaul. It will also not be possible for some users to be covered by means other than macrocells, including high mobility users.
- 5.52 Additionally, we now expect there will be only incremental capacity improvements through techniques such as coordinated multipoint and advanced interference cancellation – and these will require dedicated fibre connections between sites which we recognise will not be possible for all sites. We believe that higher-order MIMO may become practical in this period, but we understand that capacity gains will be limited by the number of antennas in devices - and there will still be a large population of devices using only one or two antennas.
- 5.53 On the demand side, it is likely that Wi-Fi will continue to relieve demand growth on mobile networks. In February 2017 CISCO estimated that 60% of total mobile data traffic was offloaded onto the fixed network through Wi-Fi or femtocell in 2016. Additionally, Ofcom is currently working to make more spectrum available at 5 GHz to allow Wi-Fi networks to use more and higher bandwidth channels. However, Wi-Fi is not a suitable substitute for mobile networks in all scenarios, because of its low power and limited coverage.
- 5.54 In the **longer term period** there is greater uncertainty around the capacity gains possible from network investment, especially considering that 5G networks will be maturing during this period. However, we believe it is likely that the macrocell network will continue to be important to provide coverage to users who cannot be covered by small cells and picocells and so access to sufficient spectrum will continue to be important to serve all of an MNO's customers.

Implications for competition assessment

- 5.55 The new evidence we have seen about the ability of MNOs with low spectrum shares to add capacity without additional spectrum – particularly as it affects the second transitional period – means we now have slightly greater concerns about the effect on competition of very asymmetric spectrum shares than at the time of the November 2016 consultation.

- 5.56 Whilst H3G has other means to address capacity issues in the second transitional period, having acquired access to spectrum in the 3.4 GHz band ahead of the Auction, the same does not apply to O2 unless it obtains spectrum in the Auction. Although it will have this opportunity, we now have a greater concern about O2 being capacity constrained in the second transitional period if it is unable to do so.

Section 6

Competition assessment

Introduction and summary

- 6.1 In the context of fulfilling our duties set out above, our aim is to design the Auction in a manner that promotes competition. In this context, our objective – as set out in the November 2016 consultation – is to ensure that consumers and businesses continue to benefit from a competitive market in the provision of mobile services.
- 6.2 This section thus considers whether there are competition concerns arising from the Auction and, if there are, what the consequences might be if we did not adopt measures to address them. In section 7, we then consider whether it would be appropriate and proportionate, in light of our assessment in this section, to impose measures in the Auction to address our competition concerns.
- 6.3 Below, we first explain our view that although auctioning mobile spectrum generally ensures the best outcome for consumers, there may be circumstances in which an unfettered market approach may be detrimental to consumers if it results in weaker competition.
- 6.4 We then discuss a number of potential competition concerns that may arise in this Auction:
- **Competition Concern 1: Very asymmetric holdings of spectrum can weaken competition (even if there are four credible MNOs).** In the current circumstances, this concern has three specific aspects:
 - Competition Concern 1(a) - Very asymmetric holdings of immediately useable spectrum;
 - Competition Concern 1(b) - Very asymmetric holdings of spectrum overall; and
 - Competition Concern 1(c) - Very asymmetric holdings of 3.4 GHz spectrum specifically.
 - **Competition Concern 2: If there ceased to be four credible MNOs, competition would be materially reduced.**
- 6.5 On Competition Concern 1(a), we conclude the risk that very asymmetric holdings of immediately useable spectrum may weaken competition in the first transitional period, before the 3.4 GHz spectrum is useable, is a significant concern. Given that we are now less confident around the timing of the future useability of 3.6-3.8 GHz spectrum, we are also concerned that very asymmetric spectrum distributions could weaken competition soon after the 3.4 GHz becomes useable (Competition Concern 1(b)). Competition Concern 1(c) - about very asymmetric holdings of 3.4 GHz spectrum specifically weakening competition - is lower.
- 6.6 On Competition Concern 2, we conclude that it is unlikely that any of the four MNOs would cease to be credible in the next few years even if they did not win any spectrum in this award - and that in the longer term there should be other

opportunities for them to win spectrum to remain credible. We therefore consider that the risk of there ceasing to be four credible MNOs as a result of this award is low.

Competition concerns can arise from an auction

- 6.7 In line with our statutory duties, we want to optimise the use of spectrum by seeking to allocate it in a way that leads to efficient use and promotes competition. We consider that auctioning spectrum is generally the best way of achieving this, but acknowledge there can be circumstances in which an auction outcome will result in a distribution of spectrum that results in weaker competition, which may harm consumers.
- 6.8 In this situation, there is the potential for a trade-off between:
- The beneficial effect for consumers from the spectrum being won by the operators who value it most, and will therefore likely make best use of it; and
 - The adverse effect for consumers if the allocation of spectrum weakens competition.
- 6.9 The nature and existence of this potential trade-off depends on the circumstances. For example, the size of an adverse effect on competition will tend to vary with the type of competition concern. Very asymmetric spectrum holdings can weaken competition significantly. But we would expect the adverse impact on competition and consumers to be even larger and more serious if there ceased to be four credible MNOs and, in effect, the UK mobile market became a three-player market.
- 6.10 To help analyse this potential trade-off, and how auction outcomes might harm consumers, we distinguish between two sources of value (i.e. expected profits) for operators in bidding for spectrum:⁴¹
- **Intrinsic value** (also known as use value) – the present value of additional profits a bidder expects to earn when holding the spectrum compared to not holding it – in the absence of any strategic considerations to win spectrum that reduces competition in mobile services from the existing level.
 - **Strategic investment value** (also known as foreclosure value) – the present value of additional expected profits earned from bids that affect the future structure of competition in mobile services by depriving one or more competitors of spectrum.
- 6.11 Competition concerns may arise from auction outcomes driven by either intrinsic or strategic value bidding, and the nature or existence of the potential trade-off for consumers may be affected by the basis for bidding valuation:
- If competition is weakened as a result of bidding based on strategic investment value, there is no trade-off, and the outcome is unambiguously harmful for consumers.
 - If competition is weaker due to bidding based on intrinsic values, there is generally a trade-off because there is likely to be an offsetting benefit from the

⁴¹ Even if operators do not necessarily make the distinction between these two sources of value in an explicit way when formulating their own valuation of spectrum, it is relevant for our analysis.

spectrum being won by the operators who will make best use of it. The net effect for consumers may be positive or negative.

Specific competition concerns arising from this Auction

- 6.12 We consider it important that there remain at least four credible MNOs and that competition amongst those MNOs is not weakened as a result of very asymmetric mobile spectrum shares. This is consistent with the competition assessment for our spectrum award of 2013⁴² (which enabled the expansion of 4G services). It reflects our view that, especially given the high barriers to entry to becoming a new MNO, competition is affected by the number of effective competitors. But it is not only the number of competitors that matters – the strength of competition between those MNOs is also important.
- 6.13 We therefore distinguish between:
- **The likelihood of there ceasing to be four credible MNOs as a result of the Auction.** As we set out below, there are currently four credible MNOs in the UK and we would be very concerned if the outcome of the Auction led to a reduction in this number. In this regard, we consider that a ‘credible’ competitor can exert an effective constraint on its rivals across a wide range of mobile services and customers – by providing, for example, high quality services, competitive prices, choice and innovation – and so contribute to the overall competitiveness of the market.
 - **The likelihood of very asymmetric mobile spectrum shares weakening competition even if there are four credible MNOs.** We consider that although retaining four credible MNOs is an important contributor to competition, it does not, on its own, guarantee that the market is as competitive as it might be. Even if there are four credible MNOs, competition could be weaker as a result of a very asymmetric distribution of spectrum because some operators may struggle to compete strongly across certain services, for certain customer segments, or temporarily over some period of time.
- 6.14 In response to our consultation, BT/EE said that if we considered it unlikely that any of the four MNOs would cease to be credible, there could be no basis for intervening. We disagree. The existence of four credible MNOs does not automatically imply that all four are equally strong or that competition is as strong as it could be. We therefore consider it meaningful to talk about competition being weaker than it might be due to certain Auction outcomes, even if there are four credible MNOs.⁴³
- 6.15 Given their importance to wholesale and retail competition in mobile services, most of our assessment relates to MNOs. However, we also welcome other types of competition and recognise that a new entrant may find innovative ways of using spectrum in the future, in a way that provides benefits to citizens and consumers.⁴⁴

⁴² See paragraphs 4.25-4.30 in *Assessment of future mobile competition and award of 800 MHz and 2.6 GHz Statement*, Ofcom, 24 July 2012 (which we subsequently refer to this as our “July 2012 statement”),

https://ofcom-build.squiz.co.uk/_data/assets/pdf_file/0031/46489/statement.pdf.

⁴³ See also the discussion in Annex 8.

⁴⁴ For example, in the future, it is possible that new business models may become important involving operators other than MNOs winning spectrum to provide services themselves in particular locations, while still relying on an access agreement with an MNO to provide national coverage.

- 6.16 We start this section by considering whether and in what circumstances, competition would be weaker if spectrum holdings were very asymmetric after the Auction. This is the competition concern on which we place most weight in this case. We consider there is a risk that the distribution of mobile spectrum holdings will be very asymmetric as a result of this Auction and that - in some cases - this could harm competition and consumers. For that reason, we refer to the risk of very asymmetric spectrum holdings weakening competition as **Competition Concern 1**.
- 6.17 One aspect of Competition Concern 1 relates to the impact of very asymmetric holdings of spectrum useable during the first transitional period. During this first transitional period the 2.3 GHz spectrum will be useable but the 3.4 GHz spectrum will not. As noted above, we refer to our concern about asymmetry in immediately useable spectrum (which includes 2.3 GHz spectrum, but excludes 3.4 GHz spectrum) as **Competition Concern 1(a)**.
- 6.18 A second aspect of Competition Concern 1 is the risk of very asymmetric spectrum holdings in the second transitional period when we expect the 3.4 GHz (and 700 MHz spectrum) is useable but the 3.6-3.8 GHz may not be. We refer to our concern about very asymmetric holdings in total mobile spectrum in the second transitional period as **Competition Concern 1(b)**.
- 6.19 We also consider potential concerns about 3.4 GHz spectrum specifically, because that particular band may be particularly important for the early launch of 5G services. We refer to this concern about asymmetry in 3.4 GHz spectrum specifically as **Competition Concern 1(c)**.⁴⁵
- 6.20 After discussing this asymmetry risk, we turn to our other potential competition concern, related to the likelihood of there ceasing to be four credible MNOs as a result of the Auction. We refer to this as **Competition Concern 2**.

Competition Concern 1: Risk of very asymmetric mobile spectrum shares

General concerns about very asymmetric spectrum shares

- 6.21 We first consider why, in principle, very asymmetric spectrum shares could give rise to competition concerns and the associated degree of asymmetry.
- 6.22 In order to remain competitive, we expect all MNOs will need to add capacity in the future to meet strong growth in mobile data demand. Having sufficient capacity is important because the amount of capacity (for a given number of users of a network) determines the average data speeds those users receive.
- 6.23 In response to the November 2016 consultation,⁴⁶ BT/EE sought to rely on market research to suggest that data speeds were not a key driver of competition and that they were no more important than other aspects of a consumer's mobile package,

⁴⁵ Compared to the November 2016 consultation, we have changed the order in which we consider the different aspects of Competition Concern 1, and consequently we have re-labelled them. We do this in order to reflect the relative degrees to which we are concerned about them. In the November 2016 consultation, we referred to Competition Concern 1(a) as Competition Concern 1(ii), Competition Concern 1(b) as Competition Concern 1(i), and Competition Concern 1(c) as Competition Concern 1(iii).

⁴⁶ https://www.ofcom.org.uk/_data/assets/pdf_file/0019/98110/BT-EE.pdf

such as content subscriptions, which could be replicated by any MNO. Vodafone also pointed to market research data to argue that consumer behaviour suggests network capacity is not central to consumers' buying decisions.⁴⁷

- 6.24 Other respondents argued the contrary. They said data speeds were particularly important and becoming increasingly important to consumers' choices.
- 6.25 We consider the evidence in more detail in annex 2 and conclude that, although speed is one factor affecting retail competition, it is not the only factor. We also recognise that the value customers place on speeds may increase in the future, although the extent of this is uncertain.
- 6.26 Nevertheless, because speeds are a factor that drives competition, it is our view that competition concerns may arise due to differences in MNOs' ability to add capacity if there are very asymmetric spectrum shares. If some MNOs were only able to provide average speeds that were materially lower than those of rivals, we consider that competition could become weaker than it might otherwise be. We recognise that it may not strictly be 'average speed' that matters, but rather being able to provide sufficient speeds to consumers for the services they are demanding. This will vary depending on the applications they are using. We use the term 'average speed' as a useful short hand for this.
- 6.27 We consider that using additional spectrum is an important way of adding capacity, and have assessed that, if the distribution of spectrum between MNOs becomes very asymmetric, the market could develop in a way that reduces competition for some services or customers (even if there remain four credible MNOs). And because competition is influenced by a *relative* comparison of one MNO to its rivals,⁴⁸ it is appropriate to consider the *share* of total mobile spectrum to which an MNO has access (rather than just the absolute amount of spectrum).
- 6.28 A very asymmetric spectrum distribution that weakens competition, even where there are four credible MNOs, can be characterised by:
- One or more MNOs with a very high share of spectrum compared to the other MNOs; and/or
 - One or more MNOs with a low share of spectrum compared to the other MNOs.
- 6.29 These are inherently inter-related. If one or more MNOs has a very high share of spectrum, there will necessarily be less for other MNOs, making it more likely that one or more will have a relatively low share. We consider each of these inter-related effects below.

Competition may be weaker if one or more MNOs has a very high share of spectrum

- 6.30 Concerns about one MNO having a very high spectrum share may arise in a range of possible ways. We provide three examples: a high spectrum share allowing the MNO to build an unmatchable competitive advantage; excess capacity distorting the market; and spectrum hoarding.

⁴⁷ https://www.ofcom.org.uk/__data/assets/pdf_file/0029/98138/Vodafone.pdf

⁴⁸ See from paragraph A3.164 of Annex 3 of our July 2012 statement for more explanation of this. https://ofcom-build.squiz.co.uk/__data/assets/pdf_file/0029/47387/annexes1-6.pdf

Unmatchable competitive advantage

- 6.31 An MNO with a particularly high spectrum share might be in a position to offer superior services that rivals are unable to replicate. This might include being able to launch a new mobile service that requires unused spectrum or a higher speed service that requires a large amount of spectrum. If other operators were unable to provide such services due to not having available spectrum, they might be unable to compete strongly for some customers (such as early adopters of new technology or consumers with especially high data demands). The rival operators might face a significant competitive disadvantage for such customers, at least for a period of time (such as until they can re-purpose or refarm their existing spectrum, acquire more spectrum, or find alternative ways to meet the demands of the specific customer group).
- 6.32 The consequence could be that, for the relevant customers and/or period of time, competition is weakened. While there might be benefits to some consumers from the superior services, the harm to competition, and therefore to consumers as a whole, could outweigh those benefits.

Excess spectrum capacity distorting the market

- 6.33 There is a risk that an MNO with a very high spectrum share - and likely some spectrum that is only lightly used - could use its excess spectrum capacity to become a leader in setting relatively high prices for some services or customer segments which cannot be served so well by competitors.
- 6.34 There is also a risk that an MNO with a very high spectrum share could pose a credible threat to competitors that it would be able to respond with aggressive price cuts if rivals sought to grow their market share of different services or customer segments through lower prices.
- 6.35 For example, it could have – or threaten to have – additional network capacity in place to be able to absorb an increase in its customer base quickly, by winning a significant number of customers from its competitors. The threat of provoking such a response may put rivals off seeking to compete more aggressively, and lead to a softening of competition for some services.
- 6.36 Having excess spectrum capacity might, in our view, also allow an MNO to be better placed to launch new services earlier than its competitors. For example, it could use its spare spectrum to launch a new service rapidly, leaving its other services unaffected, whereas rivals might need to refarm some of their existing spectrum, potentially to the detriment of their legacy services. Again, although customers of the MNO with a very high spectrum share might benefit from earlier availability of new services, there could be weaker competition and overall consumer harm.
- 6.37 There might also be an effect at the wholesale level if the MNO with spare capacity becomes the only viable alternative for prospective MVNOs, softening wholesale competition, with consequential adverse effects on retail competition.

Spectrum hoarding

- 6.38 An MNO with a very high spectrum share could in principle make limited use of any additional spectrum it wins in an auction, denying that spectrum to other MNOs who might have put it to immediate or productive use. This could weaken competition in

the short and longer term: the other MNOs might have competed more strongly if they had instead won the auctioned spectrum.

Competition may be weaker if one or more MNOs has a relatively low share of spectrum

- 6.39 MNOs with small spectrum holdings will tend to have higher marginal costs of adding capacity than operators with a large spectrum holding. This is because they would need to build significantly more sites to increase capacity whereas the operator with a high spectrum share could, for example, deploy additional spectrum on its existing sites.⁴⁹ As a result the MNO with a small spectrum holding could suffer a number of consequences. For example, it could have reduced incentives to compete aggressively for new customers. In addition, it could face the prospect of its services becoming less attractive for its existing customer base compared to the services offered by competitors with more spectrum, especially in the context of growing consumer demand for more data, faster speeds and new services.
- 6.40 The implications for competition depend on the extent to which MNOs with small spectrum holdings could find alternative means other than additional spectrum to maintain their competitive position, or adopt commercial strategies to compete strongly for new and existing customers in different ways. Where these alternatives to additional spectrum are limited, consumers could suffer adverse consequences from weakened competition.
- 6.41 As well as facing the higher marginal costs of adding capacity, there may also be practical constraints on the speed of adding capacity through means other than additional spectrum, as discussed below. For example, building new sites in some locations can be challenging, due in part to a lack of suitable sites in the right locations and to planning restrictions, and there may be practical constraints on refarming spectrum rapidly. This means some of the other solutions to adding capacity may not be very effective over a short period (one to two years), and that competition may therefore be weaker as a result of competitors having relatively low spectrum shares.
- 6.42 In its response O2 argued that there were no viable alternatives to spectrum for adding capacity even in the longer term. NERA's report for O2 argued that the only method MNOs have to meet demand growth is additional spectrum, as there is limited scope to use either enhanced technology or additional cells.⁵⁰ H3G also argued that sites cannot substitute for spectrum. It said that an MNO with a smaller spectrum share has a much higher marginal cost of expanding capacity than an MNO with twice the spectrum.⁵¹
- 6.43 As noted in section 5, and set out in more detail in annex 6, we consider that O2 and H3G have overstated the difficulty of substituting sites for additional spectrum to some extent, especially in the longer term. Nevertheless, we agree that it can be technically challenging to keep adding sites to substitute for spectrum and that the marginal costs of doing so may be higher than for rivals with more spectrum.
- 6.44 Some MNOs may have more scope than others to adopt commercial strategies to limit the adverse impact on competition of small spectrum holdings, reflecting their

⁴⁹ BT/EE challenged this view that marginal costs of adding capacity are higher with small spectrum shares. We set out why we do not agree with its view in annex 11.

⁵⁰ Paragraph 43 of O2's response and page 64 of NERA's report for O2.

⁵¹ Section 3 of H3G's response.

individual circumstances. We also recognise that if some MNOs need to adopt very restrictive commercial strategies to cope with limited capacity, then competition for some segments of consumers may weaken. We discuss commercial responses to managing data growth in annex 7.

But symmetrical spectrum shares are not necessary

6.45 Notwithstanding the above concerns about very asymmetric spectrum distributions, we do not consider that operators need to have the same, or close to the same, shares of spectrum in order for there to be strong competition. Our assessment is that:

- Rival MNOs do not need the same *capacity* in order to be strong competitors:
 - MNOs can have different market shares and so different need for capacity.
 - While for any fixed number of subscribers, higher capacity allows an MNO to offer higher average speeds, average speed is not the only factor that affects retail competition. As we discuss in annex 2, factors that are unrelated to spectrum holdings (e.g. customer service) are also important to competition.
 - As we discuss in annex 7, MNOs can remain competitive by tailoring their commercial offers to attract the type of consumer they are best placed to serve. MNOs that have the least capacity may still be able to deliver services to many consumers by choosing commercial strategies that make best use of their capacity.⁵²
- Using additional spectrum is not the only way of adding capacity. As we describe in annex 6, capacity can also be added by using existing spectrum more intensively.
- A degree of asymmetry in spectrum holdings may reflect or shape differences in operators' commercial strategies and expectations about the future. It may also reflect different future plans. Such asymmetries may give rise to consumer benefits. For example, an operator that already has a high share of spectrum may use additional spectrum in an innovative way, and an operator that has a lower share of spectrum may find innovative ways of attracting consumers to compensate for its lower share of spectrum, e.g. targeting particular consumer or business segments, or offering higher quality in other aspects of service.

Conclusion on the degree of asymmetry that, in principle, raises concerns

6.46 There is then a question as to the level of asymmetry at which we would be concerned that competition may be harmed. In a market where there are four credible MNOs holding all the spectrum, symmetric holdings would imply each having 25% of spectrum. H3G argued that to maintain a four-player market structure, each MNO's spectrum share needs to be between a 20% floor and a 30% ceiling.⁵³ We also note that most four-player mobile markets in Europe have much more symmetric spectrum holdings than in the UK, as can be seen in annex 4. However, market

⁵² However, we recognise that there is a limit to this: if very restrictive commercial strategies were adopted to cope with limited capacity, then competition for some segments of users might weaken.

⁵³ Page 3, H3G response.

shares can vary very considerably, and often are not strongly related to spectrum shares.

- 6.47 For the reasons summarised above, we would not be concerned about MNOs having spectrum shares that involved a material degree of asymmetry. We therefore believe a range of 20-30% is too restrictive. Nevertheless, at some degree of asymmetry, we expect competition to weaken. There is a difficult judgement to make about when spectrum distributions become so asymmetric they may begin to harm competition.
- 6.48 For the last major auction of mobile spectrum in 2013, we included competition measures in the form of safeguard caps on the holdings of each of low-frequency and overall spectrum at about 40% of relevant spectrum. The overall spectrum cap was set at 37% of mobile spectrum at that time.⁵⁴ This was because we were concerned that a more asymmetric distribution than this could weaken competition.
- 6.49 We note that one MNO (i.e. BT/EE) already has more than 40% of spectrum and the market appears generally to be working well for consumers currently, as described in annex 1.⁵⁵ Nevertheless, as MNOs need to continue adding capacity to meet growing consumer demand, we remain of the view that there is a risk that competition may be weakened if any single operator has more than around 40% of spectrum in the future.
- 6.50 As to when an MNO's spectrum holding is too low relative to its rivals to promote competition (despite the MNO having enough spectrum to be a credible competitor) a useful reference point is our view about the minimum requirements for an MNO to be credible.
- 6.51 As we discuss in annex 8, in our view there is a material risk of an MNO not having sufficient spectrum to be credible if it holds less than 10-15% of spectrum. However, it is possible that if an MNO only holds this minimum amount, whilst still being credible, it may not be as strong a competitor as it otherwise could be with more spectrum. For example, it might compete less strongly for some customer segments.⁵⁶
- 6.52 This is why competition might be stronger if a credible operator with a share of spectrum in the 10-15% range gained a greater share. But this is not necessarily the case. It will depend, amongst other things, on how well that operator can add capacity in other ways and on its market performance relative to that of rivals. For example, if that operator does not offer very attractive services to consumers and has a low market share, it would probably not strengthen competition if it gained a higher spectrum share and competition could instead be weakened. Having considered responses, our judgement remains that if one operator has more than around 40% of relevant spectrum, this may raise competition concerns.

⁵⁴ For the 2013 auction, we set an overall spectrum cap at 2x105 MHz (or 210 MHz of spectrum), which allowed the operator with the largest spectrum share (EE) to obtain at most 2x40 MHz of spectrum in the auction. This cap of 210 MHz prevented any operator obtaining more than 37% of the 567 MHz of spectrum that we considered relevant for mobile competition in that award (taking account of the exclusion of some of the unpaired 2.6 GHz spectrum for reasons discussed in annex 3).

⁵⁵ We explain in Annex 12 how spectrum allocations have evolved over time. BT/EE's current high share is a result of EE obtaining the maximum amount allowed in the 2013 award under the overall spectrum cap and subsequently being acquired by BT, which also won spectrum in the 2013 award.

⁵⁶ In the other European countries we have considered in Annex 4, it is unusual for a market with four or more credible MNOs to have two operators with less than 15% of the useable spectrum.

6.53 In the interests of increasing regulatory certainty, we consider it is helpful for us to be more specific than in our November 2016 consultation about when exactly a share of ‘around 40%’ may raise competition concerns. In doing so, we recognise that being more specific involves the exercise of regulatory judgement. Our judgement is that the 37% share at which we imposed an overall cap in the 2013 auction is generally an appropriate limit. Below we therefore use 37% as the threshold at which we consider competition concerns may arise.

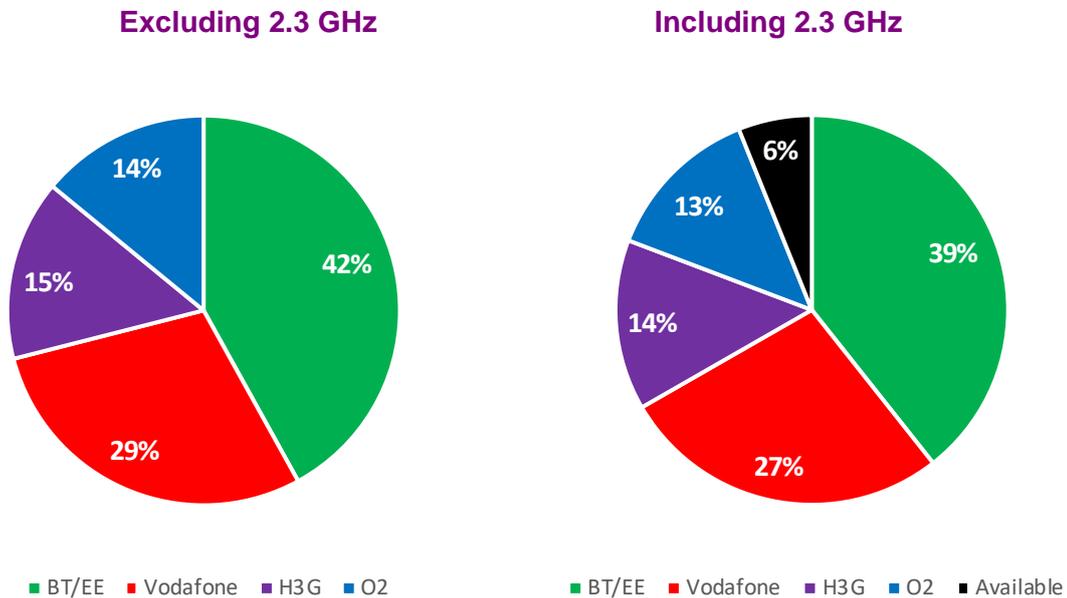
Competition Concern 1(a): The risk of very asymmetric holdings of immediately useable spectrum

6.54 We now consider the risk of very asymmetric holdings of immediately useable spectrum, by which we mean spectrum useable during the first transitional period.

Very asymmetric holdings of immediately useable spectrum could weaken competition in the first transitional period

6.55 The pie chart on the left hand side in Figure 6.1 below shows the current distribution of allocated spectrum that is immediately useable, i.e. useable in the first transitional period (now including 1400 MHz, as discussed in section 5). The pie chart on the right hand side shows the allocation including the 2.3 GHz that will be available after the Auction. Since BT/EE has comfortably the largest share of spectrum, the most asymmetric outcome would be if it acquired all of the 2.3 GHz spectrum, in which case its share would be just below 46%.

Figure 6.1: Allocation of immediately useable spectrum before award (including 800 MHz, 900 MHz, 1400 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz)



6.56 We recognise that the current degree of spectrum asymmetry does not appear to have led to a significant competition problem for mobile consumers overall up to now, as discussed in annex 1. For example, the two MNOs with the smallest spectrum shares, H3G and O2, have generally gained subscribers in recent years, while prices

have remained relatively low compared to international benchmarks, and there is a significant level of investment in new products and services.⁵⁷

- 6.57 However, during the first transitional period, we are concerned that competition could become weaker, as mobile data use continues to grow and MNOs need to continue to add capacity to be able to compete strongly. In our view, MNOs with much smaller useable spectrum shares may not be able to add capacity as cost effectively as the operator with the highest share, which may tend to weaken competition for some customers over the first transitional period.

Ability of MNOs to be able to provide acceptable average speeds

- 6.58 The current asymmetry in spectrum holdings involves the MNO with the largest spectrum holdings, BT/EE, with more than 40% of immediately useable spectrum before the Auction, and - both before and after the Auction - above the 37% threshold at which we judge that competition concerns about asymmetry in relation to capacity and average speeds may generally arise.
- 6.59 However, this does not automatically imply that it would be in consumers' interests for operators with smaller shares of spectrum to win 2.3 GHz spectrum to assist them to increase their capacity and average speeds. Whether this is the case would depend on how MNOs with higher spectrum shares might use the spectrum – for example, those operators might use the spectrum in a way that was very attractive to consumers. It also depends on the relative importance of average speeds that consumers experience, and we note in annex 2 that there are many other factors affecting competition.
- 6.60 We also recognise that H3G in particular may have scope to change its commercial offers so as to increase the average speeds it provides to < [REDACTED] , as discussed in annex 7. This may also tend to reduce concerns about H3G's ability to add capacity.
- 6.61 Despite these potential reasons, in this case, we are concerned about competition being weaker in the first transitional period due to very asymmetric spectrum holdings. On the basis of the available evidence we do not consider it likely that the operator with the largest current spectrum holdings, BT/EE, would use the 2.3 GHz spectrum in a way that was more attractive to consumers than if the spectrum was obtained by other operators with smaller spectrum shares. Our concern that a very asymmetric distribution of immediately useable spectrum may weaken competition is also increased because there is a risk that < [REDACTED] may encounter difficulties adding sufficient capacity to provide average speeds that allow < [REDACTED] to compete strongly in the first transitional period without 2.3 GHz spectrum, as we discussed in section 5.

Risk of competition concern 1(a) due to intrinsic value bidding

⁵⁷ < [REDACTED] In annex 1 we also note that H3G's share of traffic has fallen. However, H3G continues to provide a share of data traffic well in excess of its share of subscribers, and that its share of subscribers and its cashflows have continued to grow even as its traffic share has declined. The fall in H3G's traffic share does not necessarily mean that competition is weakening.

- 6.62 We consider it unlikely that BT/EE would have a higher intrinsic value for the spectrum than rivals with very low spectrum shares, because it already has a large share of immediately useable spectrum.
- 6.63 However, even if BT/EE did have a higher intrinsic value, we might still have a competition concern about it winning 2.3 GHz spectrum and denying that spectrum to competitors with much smaller shares of immediately useable spectrum.⁵⁸

Risk of strategic investment by some bidders for 2.3 GHz spectrum

- 6.64 In annex 10, we consider the likelihood of some MNOs having an incentive to engage in bidding based on strategic investment in relation to the 2.3 GHz spectrum. That is, to bid to win the 2.3 GHz spectrum, not because of the intrinsic value they gain from using it, but with the aim of weakening competition by preventing rivals from winning it. Annex 9 includes our assessment of reports and models provided by O2 and H3G on this topic in response to our consultation.
- 6.65 We conclude that the possibility of strategic investment in relation to the 2.3 GHz spectrum is a significant concern. In particular, there is a material risk that BT/EE has the incentive and ability to bid in a way that excludes rivals even if it does not have the highest intrinsic value (or that there would be coordinated strategic investment by two bidders). This risk is more acute given the relatively small amount of spectrum in the band and the relatively low shares of immediately useable spectrum of O2 and H3G.
- 6.66 We recognise the risk that Vodafone may also engage in such behaviour, but we judge this risk to be significantly lower than for BT/EE, in particular because of BT/EE's higher market share and higher diversion ratios from H3G and O2. We discuss this further in annex 10 from paragraph A10.79.

Conclusion on Competition Concern 1(a) (the risk of very asymmetric holdings of immediately useable spectrum)

- 6.67 We consider that there is a significant risk of weaker competition and consumer harm if there is a very asymmetric distribution of immediately useable spectrum in the first transitional period.
- 6.68 BT/EE already holds 39% of the immediately useable spectrum that will be available during the first transitional period after the award (including 1400 MHz and 2.3 GHz spectrum). This compares to our general judgement of the risk of competition concerns about asymmetry if one operator has more than a 37% share.
- 6.69 If BT/EE won 2.3 GHz spectrum, the distribution of immediately useable spectrum would be even more asymmetric. In the extreme, if BT/EE won all 40 MHz of the 2.3 GHz spectrum, it would have 46% of such spectrum. We are concerned that this level of spectrum concentration would mean that competition would be weaker than it would otherwise be for the reasons discussed from paragraph 6.21 above.
- 6.70 If the increased asymmetry arose, it could result in weaker competition. In particular, it might lead operators with small spectrum shares to compete less strongly,

⁵⁸ In such circumstances, there might be trade-off between weakening of competition and benefits to consumers from BT/EE's use of the spectrum. This is not straightforward to assess as we have not identified a clear reason for BT/EE to have higher intrinsic value than MNOs with much smaller shares of immediately useable spectrum, and no such reason has been put forward by stakeholders.

especially for specific customer segments, such as consumers who demand consistently high data speeds (who generally place greater demands on network capacity). This could result in increased prices for those customers to moderate the increase in data traffic of such operators.

- 6.71 Our concerns about weaker competition during the first transitional period are increased by there being a risk that 3< [REDACTED] may encounter difficulties adding sufficient capacity to provide average speeds that allow 3< [REDACTED] to compete strongly in the first transitional period without 2.3 GHz spectrum, as we discussed in section 5.
- 6.72 We consider strategic investment to be the most likely reason for a more asymmetric distribution to arise (absent competition measures). This is because BT/EE already has a large share of immediately useable spectrum, and is unlikely to have a higher intrinsic value for more such spectrum than operators that currently have very low shares. As described above, we consider there is a significant concern of BT/EE having an incentive to engage in strategic investment for 2.3 GHz spectrum to weaken competition.
- 6.73 Even if competition were to weaken in the first transitional period, there are some limits, in our view, to the extent of consumer harm. This is because there will be other spectrum that will be useable in the second transitional period and longer term, which operators with small spectrum holdings would be able to acquire, including the 3.4 GHz spectrum in this Auction. The effect would therefore be likely to be temporary. Additionally, the impact is likely to be most relevant to some customer segments rather than all customers. We take into account these points on the likely scale of consumer detriment in considering the weight we should place on this competition concern (this is relevant to our assessment of proportionality of competition measures in section 7).

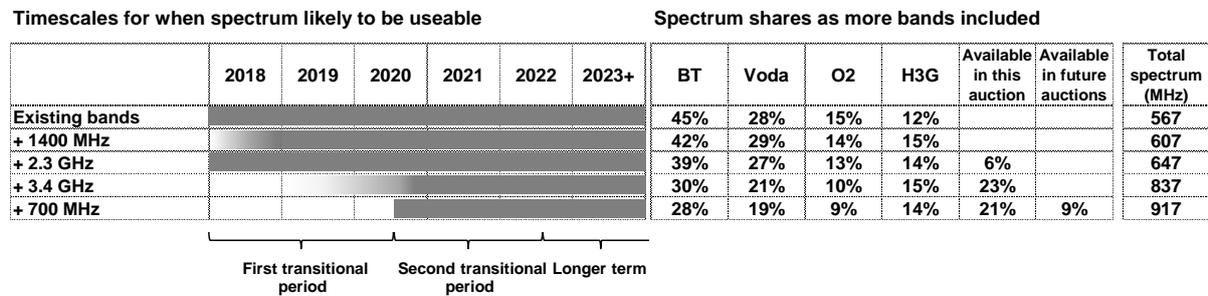
Competition Concern 1(b): The risk of very asymmetric overall spectrum shares

- 6.74 In addition to our concerns in the first transitional period about very asymmetric holdings of immediately useable spectrum, we have also assessed whether competition concerns could arise after the 3.4 GHz spectrum becomes useable.
- 6.75 As set out in section 5, we expect the 3.4 GHz band to become useable in the period 2019-20. We also expect the 700 MHz spectrum to be useable by Q2 2020, at a broadly similar time to the 3.4 GHz, or at least if the 700 MHz is useable later than 3.4 GHz, the difference is likely to be short.⁵⁹
- 6.76 We are less confident that other bands (including the 3.6-3.8 GHz band) will be useable for mobile at a similar time as the 3.4 GHz band. We therefore assess the impact for competition if no other spectrum (including at 3.6-3.8 GHz) were available in the second transitional period.

⁵⁹ The degree of certainty about 700 MHz being available and useable in the future is an important difference between our assessment of competition issues now and our assessment for the 2013 auction. In that previous assessment, we considered a timeframe up to 5-10 years into the future. During that timeframe, we concluded that we should not rely on other potential spectrum releases for mitigating competition concerns. This was because of the uncertainties about the timing of release of spectrum, and also about the availability of user devices. See paragraph A2.80 to A2.84 of Annex 2 of our July 2012 statement.

6.77 Drawing on our assessment in section 5 (and annex 3), Figure 6.2 summarises the timing of the expected availability of the bands for which we have sufficient confidence, and the shares of the useable spectrum bands that the four MNOs would have in the second transitional period and longer term based on their current spectrum holdings. The shading represents the level of certainty about when spectrum becomes available.

Figure 6.2: Future useable mobile spectrum in the second transitional period



6.78 For the second transitional period, the most asymmetric outcome would be if BT/EE were to win all 190 MHz of spectrum in this Auction. In this case, its share of spectrum available (when the 700 MHz is included) would be around 49%. This is well above the point (37%) where we generally have concerns about the level of asymmetry.

6.79 If BT/EE were to win all 150 MHz of the 3.4 GHz spectrum in the Auction (and none of the 2.3 GHz spectrum), its share of overall spectrum when 3.4 GHz is useable would be 44% in the second transitional period.

Risk of competition concern 1(b) due to intrinsic value bidding

6.80 It is possible that the allocation of spectrum based on intrinsic value bidding could lead to a weakening of competition. For example, it is possible that bidders who especially value 3.4 GHz for 5G could outbid those with small spectrum shares who might initially use 3.4 GHz to expand their 4G capacity.

6.81 In such circumstances, there could be a trade-off in the second transitional period for consumer benefits between earlier or better 5G services and weaker competition.

6.82 In our view, an MNO winning a large share of spectrum above 37% might cause a concern, especially if such an asymmetric distribution of spectrum was not necessary to realise the potential 5G benefits - in the sense that the MNO would have the capability for an early launch of 5G whilst keeping its spectrum share at or below 37%. For example, since we consider that an operator would have the capability for an early launch of 5G with 80 MHz of 3.4 GHz spectrum, BT/EE could realise such benefits with its share of spectrum in the second transitional period rising close to, but not exceeding, 37%.

Risk of strategic investment for 2.3 GHz and 3.4 GHz spectrum

6.83 In annex 10, we consider the likelihood of some MNOs having an incentive to engage in strategic investment in relation to both the 2.3 GHz and 3.4 GHz spectrum when these bands are considered together. We assess in annex 9 the reports and models

provided by O2 and H3G on spectrum valuations and strategic investment incentives in response to our consultation.

- 6.84 We conclude that it is relatively unlikely that a single bidder would have the incentive to engage in *unilateral* strategic investment in relation to all or almost all of the spectrum in the Auction in order to weaken competition, given the large amount of spectrum in the award. In addition, we conclude there is some risk that there may be an incentive to engage in *coordinated* strategic investment, but that it is uncertain.

Conclusion on Competition Concern 1(b) (risk of very asymmetric overall spectrum shares distorting competition in the second transitional period)

- 6.85 If the 3.6-3.8 GHz spectrum were useable at a similar time to the 3.4 GHz spectrum, then if BT/EE won all 190 MHz of both 2.3 GHz and 3.4 GHz available in the award it would have 40% of spectrum useable in the longer term. This is above the point at which we generally judge competition concerns about asymmetry may arise. If BT/EE won all 150 MHz of 3.4 GHz spectrum in the Auction (but no 2.3 GHz spectrum), it would have 36% of useable spectrum, when the 3.6-3.8 GHz spectrum is included as being useable.
- 6.86 However, if the 3.6-3.8 GHz spectrum is not useable at a similar time to the 3.4 GHz spectrum, then there will be a second transitional period during which BT/EE would be able to win well over 37% of spectrum (if there were no competition measures), because we would not include the 3.6-3.8 GHz spectrum in the denominator. If BT/EE won all 190 MHz in the Auction, its share of useable spectrum would be about 49%; and if it won all 150 MHz of 3.4 GHz spectrum, its share would be 44%. For the reasons set out earlier, we consider that such a distribution would give rise to a risk of competition concerns.
- 6.87 As we set out in section 5, we have less confidence about when the 3.6-3.8 GHz spectrum will be useable than we did in the November 2016 consultation. As a result we also have concerns about the distribution of useable spectrum after the first transitional period.

Competition Concern 1(c): The risk of very asymmetric shares of 3.4 GHz spectrum

Potential importance of 3.4 GHz spectrum for 5G services and risk of only one or two operators having 3.4 GHz

- 6.88 As in the November 2016 consultation, we remain of the view that the 3.4 GHz spectrum could be important for the early launch of 5G services. Responses to the November 2016 consultation agreed that 3.4 GHz spectrum would be used for 5G (as described from paragraph A11.146 in annex 11), even if it is used for 4G services initially.
- 6.89 If the 3.4 GHz spectrum were to become important for launching 5G services early, and it were difficult to launch 5G services at that time with other mobile bands, then initial competition in the provision of 5G might be weaker if not all MNOs had 3.4 GHz spectrum and could offer 5G services. Our concerns about the 3.4 GHz spectrum specifically only relate to the second transitional period, which could be from 2019-20 to 2022. The amount of 3.6-3.8 GHz spectrum that will become available subsequently, and the likelihood that existing bands will in due course be used for 5G, mitigates our concerns in the longer term about the distribution of 3.4 GHz specifically.

- 6.90 Given that H3G has acquired UK Broadband, it now already has access to 40 MHz of 3.4 GHz spectrum. There is a further 150 MHz of 3.4 GHz spectrum available in the award.

Importance of large blocks of spectrum for 5G

- 6.91 While some MNOs may want to deploy 40 MHz or less of 3.4 GHz initially, this is unlikely to be sufficient to launch a service that meets the technical requirements of the IMT 2020 vision (5G standard).⁶⁰ At least 80 MHz is likely to be needed to meet this standard.
- 6.92 There is only 190 MHz of 3.4 GHz spectrum - 150 MHz in the Auction and 40 MHz now held by H3G. This means a maximum of two operators would be able to have access to 80 MHz in the band. If there were strong demand from consumers for 5G rather than 4G in the second transitional period, it would not necessarily be beneficial for consumers to have *four* operators with 3.4 GHz spectrum because that could mean that no operator had a large enough amount for 5G.
- 6.93 However, if large amounts of 3.4 GHz spectrum were needed during the second transitional period for 5G services, then there could be a potential competition concern under some auction outcomes. For example, the Auction could lead to an outcome in which a single operator won 120 MHz, in order that no other operator could hold as much as 80 MHz for 5G (leaving only 30 MHz for another operator in the Auction, and even if this was acquired by H3G, it would still have only 70 MHz). This situation could be less competitive than an alternative in which one operator obtained 80 MHz and another operator obtained 70 MHz (or at least 80 MHz if it were H3G).⁶¹

Reasons for being less concerned about the distribution of 3.4 GHz specifically

- 6.94 There are however factors that mitigate or make more uncertain any potential competition concerns from only one or two operators obtaining enough 3.4 GHz spectrum.
- 6.95 First, while 5G services are expected to provide new, faster, more responsive and reliable mobile services relative to 4G, some responses to the November 2016 consultation argued this would be an evolution from existing services over time, rather than an immediate step change from which consumers immediately obtain much higher value. Whilst, as with earlier evolutions of mobile technology, we expect 5G services in due course to supersede services using earlier technologies, it may be possible for operators using 4G to compete sufficiently well at least for a period of time against rivals offering 5G. In particular, during the second transitional period (potentially 2019-20 to 2022), it may be possible for an operator with a smaller amount of 3.4 GHz spectrum to be able to offer sufficiently attractive services (even if not at the 5G standard) to compete strongly with an operator with 80 MHz providing a 5G service.
- 6.96 In this context, it is relevant that H3G already holds 40 MHz of 3.4 GHz spectrum. Given that H3G is the smallest operator in terms of subscriber market share, we consider it unlikely that it would win all of the 150 MHz of 3.4 GHz spectrum in the

⁶⁰ See from paragraph A11.146 in annex 11 for responses on the use of 3.4 GHz for 5G and our understanding of how it might be used.

⁶¹ How much less competitive would depend in part on the extent to which 70 MHz was inferior to 80 MHz for delivering services to consumers.

Auction. There are therefore likely to be at least two operators with 3.4 GHz spectrum (although one might only have 40 MHz). Even if it is possible to compete strongly with less than 80 MHz in the early years of the launch of 5G services, we expect this to become more difficult over time.

- 6.97 Second, it is possible that the 3.6-3.8 GHz spectrum will be useable for mobile services, and probably specifically 5G services, within a similar timeframe as the 3.4 GHz spectrum, though we are now less confident about this (than at the time of our November 2016 consultation) and under our proposed approach it may not be useable until 2022.
- 6.98 Third, existing spectrum bands are likely to become suitable for 5G in due course. This process is likely to accelerate if it becomes clear that consumers place a high incremental value on 5G services.
- 6.99 Fourth, if the 3.4 GHz spectrum were uniquely important for the early launch of 5G services and only one or two operators were to win sufficient spectrum to launch such services, then consumers of other operators would not be able to experience 5G services and those other operators may struggle to compete strongly for customers that particularly value 5G services. However, the operator or operators that could launch 5G services may have a strong incentive to deploy 5G services in order to gain a lead on their rivals. This ‘first mover advantage’ that one or two operators might enjoy could lead to a rapid deployment of 5G services, generating consumer benefits which might partly compensate for a more widespread, but potentially slower, deployment of 5G. Indeed, if any such advantage were short lived (for example, because other bands became suitable for 5G relatively quickly), the result could even involve overall benefits to consumers through other operators which were later to deploy 5G being spurred to roll out and innovate.^{62, 63}

Risk of competition concern 1(c) due to intrinsic value bidding

- 6.100 It is possible that the allocation of spectrum based on intrinsic value bidding could lead to a weakening of competition. For example, based on intrinsic values, the 150 MHz of spectrum may be split between two bidders with 100 MHz to one and 50 MHz to the other. This could be because one bidder has a high intrinsic value for 100 MHz of 3.4 GHz spectrum so as to be able to launch the highest speed 5G services. But there might potentially be a trade-off because competition could be weaker with this distribution compared to if the spectrum were split more evenly, such as 70 MHz and 80 MHz.

Risk of strategic investment for 3.4 GHz spectrum specifically

- 6.101 In annex 10, we consider the likelihood of some bidders having an incentive to bid strategically for 3.4 GHz spectrum specifically to deny competitors access to a 5G band. This is separate to the risk of strategic investment to prevent other operators from gaining spectrum for capacity more generally.

⁶² We note that H3G was concerned in its response about one of BT/EE and/or Vodafone buying all 3.4 GHz spectrum not because either operator would have an advantage over rivals but rather because they might “*decide to slow down their 5G rollouts, or to roll out less extensively than might otherwise be the case to the detriment of UK consumers*” (page 73, H3G’s response). In such a case, the detriment to consumers would be exacerbated by delayed availability of 5G services, although we consider it less likely that if an operator were in this position it would have an incentive to slow down its deployments, given that competitors will in due course be able to use other spectrum for 5G.

⁶³ Vodafone also raised concerns about enduring first mover advantage which we discuss in Annex 11.

6.102 We conclude that there is some risk of an incentive to engage in strategic investment for the 3.4 GHz spectrum specifically, but that it is uncertain. H3G already holds 40 MHz of 3.4 GHz spectrum which may reduce the potential pay-off from strategic investment by its rivals (if 40 MHz is sufficient to enable H3G to compete strongly with a rival offering 5G services with 80 MHz during the second transitional period). The potential pay-offs from such a strategy are also uncertain because it is unclear when other bands will be useable for 5G and whether consumers will be willing to pay materially more for 5G services during the second transitional period.

Conclusion on Competition Concern 1(c) (the risk of very asymmetric holdings of 3.4 GHz spectrum distorting competition)

6.103 There is only enough 3.4 GHz spectrum for at most two operators to have at least 80 MHz (taking account of the 40 MHz that H3G already holds). Competition might be weaker if it is only one operator that can launch 5G services early in 3.4 GHz spectrum rather than two. However, these concerns are mitigated by the factors set out above. Because of these factors, we are less concerned about asymmetry in 3.4 GHz spectrum band specifically compared to the previous two competition concerns.

Competition Concern 2: Risk of there ceasing to be four credible MNOs

Desirability of having four credible MNOs

6.104 The UK retail mobile market is currently made up of four MNOs, together with a range of MVNOs. We consider each of the MNOs to be credible competitors as of today. We remain of the view that it is in consumers' interests for there to be at least four credible MNOs.⁶⁴ We consider that the existence of four credible MNOs supports retail competition directly because MNOs are major competitors in supplying retail mobile services to consumers. It also supports retail competition indirectly because the MNOs compete to provide wholesale access to MVNOs.

6.105 It is important to retain at least four MNOs partly because barriers to entry are high. Any weakening of competition as a result of the market effectively becoming a three-player market might therefore be long lasting and difficult to reverse, as new entrants might not be attracted to the market even if competition was not working as well for consumers, such as through higher prices or less innovation.

6.106 All four MNOs currently provide wholesale access, although they may not all tender for all contracts or provide all services.⁶⁵ We consider that wholesale access

⁶⁴ For a longer explanation of our reasons for favouring a market with at least four MNOs see paragraphs 7.24 to 7.34 of the November 2014 consultation, https://www.ofcom.org.uk/data/assets/pdf_file/0025/78055/Public_Sector_Spectrum_Release_2-3_and_3-4_ghz_award.pdf

⁶⁵ Even if one of the four MNOs ceased to offer MVNO access, the presence of four MNOs competing strongly in the retail market will support competition in providing wholesale access. This is because an MNO that does not offer wholesale access to MVNOs will still exert an indirect constraint on the wholesale access pricing of those MNOs that do offer wholesale access, because of switching in the downstream retail market. An MNO offering wholesale access faces some constraint on raising prices to an MVNO which it supplies because, even if the MVNO does not switch to a different MNO, it is likely to pass the price increase on to its customers, some of whom may respond by switching to the MNO that does not provide access, which could make the price rise unprofitable.

provided through strong competition between MNOs is likely to lead to better outcomes than if regulation were needed to require wholesale access because such competition were not sufficient.

- 6.107 A potential disadvantage of having four - rather than fewer - MNOs is that total industry costs may be higher as a result of the large fixed costs involved with a mobile network. However, this can be mitigated by the ability to share some assets, for example through network sharing arrangements, such as those that are currently in place between BT/EE and H3G and between O2 and Vodafone.
- 6.108 Our views regarding the desirability of retaining four credible MNOs in the UK are consistent with the decision of the European Commission to block the proposed acquisition of O2 by H3G, a decision we supported.⁶⁶

Future credibility of four MNOs

- 6.109 We assess the implications of spectrum holdings for future credibility of the four MNOs in annex 8. We conclude that neither BT/EE nor Vodafone need to win spectrum in this award to retain credible spectrum portfolios either in the transitional periods or in the longer term.
- 6.110 We conclude that it is unlikely that either O2 or H3G would cease to be credible MNOs due to insufficient spectrum in the **first transitional period** even if they did not win spectrum in this award. This is because O2 and H3G have 13% and 14% respectively of immediately useable spectrum, they are generally competing well in the market (as can be seen in annex 1) and the first transitional period is only expected to last until 2019-20. Even if they became weaker competitors due to a very asymmetric spectrum distribution (Competition Concern 1) to the extent that they started to lose market share, in our view it is hard to see that they would cease to be credible in just two to three years given their current circumstances and market positions, i.e. we consider it unlikely that the current four-player market would in effect become a three- or two-player market due to spectrum in the first transitional period.
- 6.111 If O2 did not win any further spectrum, then in the second transitional period, when we expect the 3.4 GHz and 700 MHz spectrum to be useable but not the 3.6-3.8 GHz, its share of spectrum would be below 10%. O2 might therefore need more than its existing spectrum to remain credible in the **second transitional period and the longer term**. Even if O2 does need to win spectrum to remain credible, we consider the risk of it ceasing to be a credible competitor due to spectrum in the future is low (even without competition measures in the Auction). This is because it should be able to win a sufficient amount of spectrum even without any competition measures in the Auction:
- a) As one of the largest MNOs in the UK with a small spectrum share, it would have a high intrinsic valuation for any additional spectrum it needs to remain a credible competitor;
 - b) There is a large amount of spectrum in the Auction (190 MHz). In addition, in the 700 MHz band there will be 2x30 MHz of paired spectrum and 20 MHz of unpaired spectrum, which we expect to be awarded during the first transitional period; and

⁶⁶ http://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=2_M_7612

- c) In light of these considerations, other bidders would incur high costs if they tried to compete for all of the spectrum available (or a sufficiently large amount to prevent O2 from winning spectrum it needs to remain credible).

6.112 H3G will have 14% of useable spectrum in the second transitional period even if it does not win more in the Auction, given that it holds 40 MHz of 3.4 GHz spectrum through its purchase of UK Broadband. In the longer term, we expect the 3.6-3.8 GHz spectrum to also be useable. At that stage, H3G will have at least 19% of useable spectrum, since it holds 84 MHz of 3.6-3.8 GHz spectrum (again through its purchase of UK Broadband). Given its longer term spectrum position, and that it has 14% of spectrum in the second transitional period, we consider that H3G is unlikely to need additional spectrum to enable it to be credible in the second transitional period and longer term.

6.113 H3G's purchase of UK Broadband, and the spectrum rights it has gained through this, is an important change compared to the situation we assessed in the November 2016 consultation. Because of this change, we consider the risk of there ceasing to be four credible MNOs to be lower than our assessment at the time of the consultation.⁶⁷

6.114 While we consider the risk that there would cease to be four credible MNOs is low even without competition measures, if this were to happen, we expect the adverse impact on consumers would be substantial.⁶⁸ We take this into account in our decision on competition measures in section 7.

Conclusions on likelihood of detrimental spectrum allocations without measures in Auction

6.115 We consider the risk of there ceasing to be four credible MNOs as a result of the Auction (Competition Concern 2) is low. However, we have concerns about very asymmetric spectrum holdings between these four MNOs (Competition Concern 1).

6.116 We are most concerned about two aspects of Competition Concern 1:

- a) First, there is a significant risk that increased asymmetry of immediately useable spectrum would weaken competition in the first transitional period (Competition Concern 1(a)), before the 3.4 GHz spectrum is useable.
- b) Second, we are concerned about a very asymmetric distribution of spectrum in the second transitional period (Competition Concern 1(b)), after the 3.4 GHz spectrum is useable. We are concerned about this because we now have less confidence than we did in the November 2016 consultation that the 3.6-3.8 GHz spectrum will be useable at a similar time to the 3.4 GHz spectrum.

6.117 With both of these concerns, if any increase in asymmetry were to result from strategic investment, we consider that there is a real risk of harm to consumers.

⁶⁷ We previously assessed the risk to be 'not high', whereas we now regard it as low, because of H3G's purchase of UK Broadband.

⁶⁸ In its response H3G presents a high-level estimation of the potential loss to consumer surplus of persistent price increases. We note that the level of sustained price increases that H3G outlines (10% to 20% across all prices over a five to ten-year period) would denote a significant loss of competition. While we consider H3G's estimation could exaggerate the loss of competition, we recognise that a large reduction of competition in the market would lead to a substantial reduction in consumer welfare.

There may also be a risk of harm to consumers if it arose through intrinsic value bidding.

6.118 We are less concerned about the risk of a very asymmetric distribution of 3.4 GHz spectrum specifically (Competition Concern 1(c)) weakening competition.

Section 7

Measures to address our competition concerns

Summary

- 7.1 In this section we set out our decisions on measures to address the competition concerns we identified in section 6:
- We identify measures that we consider capable of effectively addressing our competition concerns, and explain why;
 - We consider whether they are the least onerous means of addressing our concerns;
 - We consider whether imposing such measures would be likely to produce adverse effects which are disproportionate to the aims we are pursuing.
- 7.2 We carry out this assessment first for the immediately useable 2.3 GHz band, and then for the spectrum useable beyond the first transitional period, including the 3.4 GHz band. We also consider alternative proposals suggested by stakeholders.⁶⁹
- 7.3 We conclude that the most appropriate and proportionate measures to secure our objectives involve the imposition of two caps on the amount of spectrum that bidders can hold at the end of the Auction:
- a) A 255 MHz cap on immediately useable spectrum; and
 - b) An overall cap of 340 MHz, defined with reference to holdings of spectrum useable during the second transitional period.

Framework for assessing measures to address competition concerns

- 7.4 We set out in section 2 our objectives for this Auction, which derive from our statutory duties. Those objectives include the aim of designing the Auction in a way that enables the allocation of the spectrum to those bidders most likely to put it to the most efficient use, and so deliver the highest possible value to society.
- 7.5 In so doing, we consider that it should be designed in a manner that promotes competition. This is with a view to seeking to ensure there is strong competition for consumers including between the four current MNOs.
- 7.6 In section 6, we identified a number of competition concerns which, if they arose as a result of the Auction, would pose a risk to the achievement of our Auction objectives. We now go on in this section to consider whether it would be appropriate and

⁶⁹ Annex 11 also considers further stakeholder proposals on competition measures being contingent on the auction price reaching a threshold price and on use of 3.4 GHz for Fixed Wireless Access and regional licences.

proportionate to impose measures in the Auction rules to address the competition concerns we have identified.

- 7.7 In doing so, we consider whether the measures identified are likely to be effective at addressing our competition concerns, and so achieve the aims we have set out. We also consider whether they are the least onerous means necessary to achieve those aims. We then step back and consider whether the measures would be likely to produce adverse effects which are themselves disproportionate to the aims pursued. We do this in respect of each of our proposed measures, and also more generally.⁷⁰

Relative weights of competition concerns and uncertainties

- 7.1 In assessing potential measures, we take into account - and balance - the relative weight we place on the different competition concerns we have identified and which the measure(s) are intended to address.
- 7.2 The relative weights of our competition concerns reflect a combination of the seriousness of the concern in adversely affecting competition and consumers, and the likelihood of the concern arising.
- 7.3 As noted in the previous section, our competition concerns for the Auction outcome relate to the likelihood of very asymmetric mobile spectrum shares, which have the effect of weakening competition (even with four credible MNOs); and the likelihood of there ceasing to be four credible MNOs.
- 7.4 We focus on two aspects of our concern about very asymmetric spectrum holdings weakening competition:
- a) First, we are concerned about weaker competition in the first transitional period due to a very asymmetric distribution of immediately useable spectrum (**Competition Concern 1(a)**).
 - b) Second, we are concerned about the weaker competition arising from very asymmetric distributions of spectrum overall (including both 2.3 GHz and 3.4 GHz spectrum) (**Competition Concern 1(b)**).
- 7.5 We place more weight on these concerns than concerns about 'credibility' because of the much greater likelihood of them arising, even though their impact may not be as great.
- 7.6 Nevertheless, we also take account of the other competition concerns on which we place less weight for this award: the risk arising from asymmetric distributions of 3.4 GHz specifically (**Competition Concern 1(c)**); and the risk that there cease to be four credible MNOs in the future - which could have a serious adverse impact but, as noted, is in our view unlikely to arise (**Competition Concern 2**).
- 7.7 In addition, we take into account the inherent uncertainties that arise in the context of a forward-looking assessment of this nature. There are uncertainties both over the likelihood of competition concerns arising without competition measures and their

⁷⁰ These principles were considered by the Competition Commission in the case of *Tesco v Competition Commission* (2009) CAT 6. See, in particular, from paragraph 136 of this judgment. http://www.catribunal.org.uk/files/Judg_1104_Tesco_04032009.pdf.

impact, and over whether competition measures might unintentionally lead to a worse outcome for consumers.

- 7.8 These uncertainties mean that assessing the appropriateness of possible measures to address competition concerns involves a measure of assessment and judgement. We have sought to carry out our assessment and exercise our judgement taking account of all relevant facts and the submissions we have received from stakeholders.

255 MHz cap on immediately useable spectrum (including at 2.3 GHz)

- 7.9 We concluded at paragraphs 6.67 to 6.73 that there is a significant risk that increased asymmetry of immediately useable spectrum would weaken competition in the first transitional period, before we expect the 3.4 GHz spectrum to be useable in the period 2019 to 2020.
- 7.10 We considered the positions of BT/EE and Vodafone and concluded that:
- a) We have a significant concern regarding the risk of BT/EE having the incentive and ability to invest strategically in the 2.3 GHz frequencies (paragraph 6.65) and that if it won the 40 MHz available in that band, whether through strategic investment or intrinsic value bidding, its share of immediately useable spectrum would be as high as 46% (paragraph 6.69).⁷¹
 - b) By contrast, the risk of Vodafone having the incentive and ability to engage in strategic behaviour is significantly lower (paragraph 6.66) and if it won the 40 MHz available, its share of immediately useable spectrum would only rise to 33%, which is below the 37% share we judge could generally weaken competition.
- 7.11 In response to these concerns, we have decided to apply a cap of 255 MHz on the amount of immediately useable spectrum any operator can hold as a result of the Auction. We now explain why we consider this cap is appropriate and proportionate.

Effectiveness of 255 MHz cap at addressing Competition Concern 1(a) and least onerous measure

- 7.12 The cap at 255 MHz prevents the current asymmetry of immediately useable spectrum from worsening and it will decrease the share of BT/EE, the operator with the largest such holdings, from 42% to 39%. We consider it is therefore effective in addressing Competition Concern 1(a) in this Auction.
- 7.13 Imposing no cap (as proposed by BT/EE) - or a less onerous cap at a level higher than 255 MHz - would in our view be ineffective. It would not address the risk of BT/EE successfully engaging in strategic investment in the 2.3 GHz band and/or increasing spectrum share asymmetry for immediately useable spectrum to a very high level (i.e. a share very significantly above 37%).
- 7.14 As explained above, the cap of 255 MHz would correspond to a level of 39% of immediately useable spectrum, somewhat higher than the level of 37% that we generally consider may raise concerns. However, a more onerous cap at 37% (i.e.

⁷¹ See paragraph 5.21 and Annex 3 for a list of the spectrum bands that are immediately useable. All percentages of immediately useable spectrum in this section are relative to the total for the bands in that list.

240 MHz) would not in our view be any more effective, and would therefore not be appropriate. This is because all other bidders would still be able to win up to the 40 MHz available and a 37% cap would not force BT/EE to reduce its holdings of immediately useable spectrum, as it could simply avoid bidding for 2.3 GHz spectrum and retain its current holdings.⁷² We also note that the 3.4 GHz and 700 MHz bands offer significant opportunities to reduce asymmetry further, after the first transitional period.

- 7.15 BT/EE argued that there should not be any cap on immediately useable spectrum. Vodafone supported our proposal for a 255 MHz cap on immediately useable spectrum. Some other stakeholders proposed more onerous competition measures in relation to the 2.3 GHz spectrum.⁷³
- 7.16 In its response to the November 2016 consultation, O2 considered that as well as preventing BT/EE from winning any 2.3 GHz spectrum, we should prevent Vodafone from winning more than 20 MHz of 2.3 GHz.⁷⁴ H3G argued that there should be a spectrum reservation of 20 MHz of 2.3 GHz for H3G and new entrants. There was a further proposal from Hutchison Europe - after the proposed acquisition of UKB was announced - for a 10 MHz reservation at 2.3 GHz for each of H3G and O2 or new entrants.
- 7.17 Imposing a more onerous measure that restricted Vodafone to 20 MHz of 2.3 GHz spectrum (as with proposals from H3G and O2) would help reduce asymmetry in the sense that the two MNOs with the largest spectrum shares would not be able to win some or all 2.3 GHz spectrum. It would increase the likelihood of O2 and H3G winning spectrum which might help competition for the reason set out at paragraphs 6.51, 6.52 and 6.61.
- 7.18 However, it is not clear to us that such a measure would be more effective at promoting competition.
- 7.19 If Vodafone were prevented from winning any 2.3 GHz, it would be restricted to 27% of immediately useable spectrum, and a restriction to winning at most 20 MHz would limit it to a share of 30%. It is not clear to us that restricting an operator to this level of spectrum holding would be good for competition, as discussed at paragraphs 6.45 to 6.49. There would therefore need to be a clear risk of harm arising, and of material impact from that risk, to cap Vodafone in relation to 2.3 GHz. However, we consider that the risk of Vodafone bidding to win 2.3 GHz spectrum based on strategic

⁷² Even if we were to determine that BT/EE should surrender some 15 MHz of its spectrum to bring it into line with such a cap, any licence revocation process to require BT/EE to reduce its current holdings from 255 MHz to 240 MHz would involve require at least 5 years' notice. This would prevent any relinquished spectrum from being immediately useable.

If BT/EE wanted to bid for 2.3 GHz spectrum, it would need to divest spectrum in advance of the auction. If it sought to do so by way of a spectrum trade, we would need to approve the trade which is subject to a competition check. We would expect any such competition check to have regard to the concerns we identify in this statement and any other competition issues that the specific details of the proposed trade might raise.

⁷³ We set out MNOs' proposals for competition measures against each of the competition concerns in Figure A11.1 in Annex 11.

⁷⁴ O2's proposed restriction of a maximum of 20 MHz for Vodafone was in addition to its proposal for a 35% cap on spectrum held after the auction. It said that the 35% cap would not prevent Vodafone from winning all 40 MHz at 2.3 GHz, as doing so would take its holding of immediately useable spectrum to 33%. O2 also referred to NERA's proposal to cap all bidders to 20 MHz of 2.3 GHz spectrum as a possible implementation of its proposed cap on Vodafone.

investment is significantly lower than the risk of BT/EE doing so, as discussed at paragraph 6.66. In addition, we expect O2 to have a high intrinsic value for 2.3 GHz spectrum, as one of the largest MNOs with a small spectrum share. We expect H3G to be able to use its 1400 MHz spectrum during the first transitional period (taking its share of immediately useable spectrum to 14%), and we discuss at paragraph 6.60 why there may be reduced concerns regarding H3G's ability to add capacity. Hence, this more restrictive measure would be more onerous than is required to achieve our aim, and could produce significant adverse effects for consumers.

- 7.20 On balance, we therefore judge that a more restrictive cap than 255 MHz on immediately useable spectrum would be disproportionate to Competition Concern 1(a).⁷⁵
- 7.21 We also consider that any spectrum reservation, as Hutchison Europe and H3G proposed, is not necessary. In the 2013 auction, we considered spectrum reservation appropriate to meet concerns that an MNO might cease to be credible. However, as discussed at paragraphs 6.110 to 6.114, we consider the risk to credibility of any of the four MNOs arising from the 2.3 GHz and 3.4 GHz award to be low, even without competition measures. In addition, a reservation would not be appropriate given that it could prevent some auction outcomes that may be in the interests of competition and consumers, such as other bidders winning the full 40 MHz available at 2.3 GHz.
- 7.22 Our decision to impose a 255 MHz cap on immediately useable spectrum further reduces our concern about the risk to credibility of any of the three MNOs able to acquire 2.3 GHz spectrum. We do not consider that the residual competition concerns are sufficiently large to justify the much more intrusive intervention of a spectrum reservation.

Risks of a 255 MHz cap on immediately useable spectrum producing adverse effects which are disproportionate

- 7.23 We do not consider a 255 MHz cap on immediately usable spectrum would be likely to give rise to adverse effects which are disproportionate to our intended objectives. We base this assessment on our identification, discussed at paragraphs 6.7 to 6.11, that harm to consumers' interests may depend on the trade-off between efficiency and competition.
- 7.24 Our decision to impose a 255 MHz cap on immediately useable spectrum could produce direct adverse effects and harm consumers' interests if BT/EE had the highest intrinsic value for some of the 2.3 GHz spectrum. But, even in that case, harm to consumers' interests would depend on the trade-off between efficiency and competition.
- 7.25 Although there would be positive efficiency effects from the spectrum being obtained by the operator with the highest intrinsic value, there would be a risk of harm to consumers from competition being weakened as a result of the increase in spectrum asymmetry.
- 7.26 We recognise that there is *some* risk of adverse effects. For example, it is possible that BT/EE might prefer to add capacity in the longer term by using 2.3 GHz

⁷⁵ At paragraphs 7.48 and 7.49, we consider the risk of strategic investment that would prevent H3G and O2 from acquiring spectrum in the Auction. Restricting Vodafone to 20 MHz at 2.3 GHz could further reduce this risk. However, our view of this risk is that such restrictions on Vodafone would be disproportionate.

spectrum rather than 3.4 GHz spectrum. This could be the case if, for example, the 2.3 GHz spectrum fits better with its existing network configuration. Also, BT/EE may have plans to deploy all of its current spectrum more intensively in the near future.

- 7.27 However, we consider the risk of harm is low, because in our view it is unlikely that BT/EE would have the highest intrinsic value for some of the 2.3 GHz spectrum:
- BT/EE already has a large amount of immediately useable mobile spectrum - 255 MHz. This represents 39% of immediately useable spectrum after the award;
 - BT/EE's current holdings include not only a large amount of paired spectrum but also some unpaired spectrum (like 2.3 GHz);
 - BT/EE combines this high share of spectrum with a large network of sites (around 18,000); and
 - BT/EE is not currently deploying all of its existing spectrum widely. It has deployed 2x20 MHz of 2.6 GHz spectrum, with an additional 2x15 MHz deployed on a number of sites in Central London, and at Wembley. BT/EE has also told us that it has begun small cell deployment using some of the 45 MHz of spectrum in the 2.6 GHz band held by BT prior to the acquisition of EE. This 45 MHz is 7% of immediately useable spectrum after the award.⁷⁶
- 7.28 Our decision to impose a 255 MHz cap in immediately useable spectrum could also produce direct adverse effects and harm consumers' interests if it increased Vodafone's incentive to engage in strategic investment against O2 or H3G, compared to if there were no competition measures.
- 7.29 In Annex 10, we consider the risk from potential strategic investment in 2.3 GHz by Vodafone, given the 255 MHz cap on immediately useable spectrum, and find it is significantly lower than for BT/EE. We also consider at paragraphs 7.16 to 7.21 the impact of measures that would constrain Vodafone's ability to engage in such strategic investment. For these reasons, we consider that it would not be proportionate to address this risk.

Overall spectrum cap of 340 MHz

- 7.30 We explain in section 6 that we are concerned about Competition Concern 1(b) because we are less confident than we were at the time of our November 2016 consultation about other spectrum being useable in the relevant timeframe, in particular 3.6-3.8 GHz (paragraphs 6.85 to 6.87).
- 7.31 We have therefore decided to apply an overall cap of 340 MHz defined by reference to a bidder's holdings of mobile spectrum that we expect will be useable during the second transitional period, which may be between 2019-20 and 2022.
- 7.32 This represents 37% of the relevant pool of spectrum: immediately useable mobile spectrum including the 40 MHz in the 2.3 GHz band, plus the 190 MHz in the 3.4 GHz band and the 80 MHz in the 700 MHz band (as illustrated in Figure 6.2 in Section 6).⁷⁷ The cap places a limit on the amount of relevant spectrum any operator

⁷⁶ Some responses to the November 2016 consultation commented on the use of existing spectrum by BT/EE (and Vodafone). We summarise these and respond to them in Annex 11.

⁷⁷ All percentages of overall spectrum in this sub-section are relative to the total for these.

can hold as a result of the Auction. This is in addition to the 255 MHz cap on immediately useable spectrum. We explain below our reasons for this decision, and why we consider it to be appropriate and proportionate.

Effectiveness at addressing Competition Concern 1(b) and least onerous measure

- 7.33 The 255 MHz cap reduces the risk of very asymmetric distributions in overall spectrum at the end of the first transitional period, but only to a limited extent. It does so by reducing the amount of additional spectrum BT/EE can obtain and by making it more likely that operators with the smallest spectrum holdings - O2, H3G or a new entrant - will win spectrum. However, it does not guarantee that any specific operator will be able to win spectrum in this Auction, including O2 (the MNO currently with the lowest share of spectrum useable at the end of the first transitional period).
- 7.34 The extent of asymmetry that could arise after the first transitional period depends on whether the 3.6-3.8 GHz spectrum is useable on an equivalent basis and within a similar timeframe to the 3.4 GHz spectrum. If it is not so useable within a similar timeframe, there will be a second transitional period in which there could still be a large degree of asymmetry in total mobile spectrum holdings.
- 7.35 At the most extreme, without the overall cap, BT/EE would be able to win 150 MHz of the 3.4 GHz spectrum in the Auction if it outbid all other operators for the entirety of the available spectrum in the band. This extreme outcome would mean it could hold 405 MHz of mobile spectrum, which represents 44% of useable spectrum in the second transitional period, well above the 37% threshold at which we generally consider competition concerns may arise.
- 7.36 This outcome would also deny O2 the possibility to increase its relative share beyond 14% at best. (H3G already has 14% of spectrum useable in the second transitional period, given its purchase of UK Broadband, and has the opportunity to increase this further if it wins 2.3 GHz spectrum.) The level of asymmetry that would be possible if 3.6-3.8 GHz were not useable on an equivalent basis and within a similar timeframe to 3.4 GHz means that we are concerned that competition could be weakened in the second transitional period.
- 7.37 In the November 2016 consultation, we proposed that applying an overall cap of 340 MHz would be disproportionate if the 3.6-3.8 GHz spectrum were useable in a similar timeframe to 3.4 GHz. We considered that in that scenario, we would be able to impose competition measures in the award of 3.6-3.8 GHz that would be appropriate and proportionate (if necessary) to address any competition concerns that we might have in relation to the award of that band at the time.
- 7.38 We recognise it is possible that 3.6-3.8 GHz may prove to be useable at a similar time to the 3.4 GHz spectrum, and there may be no second transitional period. This could mean that the overall cap proves to be more restrictive than was required. However, it is *currently* unclear whether it will be useable at a similar time to the 3.4 GHz spectrum - and under our proposed approach it is possible it will not be useable until as late as the second half of 2022.
- 7.39 Against this background, the 3.4 GHz could be useable as early as during 2019, which is potentially at least three years before 3.6-3.8 GHz becomes useable. We need to decide now what measures to apply in the award of 2.3 and 3.4 GHz spectrum when faced with the uncertainty over the timing of the 3.6-3.8 GHz spectrum availability. As we describe above, there is a risk of weaker competition if

we did not apply an overall cap and 3.6-3.8 GHz were not useable in the second transitional period.

- 7.40 We acknowledge the possibility that allowing BT/EE to win more than 37% of overall spectrum as a result of the award may give rise to some consumer benefits as discussed at paragraphs 6.7 to 6.11 and 6.80 to 6.82. However, we are concerned that the risks to competition would outweigh those benefits, and so a looser cap (or no cap) would not sufficiently address Competition Concern 1(b).
- 7.41 Neither we nor stakeholders have identified less onerous measures to address these concerns (but BT/EE and Vodafone both argued that no overall cap was necessary). We therefore consider the 340 MHz cap to be both effective to address our competition concern, and the least onerous means of doing so.
- 7.42 Some stakeholders proposed more onerous measures, including H3G, O2 and the Make the Air Fair campaign.⁷⁸ O2 considered that there should be an overall cap of 35% for spectrum in use today plus the 2.3 GHz, 1400 MHz and 3.4 GHz bands, leading to a cap of around 290 MHz. H3G and Hutchison Europe argued for an overall 30% cap for spectrum in use today plus 1400 MHz, 2.3 GHz and 3.4 GHz, leading to a 255 MHz cap (with rounding); the Make the Air Fair campaign supported this cap.
- 7.43 We do not believe it is necessary to impose more onerous measures to address Competition Concern 1(b). These more onerous measures would limit relative shares of spectrum for all MNOs, including H3G, O2 and Vodafone to a limit which is below that which, in our view, generally raises concerns, without clear justification in relation to Competition Concern 1(b) in this case.
- 7.44 Under O2's proposal, BT/EE would only be able to acquire up to 35 MHz of 3.4 GHz and would therefore not have the opportunity to bid for an amount of spectrum suitable for the launch of 5G. Under H3G's and Hutchison Europe's proposal, Vodafone would be able to acquire at most 75 MHz in 3.4 GHz and BT/EE would not be able to acquire any 3.4 GHz spectrum. The lower an overall cap, the greater the risks to innovation benefits discussed at paragraph 7.40. We conclude that these constraints would be disproportionate to the competition concern.

Risks of the overall cap producing adverse effects

- 7.45 We consider four specific adverse effects from our decision to impose an overall cap:
- a) First, the risk that it proves unnecessary if 3.6-3.8 GHz were to be useable in similar timeframes to 3.4 GHz, whilst limiting BT/EE to at most 85 MHz in the 3.4 GHz band;
 - b) Second, the possibility that the cap facilitates joint strategic investment from BT/EE and Vodafone;
 - c) Third, the effect on BT/EE's options to win spectrum in future auctions; and
 - d) Fourth, the interaction between the cap and Vodafone's eligibility points in the event that it makes withdrawals during the Auction.

⁷⁸ See a description of the campaign and the responses we received at https://www.ofcom.org.uk/_data/assets/pdf_file/0028/98128/Make-The-Air-Fair.pdf.

- 7.46 **First**, as noted above, there is a risk that applying the overall cap proves unnecessary if 3.6-3.8 GHz band becomes useable at a similar time to the 3.4 GHz band. In particular, the cap would prevent BT/EE from winning 100 MHz (or more) in the 3.4 GHz band, which some consider may be optimal for 5G. However, we consider any adverse consequences from such a restriction are likely to be limited because, as set out at Annex 11, we believe 80 MHz will be sufficient to offer a 5G service.
- 7.47 In addition, BT/EE may also mitigate this (limited) restriction over time by aggregating any spectrum it may win at 3.4 GHz with other spectrum, at 3.6-3.8 GHz or possibly in spectrum it already holds, to create a larger block through carrier aggregation. The potential for an adverse effect as a result of the cap is therefore outweighed in our view by the risk of 3.6-3.8 GHz spectrum not being available in the timeframes and the resulting implications for Competition Concern 1(b).
- 7.48 **Second**, under the measures we will apply in the award, it would be possible for Vodafone to win 40 MHz of 2.3 GHz spectrum and up to 120 MHz of 3.4 GHz and for BT/EE to win up to 85 MHz of 3.4 GHz. As discussed in annex 10, there is a possible strategic investment scenario in which Vodafone and BT/EE win all the available spectrum. This could occur under the overall cap with the limit of 85 MHz on BT/EE helping to provide a focal point for both BT/EE and Vodafone to coordinate their strategic investment (although we also consider another effect and conclude, on balance, that it is not clear that the risk of coordinated strategic investment either increases or reduces with our competition measures). In this scenario, BT/EE would then win that amount or 80 MHz and Vodafone would win the remainder of the spectrum in the Auction. The outcome would be the following: 40 MHz of 2.3 GHz and 65 or 70 MHz of 3.4 GHz for Vodafone and 80 or 85 MHz of 3.4 GHz for BT/EE.
- 7.49 Reducing this potential adverse effect in relation to the overall cap would involve changing the level of the cap. The first option would be to increase (or possibly remove) the overall cap to a level sufficiently high so that the cap on BT/EE would not be a focal point for coordination. This would likely mean a cap in excess of 100 MHz, the largest block size for 5G. A cap at such a level would not in our view sufficiently address Competition Concern 1(b), as BT/EE would be able to gain a spectrum share of at least 39%. The second option would be to reduce the overall cap to a level sufficiently low, limiting BT/EE to less spectrum in the 3.4 GHz band, so that the amount of 3.4 GHz spectrum Vodafone would need to win under the coordination scenario would be high relative to potential demand (thereby raising its cost of strategic investment), e.g. in excess of 100 MHz. This would mean restricting BT/EE to less than 50 MHz of 3.4 GHz spectrum. This would not in our view be a proportionate response to Competition Concern 1(b), as it would restrict BT/EE to less than 33% of overall spectrum.
- 7.50 **Third**, when we consider competition issues for the next mobile spectrum auction, that is due to include the 700 MHz band, it is possible that our competition assessment shows that a 37% cap was appropriate for the same set of bands as in this case - although any assessment would of course need to take account of the specific circumstances.
- 7.51 If such a cap was appropriate in that case, and if BT/EE had decided to acquire a large block of 3.4 GHz spectrum up to or close to its cap in this Auction, it would have to trade or relinquish spectrum in order to win 700 MHz spectrum in that auction. Given the time available between this Auction and the following one, this would seem practically achievable, should BT/EE want to do so. We also note that in advance of the 700 MHz spectrum award, there may be more certainty on when the 3.6-3.8 GHz

spectrum is useable, which may mean that any overall cap could include 3.6-3.8 GHz spectrum. Subject to the competition assessment for that award, such a cap may not be necessary or appropriate.

- 7.52 **Fourth**, when considered in conjunction with the cap on immediately useable spectrum, and given current spectrum holdings, the overall cap puts Vodafone in a unique position. It is able to bid for both the 2.3 GHz and 3.4 GHz bands (unlike BT/EE) but its acquisition of spectrum in the Auction is limited by the overall cap to below the 190 MHz available (unlike H3G, O2 or new entrants). This could create a situation in the Auction in which Vodafone faces reductions in eligibility points where it uses a withdrawal from one band and switches its bids to the other band. However, as we describe in section 8, this can only happen in very limited circumstances and is unlikely to have a material impact.
- 7.53 We do not therefore consider that the overall cap is likely to give rise to adverse effects which would be disproportionate to our intended objectives.⁷⁹

General risks of adverse effects with intervention

- 7.54 We have assessed above the risk of certain specific adverse effects that might arise as a result of the two caps we have decided to impose. We have also considered a number of general potential risks of adverse effects of the measures, which we set out below.
- 7.55 The likelihood and scale of the risk of unintentionally harming consumers' interests are related to the degree of intervention. The greater the intervention, in general, the greater the likelihood and scale of detrimental effects from unintended consequences. It may be the case that it is appropriate to accept a greater risk of detrimental consequences in order to address a serious and likely competition issue. If the concern is smaller, then our tolerance of detrimental effects would be lower. In this case, we do not consider that the risk of detrimental effects from the two caps is unacceptably high.
- 7.56 At paragraphs 6.7 to 6.11, we discuss the trade-off between a potential reduction in consumer benefits from restrictions on allocation of the available spectrum and from weaker competition in the absence of restrictions. For example, capping the overall amount of spectrum any operator can hold may limit an operator's ability to reduce its costs and/or increase the quality of its services, and could therefore be detrimental to consumers. We have considered such risks above in relation to both the cap on immediately useable spectrum and the overall cap.
- 7.57 There may be other risks to intervention too:
- a) **Innovation benefits from asymmetric spectrum holdings could be lost.** Although very asymmetric spectrum holdings are a cause for concern, some asymmetry may help to encourage innovation by those with larger or small

⁷⁹ The option of an overall cap of 340 MHz (in addition to a cap on immediately useable spectrum of 255 MHz) was set out in our November 2016 consultation, but was not our preferred option at that time. We said, however, at paragraph 5.94 that: "*The case for this option being proportionate would be stronger if there were evidence that having very large blocks of 3.4 GHz spectrum was unlikely to be important for 5G services and if the 3.6-3.8 GHz spectrum was likely to be useable materially later than the 3.4 GHz spectrum*". We now consider that a block of 80 MHz of 3.4 GHz (which any operator could acquire under the overall cap) would enable the provision of 5G services; and we are now less confident that 3.6-3.8 GHz spectrum will become useable in the second transitional period and at a similar time as 3.4 GHz spectrum.

spectrum shares. For example, a large share of spectrum might open up further possibilities for innovation. Also, if operators with relatively small spectrum shares are unable or unwilling to outbid operators with larger spectrum shares, they may develop other innovative ways of increasing their capacity (for example, through greater use of licence exempt spectrum) or find other ways of offering services that are attractive to consumers. We have taken this into account both in our regulatory judgement on the extent of asymmetry permitted under the caps, and through our assessment of the risks of adverse effects.

- b) **There could be a higher chance of spectrum being unsold.** If there is a spectrum cap but those eligible to bid are not prepared to pay the reserve prices (suggesting they would obtain little value from the spectrum), then caps can result in unsold spectrum. It would then be necessary to hold another auction without the caps, causing a delay in the spectrum being released – potentially delaying benefits to consumers. However, although the risk exists in principle and there are examples internationally of spectrum being unsold because of spectrum caps,⁸⁰ we consider that this is a low risk in this case, because of the value to MNOs of using the available spectrum (see Annex 10) and the relatively low reserve prices for the Auction (reserve prices are detailed in paragraph 3.1).
- c) **Bidders may modify their bids to influence future Ofcom decisions.** Some bidders may choose to bid less than their intrinsic values in this award, in the hope of influencing Ofcom’s decisions about future spectrum awards. For example, operators with small amounts of spectrum may assume that if they fail to obtain spectrum in this Auction, Ofcom is more likely to take measures in future auctions. This could lead to inefficient spectrum allocations that are not in consumers’ interests. This risk is made more relevant by the impending award of other mobile spectrum in the next few years. However, we consider that it is mitigated by our assessment of competition concerns and measures in this statement, including the increased regulatory certainty about the level (37% of relevant spectrum) at which we would generally expect to set any caps to address competition concerns about very asymmetric distributions of spectrum.

No additional measures to address Competition Concerns 1(c) and 2

7.58 We now consider the effect of the cap on immediately useable spectrum and of the overall cap on our other concerns, and the proportionality of our decisions not to apply additional measures to address these concerns.

No measure specific to Competition Concern 1(c)

7.59 At paragraphs 6.94 to 6.99, we set out why we are less concerned about Competition Concern 1(c) and why more even distributions between bidders of large blocks of 3.4 GHz may support greater competition at the expense of a potential reduction in productive efficiency. We also recognise at paragraph 6.102 some risk of strategic investment in 3.4 GHz, but an uncertain one.

⁸⁰ For example, no operator won any of the 2.6 GHz unpaired spectrum in the auctions held in the Netherlands (2010) and Spain (second award in 2011). In the Netherlands this spectrum was eventually sold in 2012 while in Spain a third award in 2011 with revised caps led to the sale of most of the leftover spectrum. See Annex 8 of Ofcom’s Statement on “*Annual licence fees for 900 MHz and 1800 MHz spectrum*”, 24 September 2015, <http://stakeholders.ofcom.org.uk/consultations/annual-licence-fees-further-consultation/statement/>

- 7.60 The 340 MHz overall cap provides some mitigation against Competition Concern 1(c), as it restricts BT/EE to 85 MHz.
- 7.61 All other MNOs can win large amounts: Vodafone could win at least 120 MHz (if it acquired all 40 MHz of 2.3 GHz spectrum) and up to 150 MHz (if it won 10 MHz of 2.3 GHz spectrum or none); each of H3G and O2 could win all 150 MHz regardless of any 2.3 GHz acquisition. If we were to impose a cap specifically on 3.4 GHz spectrum, it would constrain the ability of H3G and O2 to narrow the extent of the differences in overall spectrum shares with BT/EE which could further reduce Competition Concern 1(b). We see this as an important downside of imposing a cap specifically on 3.4 GHz.
- 7.62 We find that there is some risk of strategic investment in 3.4 GHz, but that it is uncertain (as discussed at annex 10, paragraph A10.117). Therefore the case for addressing this risk is weaker than for the risk of strategic investment in 2.3 GHz. In addition, we discuss above the cost of a cap that would address this risk, because of the constraint on overall holdings it would create for H3G and O2. Furthermore, we consider that O2 is likely to have high intrinsic value for this spectrum (see annex 10, paragraph A10.140) if it needed it to remain a strong competitor, and H3G may not be at material risk from strategic investment in the 3.4 GHz band, as it already holds 40 MHz with a further 84 MHz of 5G spectrum at 3.6-3.8 GHz, with scope for aggregation of these two blocks over time (see annex 11, paragraphs A11.157 to A11.160).
- 7.63 We therefore conclude that it would not be appropriate or proportionate to impose a competition measure specifically in relation to 3.4 GHz, in addition to the measures above, as we do not consider such a measure would be necessary to achieve our objectives for this Auction.
- 7.64 BT/EE, Hutchison Europe and O2⁸¹ did not ask for any measure for 3.4 GHz, while Vodafone proposed a safeguard cap of 80 MHz. We consider such measures as disproportionate in the light of the other caps we are applying.

No measure specific to Competition Concern 2

- 7.65 We discuss the future credibility of the four existing MNOs without any competition measures at paragraphs 6.109 to 6.114. The caps on immediately useable spectrum and on overall spectrum strengthen further the likelihood that operators that need spectrum to be credible will be able to win it in the Auction, particularly given the limit they place on the amount of spectrum BT/EE can acquire in both bands.
- 7.66 We are mindful of the magnitude of the negative impact for consumers if an MNO ceased to be credible and we find (paragraph 6.111) that O2 might need more than its existing spectrum to remain credible after the first transitional period. However, we attach significant weight to O2's position in the market, likely high intrinsic value for spectrum in the Auction or future awards that it needs to be credible, and the effects of the two caps we are adopting in the Auction in mitigating the risk of strategic investment.
- 7.67 We consider that other MNOs are unlikely to need to acquire additional spectrum to remain credible. Therefore we judge that it would not be appropriate or proportionate to apply further measures in respect of Competition Concern 2.

⁸¹ NERA, O2's advisers, proposed a cap of 100 MHz on 3.4 GHz spectrum.

Section 8

Auction design and Regulations

8.1 This section sets out our decisions on the design of the Auction as follows:

- We summarise the main decisions we made prior to our November 2016 consultation document, including the key features of the auction design, as well as the reserve prices.
- We set out our decisions on the outstanding points on which we consulted in November 2016, including the drafting of the Regulations. In summary, we have decided to implement the changes to the withdrawal rule we proposed in our November 2016 consultation, according to which bidders who withdraw bids and cause spectrum to otherwise go unsold, will be offered that spectrum at twice the price of the withdrawn bids.⁸² They will be given the option of rejecting that offer, in which case they will only pay the price of the withdrawn bids.⁸³
- We discuss the implications for the Auction Regulations of the recent acquisition of UK Broadband by H3G. In particular, we explain changes to the Regulations to allow H3G to apply for a replacement licence, so that the spectrum rights for which UK Broadband Ltd currently holds a licence can be brought into the assignment stage of the Auction. We also consider a request from H3G to amend Auction Regulations regarding the replacement licence.
- We describe the way in which we will implement the overall spectrum cap in the design of the Auction. In some circumstances the maximum number of bids bidders can make under the overall spectrum cap may be limited by the number of withdrawn bids; this will require us to take into account both bids and bid withdrawals.

8.2 We include as annex 13 to this document a revised version of the illustrative Auction procedures, which we last published in May 2015. This annex aims to provide an up to date summary and illustration of the features of the auction design – it does not replace the Auction Regulations.

8.3 We are publishing alongside this document a Notice of Ofcom's proposal to make regulations in connection with the award of 2.3 GHz and 3.4 GHz spectrum. The latter is a consultation on the Auction Regulations which will give effect to the decisions set out in this document in relation to the auction design.⁸⁴

8.4 The scope of that consultation includes:

- An overall bid constraint to give effect to our decision to impose an overall spectrum cap of 340 MHz on the amount of spectrum that any operator can hold following the award which we expect to be useable within similar timeframes to the 3.4 GHz band. This overall bid constraint for each bidder will apply in every principal stage round. The detailed implementation of this constraint means that the sum of bids (both new bids made in the round and standing high bids

⁸² This is in addition to any additional price from the assignment stage, if applicable.

⁸³ Again, this is in addition to any additional price from the assignment stage, if applicable.

⁸⁴ https://www.ofcom.org.uk/_data/assets/pdf_file/0021/103827/Notice-of-proposal-to-make-regulations-in-connection-with-the-award-of-2.3-GHz-and-3.4-GHz-spectrum.pdf

assigned at the end of the most recent round that are not superseded by new bids) needs to be equal to or less than the overall bid constraint that applies to each bidder.

- Amended detail on the regulation relating to deposits during the principal stage, whereby we may require a bidder to top up its deposit to the level of its highest financial exposure from any previous round in the Auction.
- A replacement of the name of the pre-existing licence holder in the 3.4 GHz band. Currently, this is formally UK Broadband Limited.
- A regulation to clarify how the award process would proceed in the unlikely event that the pre-existing licence holder were to be excluded, to provide certainty to bidders. This applies only to the pre-existing licence holder, to which specific rules already apply in relation to bids it may make. This was a matter within Ofcom's discretion under our previous proposed draft of the Regulations.

Summary of previous decisions on auction design

- 8.5 In May 2015,⁸⁵ we made a decision to award the 2.3 GHz and the 3.4 GHz frequency bands by means of an auction. We also decided to award the two bands simultaneously, through a single auction.
- 8.6 We noted that although spectrum frequencies in the 2.3 and 3.4 GHz bands were not likely to be seen by bidders as perfect substitutes, they were to some extent substitutable at some prices. Holding a combined auction therefore made sense from a bidder's point of view. It would also be administratively convenient and cost effective to have an auction of both bands at the same time.
- 8.7 We decided that the Auction will have two bidding stages. The first one, called the principal stage, determines the amount of spectrum each bidder wins in each frequency band, measured in MHz. The second stage, called the assignment stage, determines the exact frequencies to which rights are licensed to each successful bidder.

Principal stage

- 8.8 For the principal stage, we made a decision in May 2015 to adopt a version of a commonly used spectrum auction format, called the Simultaneous Multi-Round Ascending (SMRA) auction. We had considered alternative auction formats, particularly the Combinatorial Clock Auction (CCA) which we have used previously, but we concluded that the SMRA format had important advantages – particularly simplicity – which meant it was well suited to the particular circumstances of the 2.3 and 3.4 GHz award.⁸⁶

⁸⁵

https://www.ofcom.org.uk/data/assets/pdf_file/0027/68337/Public_Sector_Spectrum_Release_statement.pdf

⁸⁶ These circumstances, and the underlying assumptions we made about the structure of demand, are discussed in paragraph 6.135 of the November 2014 consultation document, available at https://www.ofcom.org.uk/data/assets/pdf_file/0025/78055/Public_Sector_Spectrum_Release_2-3_and_3-4_ghz_award.pdf.

- 8.9 We acknowledged that the SMRA format could present some risks to the bidders and to the outcome of the award, which we sought to address in the detailed implementation of the format. We concluded that the residual risks were not likely to have a significant impact on the efficiency of the award.
- 8.10 At a more detailed level, we made the following decisions in May 2015:
- a) The 2.3 GHz and the 3.4 GHz spectrum will be available in two different lot categories or lot types.⁸⁷ In the 2.3 GHz category there will be four 10 MHz lots and in the 3.4 GHz category there will be thirty 5 MHz lots.
 - b) The principal stage will take place through a series of rounds. In each round bidders will bid for a number of lots at the round prices set by Ofcom. At the end of each round we will assign standing high bid status to some or all of the bids made through a ranking rule.⁸⁸
 - c) The ranking rule to assign standing high bids will be random in the way it treats bids made at the same round price, subject to there being at most one partial standing high bidder in every round in each lot category. A partial standing high bidder in a category is one that holds a smaller number of standing high bids than the total number of bids it placed in that category.
 - d) A bidder will have the opportunity to withdraw, or ‘cancel’, standing high bids,⁸⁹ but risks being required to pay the full amount of withdrawn bids in the event that it is not possible to establish a standing high bid on all lots in that category later in the Auction. Bidders will be allowed to withdraw from a maximum of five rounds during the Auction.
 - e) Bidding during the principal stage will be regulated by an eligibility rule. The eligibility rule prevents bidders from increasing demand, measured in eligibility points, from one round to the next. A bid for a lot in the 2.3 GHz band uses four eligibility points, and a bid for a lot in the 3.4 GHz band uses one point. When in a round a bidder places bids that carry a smaller total number of eligibility points, compared to the previous round, this will lower their eligibility limit for the next round – subject to waivers.
 - f) Bidders will be allowed to use up to three waivers,⁹⁰ which allow them to ‘sit-out’ a round without losing eligibility. A bidder can exercise a waiver when abstaining from bidding or when the number of eligibility points in its standing high bids fall below its eligibility limit in that round. Bidders will not be allowed to submit bids and/or withdrawals and use a waiver simultaneously in any given round.
 - g) The principal stage ends after a round where there are no new bids, no withdrawals and no waivers being used.
 - h) Standing high bids at the end of the last principal stage round become winning bids, subject to the 3.4 GHz minimum requirement. We will allow bidders to set a minimum requirement of up to 20 MHz in the 3.4 GHz band.

⁸⁷ In the draft Auction Regulations, we refer to these as lot types.

⁸⁸ In this section, we use bids with standing high bid status and standing high bids interchangeably. The draft Auction Regulations refer to this as standing high bid status.

⁸⁹ In this section, we use withdrawal of standing high bid status and withdrawal of standing high bids interchangeably. The draft Auction Regulations refer to this as withdrawal of standing high bid status.

⁹⁰ Waivers are referred to in the draft Auction Regulations as ‘eligibility events’.

A bidder who ends the Auction as the standing high bidder on fewer lots than it has specified in its minimum requirement for the 3.4 GHz band will not be assigned any lots (or have to make any payments) in relation to these bids.

- i) In order to encourage truthful bidding, we will only release limited information to bidders. We will publish the names of qualifying bidders in advance of the Auction. At the end of each round during the principal stage, we will give bidders an indication of the level of excess demand for each lot category. Specifically, we will inform bidders that demand is less than the nearest, higher multiple of 20 MHz (i.e. less than 40 MHz, less than 60 MHz, etc.). If there is no excess demand for a lot category, we will simply inform bidders that demand is less than 20 MHz.

Assignment stage

- 8.10 We decided in May 2015 that if a bidding process is needed for the assignment stage, we will run a single round in which the relevant bidders will be able to submit bids for their preferred frequency assignments. In such circumstances, we decided that assignment stage prices, which are additional to the prices of the principal stage, should be calculated using a second-price rule (highest losing bid). A final price for each bidder will be calculated, combining the base price (from the principal stage of the Auction) and any additional prices (arising from the assignment stage).
- 8.11 For the 2.3 GHz band, we decided to consider only assignment stage plans in which each bidder is assigned a contiguous frequency block that corresponds to the bandwidth, or amount of spectrum, it won in the principal stage. Any unsold spectrum will form a contiguous block.
- 8.12 For the 3.4 GHz band, the outcome will depend on whether the holder of UK Broadband spectrum in the 3.4 GHz band chooses to include it in the assignment stage. If so, we said we would consolidate that existing 3.4 GHz holding to form a single contiguous block. In those circumstances, we decided on a similar rule as for the 2.3 GHz band.
- 8.13 If UK Broadband spectrum is not included in the assignment stage, we decided that the 3.4 GHz band spectrum available for assignment to winners of the principal stage should be split into two sub-bands: a sub-band with 70 MHz (3410-3480 MHz) and another sub-band with 80 MHz (3500-3580 MHz). We said we would prioritise assignment plans in which each winner is assigned a single contiguous frequency block.

Reserve Prices

- 8.14 In the statement we published in October 2015,⁹¹ we decided to set reserve prices of £10 million per 10 MHz lot in the 2.3 GHz band and £1 million per 5 MHz lot in the 3.4 GHz band. The reserve prices are the round prices for the first principal stage round, and are the lowest prices at which we would sell the spectrum.
- 8.15 The levels of the reserve prices were based on a benchmark of the prices paid for 2.6 GHz spectrum in the 2013 UK spectrum auction.⁹² We noted in the November 2014

⁹¹ https://www.ofcom.org.uk/_data/assets/pdf_file/0023/71717/pssr-statement.pdf

⁹² We describe our approach to reserve prices in paragraphs 4.106 to 4.114 of the May 2015 statement and further consultation document.

consultation that there had been few recent awards/auctions of the 2.3 and 3.4 GHz bands elsewhere which could be relevant to us, and so considered that opportunities for meaningful international benchmarking were limited.⁹³ Even though there have now been some auctions in the 3.4 GHz band in other European countries, we consider that there is still insufficient evidence to warrant any revision to our reserve prices.

Outstanding points from the November 2016 consultation

- 8.16 In November 2016, we consulted on a change to the withdrawal rule. The main proposed changes on which we consulted included:
- a) a proposal only to allow 'partial' standing high bidders to use the withdrawal rule, as opposed to any bidder who held standing high bids; and
 - b) a proposal to offer bidders (in return for the opportunity cost of their 'withdrawn bids') a licence to use any spectrum that would otherwise remain unsold as a consequence of their withdrawal.
- 8.17 At the same time, we consulted on the Auction Regulations which would set out the rules and procedures applicable to the Auction. These reflected the decisions made by Ofcom in previous policy statements on the Auction as well as the policy proposals set out in our November 2016 consultation regarding a cap on immediately useable spectrum and changes to the withdrawal rule.
- 8.18 Vodafone, BT/EE and H3G questioned the detail of the auction design and the draft Auction Regulations. The comments they made related to: 1) the revised proposals for the withdrawal rule; 2) the way excess supply is displayed to bidders during the principal stage; 3) the consequences of a failure to pay the total auction sum by UK Broadband Limited (or UK Broadband Networks Ltd); and 4) the detail of the draft Auction Regulations as they relate to a replacement licence for the pre-existing 3.4 GHz licence holder.
- 8.19 After considering these comments, and for the reasons set out below, we have decided not to change the detail of the auction design and the draft Auction Regulations in the manner suggested by Vodafone, BT/EE and H3G. However, we note that we have made changes to the drafting of the Auction Regulations in some places, in addition to the implementation of the overall spectrum cap. These changes include amendments to the deposit rule; to the name of the pre-existing licence holder in the 3.4 GHz band; and to the way we would deal with such licence holder if it were to be excluded from the award process while the Auction is in progress; and editorial changes to improve the readability of the draft Auction Regulations.

Withdrawal rule

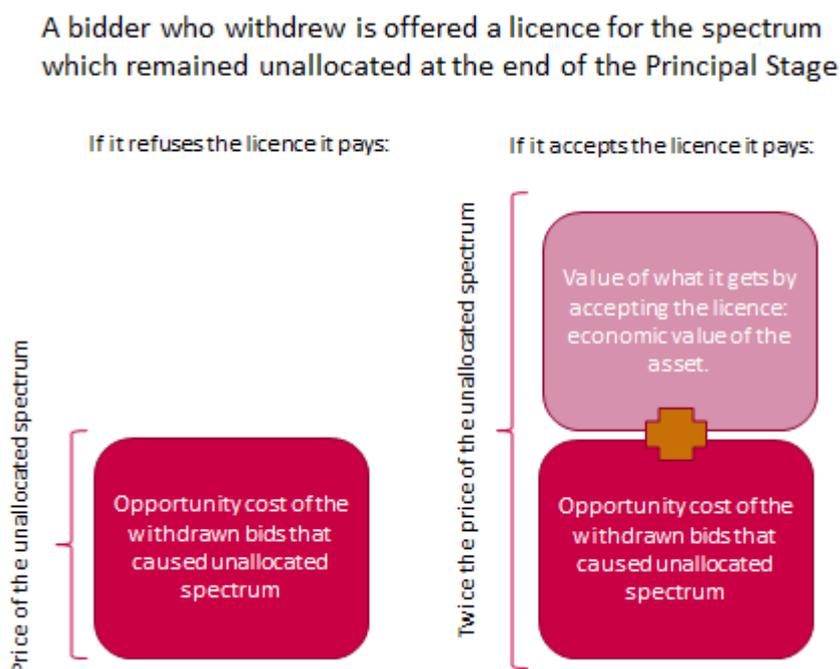
- 8.20 In the November 2016 consultation, we proposed the following changes to the withdrawal rule:
- a) Only *partial* standing high bidders should be allowed to withdraw the standing high bid status of their bids.

⁹³ See paragraph 6.161 of the November 2014 consultation.

- b) To offer bidders, at the end of the Auction, a licence to use any spectrum that would otherwise remain unsold as a consequence of their withdrawals. We referred to this spectrum as ‘unallocated spectrum’.⁹⁴
- c) If the bidder who is offered the licence for unallocated spectrum (‘withdrawal bidder’) rejects that licence, the bidder would be required to pay a sum equivalent to the number of unallocated lots multiplied by the price of the withdrawn bids in addition to any additional price from the assignment stage.
- d) If the withdrawal bidder accepts the licence, it would be required to pay a sum equivalent to the number of unallocated lots multiplied by *twice* the price of the withdrawn bids, in addition to any additional price from the assignment stage (we refer to this as the ‘withdrawal payment’ below).

8.21 Below is an illustration of our proposals in the November 2016 consultation. We refer to the opportunity cost of the withdrawn bids as the value of the spectrum to other bidders which the withdrawal bidder outbid to become standing high bidder on these lots. We refer to the economic value of the spectrum as the price that the losing bidder was willing to pay in the Auction before being outbid by the withdrawal bidder.

Figure 8.1: Illustration of the withdrawal payment



Price at which the unallocated spectrum is offered to the bidder and secondary auction

8.22 Vodafone questioned whether the level of the withdrawal payment is onerous to the point that the bidder (if any) that is offered a withdrawal licence would not reasonably pay the extra amount to win the licence. Vodafone also explained that it is concerned

⁹⁴ This is to reflect the fact that the spectrum is not unsold, but rather it is not allocated any standing high bids by Ofcom at the end of the last principal stage round.

that, given the high withdrawal payment, the only reason why a bidder might try to take advantage of this rule is to circumvent the auction eligibility rules and possibly also the spectrum cap. As an alternative, Vodafone suggested a secondary auction for the unallocated spectrum, in which all bidders that have won spectrum in the main auction would be able to participate.

8.23 We address the points raised in turn.

Violation of the eligibility rule and proposed price

8.24 We acknowledged in the November 2016 consultation that, by offering the unallocated spectrum to the withdrawal bidder, we may in some circumstances offer a bidder a quantity of spectrum which exceeds their eligibility in the last round of the principal stage. This would mean a *de-facto* violation of the eligibility rule.

8.25 We have decided to set the price at which we would offer any unallocated spectrum at a level that deliberately aims at discouraging bidders from using the withdrawal rule strategically, including trying to circumvent the eligibility rule. The closer the price at which we offer the spectrum is to the round price (i.e. the price at which the bidder withdrew), the stronger the incentives for strategic use of the withdrawal rule will be. By setting the price to win the unallocated spectrum well above this price – indeed at double the round price – we are therefore providing an appropriate disincentive to use withdrawals strategically.

8.26 As well as being practical and simple, the price we have decided to adopt possesses good economic properties.

- a) If the bidder rejects the withdrawn lot licence, it will be asked to pay the approximate opportunity cost of its bids; and
- b) The difference between accepting or rejecting the withdrawn lot licence is the approximate value of the economic asset it is acquiring.

Violation of the spectrum cap

8.27 Under the spectrum cap we proposed in the November 2016 consultation, a bidder would not be able to use the revised withdrawal rule to circumvent the cap. We explain below why this is the case both with regard to the cap on immediately useable spectrum and with regard to the overall spectrum cap we are imposing across the two spectrum bands.

Secondary auction

8.28 The withdrawal bidder who caused spectrum to remain unallocated was, in effect, the last bidder to have expressed a preference to win the unallocated spectrum. After the withdrawal, and subject to eligibility, other bidders were given the chance to bid for the unallocated spectrum at the final round price (which is equal to the price at which the bidder who withdrew the last bid, plus one price increment), but they would have not done so – or the spectrum would not have remained unallocated.

8.29 Therefore, in our view, it is sensible to offer any unallocated spectrum to the withdrawal bidder and not to all the other bidders that participated in the award by means of a secondary auction. We have discussed above the price at which we have decided this offer should be made.

- 8.30 In any event, Ofcom would take all reasonable steps to make any unallocated spectrum which is not taken up by the withdrawal bidder available to the market in a timely fashion.

Point at which the withdrawn lot licence is offered to the withdrawal bidder

- 8.31 Vodafone and BT/EE questioned whether the unallocated spectrum should be offered at the end of the principal stage rather than at the end of the assignment stage (i.e. at the grant stage). BT/EE noted that a bidder who withdrew could influence the outcome of the assignment stage, even if that bidder subsequently refused the licence for the unallocated spectrum. For example, the bidder could place bids during the assignment stage that would affect where the unallocated spectrum is positioned in the band and how much others pay for where they are located in the band.
- 8.32 The reason we have decided to offer the withdrawn lot licence at the grant stage, as opposed to the end of the principal stage, is consistency with the treatment of the 'normal' licence(s) won by being a standing high bidder at the end of the last principal stage round. Unless there is a sound reason to do otherwise, our preferred choice is to treat the licences in the same way in this regard.
- 8.33 To a significant extent, the constraints on the incentives for bidders to bid strategically in the assignment stage are similar, irrespective of the type of licence which they have won. This is because all bidders that participate in the assignment stage will be asked to pay the opportunity cost of their winning assignment stage bids, irrespective of the type of licence offered to them.⁹⁵ In particular, if a withdrawal bidder refuses the withdrawal lot licence offered to it at the grant stage, its refusal payment will include the additional price from the assignment stage. Therefore, any bidder who wishes to bid strategically and deny its competitors a particular location for their spectrum (the 'strategic location') will need to pay at least the full amount bid by the latter.
- 8.34 However, a distinction may arise between a withdrawal bidder who does not wish to accept the withdrawal lot licence and a bidder who wins a licence by virtue of being a standing high bidder (henceforth, 'standing high bidder'). This is because of any intrinsic value the standing high bidder may have for different locations for its spectrum.
- 8.35 To illustrate, we refer to the terminology and the framework we use in annex 10 of this document, when we discuss strategic investment in the Auction. The pay-off from strategic bidding in the assignment stage corresponds to the benefit that the bidder receives from denying the strategic location to its competitors. The cost of strategic bidding in the assignment stage, on the other hand, is given by the excess of the additional price the strategic bidder pays for the strategic location over and above its intrinsic value.
- 8.36 In some circumstances, all else constant, the cost of strategic bidding for a withdrawal bidder will be larger than for a standing high bidder. If a withdrawal bidder is sufficiently confident it will reject the withdrawal lot licence at the grant stage, its intrinsic value for the strategic location is likely to be zero. As such, the entirety of its

⁹⁵ In accordance with Regulation 99 (3) (4) if a withdrawal bidder refuses the withdrawal lot licence offered to it at the grant stage, its refusal payment will include the additional price from the assignment stage. In accordance with Regulations 91 and 93 if it accepts the withdrawal lot licence, the withdrawal bidder will also pay the additional price, as part of the licence fee.

additional price for the strategic location would be its cost of strategic bidding. On the other hand, if a standing high bidder has an intrinsic value for the strategic location and prefers it to the other available locations, this would reduce its cost of strategic bidding.

- 8.37 In other circumstances, again all else constant, it may be more costly for a standing high bidder to engage in strategic investment. If the standing high bidder would prefer some other location for its spectrum for intrinsic value reasons, by winning the strategic location it will be foregoing its most preferred location. This is a cost of strategic bidding over and above the cost a withdrawal bidder would incur.
- 8.38 In summary, therefore, to a significant extent there are similarities in the constraints on the incentives to bid strategically as between a withdrawal bidder and a standing high bidder at the end of the last principal stage round. Whilst there are circumstances in which differences can arise, the effect could go in either direction.
- 8.39 In light of the above, we have decided that any withdrawn lot licences should be offered to bidders at the same time as the other licences are offered to bidders (i.e. after the assignment stage).

Logic of requiring a bidder who is liable for unallocated spectrum in both bands to either accept or reject both withdrawn lot licences

- 8.40 Although it explained that it accepts Ofcom’s proposal, Vodafone queried the logic of insisting that - in the unlikely event that a bidder is liable for unallocated spectrum in both the 2.3 GHz and 3.4 GHz bands - that bidder must either accept or reject both withdrawn lot licences.
- 8.41 We note the likelihood of a bidder winning spectrum in both 2.3 GHz and 3.4 GHz as a consequence of having withdrawn from both bands is relatively low. In addition, upon withdrawing its partial standing high bids in one band, a bidder would have released eligibility points which it could use to bid in the other band, thereby reducing or eliminating the total amount of otherwise unallocated spectrum in that other band. In other words, the bidder can at least partially mitigate the risk that it might wish to win unallocated spectrum in one band but reject unallocated spectrum in the other band by bidding for the preferred type of spectrum.
- 8.42 Bearing that in mind, and for simplicity of process, we have concluded it is appropriate to offer both withdrawn lot licences to the bidder simultaneously.

Excess demand

- 8.43 Vodafone reiterated that it finds it curious that bidders are not informed whether there is no excess demand and instead the information provided to bidders is only that there is excess demand of at least zero and less than 20 MHz. However, in the interest of not delaying the Auction any further, it explained that it is comfortable to proceed with the rules as proposed.
- 8.44 We restate the rationale we put forward in the November 2016 consultation.⁹⁶ As we noted, a risk involved in indicating the actual level of excess demand is that bidders may use it to bring the Auction to an early end. This is particularly so for low levels of excess demand, or even excess supply. On the other hand, we believe an indication

⁹⁶ Paragraphs 7.12 to 7.14, in https://www.ofcom.org.uk/_data/assets/pdf_file/0026/93545/award-of-the-spectrum-bands-consultation.pdf.

that the level of excess demand is less than 20 MHz is sufficient to aid bidders for the intended purpose of conducting an efficient auction.

Failure of UK Broadband or UK Broadband Networks to pay auction sum

- 8.45 When we consulted in November 2016, the rights of use to the spectrum in the ranges 348-3500 MHz and 3580-3600 MHz were held concurrently by UK Broadband Ltd and UK Broadband Networks Ltd. We referred to these entities as the pre-existing licence holders. As a consequence of H3G's acquisition of UK Broadband Ltd, UK Broadband Networks transferred the rights of use it concurrently owned with UK Broadband Ltd into the sole ownership of UK Broadband Ltd. However, respondents to the consultation referred to the spectrum as UK Broadband and UK Broadband Networks spectrum. The text below applies irrespective of the owner of the pre-existing licence for spectrum in the ranges 3480-3500 and 3580-3600 MHz and for simplicity we now refer simply to the pre-existing licence holder as the owner of this licence.
- 8.46 In the consultation on the draft Auction Regulations, we proposed that winning bidders should, as a general rule, only be entitled to the grant of their licences if they have paid in full the 'total auction sum' by a deadline specified by Ofcom (see regulation 104). However, we proposed to allow the pre-existing licence holder to receive a 'replacement licence' (but no other licences) even if it had not paid its total auction sum.⁹⁷ BT/EE suggested that this proposal was unduly discriminatory. It recommended that, if the pre-existing licence holder failed to pay its total auction sum, it should not be allowed to receive a replacement licence.
- 8.47 We disagree with BT/EE's suggestion that it would be unduly discriminatory to allow the pre-existing licence holder to receive a replacement licence even if it has not paid its total auction sum.
- 8.48 We have included provisions within the draft Auction Regulations which allow the pre-existing licence holder to apply for a replacement licence in order to reflect the fact that it is already licensed to use 40 MHz of spectrum in the 3.4 GHz band - and therefore to facilitate the granting of contiguous blocks of 3.4 GHz spectrum under the award, in the interests of all bidders. No other participant in the Auction is already licensed to use 40 MHz of 3.4 GHz spectrum, and no other participant could therefore apply for a replacement licence. The circumstances surrounding the grant of the replacement licence can therefore be distinguished from those applicable to the grant of other licences under the award.
- 8.49 If we were to revoke the pre-existing licence in the event that the licence holder did not pay its total auction sum and not grant a replacement licence, we would not be treating it in the same way as other bidders would be treated. Rather, we would be increasing the penalty beyond what would apply to other bidders that did not pay their total auction sum. Further, we note that, in the event that the pre-existing licence holder wins additional lots in the principal stage, it would – in the same way as other winning bidders – only be entitled to the grant of other 'standard' licences if it had paid in full its total auction sum.

⁹⁷ A replacement licence would only be granted in the event that UK Broadband Limited applied for a replacement licence in the auction. This licence would replace UK Broadband Limited's pre-existing licence for spectrum in the ranges 3480-3500 and 3580-3600 MHz.

Replacement Licence

- 8.50 As noted, the draft Auction Regulations on which we consulted in November 2016 referred to the pre-existing 3.4 GHz licence holders as UK Broadband and UK Broadband Networks. In the event that these companies applied for a replacement licence, the spectrum in the licence would be included in the assignment stage of the Auction.
- 8.51 We have now changed the draft Auction Regulations to account for the fact that UK Broadband Networks has transferred the rights of use in the 3.4 GHz band to UK Broadband Ltd. If the rights of use change ownership again, we will strive to amend the Auction Regulations accordingly, in order to allow the pre-existing licence holder to apply for a replacement licence.
- 8.52 Also, we have considered whether there is any reason to change our position given H3G's acquisition.
- 8.53 First, we have assessed whether it might be appropriate to *require* the pre-existing licence holder to apply for a replacement licence if it wished to participate in the principal stage.
- 8.54 We had previously considered making participation in the Auction by the pre-existing licence holder conditional upon relinquishing the existing licence. However, we subsequently reached the view that it would not be proportionate to impose such a condition, as it would exceed the conditions imposed upon other participants.
- 8.55 We do not think our policy should change following H3G's acquisition of UK Broadband. The concerns we had in the past are the same as those we would have now. We nevertheless recognise the benefits arising from spectrum efficiency which could arise from an application for a replacement licence, and for that reason we would welcome an application which did so.
- 8.56 Second, we have considered a late request from H3G to amend the draft Auction Regulations in order to allow the pre-existing licence holder to choose at the outset of the Auction whether to seek re-assignment of 0, 20 or 40 MHz of its spectrum. We have decided not to change our policy as we consider that our current rules are more likely to lead to an efficient use of the spectrum. We set out the reasons below.

H3G's request

- 8.57 On 23 June, H3G and Ofcom had a telephone conversation at the request of the former to discuss H3G's application in the Auction for a replacement licence. The telephone conversation was followed up by a letter sent to Ofcom on the same day, via email, which we have published on our website. The letter accurately reflects what was discussed in the telephone conversation.
- 8.58 In the letter, H3G stated that %< [REDACTED] .
- 8.59 H3G would instead prefer to have its existing UKB licence converted to %< [REDACTED] .
- 8.60 As a fall-back option, H3G proposed that H3G/UKB would have the option to only seek re-assignment of 20 MHz of its spectrum - %< [REDACTED] .

✂ [REDACTED]

8.61 ✂ [REDACTED] ⁹⁸

8.62 ✂ [REDACTED] ⁹⁹

8.63 ✂ [REDACTED]

8.64 ✂ [REDACTED] ¹⁰⁰

8.65 ✂ [REDACTED]

8.66 ✂ [REDACTED] ^{101 102}

Analysis of H3G's request

8.67 H3G's preferred option – ✂ [REDACTED] we consider that market-led mechanisms to determine the allocation of the spectrum are more likely to generate an efficient outcome. We remain of this view.

8.68 We have now also considered the fall-back option presented by H3G in which it could apply for a replacement licence covering only ✂ [REDACTED] .

8.69 As a framework for considering H3G's proposal, we distinguish between three scenarios for the way in which H3G might participate in the Auction:

- **Scenario 1** – H3G would put all 40 MHz into the assignment stage;
- **Scenario 2** – H3G would put the ✂ [REDACTED] into the assignment stage; and
- **Scenario 3** – H3G would put none of its spectrum into the assignment stage.

8.70 Scenario 1 is most likely to achieve efficient use of the spectrum. Under Scenario 1, bidders can express preferences for a wider range of frequencies than they can under Scenarios 2 or 3:

- Under Scenario 3, there might be other bidder(s) that have higher values for H3G's current frequency locations than H3G. However they would be unable to bid for those frequencies because they would not be included in the assignment stage in Scenario 3.
- Similarly, under Scenario 2, it is possible that a bidder other than H3G would have the highest value for ✂ [REDACTED] . However, it would be unable to bid

⁹⁸ ✂ [REDACTED]

⁹⁹ https://www.ofcom.org.uk/_data/assets/pdf_file/0019/33094/bt.pdf

¹⁰⁰ https://www.ofcom.org.uk/_data/assets/pdf_file/0027/68337/Public_Sector_Spectrum_Release_statement.pdf

¹⁰¹ ✂ [REDACTED]

¹⁰² ✂ [REDACTED]

for that spectrum, again because it would not be included in the assignment stage.¹⁰³

- In both cases, H3G would retain the rights to its current frequency locations that were not included in the assignment stage even if it did not have the highest value for those frequencies. There would therefore be an efficiency loss and the outcome is unlikely to represent the most efficient use of the spectrum.

8.71 We have two options for how to proceed in the Auction with respect to replacement licences:

- **Option A** – we maintain our current approach. If H3G applies for a replacement licence, it has to include all 40 MHz in the assignment stage. Under this option, the only possible outcomes are Scenario 1 and Scenario 3; and
- **Option B** – we adopt H3G’s proposed approach in which ⌘ [REDACTED] into the assignment stage. There are two variants of this option: one in which the only possible outcomes are Scenario 2 and Scenario 3 ⌘ [REDACTED] and an alternative in which Scenario 1 is also possible. As we explain below, H3G is always likely to prefer Scenario 2 to Scenario 1, so inclusion of Scenario 1 in this option makes little difference to our analysis.

8.72 A feature of both options A and B is that H3G has the choice to determine the applicable scenario. We expect H3G to make this choice based on the scenario that it considers would be best for itself (e.g. most profitable).

8.73 In our view, there are reasons why H3G’s private incentives could lead to scenarios and outcomes that are not the most efficient in terms of spectrum use. For example:

- Scenarios 2 and 3 mean that H3G avoids paying an assignment stage price for some or all of its existing 3.4 GHz spectrum. This could make it more profitable for H3G to prefer those scenarios over Scenario 1, even where Scenario 1 achieves a more efficient use of the spectrum.
- ⌘ [REDACTED]

8.74 Comparing the merits of Options A and B depends on the likelihood of the different scenarios occurring in each option, and the nature and scale of the consequences for spectrum efficiency. There is material uncertainty about various elements of the comparison.

8.75 Our starting point is that Scenario 1 is likely to achieve the most efficient set of assignments for the entire 3.4 GHz band, taking into account H3G’s existing 3.4 GHz spectrum.¹⁰⁴

¹⁰³ There is also the potential for a further efficiency distortion in Scenario 2, compared to Scenario 1. ⌘ [REDACTED] This means that Scenario 2 runs the risk not only of spectrum inefficiency in relation to the frequencies that are not included in the assignment stage, but also in relation to some of the frequencies that are included.

¹⁰⁴ We expect this to be the case if bidding in the assignment stage is based on the intrinsic value bidders have for different locations within the band. As regards the possibility of strategic bidding, we make the following observations. First, strategic investment seems relatively unlikely as it is unclear that a strategic bidder would have the ability to achieve a foreclosure effect. It is more likely that the

- 8.76 Option B is likely to reduce the chances of Scenario 1 being the outcome. This clearly arises if Scenario 1 is not one of the choices available under Option B. Even if it is an available choice, Scenario 2 is still an attractive choice for H3G under Option B over Scenario 1, even when it is not the most efficient outcome. This is related to the private advantage for H3G noted in paragraph 8.73 above. In a choice for H3G between Scenarios 1 and 2, with Scenario 2 it has at least a chance that it will pay less for the same outcome, because it avoids an assignment stage price for the £ [REDACTED] (which is not included in the assignment stage in Scenario 2). £ [REDACTED]
- 8.77 We recognise that a possible offsetting advantage of Option B is that £ [REDACTED]¹⁰⁵
- 8.78 £ [REDACTED]^{106 107}
- 8.79 Given our analysis above and the uncertainties, we do not consider there is a sound basis to move from our current approach, Option A.¹⁰⁸

Implementation of the 340 MHz overall spectrum cap

- 8.80 Under the Auction design, there are two ways in which bidders can win spectrum in the principal stage:
- a) By placing bids that are assigned standing high bid status at the end of the last principal stage round; and
 - b) By withdrawing the standing high bid status of their bids and causing spectrum to remain unallocated at the end of the last principal stage round.
- 8.81 As we explained in section 7, we are imposing two different spectrum caps in the 2.3 and 3.4 GHz award:
- a) A cap of 255 MHz on the amount of immediately useable spectrum that any bidder can hold at the end of the award process; and

effect on the victim (e.g. H3G) of not winning its most preferred frequencies would be to affect its costs of relocation (potentially offset by paying a lower assignment stage price), instead of weakening it as a competitor in the use of 3.4 GHz spectrum. Second, however, another type of strategic bidding is possible: price driving. This would involve the strategic bidder making bids above its own intrinsic value in an attempt to force the victim to pay a higher assignment stage price for its preferred frequency location. But a strategic bidder placing assignment stage bids above its intrinsic value for the purpose of price driving would be running the risk of inadvertently winning that frequency location, and doing so at a loss (because of its bids being in excess of intrinsic value). We also note that a price driving outcome is unlikely to affect the efficiency of the frequency assignments, even if it affects the prices of those assignments (although a failure by the strategic bidders to achieve price driving by inadvertently winning the frequency locations could adversely affect the efficiency of the assignments).

¹⁰⁵ £ [REDACTED]

¹⁰⁶ £ [REDACTED]

¹⁰⁷ £ [REDACTED]

¹⁰⁸ £ [REDACTED]

- b) An overall cap of 340 MHz on the total amount of mobile spectrum useable in the second transitional period that any bidder can hold at the end of the award process.
- 8.82 To limit the amount of spectrum an individual bidder can hold at the end of the award process, the Auction Regulations need to restrict the maximum amount of spectrum that bidder can win in the Auction. That in turn is achieved by restricting the permissible bid submissions an individual bidder can make during the principal stage.
- 8.83 The spectrum cap on immediately useable spectrum can be implemented through a simple restriction on the maximum number of bids that bidders can make in the 2.3 GHz band, because the cap only applies to this single band in the Auction. If a bidder can only bid to the level of its cap, then it cannot win an amount that exceeds it.
- 8.84 Implementing the cap on *overall* spectrum is somewhat more complex because it applies to two bands, as opposed to just one. In particular, it is not sufficient to restrict the maximum total number of new bids that bidders can make in the round. Rather, when a bidder makes new bids in only one band, we need to restrict the *combination* of new bids made in that band *and* any standing high bids the bidder might hold at the beginning of the round in the other band. Otherwise, bidders might be able to bid up to the overall cap in one band,¹⁰⁹ while maintaining standing high bids in the other band, and as a result end up winning a total amount that exceeded the cap.
- 8.85 The restriction on the maximum number of bids the bidder can make in one band will apply irrespective of whether or not the bidder withdraws its standing high bids in the other band during the round. If the overall cap disregarded withdrawn bids (which would always be equal to the number of a bidder's standing high bids at the beginning of the round), a bidder could theoretically bid up to the overall cap in one band while withdrawing in the other band. Because the bidder could subsequently win spectrum as a result of having withdrawn, it might win a total amount of spectrum that exceeded the overall cap.
- 8.86 This interaction between the overall cap and withdrawals may have a knock-on effect for the eligibility of bidders subject to the overall cap. A bidder who is *not* affected by the overall cap would be able to withdraw from one band and bid up to its full eligibility limit in the other band, and would therefore not lose eligibility in the following round. However, a bidder who is affected by the overall cap may be constrained in the amount of eligibility points it can use in one band when it withdraws from the other. As a result it may also be unable to place new bids up to the cap in subsequent rounds. This applies even if the bidder is no longer liable for any spectrum as a result of having withdrawn (because other bidders had in the meantime bid for the spectrum that would otherwise remain unallocated). We refer to this as the 'bid constraint effect'.
- 8.87 Defining the cap on overall spectrum to include standing high bids even if these are withdrawn will apply equally to all bidders. However, the bid constraint effect only impacts bidders that are restricted by the overall cap and able to bid for both bands – hence it will only impact Vodafone. It will not impact Three, O2 or a new entrant as

¹⁰⁹ We refer to this restriction in the draft Auction Regulations as the 'overall bid constraint'. There is only one overall spectrum cap that will apply to all bidders, which is of 340 MHz. There will be one overall bid constraint calculated *for each* bidder, on the basis of its recorded spectrum holdings and the overall spectrum cap. For simplicity, we do not draw a distinction between the overall spectrum cap and the overall bid constraint in this statement.

they are not constrained by the overall cap, based on current holdings. It will not impact BT/EE as the 2.3 GHz cap means it cannot withdraw from one band and place bids in the other band.

- 8.88 Under the overall cap, Vodafone will be unable to win more than 160 MHz of spectrum in the Auction. In the event that Vodafone has bid up to (or close to) the cap *and* is a partial standing high bidder in one band, it would be impacted by the bid constraint effect. We illustrate this with a hypothetical example.
- 8.89 Assume that in round 10, Vodafone makes bids for four lots in 2.3 GHz and 24 lots in 3.4 GHz, and that it is made a standing high bidder on three lots in 2.3 GHz and on no lots in 3.4 GHz. In total, Vodafone would have used 40 eligibility points.¹¹⁰ In the next round, Vodafone withdraws its three standing high bids in 2.3 GHz. The maximum number of bids it can make in 3.4 GHz is for 26 lots, or 130 MHz, because of the overall cap – which applies both to its new bids in round 11 and its standing high bids from round 10). If it chooses to withdraw from 2.3 GHz and make bids for 26 lots in 3.4 GHz, it will use 26 eligibility points in round 11. As a result, its eligibility limit in round 12 will be 26 and will never increase. Therefore, Vodafone would be unable to bid for more than 130 MHz in the 3.4 GHz band in subsequent rounds. This applies even in the event that other bidders place new bids in the 2.3 GHz band such that Vodafone is no longer liable for any spectrum in the band from which it initially withdrew.
- 8.90 Below is the full list of examples that could restrict Vodafone to bid up to the overall cap in one band when it withdraws from the other. These figures are calculated on the basis of current holdings. In all cases, for Vodafone to be affected, it would have to be a partial standing high bidder in one band.

Figure 8.2: Possible bid constraints on Vodafone given overall spectrum cap and existing holdings¹¹¹

If Vodafone withdraws the following amount of bids (measured in MHz)	Then the overall cap will not allow it to bid for an amount of bids that exceeds (in MHz)
2.3 GHz band	3.4 GHz band
30	130
20	140

¹¹⁰ Each bid for a 2.3 GHz lot uses 4 eligibility points, and each bid for a 3.4 GHz lot uses 1 eligibility point. Therefore, by bidding on 4 lots of 2.3 GHz and 24 lots of 3.4 GHz, Vodafone would be using 40 eligibility points.

¹¹¹ Only partial standing high bidders in a lot category can withdraw bids from that category. Therefore, it is not possible to withdraw a total number of bids that amount to 40 MHz in 2.3 GHz (4 bids) or 150 MHz (30 bids) in 3.4 GHz. If Vodafone were to withdraw 10 MHz (1 bid) in 2.3 GHz, the overall cap would not restrict it from bidding for the whole 150 MHz of 3.4 GHz. Likewise, if Vodafone were to withdraw 120 MHz or less in 3.4 GHz, the overall cap would not restrict it from bidding for the whole 40 MHz in 2.3 GHz.

If Vodafone withdraws the following amount of bids (measured in MHz)	Then the overall cap will not allow it to bid for an amount of bids that exceeds (in MHz)
3.4 GHz band	2.3 GHz band
145	10
140	20
135	20
130	30
125	30

- 8.91 The table shows that the bid constraint effect can only apply when Vodafone wishes to win more than 120 MHz of 3.4 GHz spectrum. Either it is not satisfied with winning 20 MHz or 30 MHz in 2.3 GHz (as a partial standing high bidder) and wishes to win more than 140 MHz or more than 130 MHz, respectively, in 3.4 GHz; or it is not satisfied with winning between 125 and 145 MHz in the 3.4 GHz band (as a partial standing high bidder) and wishes to win more 2.3 GHz.
- 8.92 We believe that these circumstances are unlikely to arise in practice and hence this is not likely to be a material concern. In its response to the November 2016 consultation, Vodafone suggested a cap of 80 MHz on the amount each individual operator could win in 3.4 GHz. This seems to provide an indication that Vodafone would not consider a restriction to 120 MHz to be a serious concern.
- 8.93 Moreover, the bid constraint effect only applies when the bidder chooses to withdraw. No bidder is required to withdraw its standing high bids. There are alternatives to withdrawing, including waiting to be outbid in the band from which the bidder wishes to move.
- 8.94 Nevertheless, we have also considered if there are ways in which we could mitigate the impact of the bid constraint effect. Specifically, we have assessed whether it would be appropriate to increase a bidder's eligibility limit to incorporate the eligibility points from any withdrawn bids that cease to be provisionally winning bids. In the example above, if Vodafone's three withdrawn bids ceased to be provisional winning bids at the end of round 11, then this rule would imply that Vodafone's eligibility limit for round 12 would be increased by 12 points to 38.
- 8.95 However, an eligibility adjustment rule of this sort would risk being discriminatory. If we only applied it to a bidder who was restricted by the overall cap, it would place this bidder at an advantage compared to other bidders. This is because other bidders do not get their eligibility limit adjusted when the number of withdrawn bids currently winning is reduced. Alternatively, if we applied the eligibility adjustment rule to all bidders, they would be able to withdraw their standing high bids strategically, with the intention of increasing the number of eligibility points available to them.
- 8.96 Overall, we think that mitigations to the bid constraint effect are unwarranted. Their application would increase the complexity in the auction design and/or increase the

scope for strategic bidding in the Auction. Moreover, the bid constraint effect is very unlikely to have a material impact in the Auction.

- 8.97 As already noted, we are consulting on the draft Auction Regulations alongside this policy statement. The draft Auction Regulations set out how we intend to implement the overall cap in order to take into account withdrawals. We explain the rationale for this practical implementation in the introduction to the main document.

Section 9

Next steps

- 9.1 In this section of the statement we set out the next steps in our progress towards the start of the Auction of the 2.3 and 3.4 GHz spectrum bands.
- 9.2 As noted in section 2, one of the key policy objectives for this award is to make the 2.3 and 3.4 GHz spectrum available in a timely fashion to meet consumer demand for mobile broadband services with higher speeds and greater capacity. Both of the bands are already clear of other uses. The 2.3 GHz frequencies are already supported by mainstream devices, making them immediately useable by MNOs.
- 9.3 For these reasons, we consider it important to proceed with the Auction as quickly as possible so that consumers may experience the benefits that may be derived from deployment of additional mobile spectrum.

Timetable

- 9.4 As noted above, this statement is published alongside a Notice of Ofcom's proposal to make regulations in connection with the award of 2.3 GHz and 3.4 GHz spectrum. This is a consultation on the Auction Regulations which give effect to our decisions. We underline that we are consulting on the Auction Regulations only; we are not consulting on the policy decisions set out in this statement and would not take account of any submissions made in this regard. That consultation period runs for one month. Our next steps are set out in the following paragraphs. This is an approximate timetable, subject to potential delays including for judicial review as explained below. It is provided for illustrative purposes only and should not be relied upon:

- **14 August 2017** – Our consultation on the Auction Regulations closes and we will begin considering the responses.
- **Late August to early September 2017** – Subject to our consideration of the responses to the consultation on the Auction Regulations, we intend to make the Auction Regulations within two weeks of the close of that consultation. We therefore anticipate being able to publish our final statement on the making of Auction Regulations in mid-August. At the same time, we will publish on our website a detailed guidance note for potential applicants, setting out the process for applying, information applicants will need to provide and initial deposit requirements. We will also advise of the provisional application date.
- **Mid to late September 2017** – The Auction Regulations will come into force two weeks after we make them.
- **Late September to early October 2017** – Shortly after the Auction Regulations come into force, we will invite applications from potential bidders in the Auction. We will publish the details on our website, including notification of the date on which we will accept the applications. All applications must be delivered to Ofcom by hand on the designated

application day. Following submission of applications and payment of initial deposits, Ofcom will provide details of how applicants may access a training version of the electronic auction software we will be using in the Auction, together with bidder and auctioneer manuals setting out instructions on use of the software. This will enable applicants to familiarise themselves with the bidding process and to conduct internal mock auctions and training with full autonomy (that is, without intervention from Ofcom). Once we have received applications, we will conduct a formal qualification stage to assess applicants for potential overlaps between bidder groups, and for general fitness to hold a licence. We will then publish a list of those applicants who have qualified as bidders and give formal notification of the date on which bidding will begin.

- **Late October to November 2017** – Bidding begins.

Potential judicial review of decisions in this statement

- 9.5 We are aware that in the course of our consultation process, a number of stakeholders have indicated that they might consider seeking judicial review of our final decisions, depending on their nature. Because a significant part of the spectrum we are auctioning could be used to provide services immediately, we consider that any claim for judicial review should be brought promptly, with a request that the courts expedite the matter.
- 9.6 As noted above, our consultation on the Auction Regulations runs for one month, and, subject to consideration of any consultation responses, we intend to make the final regulations two weeks after its closure. We therefore consider that promptness in this case means that any claim for judicial review should be brought within six weeks of the date of this statement.

Publication of update to Information Memorandum

- 9.7 In October 2015 we published an Information Memorandum in connection with the 2.3 and 3.4 GHz Auction. We are now publishing an updated Information Memorandum alongside this statement.¹¹² The updated Information Memorandum sets out information which may be of interest to potential bidders. In summary, it:
- Describes the characteristics of the bands for which licences are to be awarded;
 - Explains certain factors that may affect licensees' use of the bands;
 - Summarises certain of the principal terms of the licences that will be issued following completion of the award process, and provides draft templates of the licences that will be issued for the 2.3 and 3.4 GHz bands respectively;
 - Sets out the spectrum lots that will be available in the award process and the reserve price for each lot;
 - Provides certain information in relation to the award process; and

¹¹² https://www.ofcom.org.uk/_data/assets/pdf_file/0030/81579/info-memorandum.pdf

- Provides information on a range of other associated issues.