dot·econ

Issues relating to the award of spectrum in multiple bands in Ireland

A report for ComReg

ComReg document 12/24

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1 Introduction

1.1 Background

1. DotEcon has advised ComReg on various aspects of the proposed award since June 2009 and has provided a series of reports to ComReg, including ComReg document 09/99c published in December 2009, document 10/71a published in September 2010, and document 10/105a published in December 2010. Over this period, the scope of the award has expanded, from initially including only the 900MHz band, to the proposal for a joint award of 900MHz and 800MHz spectrum following the greater certainty regarding 800MHz availability, and subsequently to the multi-band award of 800MHz, 900MHz and 1800MHz spectrum proposed in document 10/105.

2. Our most recent previous report (published as ComReg document 11/58) was published in August 2011 alongside ComReg's Response to Consultation and Draft Decision on the Release of the 800MHz, 900MHz and 1800MHz bands (ComReg document 11/60). This was the latest of a series of ComReg publications relating to the proposed multi-band award and took into account the responses received to ComReg's previous consultation documents 09/99, 10/71 and 10/105.

3. In this report, we review various aspects of the proposed award process for the 800MHz, 900MHz and 1800MHz spectrum bands based on the views of interested parties in relation to ComReg document 11/60 and our accompanying report, published as ComReg document 11/58.

4. Since publication of ComReg documents 11/58, 11/60 and 11/60a, ComReg has published a number of further documents that are referred to in this report and which are of direct relevance to the issues raised by respondents. Shortly after publishing 11/60, ComReg published its Draft Information Memorandum for the Multi-band Spectrum Release[1] which outlines the detailed auction rules for the award. Furthermore, ComReg has also published two documents concerning its overall spectrum strategy: ComReg document 11/88[2] reviewed ComReg's previous spectrum strategy and set out proposals in the light of issues raised by respondents to ComReg document 11/28, while ComReg document 11/89[3] set out ComReg's statement of its "Strategy for Managing the Radio Spectrum: 2011 -2013".

5. In this document, we have focussed on responses to ComReg's Draft Decision (11/60). However, some of the issues raised will have subsequently been clarified by publication of the detailed auction rules in the Draft Information Memorandum (ComReg document 11/75). Equally, some comments raised in

[1] ComReg document 11/75, published on ComReg's website on 24 October 2011

[2] *Review of the Period 2008 – 2010 & Proposed Strategy for Managing the Radio Spectrum: 2011 – 2013,* ComReg document 11/88, 22 November 2011.

[3] *Strategy for Managing the Radio Spectrum: 2011-2013,* ComReg document 11/89, 22 November 2011

subsequent responses to the Draft Information Memorandum concern broader matters, rather than detailed auction rules, and are more appropriately addressed here. Therefore, throughout this report we have acknowledged respondents' comments provided in response to ComReg document 11/75 where appropriate including, but not limited to, issues relating to:

- inclusion of the 2.6GHz band;
- reservation of spectrum for a specific class of bidder (either entrants or existing operators in a given band);
- advanced commencement of liberalised licences assigned in the auction;
- spectrum packaging – the two time slice approach;
- implementation of the proposed early liberalisation option;
- spectrum sharing; and
- licence conditions.

6. However, this document does not provide a full response to the issues raised in response to the Draft Information Memorandum. In particular, all points concerning the detailed auction rules will be addressed in a subsequent document.

1.2 Structure of this document

7. In this report, we consider issues raised by parties in their responses to ComReg document 11/60, including:

- the spectrum to be included in the award;
- competition issues, especially the matter of spectrum caps to protect downstream competition in mobile service;
- specific details of the award process including the choice of a Combinatorial Clock Auction format for the process and the associated eligibility points and activity rules (in general terms, as specific points about detailed auction rules will be addressed when considering comments on the Draft Information Memorandum);
- the adoption of an early liberalisation option for existing spectrum licensees;
- issues related to the proposed assignment stage of the auction;
- issues related to spectrum sharing, both in relation to spectrum caps and the assignment stage; and
- issues related to licence conditions and spectrum fees.

2 Spectrum to be included in the award

2.1 DotEcon's stated views and recommendations to date

8. Throughout the consultation process, in considering the bands to be included in the proposed award, we have given attention to the potential substitutability and complementarity of spectrum in various bands and considered the efficiency benefits of combining multiple bands in a single award process.

9. Demand interrelationships arise when the pricing or availability of spectrum in one band affects demand for spectrum in another band. Particular forms of interrelationship are substitutability (spectrum in one band forms an alternative to spectrum in another band) and complementarity (the value of spectrum is enhanced by winning spectrum in another band). Demand interrelationships can be complex and it is possible that spectrum across two bands can be both substitutes and complements depending on the context. For example, a bidder might want to hold spectrum in two bands (for example to reduce risks arising from the timing of equipment availability) but at the margin may be able to use additional spectrum in either band to provide additional capacity. The nature and magnitude of demand interrelationships across bands may vary significantly across bidders (especially entrants and incumbents). In particular, existing players, especially where they have other spectrum holdings, may be more likely than entrants to see spectrum in different bands as being substitutes at the margin.

10. To achieve efficient outcomes where there are demand interrelationships, it is necessary to use a single unified auction, rather than a sequence of separate auctions, one each for a different band. In a sequence of auctions, bidders valuations and demand for spectrum would be based on the *expected* price and availability of substitutable and complementary spectrum to be awarded in the future. If expectations with regard to future prices or availability are incorrect, as is likely, then a sequential process will be inefficient.

11. Having considered the benefits of adding the potentially substitutable 800MHz band to the original 900MHz auction proposal, in 10/71a - following the emergence of new information on the availability of the 800MHz band from 2013 onwards - we recommended that ComReg pursue a dual-band auction in which the 900MHz and 800MHz bands would be assigned simultaneously in the same award process.

12. In ComReg document 10/105a, given the timing of the proposed award process and the imminent expiry of Telefonica O2's (hereafter referred to as Telefonica) and Vodafone's 1800MHz licences on 31 December 2014, and the potential substitutability of sub-1GHz and 1800MHz spectrum at the margin in providing capacity, we recommended the inclusion of 1800MHz spectrum in an award with sub-1GHz spectrum.

13. In our recent report, published as ComReg document 11/58, we also passed comment on the inclusion or otherwise of 2.6GHz spectrum in the proposed multi-band award. This was in response to one respondent calling for a separate award process for high frequency spectrum in which the 1800MHz and 2.6GHz bands would be awarded together in the same process. We noted

that postponing the award of available 1800MHz spectrum until the 2.6GHz band becomes available would be unjustifiable on efficiency grounds. Spectrum in the 2.6GHz band might not come available before 2019 whereas some unassigned 1800MHz spectrum is available for immediate award and the full band will be available from 2015.[4]

14. Following consideration of the relevant issues raised throughout the consultation process, in document 11/58 we maintained our view that the 800MHz, 900MHz and 1800MHz band should all be awarded in a single award process.

2.2 Respondents' views

15. In their responses to ComReg document 11/60, two respondents (Vodafone and H3GI) restated their case for the inclusion of the 1800MHz band in the multi-band auction. eircom did not provide any further comment on the issue of inclusion of 1800MHz spectrum in the proposed award process.

16. In addition, Vodafone noted that the granting of an interim 900MHz licence has mitigated their previous concerns around the impact of delay in holding the proposed spectrum award process. Vodafone noted that its proposed alternative option[5] in the event that ComReg were to include 1800MHz spectrum in the auction no longer appears to be feasible given the requirement to complete an award process without additional delay.[6]

17. However, respondents sought further clarity on the availability of 2.6GHz spectrum on the basis that maximum transparency is needed in the timing and availability of the 2.6GHz band and that further clarity would enable bidders to determine their valuations of spectrum, maximising the prospect of an efficient allocation in the related bands.[7] In a letter to ComReg on 9 March 2012 eircom Group re-emphasised its concern regarding uncertainty in relation to the availability of the 2.6GHz band commenting that the absence of clarity will undermine efficiency of the proposed multi-band award process.

18. Telefonica restated its views on the inclusion of 1800MHz spectrum, again outlining its view that ComReg should ensure that 800MHz and 900MHz frequencies are auctioned together and that frequencies in the1800MHz and 2.6GHz bands should be auctioned together (possibly with 2.3GHz frequencies). Furthermore, Telefonica suggested that if ComReg cannot

[4] See Section 2.5.2 of ComReg document 11/58

[5] In their response to ComReg document 10/105, Vodafone proposed an option that would remove the need to award licences for two temporal lots. For this to work, it was proposed that following agreement from existing licensees ComReg would buy out the remaining term of existing licences in both the 900MHz and 1800MHz bands (at prices based on those determined within the auction) to make all spectrum in the proposed award available from the same date (January 2013).

[6] See page 3 of Vodafone's response to ComReg document 11/60

[7] See page 10 of Vodafone's response to ComReg document 11/60

combine all four bands into a quad-band auction, then they should be separated into two separate auctions, below 1GHz and above 1GHz.[8]

19. The main reasons provided by Telefonica in respect of its position include that:

- Lots that are substitutes should not be sold in separate auctions and ComReg's primary justification for auctioning 800MHz and 900MHz spectrum together apply exactly to 1800MHz and 2.6GHz spectrum;
- Greater weight must be given to ensuring substitutable spectrum is auctioned together than potentially complementary spectrum. Following from this, ComReg has failed to consider the greater efficiency gains of auctioning 1800MHz and 2.6GHz together;
- ComReg has placed emphasis on the perceived needs of a new entrant to purchase both below and above 1GHz simultaneously rather than sequentially. However, sequential assignment will happen in any event as the 2.6GHz band is not included in this auction;
- There would be a benefit to a new entrant of greater supply of spectrum if the award of 1800MHz spectrum is delayed to a later auction of both1800MHz and 2.6GHz spectrum.

20. In addition, Telefonica is of the opinion that the grounds for not auctioning 1800MHz and 2.6GHz together are not justifiable and confer an unfair advantage to UPC (the incumbent user of 2.6GHz spectrum for MMDS) in any future competition for spectrum in the 2.6GHz band on the basis that mobile operators will likely have insufficient funds or remaining demand following the proposed auction of 800MHz, 900MHz and 1800MHz spectrum to be able to meaningfully compete for 2.6GHz spectrum.[9] Telefonica submits that current MMDS licences all expire in 2014 at the latest while 1800MHz licences expire in 2014 or mid 2015 and consider that *"the only logical option available to ComReg would seem to be to extend some of the MMDS licences to 2014, and to include the 2.6GHz band in the multiband auction."* [10]

2.3 DotEcon commentary

21. As set out previously, there remains some uncertainty with regard to the availability of 2.6GHz spectrum and it would, therefore, be wrong to delay the current award process in an attempt to include a further band in the auction. In particular, delay of the award process would risk:

- Leaving existing operators with 900MHz spectrum in transitional arrangements for much longer than necessary, with potentially adverse effects on investment incentives and competition; and,

[8] Page 13 of Telefonica response to ComReg document 11/60

[9] Page 15 of Telefonica's response to ComReg document 11/60

[10] Page 31 of Telefonica's response to ComReg document 11/75

- Delaying the availability of 800MHz and 1800MHz spectrum, with consequent welfare losses from deferring new services.

22. Both points are likely to lead to delay in the introduction of advanced data services. In effect, such a delay is a restriction on the current competitive process. This might well benefit incumbent operators as a group, as the costs of network upgrades might be delayed, but this is not in the interest of consumers.

23. It is true that the1800MHz and 2.6GHz bands are potential substitutes for providing network capacity, in the sense that they are both above 1GHz and have shorter range propagation than 800MHz and 900MHz spectrum. However, the substitutability of 1800MHz and 2.6GHz bands in Ireland is tempered by the different timing of their availability. Much of the1800MHz band is available for assignment now. The 2.6GHz band is currently licensed for the provision of MMDS services as an ECS until at least 2014[11]. Clearly, any further delay in the release of available spectrum in the 800MHz, 900MHz and 1800MHz bands until 2014 on account of availability of 2.6GHz frequencies would be disadvantageous to the development of advanced data services. In addition to the significant difference in availability relative to most of the 1800MHz spectrum to be awarded in the currently proposed process, the governing licensing regulations hold out the possibility of extension of existing licences in the 2.6GHz band for a period of up to five years (i.e. 2019). This uncertainty surrounding expiry of existing licences in the 2.6GHz band and the possibility of an extension of 2.6GHz licences to 2019 strengthens further the case for progressing with an award of spectrum in the 800MHz, 900MHz and 1800MHz bands without delay and awarding 2.6GHz frequencies as and when the entire band is available for assignment.

24. On 2 November 2011, ComReg published a separate consultation paper on the "Future of the 2.6GHz radio spectrum band"[12] seeking views on extending the termination date of three MMDS licences in force in the 2.6GHz band. The outcome of this consultation may provide further clarity to respondents on the future availability of spectrum in the 2.6GHz band, but we consider that at present there is still some uncertainty about the timetable of the availability of 2.6GHz spectrum, at least in the short term. There is no certainty that any such review and consultation required for these short term MMDS licence

[11] The 2.6GHz band is subject to a European Commission Decision of 13 June 2008 on the harmonisation of the 2500 - 2690MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community No. 2008/477/EC. The Decision aims at harmonising the conditions for the availability and efficient use of the 2.6GHz band for terrestrial systems capable of providing electronic communication services ("ECS") in the Community. ComReg is obliged to consider the usage of the 2.6GHz band within the scope of the EC Decision. Further, where an MMDS is deployed in the 2.6GHz band in a Member State, the Member State is obliged to ensure that the MMDS is compliant with the EC Decision. The Radio Spectrum Committee Explanatory Memorandum on MMDS (RSCOM08/-39) notes that MMDS is an ECS within the meaning of the Decision and section 4 of that document provides a further discussion of the aspects that need to be taken into account to ensure that MMDS applications can comply with the EC Decision.

[12] ComReg document 11/80

extensions will be concluded within the time period of the proposed award process, and to delay the current award process on that basis would result in delay of the benefits of liberalised spectrum in other bands.

25. Whilst it is arguable that business cases for 1800MHz spectrum might be affected by the future availability of frequencies in the 2.6GHz band, it is clearly impossible to provide a high degree of certainty about future market developments; bidders for 800MHz, 900MHz and 1800MHz spectrum will need to factor in expectations about the availability of other bands, as well as forecasts of network traffic and technological change, when valuing spectrum. A sensible balance would not be struck by simply delaying the release of a significant amount of the spectrum available now because of some uncertainty about availability of other, potentially substitutable, bands.

26. Moreover, a recent report published by the Global mobile Suppliers Association (GSA) suggests 1800MHz spectrum is key to the global success of LTE services.[13] The report concludes that deployment of LTE 1800MHz can result in a faster time to market, and also finds that providing initial widespread coverage with LTE in the 1800MHz band can be up to 60% cheaper than covering the same area with LTE using higher frequency bands, again suggesting that substitutability between 1800MHz and 2.6GHz has limitations. The potential importance of the 1800MHz band for future LTE services is a strong further reason why allocation of the 1800MHz band should not be unjustifiably delayed if consumer benefits from access to advanced data services are to be achieved as soon as possible.

27. Furthermore, an approach of auctioning sub-1GHz spectrum in an earlier auction and 1800MHz and 2.6GHz spectrum in a much later auction would have asymmetric effects on different classes of bidder. In particular, incumbent operators would be less disadvantaged by such an approach than potential entrants. Incumbent operators may themselves be affected in different ways, according to their chosen network design and strategies.

28. While it may not be Telefonica's preference, an entrant may treat spectrum above and below 1GHz as complements in the main (in the sense that it would prefer a mix of holdings in high and low frequency bands for network optimisation and to reduce risk) even where spectrum is substitutable at the margin in providing capacity. Splitting up the bands into two auctions for low and high frequencies respectively would create risks for entrants, as it would not be possible to purchase complementary spectrum in a single process through package bids. Such an effect may be exacerbated by a substantial delay between the two consecutive processes. This could potentially suppress demand for spectrum in the first auction, as there would be no guarantee of being able to obtain complementary spectrum later, and also in the second

[13] See GSA, *Embracing the 1800MHz opportunity: Driving mobile forward with LTE in the 1800MHz band*, November 2011., overview found at http://www.gsacom.com/news/gsa_342.php4, and GSA, *GSM/3G Market/Technology Update*, 'LTE1800: LTE deployments in the 1800MHz band', January 2012, found at http://www.gsacom.com/downloads/pdf/Extract_LTE1800_GSA_evolution_to_lte_report_050112.php4

auction, as the spectrum might only be attractive to those who won spectrum in the first auction.

29. We do not agree with Telefonica that the overriding concern is that spectrum which is most substitutable should be sold in a single auction, even if this means running multiple processes due to the staggered availability of different bands. Rather, all interdependencies between spectrum bands need to be considered, including both substitutability and complementarity. These interdependencies may vary across types of bidder. For instance, for existing operators, it might well be that there is weak complementarity between 1800MHz spectrum and sub-1GHz spectrum or in some cases they will be substitutes at the margin. However, even if this was the case, the interdependencies underlying the valuation structure of other bidders (such as entrants) may be quite different.

3 Case for using an auction for the proposed award

3.1 DotEcon's stated views and recommendations to date

30. In our report, published as ComReg document 11/58, we considered that there were strong general arguments in favour of auctions. We also considered the possibility of a mixed award combining direct assignment of some spectrum and auctioning of other spectrum within the same band as a possible means to deal with expiring licences.

31. In particular, in our discussion of a mixed award that would combine some direct assignment with an auction, we acknowledged that there are significant shortcomings of a hybrid approach when compared to a multi-band auction:

- Following a direct allocation of some spectrum, the possible allocations of the available spectrum across applicants is significantly constrained as compared with a situation where all of the spectrum in the relevant bands is assigned via an auction. There is then a risk that the outcome is relatively less efficient as a result.
- Direct assignment of at least 2x5MHz of 900MHz spectrum to existing 900MHz operators for business continuity reasons could lead to excessive fragmentation of spectrum holdings, forgoing benefits from contiguous spectrum assignments. An auction would allow greater flexibility in terms of allowing bidders to determine whether they should be located in the 900MHz band, the 800MHz band or in both bands.
- Bidders in the auction may seek a package that contains a mix of frequencies with which to achieve the minimum bandwidth required to support its projected amount of traffic. A partial direct assignment may lead to spectrum being inefficiently assigned if a bidder subsequently fails to acquire sufficient spectrum in the auction.
- The mixed award proposals are not essential to protect the customers of incumbent operators who would in any case need additional spectrum. Spectrum caps can be used to limit the degree to which a bidder might be able to deny incumbent operators access to spectrum and create disruption for existing customers (indeed, this is the basis of the proposed cap on 900MHz spectrum for the first time slice).

32. We concluded that ComReg should use an auction process to award all the spectrum available, as it provides a more robust methodology for determining an efficient assignment and supporting prices to be paid by winners. The implementation of an auction, with appropriate spectrum caps, would be preferable to spectrum reservation.

3.2 Respondents' views

33. In general, while Vodafone considers that the current ComReg proposals are reasonable and in large measure address the concerns it has previously expressed about the continuity of existing GSM services, it maintains its view as set out in its response to ComReg document 09/99 that administrative assignment of at least 2x5MHz of 900MHz spectrum and at least part of the 1800MHz band to existing mobile operators on a liberalised basis is a superior

approach in terms of achievement of ComReg's statutory regulatory objectives.

34. H3GI reiterates its support for an auction without prejudice to its previous advocacy of an administrative assignment. In its response to ComReg document 11/75, H3GI comments that ComReg should reserve lot A of the 900MHz band in the first time slice for a new band entrant. Furthermore, it considered that ComReg should also reserve lot A in the second time slice and unassigned 1800MHz spectrum in both time slices for a new band entrant.[14] These arguments were reiterated by H3GI in a letter to ComReg on 23 January 2012.

35. Telefonica submits a number of comments in relation to the proposal to hold a full band auction:

- Before ComReg incurs further significant expense on the auction process it should establish demand in each of the three bands at issue. In any band(s) where demand does not exceed supply, ComReg should proceed to allocate spectrum immediately to the relevant applicants. Telefonica remains of the view that the full band auction format for the entire licence period might not be the correct option to meet ComReg's statutory obligations, when the alternative of a partial auction and partial assignment better meets its obligations in a more proportionate and less risky manner.
- Partial auction and assignment combines the same benefits of having prices set by auction and facilitating new entrants, while also ensuring against the risk of consumer and industry disruption that would arise from sudden loss of 900MHz spectrum to an existing operator.
- Auction of all the available spectrum in the relevant bands carries the risk of serious consumer disruption where one or more GSM incumbents fail to be assigned sufficient 900MHz spectrum.
- ComReg can avoid this risk as – now that the auction includes 800MHz as well as 900MHz spectrum - ComReg has sufficient sub-1GHz spectrum to grant extensions to existing GSM licences and still have enough spectrum left over to meet the demand for sub-1GHz spectrum for new entrants.

3.3 DotEcon commentary

36. We have addressed calls for partial assignment or reservation of spectrum extensively in our previous reports. As no new substantive arguments were made in the last consultation round, we do not consider this issue at length. The overriding principle is that a hybrid approach of reservation or partial assignment requires administrative judgments and cannot be as efficient as market testing within a full band auction. Furthermore, a hybrid system would have the challenge of ensuring fair, reasonable and efficient pricing for reserved spectrum that is robust to challenge.

[14] See page 7 of H3GI's response to ComReg document 11/75

37. With regard to H3GI's proposal to extend the reservation of blocks to the second time slice, in both the 900MHz band and the 1800MHz band, we understand this is based in part on concerns of uncertain availability of 900MHz and 1800MHz spectrum in the second time slice. While ComReg has made contingencies for delayed access to lots in the second time slice[15] there is no expectation that any transitional activities will result in delayed access. We consider that H3GI's proposal lacks sufficient justification and believe there are no grounds for fearing delayed availability of liberalised use licences in the second time slice.

38. With regard to Telefonica's proposals for direct assignment of spectrum where there is no excess demand, we would note that the application stage of the award process *already* incorporates such provisions. Applications effectively require a binding bid at reserve prices from each bidder. These are then used to assess the extent of over-subscription and the need for an auction. If there is no over-subscription in any of the available bands, there would be no Main Stage auction and lots would be assigned at reserve prices. However, a subsequent assignment stage auction would still be needed to determine which specific frequencies were assigned to bidders. Telefonica, however, appears to argue that this test should be applied on a band-by-band basis: in any band where demand does not exceed supply, that band should be allocated to applicants immediately. We do not consider this to be a suitable approach, on the basis that proceeding with an auction for some bands while directly assigning other bands - essentially withdrawing them from the main stage of the auction - removes the ability of bidders to shift between substitutable and complementary bands on the basis of changing relative prices. Adopting such an approach could lead to a reduction in the range of potential auction outcomes and an inefficient assignment compared with that resulting from the currently proposed approach.

39. Furthermore, we note that a similar issue was discussed in the bilateral meeting between ComReg and Telefonica on 1 July 2009.[16] Telefonica noted that it is very easy to express interest in obtaining spectrum, but that does not necessarily reflect an intention to invest in and use spectrum. ComReg noted that in its past experience of auctions to date, it is practically very difficult to place any reliance on expressions of interest. It was agreed that there are practical difficulties involved. ComReg commented further on this issue in ComReg document 09/99 in which it noted that, "*ComReg does not consider that it is reasonable or indeed necessary conclusively to determine the real level of demand prior to deciding to hold, or holding, any competitive process*"[17]. As previously discussed, we consider that the proposed process already incorporates provisions for a situation where there is no excess demand and there is no justification for a revision of these provisions.

[15] See Section 2.2.6 of The Draft Information Memorandum, ComReg document 11/75

[16] See Minutes of a Bilateral Meeting between ComReg and Telefónica O2 Ireland Ltd. Published as ComReg document 09/73

[17] See Section 6.8.2 of ComReg document 09/99

40. In response to the issues surrounding consumer disruption in the event that one or more than one GSM incumbent gets a licence in respect of less than its current holdings of 900MHz spectrum, or no 900MHz spectrum, while we agree that these issues are of importance for the first time slice, we feel that this possibility will be of less importance in the second time slice. On this basis we have proposed a 2x10MHz cap on the 900MHz band in the first time slice only[18]. In order to further mitigate consumer disruption issues we have also proposed specific rules for the Main Stage of the auction (specifically the final price cap and other activity rules detailed in the Draft Information Memorandum) that ensure that the outcome of the primary bid rounds cannot be readily overturned by further bids made in the supplementary bids round, enabling bidders to pursue strategies aimed at securing certain minimum amounts of spectrum (provided bidders are willing to compete for those during the primary bid rounds).

[18] Although Telefonica submits that a full auction carries the risk of serious consumer disruption and the possibility that one or more GSM incumbent may not get any 900MHz spectrum, at the same time it argues for the removal of the 900MHz cap in the first time slice, introduced to limit the possibility of such an outcome.

4 Spectrum caps

4.1 DotEcon's stated views and recommendations to date

41. In the context of a joint award of 800MHz, 900MHz and 1800MHz spectrum, in our December 2010 report (published as ComReg document 10/105a) we proposed the following spectrum caps for the planned award of spectrum in the 800MHz, 900MHz and 1800MHz bands:

    - a cap of 2x20MHz of sub-1GHz spectrum per bidder; and
    - an overall cap of 2x50MHz of spectrum per bidder.

42. We concluded that a sub 1-GHz spectrum cap of 2x20MHz struck a reasonable balance between allowing for sufficiently large contiguous blocks of spectrum to be held by individual operators so as to be able to benefit from spectral efficiencies, while not allowing for excessively concentrated outcomes where competition would be likely to be harmed. Furthermore, an overall cap of 2x50MHz in combination with a sub-1GHz spectrum cap struck a balance between ensuring downstream competition and unnecessarily suppressing competition for spectrum within an auction amongst bidders who might conceivably take quite different approaches with regard to the services they intend to offer and the spectrum they require.

43. In our August 2011 report (published as ComReg document 11/58) we further considered a number of comments raised by respondents. We do not re-state our arguments in full here, but refer the reader to Chapter 4 of ComReg document 11/58 in that regard. However, in summary, we set out our views on:

    - ***A proposed lower sub-1GHz spectrum cap of 2x15MHz.*** Given the high intrinsic value of sub-1GHz spectrum and the importance of ensuring that this spectrum is awarded to ensure its most efficient use in providing services over the duration of the relevant licences, we did not consider that there was a case for imposing a spectrum cap of 2x15MHz, as it would preclude operators from holding larger blocks of spectrum for no guaranteed gain in terms of the long-run competitiveness of service markets. In particular, this would preclude operators from holding large enough blocks of spectrum below 1GHz to allow the most efficient deployment of LTE. In order for all available spectrum in the 800MHz and 900MHz bands (i.e. 2x65MHz in total once existing licences expire) to be assigned under a 2x15MHz cap, there would need to be at least five distinct winners (or unsold spectrum). We did not consider that there was a case for ensuring that there were at least five distinct winners of spectrum as any benefits arising from this would be offset against the likely detriment to the efficient deployment of LTE, that is, deployment of LTE using relatively large blocks of spectrum.
    - ***A proposed lower overall cap to avoid harm to competition.*** Given the importance of allocating the spectrum available in the most efficient way, there was no compelling case for lowering the *overall* spectrum cap given the presence of a parallel cap of 2x20MHz on sub-1GHz spectrum. The imposition of a lower overall cap would likely result in significant

inefficiency of assignment. Overall, there would be 2x140MHz of spectrum available across the 800MHz, 900MHz and 1800MHz bands. Providing there is no unsold spectrum, a 2x20MHz sub-1GHz cap requires at least four distinct winners of sub-1GHz spectrum. A winner of 2x20MHz of sub-1GHz spectrum could purchase at most 2x30MHz of 1800MHz, whereas a winner of 2x5MHz of sub-1GHz spectrum could purchase at most 2x45MHz of 1800MHz spectrum. In this latter case, somewhat over half of the 1800MHz band could be bought by a single bidder, but in this case that bidder would face a countervailing disadvantage in the comparatively smaller amount of sub-1GHz spectrum held. There would need to be at least two winners of 1800MHz spectrum (if there is no unsold spectrum), so no single winner could control the whole band. Whilst this overall cap would allow for just two winners of 1800MHz spectrum, provided all sub-1GHz spectrum is sold there should be at least four winners overall; these winners might well hold existing spectrum in the 2.1GHz band as well.

- ***A proposed additional cap on 900 MHz spectrum in the first time slice.*** We considered there to be merit in imposing a 2x10MHz cap on 900MHz spectrum in the first time slice, and that the cost of doing so, if any, is small as during this time the use of the band would be significantly constrained by the need to transition from GSM use. However, this would prevent bidding intended primarily to frustrate incumbents by denying them spectrum needed for continuity of their existing services (with potentially adverse consequences for existing GSM customers). By confining the cap to the first time period, such an approach does not preclude subsequent defragmentation, in the sense that bidders could specialise in the 800MHz or 900MHz bands from 2015 onwards in order to hold larger contiguous blocks of spectrum. On this basis, we recommended that such a cap (limited to the first time period only) be implemented in the proposed multi-band auction in addition to the sub-1GHz and overall spectrum caps.

44. Throughout, our concern was to ensure that existing levels of competitive intensity in downstream service markets were protected and that damaging concentration of spectrum holdings could not occur. However, this need not necessarily require that all mobile operators finish the auction with closely symmetric holdings. Effective competition does not require symmetric spectrum holdings across each and every band; indeed such an approach could lead to excessive fragmentation and operators holding smaller contiguous blocks of spectrum with loss of technical efficiency. It is possible that operators might choose to adopt different competitive strategies and to hold somewhat different mixes of spectrum; however, this is not necessarily incompatible with protecting existing levels of competitive intensity.

45. Furthermore, spectrum caps should not provide protected opportunities for market entry and to create unsustainable competition. The intention of the proposed caps is to be largely neutral with regard to the impact on current market structure and to ensure that there is not a material risk of any reduction in current levels of competitive intensity in downstream markets. The spectrum caps are not intended to be a forceful intervention aimed at picking

some particular outcome or ensuring that the existing market structure will be fundamentally changed as a result of the corresponding auction outcome.

46. Caps were intended to be sufficiently loose that demand from existing operators could contest the available spectrum in this auction, thus giving all four incumbent operators the opportunity to win some amount of spectrum but ensuring that there would still be competition for all spectrum available. In particular, the proposed caps would permit the four incumbent operators in total to demand 2x80MHz of sub-1GHz spectrum (against 2x65MHz available) and 2x200MHz of spectrum overall (against 2x140MHz available). At these levels, the caps permit a range of outcomes (especially in regard to the distribution of 1800MHz spectrum) and do not predetermine a symmetric outcome amongst incumbent operators. Caps at lower levels (especially the sub-1GHz cap) would effectively preclude competition amongst incumbents for spectrum without providing any guarantee of a sustainable increase in the competitive intensity of downstream service markets. In particular, moving to a 2x15MHz cap for sub-1GHz spectrum would reduce the maximum demand from incumbents to 2x60MHz against the 2x65MHz available, so would effectively reserve 2x5MHz for a fifth entrant.

47. In DotEcon's August 2011 report (published as ComReg document 11/58) we reaffirmed the following spectrum caps to be applied to the award of the 800MHz, 900MHz and 1800MHz spectrum:

- A cap of 2x20MHz of sub-1GHz spectrum per bidder;
- An overall cap of 2x50MHz of spectrum per bidder;
- A cap of 2x10MHz of 900MHz spectrum per bidder in the first time slice.

48. In the sub-sections below, we consider separately the views expressed in relation to a 2x20MHz sub-1GHz cap, a 2x50MHz overall cap, and an additional cap of 2x10MHz on 900MHz spectrum in the first time slice.

4.2 Sub-1GHz cap

4.2.1 Respondents' views

49. In general, there is a high level of support from respondents in relation to a 2x20MHz cap, with those in favour agreeing that this cap strikes an appropriate balance between allowing access to wider contiguous blocks of spectrum while not allowing for excessively concentrated outcomes where competition in downstream markets would be likely to be harmed.

50. While welcoming the decision not to impose an even higher sub-1GHz cap, one respondent (H3GI) maintained its position that a cap of 2x20MHz is too high for a number of reasons, as summarised below:

- Competition in the market will be distorted in the likely situation where three operators each obtain 2x20MHz of sub-1GHz spectrum with a fourth operator obtaining only 2x5MHz;
- The minimum amount of sub-1GHz spectrum required is 2x10MHz of contiguous sub-1GHz spectrum and a bidder only obtaining 2x5MHz will be at a significant competitive disadvantage;

- 2x5MHz of sub-1GHz spectrum combined with some (or no) 1800MHz spectrum is not a substitute for 2x20MHz of sub-1GHz spectrum, and this would distort competition.

51. Furthermore, H3GI requested an explanation as to why a situation in which three operators hold 2x20MHz of sub-1GHz spectrum and one operator holds only one block of 2x5MHz of sub-1GHz spectrum is not considered to be an "extreme" outcome.[19]

4.2.2 DotEcon commentary

52. In our most recent August 2011 report (published as ComReg document 11/58), we provided a response to H3GI's similar comments made previously (in its response to ComReg document 10/105) regarding their concern that a sub-1GHz spectrum cap of 2x20MHz creates a risk of only being awarded 2x5MHz of sub-1GHz spectrum. In particular, in ComReg document 11/58, we pointed out that:

- A 2x20MHz sub-1GHz cap would not allow three operators to use their bids in the auction to prevent a fourth bidder from winning *any* sub-1GHz spectrum;
- A bidder *cannot* win 2x5MHz of sub-1GHz spectrum unless it has explicitly made a package bid including only one block of sub-1GHz spectrum. Packages are never subdivided. Therefore, if a bidder considers that 2x5MHz alone is unviable, bids should be made only for strictly larger packages (i.e. packages including 2x10MHz or more of sub-1GHz spectrum);
- With a sub-1GHz cap of 2x20MHz, the risk of only being awarded 2x5MHz of sub-1GHz spectrum does not apply only to one operator, but to *any* bidder who makes bids for packages of spectrum including just 2x5MHz of sub-1GHz spectrum;
- Given a sub-1GHz cap of 2x20MHz for each bidder, under the assumption that there will be four competing operators participating in the auction for a total of 2x65MHz of sub-1GHz spectrum, the situation where one of the operators only acquires 2x5MHz of spectrum can *only* occur if the incremental value of a second 2x5MHz block for this operator falls below the incremental value of a fourth 2x5MHz block for *every* one of the other three competing operators.

53. To reiterate, in order for one bidder to win only 2x5MHz of sub-1GHz spectrum the following conditions all need to be satisfied. First, the bidder must actively bid for a package including just 2x5MHz of sub-1GHz spectrum. Second, it must fail to win any package bids including 2x10MHz or more of sub-1GHz spectrum. If there were three other winners, they would necessarily *all* have to bid for and win 2x20MHz of spectrum each. *Every one* of these bidders winning 2x20MHz would need to have expressed an incremental valuation for their

[19] See page 31 of H3GI's response to ComReg document 11/60

fourth 2x5MHz block (i.e. a value of 2x20MHz relative to 2x15MHz) that exceeds that of the 2x5MHz winner for a second block (i.e. the value of 2x10MHz relative to 2x5MHz, which may be a large proportion of the total value of 2x10MHz). However, if this outcome were the result of bids reflecting valuations for the spectrum (provided these do not include any anticipation of gaining downstream market power) then the result would in fact be consistent with an efficient allocation of spectrum.

54. All these points remain valid. Furthermore, we remain sceptical that with a sub-1GHz cap of 2x20MHz a bidder is likely to be forced down to 2x5MHz of spectrum due to each one of its rivals boosting its valuation for a fourth block of sub-1GHz spectrum in anticipation of benefits from muted downstream competition, rather than simply because it was more efficient for additional blocks to be assigned to other winners. There are three main reasons for this:

- First, it is not clear that long-run downstream competitive intensity would be materially greater if there were four winners with at least 2x10MHz as compared with an outcome in which three players have 2x20MHz and one has 2x5MHz of sub-1GHz spectrum augmented by spectrum in other bands.
- Second, in order for an exclusionary strategy (that leaves an operator with only 2x5MHz of sub-1GHz spectrum) to succeed, it is necessary that three players *all* win the maximum amount of 2x20MHz of sub-1GHz spectrum. If *any* of these three bidders did not make a sufficiently high bid for 2x20MHz relative to 2x15MHz, then it would not be possible to limit the fourth bidder to just 2x5MHz. Notwithstanding the incentives for other forms of tacitly collusive behaviour, there is inherent fragility in three bidders trying to force a fourth down to 2x5MHz, as if any one of this coalition deviates from the strategy, then the fourth player will obtain more spectrum. Once prices are sufficiently high it becomes increasingly attractive for one of these three bidders to contract demand to less than 2x20MHz.[20]
- Third, if, as H3GI claims, there is little value in a single block, then bids should not be made (or made at an appropriately low level reflecting their low value) for packages including just 2x5MHz of sub-1GHz spectrum.
- Fourth, if, as H3GI claims, there is little value in a single block, this acts as an impediment to the selection of outcomes with three bidders winning 2x20MHz and one bidder winning 2x5MHz of sub-1GHz spectrum, as the residual 2x5MHz is likely to add little value to the winning combination of bids. If no bids are made for 2x5MHz of sub-1GHz spectrum (with or

[20] A similar situation arose in the German 3G auction, where Mannesmann (now Vodafone) and T-Mobile, the two largest incumbents in Germany, faced the decision to either jointly drive out a sixth 3G licence by continuing to bid for 3 rather than 2 lots or to reduce demand to 2 lots and finish the auction with 2 lots each. Eventually, T-Mobile backed down to 2 lots whereas Mannesmann kept on bidding for 3 until eventually also settling for 2 lots. For more information on this award, see Grimm, Riedel and Wolfstetter, 2001, The Third Generation (UMTS) Spectrum Auction in Germany, CESifo Working paper No. 584, available online at: http://ideas.repec.org/p/ces/ceswps/_584.html.

without spectrum in other bands), then if three bidders win 2x20MHz of sub-1GHz spectrum this necessarily entails 2x5MHz going unsold. Such an outcome would need to involve a sufficiently high total value of bids for winning packages with 2x20MHz of sub-1GHz spectrum in order to exceed any alternative outcome in which all sub-1GHz spectrum was assigned.

Relationship to UK proposals for minimum portfolio packages

55. Implicit in H3GI's arguments is the assumption that effective competition requires at least four largely symmetric players and that ComReg should actively intervene to achieve such an outcome. However, no argument or evidence has been provided by H3GI to support this assumption, save than by analogy with the UK.

56. Ofcom's most recent proposals for the UK's combined auction of 800MHz and 2.6GHz bands have sought to ensure that at least four players achieve certain minimum spectrum holdings (so called "minimum portfolio packages" or "MPPs") considered necessary by Ofcom to be an effective national network operator. Ofcom is still consulting on these proposals and there is currently no certainty that this approach will eventually be used in the UK[21]. Further, even if the approach is adopted, there is no certainty at present about the set of MPPs that would be used. Therefore, even though Ofcom has now launched a second consultation, these proposals are still not stable and cannot be considered as establishing a relevant and compelling precedent.

57. In particular, there have been fundamental changes to the MPPs proposed by Ofcom in its January 2012 consultation relative to those proposed in its consultation in March 2011. Its current proposals include two significantly different options regarding the sets of MPPs necessary to be an effective national operator. We discuss Ofcom's proposals in detail in Section 4.5, with Table 3 below reproducing Ofcom's latest proposals regarding the MPPs. However, we note here that, although Ofcom has revised its proposals in terms of considering that 2x5MHz of 800MHz spectrum alone is likely to be insufficient for an effective national operator (with 2x10MHz being the smallest amount of 800MHz spectrum considered potentially compatible with being an effective national operator), Ofcom also considers that high frequency spectrum (and especially 1800MHz spectrum) could be an effective substitute for 800MHz spectrum, albeit in larger amounts. Indeed, with Ofcom's "Group 1" MPPs, a bidder would be considered to have sufficient spectrum to be an effective national operator if it held either 2x10MHz of sub-1GHz spectrum or no sub-1GHz spectrum with 2x15MHz of 1800MHz spectrum. Therefore, the current Ofcom consultation is clear that sub-1GHz spectrum is not essential to

[21] Furthermore, we would note that in recent European auctions such as those in Italy, Spain, Greece, Germany and Sweden, no other countries have proposed MPPs or spectrum floors. Ofcom's proposals are novel in this regard. We note that a floor of 2x5MHz was implemented where paired blocks of 2x2.5MHz were offered in Greece. This is the minimum block size to realistically provide UMTS or LTE services and accordingly, does not appear to have the same motivation as the spectrum floor proposed by H3GI.

be an effective national operator provided that a sufficient quantity of spectrum above 1GHz is held.

58. The availability of 1800MHz spectrum in the UK auction is not certain. This depends on whether Everything Everywhere divests 1800MHz spectrum pursuant to undertakings required for clearance of the merger of Orange and T-Mobile, which it has every incentive to do to realise the value of this spectrum.[22] Only if divestment has not occurred prior to the beginning of the auction will 2x15MHz of 1800MHz spectrum be returned to Ofcom and then included in the UK auction.[23] In contrast, in Ireland a much larger amount of 1800MHz spectrum will be definitely available for award. Therefore, even under the scenario of three players securing the maximum 2x20MHz of sub-1GHz spectrum, there is still the potential in the Irish auction for a fourth player to secure sufficient 1800MHz spectrum to achieve Ofcom's "Group 1" MPP and indeed larger amounts corresponding broadly to Ofcom's high frequency only "Group 2" and "Group 3" MPPs (irrespective of the relevance of this test for Ireland and the available of 900MHz spectrum as well).[24] A bidder winning 2x5MHz of sub-1GHz would be able to win up to 2x45MHz of 1800MHz under the overall spectrum cap, which far exceeds all of the MPPs considered by Ofcom.

59. Therefore, the spectrum cap coupled with the greater availability of spectrum in the Irish case mean that the implicit conclusions of Ofcom's competition analysis for the UK - as reflected in Ofcom's proposed MPPs - are likely to be achieved in this auction in any case.[25] Notwithstanding this, there is no reason whatsoever that any conclusion in regard of the UK mobile market should automatically apply to Ireland. With a much smaller population and more challenging geography (in terms of the distribution of the population across rural areas), it is likely that the needs of customers and the practicalities of national roll-out by multiple operators will differ between the two markets.

[22] Everything Everywhere has announced plans to auction this spectrum itself in advance of the UK 4G auction. See: http://uk.reuters.com/article/2012/01/10/uk-everything-everywhere-idUKTRE8092HY20120110.

[23] On 17 February 2012, Ofcom published an addendum to its 12 January 2012 consultation relating to what changes might be made to proposed minimum portfolio packages if, before the auction, Everything Everywhere (EE) sold the rights to use the 2x15MHz of 1800MHz spectrum that it is required to divest as part of its merger commitments. See: http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/annexes/addendum.pdf

[24] The only scenario in which could not occur is if three players win the maximum 2x20MHz of sub-1GHz spectrum and at least two of these three also win sufficient 1800MHz to prevent the fourth bidder from win more than 2x5MHz of sub-1GHz or 2x15MHz of 1800MHz spectrum (in line with Ofcom's "Group 1" MPPs).

[25] To prevent a fourth bidder from achieving at least one of Ofcom's "Group 1" MPPs, three other bidders would each need to win 2x20MHz of sub-1GHz spectrum and, in total, 2x70MHz of 1800MHz spectrum.

The Irish mobile market does not currently have four symmetric players[26] and it is far from obvious what a sustainable long-run market structure might be. There are a number of small European mobile markets (e.g. Austria and Switzerland) that have not sustained four competitors. Furthermore, many countries have seen network-sharing arrangements to control costs and reap scale economies.

60. There are also specific reasons why it might be desirable to take a more interventionist approach in the UK through the use of spectrum floors. Ofcom's combined auction is solely for the 800MHz and 2.6GHz bands, with the potential for a small (2x15MHz) amount of 1800MHz spectrum to be included only in the event that Everything Everywhere does not divest this prior to the auction. In particular, the UK auction does *not* include 900MHz spectrum, which is held only by Vodafone and Telefonica. Therefore, there is a strongly asymmetric distribution of *existing* holdings of 900MHz spectrum in the UK that will not be affected by the auction. In contrast, the Irish multiband auction includes the entire 900MHz band, making *all* sub-1GHz spectrum available to be contested simultaneously. This is a very significant difference, as the total quantity of sub-1GHz spectrum available for award is significantly greater in Ireland than in the UK.

61. For these reasons, we see no solid case for *active* intervention using the auction as an instrument to engineer a largely symmetric four-player outcome in the Irish mobile market. It is not clear that such a situation is essential for effective downstream competition and needs to be mandated. There is also a risk that this would simply create a transient and ultimately unsustainable market structure through an implicit public subsidy generated by the restriction on competition *for* spectrum that tighter caps (or other measures such as MSPs) would create.

ComReg's competition objectives

62. We understand that ComReg's aim for the award process and its outcome is to ensure - to the extent reasonably possible - that following the award process there is no material restriction of downstream competition relative to the current situation.[27] Within this constraint, competition for spectrum should be maximised by giving bidders maximum flexibility to bid for the packages of spectrum they might want.

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[26] Market share by subscribers including mobile broadband: Vodafone (41.2%), Telefonica (30.3%), eircom Group (19.2%) and H3GI (7.2%). Market share by revenue: Vodafone (43.3%), Telefonica (31.4%), eircom Group (17.6%), H3GI (6.7%). See ComReg 11/98 "*Quarterly Key Data Report*" Q3 2011, 9 December 2011. In contrast, the UK market, although now more concentrated following the Orange/T-Mobile merger, has demonstrated periods with four reasonably symmetric national network operators (prior to the entry of H3G) and five operators (following the entry of H3G, though H3G did not have a full national network and relied on roaming).

[27] In this respect, we note that in paragraph A6.168 of ComReg document 11/60a, ComReg considered that the 2x20MHz spectrum cap proposal was superior as it allows for some asymmetry in spectrum distribution but not so much to distort competition in the market for services provided using this spectrum, whilst preserving competitive tension in the spectrum award competition and allowing for an efficient outcome.

63. Therefore, the protection of downstream competition has an absolute priority, but equally unnecessary restrictions should not be placed on competition for spectrum if these are not required to support effective downstream competition. Indeed, unnecessary restrictions on the packages that bidders may buy could well adversely affect downstream competition too, in that bidders may be prevented from pursuing future strategies to compete for customers and offer new services through lack of spectrum appropriate to their particular needs.

64. The spectrum caps have been proposed specifically in order to provide maximum flexibility for bidders within the constraint of protecting downstream competition. Alternative tighter caps would not provide a clearly superior approach against these objectives, as we discuss in the following subsection.

65. The auction rules and licence conditions also contain a range of features specifically designed to promote downstream competition:

- Setting spectrum caps that do not impose as a necessity a symmetric outcome with all winners receiving equal shares of each band, but rather permitting a variety of different strategies with regard to the distribution of spectrum held across different bands to compete within the auction and then subsequently in the downstream market for mobile services.
- Setting a licence duration (of the main licences, those from 2015-2030) at a level that provides certainty to licensees for a sufficient period to make efficient investment decisions in equipment and services to be provided over the licence term.
- Balance of payments across upfront fees (SAFs) and ongoing payments (SUFs) to allow bidders to spread some of the cost of licences over the licence term and, conversely, to incentivise bidders to re-assess their need for spectrum on account of fees to retain their spectrum holdings. This promotes the continued optimal use of spectrum to the benefit of competition in downstream markets.
- Setting of licence conditions such as coverage at a level that insures against licensees not rolling out services or cherry-picking only dense urban areas, but allows licensees to decide on the exact level of coverage that they wish to set based on commercial considerations.
- Setting licence conditions other than coverage equally for all potential licensees, so that bidders will know that if successful in winning spectrum they will be subject to the same licence conditions as all other bidders.

66. Various measures have been taken to promote competition for spectrum and provide flexibility for bidders with no compromise to downstream competition. Indeed, these measures promote efficient allocation of spectrum that should ultimately benefit downstream competition too:

- The inclusion of spectrum in different bands available at around the same time that may be considered substitutable and/or complementary in the same award process to allow bidders to express valuation linkages for spectrum across bands and pursue a variety of strategies.

- The inclusion of all spectrum within a given band on common terms despite differing dates of actual availability in order to ensure that differing expiration dates for existing licences would not dampen competition for certain frequencies or competition from certain bidders for new licences.
- Use of a multi-round auction format so that in the case of common value uncertainty, bidders will have the opportunity to choose to continue to bid as prices rise as a result of overall demand (rather than bid based on valuations alone, without the opportunity to re-bid based on others' bidding behaviour).
- Limiting of transparency during the auction thereby making outcomes that might dampen competition such as collusive outcomes more risky and difficult to achieve.
- Significant reserve prices to promote competition by reducing the benefits to bidders of coordinated behaviour such as strategic demand reduction.
- Providing transparency of the process from an early stage (through the publishing of a draft IM) so that all potential participants in the award process have the same degree of certainty as to how the award process will progress once underway.

Adverse effects of a tighter sub-1GHz spectrum cap

67. We now return in detail to the question of the level of spectrum caps. Moving to a 2x15MHz sub-1GHz cap (one of the suggestions made by H3GI) would mean that, without competition from a new entrant, there would be no competition amongst the four incumbent operators for sub-1GHz spectrum, with each receiving 2x15MHz uncontested at the reserve price. At least 2x5MHz would go unsold or be allocated to a fifth winner under this approach. Competition amongst incumbents to determine who received larger or smaller amounts of sub-1GHz spectrum would have been eliminated by the spectrum cap and the auction outcome significantly pre-determined.[28] Competition for spectrum could only come from a new entrant. There is no necessary long-term increase in downstream competitive intensity, as a fifth operator would likely have little spectrum and there must be doubts about the sustainability of such a situation. At the same time, limiting access to spectrum for operators wanting an option to expand might actually weaken downstream competition.

68. H3GI's proposal in favour of a sub-1GHz spectrum cap of 2x15MHz that can be relaxed to 2x20MHz in the absence of demand for the remaining 2x5MHz block[29] would also have some worrying consequences:

[28] Note that a 2x20MHz sub-1GHz cap would allow 2x10MHz in each of the 800MHz and 900MHz bands. This is still fragmented, but less so than would result with a 2x15MHz cap.

[29] *"H3GI has set out in its previous responses and submissions its view that a sub-1GHz spectrum cap of 2x20MHz is unnecessarily high, and has called on ComReg to adopt a cap of 2x15MHz with possible relaxation to 2x20MHz, should supply exceed demand."* See page 12 of H3GI's response to ComReg 11/60

- With an initial sub-1GHz spectrum cap of only 2x15MHz, in the case of four competing bidders, this would necessarily result in 2x5MHz being 'set aside', essentially to be left for a fifth entrant. There is no apparent justification for this on competition grounds, and could lead to an inefficient outcome in the absence of a new entrant.
- H3GI suggests that if one block of sub-1GHz spectrum would otherwise go unsold, then the cap could be relaxed to 2x20MHz. However, this clearly gives an incentive for speculative acquisition of that single block. If there were a fifth bidder – apart from the four incumbents – then the spectrum cap would not be relaxed and that bidder could obtain a single block at the reserve price. Under a future spectrum trading regime, that single block could then be sold later to one of the four incumbent bidders in what would likely be a quite competitive process creating a significant windfall gain for the fifth bidder. This private windfall gain arises directly from the spectrum cap being contingent on demand.
- If spectrum caps were relaxed to 2x20MHz for each bidder in the case that there was otherwise no demand for the last block (i.e. in the absence of such a fifth bidder), bidders would continue to bid their valuation for this 'reserved block' and the spectrum would once again be awarded to the operator with the highest incremental value for an additional block of sub-1 GHz spectrum. Therefore, in the case that there is only demand from incumbents, the outcome is no different from simply having an *unconditional* cap of 2x20MHz.

69. In summary, a 2x15MHz cap relaxed contingently to 2x20MHz if there is no demand for the last block has one of two effects:

    a) It may encourage speculative demand for a single block to prevent the cap being relaxed and exploit the restriction that this imposes on incumbents;

    b) Alternatively, if there is no such demand for a single block, the situation is no different from a 2x20MHz cap (and the additional complexity of a contingent cap is not needed).

70. For these reasons, we do not see that H3GI has made a valid argument for the reduction of the sub-1GHz cap from 2x20MHz to 2x15MHz. However, H3GI's primary proposal is for a system of spectrum floors as currently under consultation in the UK. We return to the issue of spectrum floors in Section 4.5 below. While the spectrum floor approach could potentially avoid some of the deficiencies of a 2x15MHz cap for sub-1GHz spectrum (with or without a contingent relaxation) discussed above there are also a number of shortcomings that must be considered in combination with the merits of this approach.

4.3 Overall spectrum cap

4.3.1 Respondents' views

71. In responding to ComReg document 11/60, one respondent (Vodafone) expressed its support in relation to the overall spectrum cap.[30] However, two respondents (H3GI and eircom Group) raised specific concerns, both proposing a lower overall cap of 2x40MHz. Arguments put forward in support of this view include:

- The proposed cap of 2x50MHz across the three bands leads to the risk of highly asymmetric outcomes with a significant detrimental impact on competition; and
- A cap of 2x40MHz is necessary to ensure the existence of four credible players in the market.

72. eircom Group outline their disagreement with our view that neither of the most asymmetric outcomes that might result from the proposed spectrum caps would be unequivocally harmful to competition. eircom present some outcomes that may arise given the proposed spectrum cap in the case of the four existing operators, and in the case of a new entrant.[31] These are summarised below.

Table 1: Possible allocation of spectrum amongst five bidders with a 2x50MHz cap

Outcome 2	Bidder 1	Bidder 2	Bidder 3	Bidder 4	Bidder 5
Sub 1GHz	2x20MHz	2x20MHz	2x20MHz	2x5MHz	-
1800MHz	2x25MHz	-	-	-	2x50MHz

Source: Page 13 of eircom Group's response to ComReg document 11/60

[30] *"Vodafone agrees with ComReg's proposals that an overall 2 X 50 MHz cap covering the sub-1 GHz and 1800 MHz bands and a 2 X 20 MHz cap on sub-1 GHz spectrum would be appropriate to avoid the possibility of extreme asymmetries in distribution of spectrum as an outcome of the award process that could have an adverse impact on competition in the provision of communications services"* See page 2 of Vodafone's response to ComReg document11/60

[31] See page 13 of eircom Group's response to ComReg document 11/60

Table 2: Possible allocation of spectrum amongst the four existing operators with a 2x50MHz cap

Outcome 1	Bidder 1	Bidder 2	Bidder 3	Bidder4
Sub 1GHz	2x20MHz	2x20MHz	2x20MHz	2x5MHz
1800MHz	2x30MHz	2x30MHz	2x15MHz	-

Source: Page 13 of eircom Group's response to ComReg document 11/60

73. H3GI disagrees with the proposed overall spectrum cap of 2x50MHz. H3GI considers that it would be possible for one bidder to be awarded only 2x5MHz of sub-1GHz spectrum, which would fall significantly below a holding of 2x20MHz that the remaining operators could obtain and argue that the weakest bidder in the upcoming auction will thus be placed at a significant competitive disadvantage. Further, in relation to an entrant winning 2x50MHz of 1800MHz spectrum, H3GI considers that this does not address the minimum amount of spectrum a credible mobile network operator requires to compete with a mobile network operator with 2x20MHz of sub-1GHz spectrum. H3GI comments that an overall spectrum cap of 2x40MHz is necessary to ensure the existence of four credible players in the market, with each operator holding a sufficient spectrum post-auction.

4.3.2 DotEcon commentary

74. We note that these outcomes presented by H3GI are similar to those presented by eircom Group in the tables above and believe that our response, as outlined below, applies equally to the comments both parties.

75. In relation to the possible allocations (assignments) presented above, we do not consider that these are necessarily plausible or likely outcomes. In particular, it is reasonable to expect that an outcome such as that in Table 1 would be dominated by an alternative outcome in which synergies between sub-1GHz and 1800MHz are achieved (i.e. bidder 4 and bidder 5 are combined) giving a greater total value of winning bids. The outcome in Table 2 assumes that one bidder has bid solely for a single block of sub-1GHz spectrum and no 1800MHz spectrum; this outcome cannot arise in any other way, as bids for packages of lots are indivisible, with the package being won in its entirety or not at all.

76. Nevertheless, these examples are consistent with the most asymmetric outcomes we have already identified and considered in our August 2011 report published as ComReg document 11/58, namely that:

a) Two existing operators winning 2x20MHz each of sub-1 GHz spectrum and 2x30MHz each of 1800MHz spectrum, with 2x25MHz of sub-1GHz spectrum available for other winners (which would allow the outcome in Table 1 above or, more plausibly one winner of 2x15MHz and one of 2x10MHz of sub-1GHz spectrum);

b) An entrant winning 2x50MHz of 1800MHz spectrum with the remaining 2x25MHz distributed amongst the existing operators, who also win the

maximum amount of sub-1GHz spectrum each. The outcome in Table 1 represents one of these cases, where the remaining 1800MHz spectrum is concentrated in the hands of one bidder.

77. Despite these being unlikely outcomes, in neither case did we consider that there would necessarily be significant problems for downstream competition that warranted intervention. In case a), there would either be three reasonably symmetric players or four players with at least 2x10MHz of sub-1GHz. In case b), we did not consider a single operator holding 2x50MHz of 1800MHz spectrum to be problematic given that the sub-1GHz cap ensures a minimum of three players with at least 2x10MHz of sub-1GHz spectrum (and more likely four for the reasons discussed above) and the fact that the 2.1GHz band provides an alternative high frequency band, with the 2.6GHz band potentially available later. In this context, we note that in Ofcom's most recent consultation on the UK 800MHz and 2.6GHz auction (dated 12 January 2012) where it considers the minimum amount of spectrum that an operator would have to hold in order to be an effective competitor, it considers that an operator holding 2x15MHz or more of 1800MHz spectrum should be able to compete effectively against other operators including those holding sub-1GHz spectrum.

78. Whilst H3GI's and eircom's examples are possible, they are not necessarily likely. A bidder can only be assigned a certain amount of spectrum if they bid for it. Hence in the tables above, one of Bidder 4's bids would have to be for only 2x5MHz in the sub-1GHz bands in order to win that amount of spectrum. As explained previously, bids are mutually exclusive so a bidder would win at most one of the packages for which he placed a bid. Bids are thus made on the basis of there being a positive business case if that package of lots was indeed won.

79. We do not agree with eircom's comment that DotEcon has sought to identify the most preferable outcome in terms of maximising the number of outcome permutations in the award process.[32] Indeed, that objective would only be achieved by having no caps at all. Rather, we have sought to ensure that caps are not so loose that the acquisition of spectrum may be motivated by an expectation of muting downstream competition. However, subject to meeting this requirement, we do not wish to make caps unnecessarily tight, as this impedes the ability of the auction to explore a range of possible outcomes and could limit competition for spectrum without any significant gain in downstream competitive intensity. Indeed, if caps are set too tight, then subsidised entry and expansion opportunities may be created for no gain in long-run downstream competition and technical efficiencies associated with the use of newer technologies in larger contiguous blocks of spectrum may be destroyed unnecessarily.

80. In relation to comments from both H3GI and eircom in support of an overall cap of 2x40MHz, we note that such a cap would limit total demand from the

[32] See page 14 of eircom's Response to ComReg document 11/60

four incumbents to at most 2x160MHz, which does not exceed the available 2x140MHz by much. Therefore, these counterproposals can be expected to limit competition for spectrum within any auction to a very significant degree.

81. A 2x40MHz overall cap would be an unnecessary restriction and an impediment to competition for spectrum. For example, consider the most asymmetric distribution of sub-1GHz spectrum, with three winners of 2x20MHz and one winner of 2x5MHz. The winners of 2x20MHz of sub-1GHz spectrum could only acquire 2x20MHz of 1800MHz spectrum, a demand of 2x60MHz in total. Therefore, if the winner of 2x5MHz of sub-1GHz spectrum *unilaterally* reduced its demand for 1800MHz spectrum to 2x15MHz, competition for 1800MHz spectrum would be eliminated entirely and such spectrum obtained at the reserve price.

82. This example illustrates a general point about compatibility of the sub-1GHz cap and the overall cap. For a given level of the sub-1GHz cap, the overall cap should not be so tightly set that competition between winners of sub-1GHz spectrum for 1800MHz spectrum is greatly impeded. Broadly speaking, the higher the sub-1GHz cap, the higher the overall cap needs to be if perverse effects are to be avoided.

4.4 900MHz cap in the first time slice

4.4.1 Respondents' views

83. Following the proposal to introduce an additional cap of 2x10MHz on the 900MHz spectrum in the first time slice, three respondents to ComReg document 11/60.

84. Vodafone and eircom Group, generally supported this cap for a number of reasons including:

- Under some circumstances this could facilitate the early release of liberalised spectrum;
- The introduction of this cap recognises the imperfect substitutability between 800MHz and 900MHz spectrum, striking the correct balance to deal with short-term substitutability issues.

85. In addition to agreeing with the concept of a 2x10MHz cap on 900MHz spectrum in the first time slice, H3GI argued that ComReg should go further and impose this cap on 900MHz spectrum in both the first and the second time slice.

86. However, there was strong opposition from Telefonica. The main concerns expressed by Telefonica include:

- Discrimination in favour of H3GI in the launch of advanced services;
- ComReg forcing long-term technology selection on operators and the market;
- Unjustifiably driving up the price of 800MHz spectrum;
- Fragmentation between the 800MHz and 900MHz bands;
- Driving down the price and demand for 900MHz spectrum.

87. Telefonica submits that the introduction of the 900MHz cap:

- Restricts the outcome of the auction and pre-determines that at least one lot of 900MHz spectrum will either remain unsold, or will be sold to a new entrant in the band;[33]
- ComReg has pre-determined that there should be at least four operators in the 900MHz band;[34]
- Neither ComReg nor DotEcon have stated specifically why it is now proposed to introduce this new cap.[35]

88. Furthermore, while in agreement with the proposal to implement an additional cap on 900MHz spectrum in the first time slice, H3GI proposed that ComReg extend this additional spectrum cap to the second time slice.[36]

DotEcon commentary

89. We consider that a number of the points made by Telefonica fail to consider the implications of the cap applying *solely* to the first time slice and the potential for reconfiguration of spectrum holdings in 2015 to address fragmentation problems, as we discuss in detail below.

90. It is useful to begin by reconsidering the original reasons for imposing a cap on the 900MHz band in the first time slice:

- Due to the existing use of 900MHz spectrum by GSM licensees, we do not believe a complete reconfiguration of the band is feasible immediately as current GSM operators will have to continue serving their GSM customers in the near term using frequencies in this band. However, this situation is likely to have changed by the start of the second time slice (i.e. 2015); and,
- The 2x10MHz cap in the first time slice of the 900MHz band is intended to protect existing GSM customers in the short term, as it ensures that all current GSM operators will be able to win at least 2x5MHz in this band under the assumption of four successful bidders. This cap thus reduces the potential for disruption to GSM consumers arising from existing providers being 'squeezed out' by other disruptive bidders.

91. Telefonica considers that the introduction of the 2x10MHz 900MHz cap in the first time slice restricts the outcome of the auction and pre-determines that at least one lot of 900MHz spectrum will either remain unsold or will be sold to a new entrant in the band; as a result, ComReg has pre-determined that there should be at least four operators in the 900MHz band. We re-emphasise that the main reason for the introduction for such a cap is to protect existing GSM customers in the short term. The imposition of such a cap mitigates the

[33] See page 19 of Telefonica's response to ComReg document 11/60

[34] See page 20 of Telefonica's response to ComReg document 11/60

[35] See page 20 of Telefonica's response to ComReg document 11/60

[36] See page 36 of H3GI's response to ComReg document 11/60

potential for disruption to GSM consumers by reducing the possibility of existing providers being squeezed out. While we do not believe a complete reconfiguration of the band is feasible immediately, we note that this restriction is imposed only in the first time slice, and does not intend to restrict or pre-prescribe any auction outcome over the duration of the full licence period to 2030.

92. We do not see merit in Telefonica's suggestion that the 2x10MHz 900MHz spectrum cap in the first time slice would give H3GI an unfair advantage in launching advanced services. The claim that H3GI will be given a head start with UMTS900 as it is guaranteed to win 2x5MHz in this band and current GSM operators are forced into the 800MHz band to deploy LTE and will thus be "locked-in" to that technology for the second time slice is unfounded.

    a) First of all, if other existing operators bids made full use of their cap, there would be 2x5MHz of spectrum remaining for H3GI.[37] However, H3GI considers that 2x5MHz of 900MHz spectrum would not be sufficient to roll out advanced services[38] and that it would have to win at least 2x10MHz in the 900MHz band to offer advanced services.[39] Therefore, it is difficult to understand how H3GI would get a head start if it only wins 2x5MHz in the 900MHz band where H3GI considers this to be insufficient.

    b) Second, it is far from clear that obtaining spectrum in the 900MHz band would allow H3GI to pre-empt Telefonica (or other 900MHz incumbents) significantly in bringing advanced services to market. Furthermore, GSM incumbents would have various strategies available to them to respond in the marketplace, including accelerated transition of GSM customers and taking advantage of their larger customer bases.

93. In response to Telefonica's comments regarding the impact on the prices of different spectrum bands and fragmentation, these are key reasons why the additional cap only applies to the first time slice. The imposition of an additional cap in the first time slice strikes a balance between allowing operators to specialise in the 800MHz and 900MHz bands in the second time slice (so allowing technical efficiencies from holding larger contiguous blocks of spectrum) whilst protecting GSM customers from bidding behaviour in the first time slice intended or having the effect of denying spectrum to GSM incumbents. Any delay on the ability of operators to consolidate all sub-1GHz spectrum holdings into the same band is limited to the first time slice.

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[37] This result is based on the assumption of four bidders in the auction for the purposes of evaluating Telefonica's and H3GI's arguments only and does not indicate an assumption as to the number of bidders that will participate in the auction.

[38] *"…5MHz of sub-1GHz spectrum is insufficient to compete with an operator with 2x20MHz of sub-1GHz spectrum."* See page 13 of H3GI's Response to ComReg document 11/60

[39] See page 12 of H3GI's Response to ComReg document 11/60

94. Further, we note that if there were only a 2x20MHz sub-1GHz cap, the smaller amount of spectrum available in the first time slice relative to the second time slice would increase the probability of more extreme outcomes in the first time slice than would be possible in the second time slice. For example, in this scenario it is possible that one bidder could win 2x20MHz of 900MHz spectrum in the first time slice, and another bidder could win the remaining 2x15MHz of 900MHz spectrum. This would leave at least one incumbent unable to service existing demand for GSM 900 MHz services and could result in significant consumer disruption. While such an outcome may be acceptable to operators in the second time slice when it is considered that 800MHz and 900MHz spectrum will be substitutable, this is not necessarily so in the first time slice.

95. For the reasons outlined above, we do not see merit in H3GI's suggestion that the 900MHz cap should be extended to the second time slice as this would force an enduring fragmented outcome.

4.5 Spectrum floors

4.5.1 Respondents' views

96. H3GI considers that ComReg should adopt the approach currently under consultation in the UK for Ofcom's future combined auction of 800MHz and 2.6GHz spectrum of setting 'spectrum floors'. Specifically, H3GI contends that there should be a restriction on outcomes of the auction to ensure that at least four players each win at least 2x10MHz of sub-1GHz spectrum.[40]

4.5.2 DotEcon commentary

97. It is important to recognise that the UK proposals are still subject to consultation and an eventual decision by Ofcom. In particular, there is at present no certainty that Ofcom will adopt the spectrum floors approach, as opposed to simply relying on spectrum caps, a point made clear by Ofcom in its setting out of proposed auction rules in its most recent consultation in January 2012. Also, no decision has been taken in the UK on the minimum spectrum holdings (i.e. the 'minimum portfolio packages' or 'MPPs') that bidders would have to reach.

98. The most recent consultation proposals from Ofcom consider trade-offs between high and low frequency spectrum in meeting the spectrum floor. In particular, with Ofcom's "Group 1" MPPs a bidder would be considered to have achieved the spectrum floor with 2x10MHz of sub-1GHz spectrum, or with no sub-1GHz spectrum if 2x15MHz of 1800MHz were held. Ofcom also presents two possible larger groups of portfolios that could be considered to satisfy an MPP "Group 2" and "Group 3". Each of these groups has various combinations

[40] "*…H3GI and its independent consultants Value Partners and RRA have recommended the imposition of a spectrum floor of 2 x 10 MHz of contiguous sub-1GHz spectrum (alongside the 2 x 20 MHz sub-1 GHz spectrum cap already proposed by ComReg).*" See page 19 of H3GI's response to ComReg document 11/60

of spectrum that could be considered to satisfy an MPP and encompass more spectrum in aggregate than Group 1.[41]

Table 3: Ofcom's proposed groups of MPPs

	800MHz	1800MHz	2.6GHz
Group 1 (Smaller Portfolios)			
Portfolio 1	2x10MHz		
Portfolio 2		2x15MHz	
Group 2 (Medium Portfolios)			
Portfolio 3	2x15MHz		
Portfolio 4	2x10MHz		2x10MHz
Portfolio 5	2x10MHz	2x15MHz	
Portfolio 6		2x15MHz	2x10MHz
Group 3 (Larger Portfolios)			
Portfolio 7	2x20MHz		
Portfolio 8	2x15MHz		2x10MHz
Portfolio 9	2x10MHz		2x20MHz
Portfolio 10	2x10MHz	2x15MHz	
Portfolio 11		2x15MHz	2x20MHz

Source: See Figure 4.11 of Ofcom's consultation paper published 12 January 2011

Note: Ofcom published an addendum to the second consultation for the award of 800MHz and 2.6GHz spectrum on 17 February 2012. This addendum notes how the portfolio packages would change if before the auction Everything Everywhere sold the rights to use the 2x15MHz of 1800MHz spectrum that it is required to divest as part of its merger commitments, to a party other than Vodafone or Telefonica. However, the portfolios outlined in the table above are still relevant to this discussion as they present the absolute amounts of spectrum (including existing holdings) that an operator would require to be a credible national wholesaler.

99. We emphasise that no decision on this consultation has yet been taken, and Ofcom will review its alternative proposals in light of stakeholder responses to its consultation after the deadline for responses passes in March 2012.

[41] See Figure 4.11 of Ofcom's consultation paper published 12 January 2011: http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf.

Therefore, it is not yet known if the UK will necessarily use a spectrum floor of 2x10MHz of sub-1GHz spectrum or if such spectrum floors will be used at all.

100. Nevertheless, all of these various proposals have the common feature that a sufficient amount of high frequency spectrum is a potential substitute for sub-1GHz spectrum in providing a sufficient amount of spectrum to permit a national network operator to function effectively. We note that, in contrast to the proposals in its March 2011 consultation, none of the MPP groups proposed in the current consultation mandate the holding of sub-1 GHz spectrum as the only possible route to becoming an effective national network operator.[42]

101. In the context of the Irish auction, if a requirement were set for a 2x10MHz sub-1GHz floor to be met by at least four bidders, then it would create a restriction that is roughly intermediate in effect between a 2x15MHz and a 2x20MHz sub-1GHz cap. However, it would not specifically ensure that no bidder would be left with only 2x5MHz of sub-1GHz spectrum. For example, this could occur if a bidder bid for that amount of spectrum and there were a sufficient number of other bidders bidding for at least 2x10MHz to achieve the floor.

102. H3GI submits that the imposition of the proposed floors would guarantee the existence of four credible players in the market post auction. However, the introduction of such a floor is justified only on the basis that an active intervention is necessary to create or maintain a four-player market with sufficient symmetry in spectrum holdings. As discussed above, apart from the requirement to design of an award process that can reasonably be expected to achieve ComReg's objective of promoting downstream competition, ComReg does not need to ensure that any particular market structure is created or preserved going forward, save to ensure that there is not an unacceptable risk of a material reduction in downstream competitive intensity. In particular, it would be entirely counterproductive to create an unsustainable market structure through unwarranted intervention. Entry or expansion of weaker players should not be subsidised unless there is a clear case that an active intervention is needed to protect downstream competition in mobile services, rather than benefit one particular competitor.

103. In addition, as mentioned by another respondent to ComReg document 11/60 (eircom), the introduction of a spectrum floor would unnecessarily increase the complexity of the award process. Ofcom's proposals for an auction using spectrum floors are still in development at the time of writing and no spectrum regulator has yet implemented such spectrum floors.

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[42] In this regard, Ofcom states that *"In March we identified the ability to provide service deep indoors as important to the credibility of a national wholesaler and that some sub-1GHz spectrum would be likely to be needed to offer such services. We now consider that it is less certain that the locations that can only be realistically served with a macrocell network using sub-1GHz spectrum (and cannot be served using other technologies such as Wi-Fi and femtocells) are likely to be sufficiently important in the overall market that not having a capability to serve them would be likely to bring into question the credibility of the national wholesaler",* see paragraph 4.104 of Ofcom's January 2102 consultation: http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/summary/combined-award-2.pdf.

104. Following the above discussion, we maintain our view that, given the spectrum caps in place and the need for competition to shape the market outcome, there is no clear case for the addition of a spectrum floor to the current proposals.

4.6 Addressing further comments from H3GI

105. H3GI comment that *"ComReg fails to set out its views as to the desirable/appropriate number of players in the market. It is nevertheless implicit that DotEcon believes this might involves three operators or four network operators that are not largely symmetric. The rationale and/or basis for DotEcon's position is however, unclear and unsubstantiated, and the terminology used is best vague and unhelpful. In particular, DotEcon does not provide any guidance as to what "largely symmetric" might mean in practice"*.

106. In relation to H3GI's comments regarding the need for an explicit competitive assessment, ComReg has properly considered the impact of competition throughout the design of the award process. ComReg has previously noted its goal of only precluding outcomes that would compromise downstream competition, whilst otherwise providing maximum flexibility to bidders.[43]

107. With regard to H3GI's view that a judgement cannot be avoided regarding the number of players that the market will sustain, ComReg noted (in ComReg document 11/60) that it is not required to ensure a particular number of competitors in the market and considers that the underpinning legislation is principled in nature and not prescriptive. In other words, ComReg need not prescribe a specific number of market operators and to do so would be inappropriate unless a failure of competition in the market or similar circumstances requires ComReg to do so. Rather, leaving to one side the design of an award process that can reasonably be expected to achieve ComReg's objective of promoting competition, the particular issue in this context is to set constraints on the possible outcomes of the auction to prevent, as far as is reasonably possible, a material restriction of downstream competition relative to current market conditions.

108. In this regard, it is important to acknowledge that there are trade-offs that must be struck in setting spectrum caps (or spectrum floors). Allowing operators access to more spectrum reduces the capacity costs and encourages deployment of advanced services, creating benefits for consumers. This is procompetitive up to a point, provided that rivals are not left with so little spectrum that competition becomes ineffective. In particular, a symmetric distribution of spectrum is not necessary for effective competition, though

[43] See paragraph A6.168 of ComReg 11/60a, *"ComReg considers that its proposal to apply a 2 × 10 MHz 900 MHz cap (for the first time slice), a 2 × 20 MHz sub-1 GHz cap and an overall cap of 2 × 50 MHz best achieves its goal of only precluding outcomes which would comprise extreme asymmetries, which could in turn affect competition in the market. In light of this, ComReg maintains that its proposal is superior to the VP/RRA proposal, as it allows for some asymmetry in spectrum distribution but not so much to distort competition in the market, whilst preserving competitive tension in the spectrum award competition and allowing for an efficient outcome."*

clearly the distribution of spectrum must not become too concentrated. However, what is at issue here is the effect on competition, rather than the position of any particular competitor. Given the difficulties of quantifying this trade-off, it is reasonable to be guided by the current market structure and to ensure that the auction does not run a significant risk of worsening competitive conditions relative to the status quo.

109. In assessing the effect on downstream competition, and given the granularity of spectrum only usable in discrete blocks, we need to consider the overall distribution of spectrum amongst operators. The number of licensees is one aspect of this distribution, as is the extent of asymmetry. However, effective competition does not require imposing symmetric outcomes, ensuring any particular number of players or protecting the position of any particular operator. Rather, we need to consider various scenarios for possible post-auction spectrum holdings and identify the most troublesome cases for downstream competition and consider the likelihood of their occurrence and prohibit such outcomes where they would undoubtedly be harmful to competition, as we have done.

110. H3GI comments further that it "*it is entirely inappropriate for ComReg to interfere with the market and positively seek to bring about the exit of a player, by way of structure of the upcoming auction. The survival of operators in the market should occur as a result of normal competitive tension, in a market where all operators have been afforded the opportunity to compete on fair and equal terms. It is submitted that ComReg's proposed spectrum caps will not allow operators to compete on fair and equal terms.*"[44] The proposed spectrum caps clearly do not seek to interfere with the market or seek the exit of a player. Rather, they are intended to ensure that competition is not weakened relative to current conditions, but otherwise not to impose further restrictions. All bidders in the auction will be subject to the same spectrum caps and the same rules apply to all; bidders will compete on equal terms.

4.7 Spectrum caps with joint bidding

111. In their responses to ComReg document 11/60, Telefonica challenged ComReg's position that combined bids should be treated the same as any other bids in the competition and be subject to the same spectrum caps as any other bid.[45]

112. We discuss the issue of joint bidding further in Section 13.

[44] See page 18 of H3GI's response to ComReg document 11/60

[45] See Paragraph 4.45 of ComReg document 11/60

5 Contingencies within the award process

5.1 Unsold spectrum at the end of the auction

5.1.1 DotEcon's stated views and recommendations to date

113. In ComReg document 11/58 we considered the case where there may be unsold spectrum at the end of the auction for reasons including bidding behaviour in the auction and the outcome of the winner determination.

114. We recommended that, while the approach should be evaluated on the merits of the particular case a principle should be set that spectrum left unsold at the end of the auction would not otherwise be assigned for a period after the auction of at least 1-2 years. We recommended this on the basis that it would mitigate any strategic incentives for bidders to *"wait and see"* by withholding demand during the auction in the hope of being assigned this spectrum on the same terms in a follow-up process.[46]

5.1.2 Respondents' views

115. In its response to ComReg document 11/60, Vodafone commented that, further to leaving a sufficient time period following completion of the auction, ComReg should also confirm that any future award of this spectrum would be on terms no more favourable than the current multiband auction. Without such confirmation, Vodafone believes that incentives to strategically withhold demand in the current awards round will remain.[47]

116. However, H3GI commented that ComReg should not decide that spectrum that is left unsold should not be assigned for a period following the auction, given the scarcity and importance of the spectrum involved.[48]

5.1.3 DotEcon commentary

117. If spectrum is unsold following the auction, this might be because of insufficient demand overall, or because there are lots left that cannot be fitted into the optimal winning combination. In both cases, the auction outcome is still efficient given the demand for spectrum as stated by bidders via bids submitted during the auction.

118. Under such circumstances, there is little point in trying to assign unsold blocks immediately, as the auction has already revealed that there is no efficient way to do this. Therefore, there is little loss in committing not to release any leftover lots until such time as circumstances have changed sufficiently. Therefore, although we agree with H3GI that these bands are both scarce and important, we do not see any significant harm in deferring attempts to re-

[46] ComReg restated these recommendations at paragraph 4.33 of ComReg document 11/60

[47] See page 3 of Vodafone's response to ComReg document 11/60

[48] See page 51 of H3GI's response to ComReg document 11/60

award any unsold spectrum for a period provided this period is not too long. Indeed, preparing proposals for a subsequent award of spectrum (and consulting on these) in any case limits the speed with which any unsold spectrum could be brought back to market.

119. This approach has the benefit of reducing incentives for strategic behaviour by bidders where they do not express their full demand for spectrum in the hope of creating a situation where unsold spectrum might be bought later on better terms. Vodafone is correct to argue that a commitment that subsequent spectrum would not be available on better terms would further reduce this incentive. However, we also need to consider that circumstances change over time and the value of spectrum could rise or fall over time depending on changes to both demand and supply. Therefore, it is not appropriate to constrain the future terms on which spectrum will be made available to too great a degree.

120. Overall, a minimum period before a follow-up sale of any unsold spectrum strikes a reasonable balance. It is a substantial disincentive to strategic reduction in demand, as a bidder has no certainty of obtaining spectrum in a subsequent follow-up process. At the same time, this approach provides flexibility for ComReg to respond to changing circumstances over that period and ensure that appropriate reserve prices are used in any follow-up process given the conditions applying at the time.

121. We do not believe it is necessary to specify a firm bound on how long after the initial auction a follow-up sale should occur. This is because the timing of any subsequent auction and the terms on which spectrum will be made available will depend on the reason for unsold spectrum and the circumstances prevailing in the market following the passing of the minimum period.

5.2 Spectrum liberalised prior to 2013: advanced commencement

5.2.1 DotEcon's stated views and recommendations to date

122. Following consideration of spectrum packaging options and the associated transitional issues, ComReg has proposed to issue preparatory licences in order to facilitate the earliest possible provision of new services. Furthermore, in ComReg documents 11/11 and 11/29 relating to extension of Vodafone and Telefonica's existing licences, ComReg proposed that liberalised use of spectrum may be permitted after completion of the auction, subject to consent of all spectrum winners (and any holders of 900MHz spectrum not liberalised) in order to achieve timely transition to locations in the band linked to the outcome of the assignment round for the first time slice and ensure the earliest possible availability of advanced services.

123. In ComReg document 11/58, we commented on the issues surrounding the advanced commencement proposal. We noted a significant benefit of the proposal was that it might allow advanced data services to become available in Ireland earlier than might otherwise be the case. In addition, we considered that a benefit of the proposals was that they would ensure that advanced data services will be provided in Ireland as soon as possible even in the unlikely case that there is delay in the availability of 800MHz spectrum. We considered that there would be no significant negative effect on competition from advanced

commencement. Therefore, we concluded that there was merit in the inclusion of the proposed combination of preparatory licence and advanced commencement relative to the alternative option of permitting use of all spectrum assigned in the auction only from February 2013.

124. Subsequently, in ComReg document 11/60, ComReg stated its commitment to the commencement of liberalised licences (on a per block basis) prior to February 2013 where possible and set out a number of scenarios where the feasibility of advanced commencement of liberalised usage rights is known.[49]

5.2.2 Respondents' views

125. Two respondents to ComReg document 11/60 were in agreement with the proposal for an advanced commencement option. eircom Group agreed with the principle of allowing the possibility of earlier commencement of a 900MHz liberalised use licence in respect of Blocks A and Block B, or Block A only, depending on the relevant circumstances, provided it is not done in a manner that is prejudicial to eircom Group. H3GI stated that it welcomed ComReg's advanced commencement proposals.

126. However, these views were not without further comment. H3GI suggested that in order to encourage prompt completion of transitional issues and ensure prompt delivery of liberalised services using 900MHz frequencies, ComReg should reserve Lot A of the 900MHz band in the first time slice for a new band entrant. In addition, in its response to ComReg document 11/75, H3GI argued that ComReg should also reserve Lot A in the first time slice and unassigned 1800MHz spectrum in both time slices for a new band entrant, on the basis that this would provide an incentive to the existing GSM licensees to promptly complete their transitional activities.[50] In a letter sent to ComReg on 23 January 2012, H3GI re-emphasised its case for reserving Lot A in both time slices in the 900MHz band and spectrum currently available in the1800MHz band for a new band entrant and ensuring that all spectrum in these bands is available no later than February 2013.

127. Furthermore, eircom commented that at least one of the blocks in the 900MHz band would be required to facilitate any relocation activities within the band. Depending on when the award process is completed, which determines the period over which relocation activities must be completed, and the extent of the relocation needed, there may be a requirement for both Blocks A and B to be used to facilitate relocation activities. As such, it considers that it cannot be stated unequivocally that Block A could be made available immediately following completion of the award process as such matters can only be determined when all the facts are known following completion of the award process.

128. On the issue of the application of pro-rata SUFs in the event that one or more parties exercises the Advance Commencement option, eircom Group had no

[49] See Chapter 7 of ComReg document 11/60

[50] See page 7 of H3GI's response to ComReg document 11/75

objection. However H3GI comment that if "*the proposed assignment stage of the proposed auction would allow bidders to incorporate and determine the equivalent "access" element for advance commencement blocks in the 900MHz band*"[51], it does not understand why a bidder would pay additional daily 900MHz SUFs payable from 5 months following the proposed auction. This would amount to an increase in the winning bid in respect of something that had already been factored in and in respect of which there is no certainty in advance of the auction outcome. H3GI submits that a successful bidder for advance commencement blocks should only pay annual spectrum fees in respect of advanced commencement. Furthermore, in their response to ComReg document 11/75, H3GI added that this would amount to an increase in the winning bid in respect of which there is no certainty in advance of the auction outcome.

129. Telefonica was not supportive of the proposals for various reasons, including that:[52]

- *"[I]t is not technically feasible to make the spectrum in question available as proposed, as the full band will likely be required to physically facilitate the relocation and re-tuning of 900 MHz lots prior to licence commencement required by ComReg's Full Assignment Round approach."*
- *"[ComReg] envisages that licences may begin operating 5 months after the auction closes, assuming that all necessary re-tuning and re-location required by the auction outcome has taken place. Telefonica notes that under current time-lines, and depending on the actual auction outcome there is likely to be less than 6 months between auction conclusion and the proposed start dates of January 2013, meaning that Advanced Commencement as currently proposed would not bring liberalisation forward."*
- *"There could be a significant amount of network re-engineering and re-tuning work required in the 900MHz band post-auction which would involve network operators undertaking network adjustments both sequentially and concurrently. It is not known how different operators will prioritise and value the ability to obtain spectrum for continued GSM service or for provision of liberalised services – this will only be determined by the assignment round of the auction. It is possible that an operator would place a higher value on the ability to re-configure its network early than on maintaining the existing position within the band, and the sequential actions might require one operator to vacate spectrum so that another operator can move-in to that position in the band. ComReg also needs to consider that network sharing operators might want to hold contiguous assignments in the band."*

130. In its letter to ComReg dated 23 January 2012, H3GI stated its disagreement with Telefonica's assertions that transitional activities will take a significant amount of time and that the entire band will be required for this transition.

[51] See Section 7.47 of ComReg document 11/60

[52] Section 11 of Telefonica's response to ComReg document 11/60

5.2.3 DotEcon commentary

131. We note that many of the issues raised by respondents on the subject of Advanced Commencement are mainly technical in nature and relate to the availability of blocks A and B and the need for re-location, re-engineering and re-tuning by network operators. We do not comment on these issues.

132. However, with regard to the payment of additional daily SUFs in the case of Advanced Commencement of licences, we consider that such an approach is justified, as a bidder also gains benefits as well as paying additional SUFs. Bidders need to assess the probability of Advanced Commencement and the net benefit it would provide after the payment of SUFs when making their bids. Notice that if bidders did *not* pay SUFs during the additional time that spectrum could be used, then this would *increase* the impact of Advanced Commencement on licence value. Difficulty in forecasting licence value appears to be part of H3GI's complaint. However, this uncertainty is *reduced* by paying additional SUFs if there is advanced commencement, as this decreases the difference in licence valuation between the cases where Advanced Commencement occurs or does not occur.

133. In this respect, we would note that in the Draft Information Memorandum, ComReg outlines two methods of obtaining a commencement date for a liberalised use licence before 1 February 2013. Furthermore, it was noted in the same document that ComReg will notify winning bidders of lots to which advanced commencement could apply and that notification will outline the obligations that the winning bidder has to fulfil in advance of the issue of the liberalised use licence. This will include how any additional SUF payments and/or rebates that may apply would be calculated in the case of advanced commencement being permitted.[53]

134. In addition, we clarify that it remains possible to incorporate the advanced commencement proposals into the assignment stage of the proposed award process.

[53] See Section 2.4.2 of ComReg document 11/75

6 Award format

6.1 DotEcon's stated views and recommendations to date

135. Section 6.1 of ComReg document 11/58 provides a detailed review of our discussion of various auction formats considered over the course of the consultation process. While not wishing to re-state the full description here, we note the key points:

- In ComReg document 09/99c, published in December 2009, we assessed the relative merits and drawbacks of both a Combinatorial Clock Auction (CCA) and a Sealed Bid Combinatorial Auction (SBCA) formats in the context of a 900MHz band only award. We recommended the use of a SBCA given the relative benefit of reducing common value uncertainty using an open auction format versus the greater risks of strategic behaviour to weaken competition in such a format.
- In conjunction with the proposed inclusion of the 800MHz band in a joint award with the 900MHz band in ComReg document 10/71, we revisited the discussion of the auction format in our report (published as ComReg document 10/71a) in September 2010. Based on respondents' arguments that there was in fact considerable common value uncertainty and their concerns surrounding business continuity risks for existing GSM licensees, the balance between a CCA and SBCA shifted towards the use of a CCA for the proposed award.
- In our December 2010 report (published as ComReg document 10/105a), taking into account the proposed inclusion of the 1800MHz band into the award process, the choice of auction format was not altered as the factors influencing the choice had not changed significantly from previous discussions.

136. In ComReg document 11/58, we concluded that the use of a CCA combined with the use of relative caps for constraining supplementary bids was an uncontested aspect of the proposals and thus we did not consider the issue further. This section considers additional comments put forward by respondents to ComReg document 11/60 in respect of the use of a CCA for the proposed award of sub-1GHz and 1800MHz spectrum.

6.2 Respondents' views

137. In their responses to ComReg document 11/60, eircom Group[54] and Vodafone[55] both restated their support for the use of a CCA format combined with the relative cap rule. Specifically, Vodafone commented that this is a

[54] "eircom Group agrees in principle with the high level design proposal of multiple combinatorial clock rounds subject to detailed activity rules yet to be published for review by interested parties." See page 9 of eircom Group's response to ComReg document 11/60

[55] "Vodafone supports the use of a CCA format when combined with the relative cap activity rule…" See page 3 of Vodafone's response to ComReg document 11/60

reasonable approach and in large measure addresses their previous concerns (including the issues of risks of serious service disruption that could arise as outcomes of the alternative auction formats).[56]

138. However, in its response to ComReg document 11/75, Vodafone commented that its interpretation of the rules outlined in the Draft Information Memorandum were to make the CCA more like a Simultaneous Multiple Round Ascending (SMRA) auction. On this basis, Vodafone commented that ComReg could just run an SMRA as has been run in other countries in Europe recently.[57]

139. Telefonica was not as supportive, and expressed concern that auction rules associated with CCAs are relatively complex to read and interpret compared to other formats such as an SMRA. As such, Telefonica noted that if ComReg is to proceed with a CCA, the rules should follow closely the rules used for recent awards in other countries.[58]

140. Telefonica provides comment on a number of key aspects of the process:

- It is important to have as much certainty as possible over the scheduling of bidding rounds, so that bidders can manage internal governance processes. ComReg should set clear bounds within which it will make decisions on round scheduling;
- ComReg should set clear bounds within which it will make decisions on bid increments and in particular to focus on absolute bid increases not just percentage increases;
- Given that activity rules are one of the more complex aspects of the auction, Telefonica urges ComReg not to deviate from rules used elsewhere without very clear explanation;
- Regarding information revelation in primary rounds, given ComReg's stated concern about tacit collusion, Telefonica views restrictions on transparency as a more effective and less distorting measure to tackle this issue than setting higher reserve prices;
- Telefonica does not see any reason for restricting information regarding base prices for each bidder and urge full revelation of results as soon as the winner and price determination process following the supplementary round is concluded, as this should help all bidders prepare for the assignment bid round;
- To avoid risk of abandonment, ComReg should require the payment of the relevant fee following the clock and supplementary rounds before commencing the assignment round. If there is a default at this time, it will

[56] See page 3 of Vodafone's response to ComReg document 11/60

[57] See page 12 of Vodafone's response to ComReg document 11/75

[58] Telefonica provide the Danish 2.6GHz auction as an example. See page 24 of Telefonica's response to ComReg document 11/60

be possible to re-run the primary rounds before concluding the auction; and

- In the supplemental round there should be more transparency. The winners, the number of lots per winner, and the price to be paid will all simply be announced following the Supplementary Bid Round without any facility for bidders (winning or losing) to verify how their particular bid led to the final result. This will be of concern where the outcome of the Supplemental Round is materially different from the status at the end of the Clock Rounds.

6.3 DotEcon commentary

141. Although respondents to ComReg document 11/60 were generally in favour of the use of a Combinatorial Clock Auction for the proposed award process, there were a number of comments related to detailed auction rules, namely from Telefonica, for example in relation to round scheduling, bid increments, activity rules and information revelation.

142. Following the submission of responses to ComReg document 11/60, ComReg published the Draft Information Memorandum[59] which aims to outline the detailed auction rules including those in relation to round scheduling, bid increments, information revelation and activity rules, and respondents have since had a chance to provide comments on these detailed auction rules. In this report, we do not provide detailed comment on the issues raised by Telefonica, but refer the reader to the detailed auction rules as laid out in ComReg document 11/75.

143. Furthermore, in reviewing respondents' comments on the Draft Information Memorandum, we note that where the above issues have not been clarified to the satisfaction of respondents, the issues have been re-stated or respondents have referred back to their comments raised in response to ComReg document 11/60. As such, we will return to any outstanding issues related to the detailed auction rules in our forthcoming report in relation to responses to the Draft Information Memorandum**.**

144. In relation to references made by respondents to possible use of an SMRA, we have previously noted the drawbacks of such an approach relative to the use of a combinatorial clock auction. In our report published as ComReg document 09/99c, we provided a full discussion of candidate auction formats along with a discussion of their relative advantage and disadvantages. Section 6.2 of ComReg document 09/99c provided comment on the use of a SMRA. The greatest problem with such an auction format it that it is poorly suited to dealing with aggregation risk since it is possible that, while bidding on a combination of lots, the bidder could end up as a standing high bidder on some but not all of the lots which they wished to win. Furthermore, there are substantial fragmentation risks and with the high level of transparency it

[59] ComReg document 11/75

would be easy to formulate gaming strategies and to establish tacitly collusive arrangements.

145. In contrast, a combinatorial auction removes the problem of aggregation risks since a bidder can express mutually exclusive package bids of which the bidder will win at most one. Package bids are also non-divisible, meaning that a bidder will either win the package in its entirety or fail to win that package in its entirety. We consider this to be of particular importance in a multi-band award which involves the simultaneous award of both substitutable and complementary spectrum, with bidders benefiting from being able to bid for complete packages with a mix of spectrum to suit their needs. Furthermore, a combinatorial clock auction with multiple open rounds mitigates common value uncertainty. We have also proposed specific activity rules for this auction that address the issue of business continuity risk for GSM incumbents, in that it is possible to pursue strategies that enable a bidder to win no less spectrum than bid for in the final clock round provided that bidder is prepared to make sufficient high bids.

146. We maintain our position that a combinatorial clock auction is the most appropriate auction format for this award process.

6.4 The Swiss multi-band auction

147. In a letter to ComReg dated 1 March 2012, Telefonica raised concerns about the outcome of the Swiss multi-band auction concluded at the end of February 2012. eircom Group also raised concerns about the outcome of the Swiss auction in a letter to ComReg dated 9 March 2012. This auction included 800MHz, 900MHz and 2.6GHz spectrum and used a CCA format, though with somewhat simpler activity rules than proposed for the Irish multi-band auction.[60] In this subsection, we consider the points raised by Telefonica and eircom Group at this very late stage.

148. Telefonica did not articulate clear and specific objections to the approach taken in Switzerland, but rather had diffuse concerns about disparities between the prices paid between the three winning bidders. Telefonica considers that this 'disparity' suggests that the mechanism may have been susceptible to strategic behaviour and failed to give bidders clarity and certainty about the amount that they were likely to pay as a result of their bids. Telefonica did not explain why they considered that this inference could be drawn from the auction results. eircom Group commented that similar disparities in Ireland would be highly damaging to the competitive functioning of the market but did not provide an explanation for this view.

149. We do not consider that the Swiss result raises any concerns about the appropriateness of a CCA format for a multi-band auction. Moreover, we do

[60] DotEcon advised the Swiss regulator BAKOM on the design and implementation of this auction. The comments here are based solely on public information concerning the auction outcome and general features of the auction design; they are not based on any aspects of the bidding strategies actually adopted by bidders in the auction or any other information not already in the public domain.

not consider that it is reasonable to draw the inferences suggested by Telefonica.

150. Whilst the results of the Swiss auction are public, the specific bids made by individual bidders are not public and will remain confidential. Therefore, we are not able to conduct a detailed post mortem of the result on the basis of actual bids submitted. Confidentiality of the bids was a specific feature of the Swiss auction and has been used in some other auctions (e.g. the Dutch 2.6GHz auction) to protect the business secrets of bidders (indeed, as requested by some bidders during the consultation process on the auction design). This approach is entirely compatible with transparency of the process, as the procedure for determining the winning outcome and prices was unambiguously defined as part of the auction rules and the actual result subject to rigorous verification.[61]

151. In the Swiss auction there were just three bidders (the incumbent operators). As these three bidders all won spectrum in the award process, the entirety of competition within this auction arose from one or more bidders wanting larger packages of spectrum than they eventually won.

152. Under these circumstances, opportunity cost pricing can easily lead to bidders paying different amounts for similar spectrum packages. Consider a simple example with just two bidders – A and B – who both win identical packages that exhaust the available lots. Therefore, each bidder wins half of the available spectrum. (The specific details of the lots available are irrelevant to the example and for simplicity let us suppose there are no spectrum caps.)

153. Now suppose that bidder A bids for just one package, which turns out to be its winning package. In contrast, bidder B bids for a variety of different packages including some packages larger than its winning package (i.e. containing at least as many lots in each category as its winning package and strictly more in one or more categories). Because of the different bids made by each bidder, they are in an asymmetric situation when it comes to determining the prices they pay.

154. In particular, bidder A's opportunity cost is determined by the larger bids of bidder B that are precluded by A winning the spectrum it wins. Therefore, A's winning price is determined by the incremental value that B places on adding lots to its winning package. In contrast, bidder B has a zero opportunity cost, as even if B is not awarded any lots, then bidder A has not demanded any package larger than its winning package. Therefore, bidder B will pay reserve price.

155. This price difference is not a 'disparity' as the two bidders are not in symmetric positions. Bidder A has not competed for any additional spectrum beyond what it has won; this benefits bidder B, not bidder A itself.

[61] ComReg has indicated that it intends to follow a similar practice and has indicated, in section 4.6.6 of document 11/75, the information that will be released .

156. It is also clear in the example that the outcome has not been distorted by strategic behaviour. It could be that bidder A is only interested in one package, in which case this outcome is efficient and the winning prices support this efficient outcome.

157. Alternatively, it could be that bidder A has unsuccessfully attempted to game the auction by not submitting bids for larger packages, even though it places value on winning incremental spectrum additional to its winning package. In some auction formats – such as the SMRA – such a strategy of moderating the quantity demanded may benefit a bidder by reducing competition within the auction and securing a smaller quantity than ideally wanted, but at a much better price. This behaviour is sometimes called 'strategic demand reduction'. However, this strategy does not work in a CCA, as this simple example demonstrates. If bidder A moderates the quantity it demands, by not bidding for larger packages it actually values, then this benefits the rival bidder B, but not bidder A itself. This is a deliberate feature of the second price rule intended to disincentivise gaming behaviour and encourage straightforward bidding. Therefore, if there was strategic behaviour by bidder A in this example, it has been penalised by the pricing rule.

158. To provide appropriate bidding incentives, it is necessary for bidders A and B to pay different amounts even though they may win identical packages in this example. This is not discriminatory as the two bidders are not in symmetric positions despite winning the same package. Winning prices are determined by the counterfactual where a bidder is not awarded any lots and the counterfactuals are quite different for the two bidders.

159. This simple example also demonstrates the value of using a CCA in situations where demand is likely to come primarily from incumbent operators and be closely matched to available supply. With a CCA, there are good incentives for bidders to compete for additional spectrum. In particular, where bidders have value for additional spectrum it is worthwhile for them to bid for various packages reflecting the incremental value of adding further lots. In the event that bids for larger packages are unsuccessful, this will typically not result in the bidder paying more for a smaller winning package (relative to the case in which the bidder did not make bids for larger packages). A bidder moderating the quantity it demands reduces competition for rivals and the amount that they pay, but typically will not benefit the bidder itself.

160. Telefonica raises the further point that the amount that a bidder may need to pay in a CCA is unpredictable. Whilst it is true that a bidder may often pay less than its winning bid, this cannot be characterised as 'unpredictability' detrimental to a bidder's interest. In particular, where a bid is made for a package, this is a commitment to pay any amount up to and including that bid amount. Depending on the strength of competition from rivals, it is quite possible that a bidder could pay its entire winning bid or close to this. Therefore, it is quite unsafe for a bidder to assume that if a bidder bids in excess of its true value for a package, then it will not have to pay this amount as the winning price will be less; this would be a highly risky strategy. Furthermore, there is no clear benefit from such a deviation from straightforward bidding. It simply creates the risk that a bidder will win a package and pay in excess of its valuation for no clear benefit in terms of increasing its chances of winning the package at a price less than its valuation;

furthermore, such a bid may distort the preference expressed by the bidder across different packages, resulting in the bidder winning a package that it regrets after the event.

161. The second price rule largely removes any need for a bidder to consider the bidding strategies of rivals and allows a bidder to focus on expressing its own preferences across different packages. The winning price reflects the minimum amount that the bidder needs to pay to win given competition from rivals. Therefore, rather than creating unpredictability, this approach creates a large measure of predictability for bidders, by removing dependence of their optimal bidding strategy on extraneous factors outside the bidder's control.

162. In the CCA, the prices established in the open primary bid rounds are intended to provide an indication of the likely price that winners will pay. However, this is only an approximation, as it is not possible to consider the full range of issues created by packing together bidders' competing demands within the available spectrum until after the supplementary bid stage when the full range of alternatives that bidders are prepared to accept is known. Therefore, it is always possible that prices winners will pay will vary – possibly significantly - from the price of their winning package in the final primary bid round, but will nevertheless not exceed their winning bid. The extent to which prices in the final primary bid round approximate eventual winning prices depends on issues such as the intensity of competition for spectrum and the extent of demand complementarities (i.e. valuation synergies when winning more lots).

163. The Irish multi-band auction benefits from improved activity rules relative to previous CCAs run to date that should improve the extent to which prices in the final primary bid round are indicative of likely winning prices (though obviously they will always be just an approximation). These rules are detailed in the draft Information Memorandum. In particular, there is a final price cap to limit the extent to which bidders can express an incremental demand for lots in excess of their final primary package at a value exceeding the lot prices applying in the final primary bid round. This measure makes the final primary bids more committing. At the same time, greater flexibility is provided for bidders to bid for their most preferred packages in each primary bid rounds through provisions for relaxed primary bids. We note that Ofcom has proposed similar rules in its current consultation for the UK 800MHz and 2.6GHz auction and that ACMA is proposing a somewhat similar approach for its next auction in Australia.

7 Eligibility points and activity rules

7.1 DotEcon's stated views and recommendations to date

164. Section 7 of our August 2011 report (published as ComReg document 11/58) gives a detailed description of our recommendation of eligibility points for different lot categories. The key points considered in forming our recommendation include:

- Bidders would have a total amount of eligibility to bid in each time slice and would not be able to increase bidding in one time slice as a result of reducing activity in the other;
- Given the substitutability of 800MHz and 900MHz spectrum, a bidder would be able to switch its bidding between 800MHz and 900MHz lots subject to a cap on total bidding activity within that time slice;
- It would be possible to transfer bidding eligibility from sub-1GHz spectrum to 1800MHz spectrum and vice versa within a time slice, as at the margin the bands are substitutes (even if they are complementary in the large, in that some bidders may want a mix of spectrum);
- Taking into account likely value differences between sub-1GHz spectrum and 1800MHz spectrum due to different levels of supply and differing intrinsic value (in terms of propagation characteristics), there should be a difference in the number of eligibility points for a single lot of sub-1GHz spectrum and a single lot of 1800MHz spectrum;
- The findings of our December 2010 benchmarking report (published as ComReg document 10/105a) suggested that the value of a 2x5MHz lot above 1GHz is approximately half that of a 2x5MHz sub-1GHz lot. Therefore, we proposed that sub-1GHz lots would have twice as many eligibility points associated with them as 1800MHz lots.

165. We, therefore, proposed the following eligibility points for these lot categories:

Band	Number of eligibility points attributed to a 2x5MHz lot in a given time slice
800MHz band	**2**
900MHz band	**2**
1800MHz band	**1**

166. In addition, in our July 2010 report (published as ComReg document 10/71a), we recommended the use of a relative cap activity rule. The Draft Information Memorandum contains detailed proposals for activity rules, including a final price cap on all supplementary bids. This is aimed at providing reasonable certainty for bidders seeking to win spectrum for business continuity reasons. Because of the restriction this imposes on supplementary bids, the proposed

auction rules also contain provisions to allow bidders additional flexibility to bid for packages of lots in the primary bid rounds through so-called "relaxed primary bids".

167. Whilst acknowledging that the proposal for a relative cap activity rule had been welcomed by respondents, detailed activity rules had not been outlined prior to publication of the Draft Information Memorandum (ComReg document 11/75).

7.2 Respondents' views

168. In their responses to ComReg document 11/60, two respondents provided comments on the proposed eligibility points. eircom Group stated its agreement, in principle, with the design of eligibility points, and Telefonica considered that ComReg's proposed eligibility points ratios are reasonable and the decision to link minimum prices to eligibility points within time periods is prudent.[62] However, in addition, Telefonica expressed concern that the eligibility points between 1800MHz and 800/900MHz spectrum would have an undue effect on the pricing of 1800MHz spectrum.

169. With regard to the activity rules, in their responses to ComReg document 11/60, eircom Group, Vodafone and Telefonica all expressed their support for the use of relative cap activity rules; however, Telefonica added that, given this is one of the more complex aspects of the auction, ComReg should not deviate from rules used elsewhere without very clear explanation.

7.3 DotEcon commentary

170. Overall, there was a broad measure of agreement with the proposed eligibility points for each lot category.

171. With regard to Telefonica's point about the minimum prices, the eligibility points of spectrum blocks in the 800/900MHz and 1800MHz bands were set based on the estimated value difference between 1800MHz and sub-1GHz spectrum (estimated using a benchmarking approach), not the other way around. The proposed activity rules and auction format do not require the relative prices of 800/900MHz and 1800MHz spectrum to remain locked in a 2:1 ratio. Therefore, we do not consider that there are reasonable grounds for Telefonica's concern.

172. The detailed activity rules described in the Draft Information Memorandum (ComReg document 11/75) make provisions for "relaxed primary bids" which assist significantly in ensuring that the choice of eligibility points for different lot categories should not have an undue influence on the auction outcome. Therefore, the precise choice of relative eligibility points is not a critical aspect of the auction design and any reasonable approximation of relative value should be adequate.

[62] See page 54 of Telefonica's response to ComReg document 11/60

173. Following publication of the Draft Information Memorandum, which provides details of the auction rules, including further detail on the proposed activity rules for this auction, respondents were provided with an opportunity to provide comment on the exact activity rules proposed. Respondents' provided a number of comments on the detailed activity rules proposed. Due to the technical nature of this issue and its importance to the detailed auction rules, we will address the issue of the proposed activity rules in more detail when responding to comments on the Draft Information Memorandum.

8 Spectrum packaging

8.1 DotEcon's stated views and recommendations to date

174. This section discusses a number of the key features of the proposed auction design that have been consulted on previously, including:

- **Lot size:** Spectrum in all three bands will be awarded in lots of 2x5MHz.
- **Licence duration:** All licences awarded in the auction will be of finite duration, with the auction outcome determining the allocation of spectrum in these bands for a 17-year period running to 2030.
- **Two time-slice proposal:** Spectrum in these bands will be awarded from January 2013 to July 2030 in two distinct licence periods ('time slices') which, although separate, can be bid for together (as packages of lots) in the award process:
  - First time slice - spectrum rights of use covering February 2013 to 12 July 2015; and
  - Second time slice - spectrum rights of use covering 13 July 2015 to 12 July 2030.

  The two time slices are needed to take account of the fact that, for a small part of the licensing period, there will continue to be existing licence holders in the 900MHz and 1800MHz bands:
  - In the 900MHz band, Meteor, whose licence expires in July 2015;
  - In the 1800MHz band, Telefonica and Vodafone, whose licences expire in December 2014, and Meteor, whose licence expires on 12 July 2015.
- **The possibility of interim licences from December 2014 to July 2015 (1800 MHz band):** In the case where Telefonica and Vodafone were not to avail of the early liberalisation option for spectrum in the first time slice, and did not win sufficient liberalised spectrum in the first time slice but won liberalised spectrum in the second time slice, there would be a period of about six months between the expiry of their existing licences and the commencement of new liberalised licences, raising the issue of whether ComReg would need to provide licences for the interim period to ensure continuity of GSM services.
- **Preparatory licences until 2013:** All winners of liberalised rights of use in the proposed multi-band spectrum award would be issued with a "preparatory licence" as soon as practicable following completion of the proposed award. Such a licence would enable recipients to install networks and associated equipment but would not allow any wireless telegraphy transmissions in any of the relevant bands.

175. In the following sub-sections, we discuss in turn a number of aspects of spectrum packaging in the proposed award about which there has been comment from interested parties in their responses to ComReg document 11/60. Other issues such as the advanced commencement of liberalised 900MHz spectrum contingency and the early liberalisation option are

discussed elsewhere in this document, in Section 5.2 and Section 9 respectively.

8.2 Licence duration

8.2.1 Respondents' views

176. In response to ComReg document 11/60, three operators (eircom Group, Telefonica and H3GI) opposed ComReg's view that licences awarded during the auction would be for a finite period only. The main arguments presented by the respondents in favour of indefinite licences include that:

- the approach fails to promote continuous investment;
- there will be a lack of incentive for licensees to continue to invest in their networks in the final years before licence expiry; and
- there should at least be a minimum notice period before termination of licences – this period should be no less that 5 years.

Further, it was asserted that ComReg should amend the 3G licences of Vodafone, Telefonica, Meteor and H3GI to provide that they too are indefinite.

177. Furthermore, H3GI refers ComReg to an independent report commissioned by H3GI from NERA Economic Consulting ("NERA") contained in Annex 3 of its response to ComReg document 11/60.[63] In this report, NERA concludes that there is a strong case for Ireland to adopt indefinite terms for mobile spectrum licences, subject to suitable conditions being imposed to protect ComReg's ability to fulfil its statutory objectives. H3GI re-iterates its previously expressed position and urges ComReg to award "indefinite licences" in respect of 900MHz and 800MHz spectrum and amend the 3G licences of Vodafone, Telefonica, Meteor and H3GI to provide that they too are indefinite (so that equality of treatment is protected).

178. In its report, NERA discuss three different approaches that regulators can and have adopted for licence duration:

- Fixed term with no defined renewal provision or expectation of renewal;
- Fixed term with a renewal provision or expectation of renewal for another fixed term; and
- Indefinite term with revocation possible in specific and well-defined circumstances.

179. NERA then consider the costs and benefits of each of these approaches from the perspective of stakeholders, including the spectrum manager, incumbent licensees, potential new licensees and consumers.

[63] The same report was also submitted by H3GI in support of its response to ComReg document 11/28 (Review of the Period 2008 - 2010 & Proposed Strategy for Managing the Radio Spectrum 2011 – 2013)

180. NERA also consider the specific case of mobile networks in Ireland and outline what they believe to be the static, dynamic and competitive benefits of moving to indefinite terms.

181. As part of their conclusions and recommendations NERA assert that:

- A shift to an indefinite licence regime would provide stronger incentives for investment and for spectrum trading;
- Indefinite licence terms are better suited to meet the relevant objectives of a spectrum manager, provided they incentivise efficient utilisation of scarce spectrum, and promote competition and investment which should benefit consumers as well; and
- Static and dynamic efficiency gains from moving to indefinite licence terms in Ireland could plausibly be of the order of €250 million to €450 million over a 15 year period.

182. In response to ComReg's consultation on its Spectrum Strategy Statement 2011 -2013, in a letter to ComReg dated 22 December 2011, H3GI expressed its disappointment that ComReg is not proposing to introduce a policy of indefinite spectrum licencing. In this letter, H3GI re-stated its arguments in favour of indefinite licencing for all spectrum bands in Ireland.

8.2.2 DotEcon commentary

183. On the issue of licence duration ComReg has been consistent in its view that licences awarded in the planned process should be for a fixed term.

184. On the 22 November 2011, ComReg published its Strategy Statement, "Strategy for Managing the Radio Spectrum: 2011–2013".[64] In Section 4.3 of this Statement ComReg outlines its position on licence duration and provides its reasons as to why it considers licences of finite duration to allow a spectrum manager to maintain co-ordination of the most important bands and presents its views on the arguments regarding uncertainty and investment incentives in the presence of finite licence duration. Therefore, ComReg has already stated its policy on this matter applying to the auction.

185. In addition, ComReg considered the report submitted by NERA on behalf of H3GI in Section 3.4 of ComReg document 11/88[65] and provided its specific comments. We refer the reader to ComReg document 11/88 on this matter. We also note the further submission from H3GI dated 22 December 2012 which responded to ComReg's Spectrum Strategy Statement 2011-2013 and re-stated its case for indefinite licences.

186. Regardless of the merit or demerit of indefinite licences, it is worth noting that the auction would allocate spectrum in the three bands until 2030. Given that the availability of this spectrum is determined for the next 18 years, it is

[64] ComReg document 11/89

[65] ComReg, 22 November 2011, "Review of the Period 2008 – 2010 & Proposed Strategy for Managing the Radio Spectrum: 2011 – 2013." ComReg document 11/88

unlikely that there would be any material effect on investment incentives in the near term.

8.3 Two time slice proposal

8.3.1 Respondents' views

187. In their response to ComReg document 11/60, two respondents (Vodafone and eircom Group) outlined their support for the two time slice proposal. Vodafone considered that it was appropriate for ComReg to proceed with the currently proposed auction format, including the use of time slices,[66] while eircom stated its agreement, in principle, with the proposal.

188. Additionally, eircom commented that eligible bidders should be refunded the spectrum access fee pro rata for the period, in the case of any delay. H3GI also expressed its view that in the event that 800MHz spectrum availability is delayed, ComReg should refund spectrum fees pro rata.

189. However, on this issue, Telefonica provide additional commentary in its response to the Draft Information Memorandum. Telefonica comments that there is an on-going risk associated with analogue switch-off for the 800MHz band and the delayed completion of the auction process means that there is growing uncertainty around availability of the 900MHz band. It further comments that the risk associated with availability of the 800MHz band in particular will distort valuations in bidding behaviour. Furthermore, Telefonica submits that it does not believe that ComReg's proposal that licensees should be compensated is an adequate solution to this problem.

190. Despite general agreement from other operators, on the two time slice proposal, Telefonica expressed concern with the proposed approach on the basis that ComReg is running out of time to implement this and should adjust the time periods, or dispense with the first time slice altogether.

191. Telefonica's main points are that:

- Given the start date for the first time slice of early 2013, and Telefonica's belief that the earliest the auction can happen is Q3 of 2012, the maximum amount of time left between the auction end and the proposed licence commencement is 6 months or less, providing insufficient lead time for re-tuning and re-location and insufficient time to mitigate the risk of widespread consumer disruption caused by failure to win spectrum at auction;
- ComReg should select a licence start date that leaves sufficient time post-auction to allow for all auction outcomes. Telefonica maintains that it would take 4 years to re-tune and re-locate in the case of the most disruptive scenario of spectrum loss, while noting that Vilicom suggest at

[66] Vodafone noted that its previously proposed modified auction approach whereby ComReg would buy out the tail period of relevant existing licences, no longer appears feasible given the requirement to complete the award process without additional delay. See page 4 of Vodafone's Response

least 2 years would be required. ComReg could leave a sufficient amount of time between the end of the auction and the licence start date and then provide for advanced commencement of the new licences post-auction, in much the same way as it currently proposes if an earlier start date proves feasible following the outcome of the auction;

- Given an auction may not take place until at least mid-2012, there has been a reduction in length of the first time slice to 18 months – no other NRA has ever licensed spectrum on such a short basis;
- The time-slice proposal unnecessarily overcomplicating the auction, with an untested design and thereby increasing the risk of error is something ComReg should seek to avoid;
- The proposal creates scope for gaming behaviour whereby a bidder with lower demand can bid up the price of lots of spectrum for their competitors with greater demand, especially legacy demand which it is public knowledge must be met by incumbents;
- The suggestion that a two time slice approach allows scope for more refined bidding behaviour given different demand for 900MHz spectrum is not necessarily correct. Demand for GSM will simply not disappear in 2015, meaning there is likely to be limited scope for such adjustment of demand for 900MHz spectrum between the two time slices; and
- Contiguity of spectrum across time lots cannot be guaranteed. One example would be where three operators buy two lots of 900MHz spectrum each and a fourth buys one lot in the first time. Then, in the second time slice, the fourth operator buys three lots, while the other operators' allocations reduce to one lot each. In that situation, it is not possible for the fourth operator to obtain contiguous spectrum without requiring at least two of the other three operators to move.[67]

192. Telefonica states its belief that the earliest the proposed multi-band auction can now happen is Q3 of 2012, which would result in a maximum of 6 months between the auction end and proposed licence commencement. Many of Telefonica's arguments are then founded on this belief.

193. With regard to the time available to operators to mitigate the risk of consumer disruption in the case where they fail to win spectrum in the auction Telefonica raise a number of points, including that:

- ComReg itself is proposing that consumers must be given at least 6 months advance notice of termination of any technology, however under the current proposal, Telefonica and Vodafone are likely to have less than six months to cease using the 900MHz band in the event that they do not win 900MHz spectrum.
- New entrants to the band would simply not have enough time post-auction to rollout alternative services for these customers, while no

[67] See page 32 of Telefonica's response to ComReg document 11/60

existing operator has the capacity to pick up these customers if either Telefonica or Vodafone had to exit the band.

- It is wrong to state that the risk of either operator not winning spectrum is eliminated or even that it is remote. ComReg's reasoning wrongly equates how much Telefonica and Vodafone have to pay with actually being either able or willing to pay the very significant sums involved.
- ComReg leaves itself open to the allegation that it is manipulating the auction set up to maximise the pressure on Telefonica and Vodafone (and not the other operators) to purchase spectrum or otherwise face the immediate loss of almost their entire business, thereby unfairly discriminating against these operators.

194. Further, Telefonica asserts that the 2x10MHz sub-cap in the 900MHz band in the first time slice creates artificial scarcity of 800MHz spectrum on account of limited possibilities for switching from 800MHz to 900MHz spectrum in response to relatively high prices for 800MHz lots.

195. Telefonica puts forward three further options that it believes are open to ComReg to consider and it considers are more in keeping with ComReg's statutory objectives. These options include:

- One time slice with all blocks starting 12 months post auction except for three 900MHz blocks starting in 2015. Under this option, the three GSM operators release back 2x2.2MHz of their existing 900MHz holdings, in return for an extension to 2015 of one block each of 900MHz spectrum. This would enable ComReg to auction all but three blocks of 900MHz spectrum with a licence start date of 12 months post auction, with the remaining three blocks being auctioned with a start date of 2015.
- One time slice with licences starting from 2014 and licence buy out from Meteor. This is similar to Vodafone's proposed format in response to ComReg document 10/71, but this proposal would involve buying back only 12 months of the licence, and would give Meteor a longer buffer between auction end and licence start.
- One time slice with licences starting from 2015. Under this option, existing licences would be extended so that they all co-terminate, allowing for a straightforward auction of licences all with the same start date, without having to buy out any licences. This option removes the need for time slices and thereby eliminates the risks outlined above of error, manipulation and licence gaps.

8.3.2 DotEcon Commentary

196. On the issue of a refund of the spectrum access fee pro rata for the period, in the case of any delay, we note that the Draft Information Memorandum outlines further detail on the calculation of rebates associated with any delay.[68] Respondents have given further comment in their responses to

[68] See Section 2.2.6 of ComReg document 11/75

ComReg document11/75 on this aspect of the proposed award process, and we note that issues related to this proposal will be addressed subsequently in responding to those comments.

197. It is self-evident that if there is delay in delivering the auction process then the first time slice will be squeezed and in the case of sufficient delay, may not be worth including at all. However, given ComReg's current intention to successfully complete an auction in 2012 and the speed with which ComReg is currently progressing, we should not formulate proposals on the basis that a delay will occur to that timetable without good reason. This point is further emphasised by the European Commission's view that member states should implement Commission Decision 2011/251/EU *"as soon as possible given the increasing market demand for the introduction of LTE and WiMAX in these bands"*.[69]

198. Clearly, in the event of a sufficient delay, ComReg would need to reconsider the options open to it in ensuring the earliest possible availability of liberalised spectrum whilst allowing sufficient time for re-tuning and re-location activities. However, this eventuality has not yet occurred. Telefonica is assuming that the first time slice is reduced to 18 months. However, on the basis of the current timetable, the first time slice is still expected to last for two and a half years which represents a sufficient period of time to justify using a two-time slice approach.

199. In relation to Telefonica's comments on the suitability of compensation in the event of delayed availability of spectrum, we understand from ComReg that there is no expectation of significant delayed availability of the 800MHz band due to delayed clearance of analogue television. Indeed, the Minister for Communications, Energy and Natural Resources, Pat Rabbitte, has made public that the date for national analogue switch-off will be 24 October 2012.[70] There are no similar factors affecting the availability of 900MHz and 1800MHz spectrum. Given that delayed availability is a remote risk relating to the timing of the start of the licence period (rather than the availability of the spectrum per se), it is more proportionate to use a refund mechanism if a short delay occurs, rather than delay the entire auction process.

200. Furthermore, in response to Telefonica's submission that ComReg should maintain a sufficient time post-auction to allow for transition under any possible auction outcomes, it would seem that it is requesting a period of at least 2 years (based on Vilicom's re-tuning prediction) up to a maximum of 4 years (based on its own estimation). Such a time period seems excessive and could significantly delay liberalised usage of spectrum. Allowing for advanced commencement on a similar basis as is currently proposed does not seem to be a satisfactory option in this case, as this would create significant uncertainty. Operators would not know, until the outcome of the auction was announced, whether liberalised spectrum would be made available

[69] See Recital 6 to Commission Decision 2011/251/EU

[70] DCENR press release 10 January 2012

immediately or not for (at least) 2 years. This would lead to significant difficulties in valuation of spectrum and network planning. We do not see merit in the proposed option.

201. In response to Telefonica's argument that the first time slice is now too short[71], and represents a complex and untested format, we note that this is due to the specific situation arising in Ireland where ComReg is aiming to provide new licences on a liberalised basis, and to deal with complications in the differing expiry dates of existing licences in both the 900MHz and 1800MHz bands. The proposals need to deal with this situation, which inevitably means that the auction process will need some novel features and have a certain unavoidable degree of complexity. Nevertheless, the fundamental elements of the auction design have been successfully deployed in a number of previous spectrum auctions.

202. In response to Telefonica's argument that the two time slice proposal introduces complexity and the risk of error on the part of bidders as a result, we refer back to our arguments in favour of the two time slice proposal in ComReg document 10/71a. In particular, we note that where a bidder wishes to bid for the same amount of spectrum in a band in both time slices, relative to a single time slice approach, the two time slice approach involves no more complexity than the requirement to bid on a given lot in both time slices rather than one; given package bidding there is no risk inherent in the two time slice proposal that bidders risk winning a subset of these lots.

203. In relation to Telefonica's concern that there is a risk of *"gaming behaviour"*,[72] the possibility for such an occurrence in the auction is limited by the provision of a number of restrictions on bidders, including the proposed spectrum caps and eligibility points. In particular, one of the reasons for imposing an additional cap on 900MHz spectrum in the first time slice is exactly this risk. The presence of two time slices is not by itself a reason to expect there to be greater opportunities for gaming behaviour. The auction rules proposed are intended to control any such opportunities, for example through limited transparency and activity rules designed to promote straightforward bidding.

204. We would still consider that implementation of the two time slice approach will allow for more refined expression of bidders' spectrum requirements. In particular, this approach allows for one organisation of operators across the 800MHz and 900MHz bands until 2015 to deal with transitional issues regarding GSM and then, potentially, a different one after 2015 if operators wish to defragment their holdings across the bands.

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[71] *"Telefonica considers that this T1 licence has reached a point where, given its extremely short duration and the difficulties it creates for the auction, it must be fundamentally reassessed."* See paragraph 6.3 of Telefonica's Response to ComReg document 11/60

[72] *"Telefonica considers that there is a real risk of "gaming behaviour" by auction participants, whereby a bidder with lower demand can bid up the price for lots of spectrum for their competitors with greater demand, especially legacy demand which it is public knowledge must be met."* See paragraph 6.5 of Telefonica's Response to ComReg document 11/60

205. Telefonica provides an example to show that continuity of spectrum across time cannot be guaranteed. For the avoidance of doubt, the proposals provide for contiguous spectrum to be assigned to bidders in each time slice. Further, if a bidder receives the same amount of spectrum in a band in each time slice, the frequency range will be the same for both time slices. However, if a bidder does not receive the same amount of spectrum in both time slices (as in Telefonica's example) there cannot be any guarantee that the frequency ranges received in the two time periods will overlap, though each will be a contiguous range. However, such a bidder will be able to express a preference through its bids for frequency ranges in each time period that overlap or when one includes the other.

206. In response to Telefonica's argument that a 2x10MHz sub-cap on 900MHz spectrum will create artificial scarcity for 800MHz spectrum on account of limited possibilities for switching from 800MHz to 900MHz spectrum in response to relatively high prices for 800MHz lots, we note that according to Telefonica (and other respondents to ComReg's various consultations regarding the proposed award) much of this band will be required in the short term for the provision of continued services to GSM customers, and that the reduction of spectrum allocated to existing operators in this band would result in a lengthy process of re-tuning. We also note that these existing operators span over 5 of the 7 lots available in this band. Therefore, given that this proposed sub-cap covers only the first time slice, it is not clear what feasible outcomes which were acceptable to the existing operators (including Telefonica) would be precluded by the 900MHz sub-cap in the first time slice relative to the situation where the sub-cap did not exist.

207. In response to Telefonica's proposed alternative approaches, we discuss each in turn:

a) In response to the first of these suggestions (one time slice, 4 lots commencing 12 months post-auction, 3 lots commencing in 2015), we consider that this raises issues related to the partial assignment of spectrum to incumbent operators. In particular:

i) Given that 4 lots in the band would be awarded on a liberalised basis 12 months post auction, there may be few potential buyers other than the incumbents of the three 900MHz lots starting in 2015. This is because any operators entering the band in 2015 would be entering a market for advanced mobile services provided using spectrum in this band that would already be relatively well developed (as opposed to commencing services at the same time as winners of liberalised 900MHz spectrum commencing 12 months post auction);

ii) Similarly, bidders without existing sub-1GHz spectrum holdings might consider unfavourably 900MHz lots available at the later date of 2015 relative to 800MHz spectrum, given the similar consequences this may have for their competitive potential in the market for advanced mobile services;

iii) By committing three lots in this band to GSM usage rights only until 2015, this option would remove the incentive for 900MHz

incumbents to phase out GSM services and transition to more advanced technologies as soon as practicable;

iv) This approach assumes that the two time slice approach and the 900MHz sub-cap would be removed from award proposals. In this instance, reducing the amount of liberalised spectrum available 12 months post auction in combination with the 2x20MHz sub-1GHz spectrum cap creates perverse incentives for bidders as they may be encouraged to bid for more 900MHz spectrum in an attempt to block competitors gaining access to liberalised sub-1GHz spectrum prior to 2015. For example, such a scenario would allow for one bidder to win at least three of the four 2x5MHz lots of available 900MHz spectrum available earlier than 2015. While the negative effect on competition that this would create might be tempered by simultaneous availability of 800MHz spectrum, as discussed in previous consultations, this will not be as good a substitute for 900MHz spectrum in the period up to 2015 (owing to different technologies in each band, the customer equipment deployed and associated equipment availability).

b) As Telefonica note, the second of these options (one time slice, licences starting in 2014, buyout of remaining term of Meteor licences) is very similar to the modified format proposed by Vodafone in its response to ComReg document 10/71. ComReg rejected this initial proposal for the reason, among others, that it would be difficult to negotiate licence buy-back from Meteor. Telefonica comment that this would not be the case here as "*Telefonica's proposal would involve buying back only 12 months of the licence, and would give Meteor a longer buffer between auction end and licence start.*"[73] However, this proposal would require Meteor to give up 2x2.2MHz of its existing 900MHz spectrum assignment during the lifetime of its existing licence. It is still the case that this proposal is entirely dependent on the assent of Meteor. Further, it would require agreement between the three existing operators in the 900MHz and 1800MHz bands and ComReg on the price that would be paid by ComReg (as an offset to the upfront fee to be paid by these operators if they were to win spectrum in the award) for the curtailment of existing licences. In this respect, we note the considerable disagreement in the consultation process to date as to how such prices may be determined. In addition, given the principle that ComReg has set out that liberalised licences will only be awarded to winners in a competitive process, this would mean the delay of availability of liberalised 900MHz and 1800MHz spectrum for a year relative to current proposals. This proposal also leaves open the issue of what would happen to spectrum in the 800MHz band: either this spectrum would be unallocated for a year relative to current proposals; or it would be necessarily decoupled

[73] See paragraph 6.11 of Telefonica's response to ComReg document 11/60

from the availability of 900MHz spectrum. Both of these alternatives represent a considerable downside to this proposal.

c) In relation to the third of Telefonica's proposals (one time slice, all lots licensed from 2015), we are concerned that the licence period would not commence until 2015. In particular, we note that the Commission Decision 2011/251/EU requires that spectrum should be liberalised *"as soon as possible"* and this approach unnecessarily delays liberalisation, as Telefonica itself acknowledges. Furthermore, where liberalisation is delayed, consumers in the Irish market will not benefit from the enhanced services likely to arise from licensees' timely access to liberalised spectrum. In addition, this proposal leaves open a number of further issues that have been contentious in the consultation process to date; in particular it leaves open the issue of licensing of spectrum in the 900MHz and 1800MHz spectrum bands to O2 and Vodafone until 2015; and it does not consider how to licence spectrum in the 800MHz band, which is a long run substitute for 900MHz spectrum and is due to become available for licensing in February 2013. As such, while this proposal addresses one particular point, it is not a comprehensive and feasible alternative to the current approach.

8.4 Interim licences in the 1800MHz band

208. The proposed approach to the multi-band award raises timing issues in the 1800MHz band, due to a six and a half month period between the expiry of Vodafone and Telefonica's current GSM 1800MHz licences and the proposed commencement date of liberalised 1800MHz licences in the second time slice (13 July 2015).

209. As noted by ComReg in its August 2011 consultation (published as ComReg document 11/60), the timing difference only becomes an issue where Vodafone and/or Telefonica do not avail of the proposed early liberalisation option and do not acquire sufficient liberalised spectrum in the first time slice to allow them to continue to provide a GSM service during this six and a half month period.

210. ComReg took the view that given the inherent uncertainty owing to the results of the auction not being known, and the contingent nature of the requirement for such licences, it would be inappropriate for it to commit to granting any future interim GSM 1800MHz rights at that time.[74] ComReg went on to confirm that it will re-consider the matter once the outcome of the auction is known and significantly prior to the expiry of the relevant GSM 1800 MHz licences. ComReg's position on the matter is to "*re-consider the matter once the outcome of the auction is known…and determine whether to grant such licences*".[75]

[74] See paragraph 4.126 of ComReg document 11/60

[75] See paragraph 4.127 of ComReg document 11/60

8.4.1 Respondents' views

211. There were two respondents (Telefonica and Vodafone) that provided further comment on this issue as part of their respective responses to ComReg document 11/60.

212. Telefonica submitted that this stance by ComReg is contrary to its obligations and objectives, and in itself renders the auction proposal as a whole legally non-compliant.

213. [Confidential text removed.]

214. In addition, Vodafone highlights this issue as a problematic aspect of the proposed structure of the multi-band award process that would present significant risks of disruption to the delivery of current standards of communications services. Vodafone comment that a firm advance commitment from ComReg to grant interim 1800MHz licences in relevant circumstances is appropriate and necessary and would in large measure address the uncertainty and possible risk to quality of service for a period that otherwise arises under ComReg's current spectrum auction proposals.

215. Referring back to its response to ComReg document 10/105, Vodafone notes that the opportunity cost of granting Interim 1800 MHz licences is very low to non-existent while the benefits would be considerable. Vodafone therefore urges ComReg to provide a commitment to grant interim 1800MHz spectrum licences, where requested by licensees in the relevant circumstances highlighted above, in its Decision on the multi-band spectrum award process.

8.4.2 DotEcon Commentary

216. ComReg has previously outlined is position on this matter. We do not comment further on this issue, but note that ComReg has set out its latest position on this matter in its Response to Consultation and Decision.

9 Early liberalisation option for existing licence holders

9.1 DotEcon's stated views and recommendations to date

217. The current proposal as presented in ComReg document 11/60 is based on the option put forward in ComReg document 09/99c that Meteor should be permitted to liberalise its spectrum in the 900MHz band prior to the current expiry of its licence in 2015. Following the inclusion of spectrum in the 800MHz and 1800MHz bands, any conclusion on this option would be applicable to licences held by the three existing GSM operators in the 1800MHz band. The proposals are intended to ensure that efficient use is made of liberalised spectrum at the earliest opportunity.

218. Following a detailed consideration of the views of respondents throughout the consultation process, in our August 2011 report (published as ComReg document 11/58) we outlined our view on the issue and concluded that existing operators in the 900MHz and 1800MHz bands should be permitted to liberalise existing spectrum holdings, and where this option is taken up, receive a rebate based on purchase price and time remaining on the licences for the spectrum usage rights relinquished in turn. Without such rebates, bidders would not be bidding on an equal footing, as a bidder with a licence in force would determine its bid according the incremental value of liberalising spectrum already held, whereas a bidder winning spectrum *de novo* would reflect the value of spectrum as compared with having none. A rebate places such bidders on a more equal footing.

219. This rebate methodology must reflect the status of a licensee as having a usage right (subject to limitations) that would be curtailed rather than a property right over spectrum. A licensee giving up the tail of a licence (and receiving a liberalised licence in turn) is not in the same position as an owner selling the residual term at market value. In particular, it would not be appropriate for a licensee to receive capital gains associated with any value that an unliberalised licence might have in excess of what the licensee paid for it, or be compensated according to the deprival value of the unliberalised licence to the licensee in its current use.

220. Although notionally we can think about an existing licensee giving up an existing unliberalised licence and winning a new licence (and indeed this is a useful way of understanding the operation of the auction rules), in practice a bidder is simply buying a right to liberalise spectrum that it already has access to. Therefore, the relevant question is whether the amount that a licensee previously paid for a licence should have been different if the term was different, and to base the rebate on this difference.

221. In Section 9.4 of ComReg document 11/58, we outlined a methodology for calculating rebates for relinquishing the tail end of licences within the auction in exchange for receiving liberalised licences for the same time period. While the value differences between the rebates calculated under our methodology and those calculated under ComReg's methodology were small, we noted that these were significantly different from Meteor's proposals and concluded that the methodology proposed by Meteor should not be adopted.

9.2 Respondents' views

9.2.1 Early liberalisation option

222. eircom Group provided significant comment on the early liberalisation option and the calculation of rebates as part of its response to ComReg document 11/60. Vodafone acknowledged ComReg's adoption of its recommendation that the rebate should take the form of a discount from the up-front and/or annualised spectrum usage fees that would otherwise be payable by the licensee[76]. Telefonica and H3GI did not pass comment on this issue in their responses to ComReg document 11/60.

223. eircom group consider that the early liberalisation option is a critical component of ComReg's proposals and has agreed to the general principles.[77] However, eircom Group expressed its objection to the way in which the rebate is to be calculated.

9.2.2 Calculation of rebates

224. As part of its response to ComReg document11/60, eircom Group considered that it would be upgrading its licence from a technology-specific GSM licence to a technology-neutral licence. It comments that the market price paid less rebate should represent the upgrade cost, i.e. the rebate should equal the market value of a technology-specific GSM licence. On this basis, it considers that the approach considered by DotEcon and the approach ComReg proposes to calculate the rebate is deficient. eircom Group recommends alternative figures for the rebates based on a report prepared for it by Power Auctions LLC.[78]

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[76] *"Vodafone appreciates ComReg's adoption of our recommendation of how rebates from taking up the early liberalisation option should be administered, namely that this should take the form of a discount from the up-front and/or annual spectrum usage fees that would otherwise be payable by the licensee. This approach avoids any distortion that would arise from direct or indirect subsidy of operators by funding this rebate as a direct payment from other licensees/bidders/operators in the market.* " See page 4 of Vodafone's response to ComReg document 11/60

[77] *"It is our understanding that the winner determination algorithm will be designed to ensure that eircom Group will only be successful in seeking to avail of the Early Liberalisation Option if its bid exceeds the opportunity cost of spectrum in question. As such eircom group must pay the market price for the spectrum. Subject to reviewing the detailed activity rules and algorithms yet to be published, we have no objection to this in principle."* See page 12 of eircom Group's response to ComReg document 11/60

[78] *"In effect eircom Group would be upgrading its licence from a technology specific GSM licence to a technology neutral licence. It is our understanding that the rebate is intended to ensure that eircom Group is able to make efficient decisions. The market price paid less rebate should represent the upgrade cost. i.e. the rebate should equal the market value of a technology specific GSM licence. However both the approach considered by Dotecon and the approach ComReg proposes to calculate the rebate are deficient and cannot be justified. We submit at Appendix 2 to this response, an expert report prepared for us by Power Auctions LLC which identifies and corrects for these deficiencies. As such we recommend a rebate of € 4.53m to be allocated to the 900 MHz spectrum and a rebate of € 3.19m to be allocated to the 1800 MHz spectrum."* See Section 3.3.8 of eircom Group response to ComReg document 11/60

225. In its report, Power Auctions LLC recommends a new rebate calculation based on ComReg's and our own proposed approaches. Its calculation builds upon previous calculations by:

a) accounting for growth in the wireless market;

b) removing an unnecessary inflation adjustment; and

c) accounting for the short period before the licences went into use.

Furthermore, Power Auctions comments that it corrects for some *"apparent calculation errors in DotEcon's report."*[79]

226. Using these adjustments Power Auctions LLC recommends rebates of €2.73m for Vodafone, €2.73 for Telefonica, and €7.72m for Meteor. This is in contrast to the rebate figures we proposed in ComReg document 11/58 of €0.81m for Vodafone, €0.81 for Telefonica, and €3.86 for Meteor.

227. Power Auctions LLC notes that our recalculation of ComReg's rebate calculation differed from ComReg's calculations presented in ComReg document 10/105. ComReg excluded the €1.9m administrative fee (to cover the costs of the award process) that Meteor paid as part of its initial spectrum fees in June 2000. In addition, ComReg used a time period of 2.5 years out of a total 15 years for both parts of Meteor's rebate as a simplifying assumption.

228. In ComReg document 11/58, after first recalculating values based on Meteor's proposed methodology which included the corrections made to the ComReg methodology and included an inflation adjustment, we then outlined a new methodology for computing the rebates, and it is on this methodology that Power Auctions LLC provides comment.

229. For clarity, in proposing our new methodology, we acknowledged the need to account for the time value of money and used a discount rate of 10.21% (eircom's WACC). We argued that Meteor was applying the WACC incorrectly to the undiscounted price. For the avoidance of subsequent confusion, this figure is a nominal WACC for eircom in 2008 previously used for regulatory purposes by ComReg. It is not specifically the cost of capital of a mobile operator (which might be greater) nor is it corrected for inflation.

230. Whilst acknowledging there was considerable merit to the approach undertaken by DotEcon, Power Auctions LLC made three substantive comments about the approach we undertook in ComReg document 11/58:

- The numbers included in the report seem to be irreproducible;
- The assumption of "*a constant stream of annualised payment over the term of the licence "* seems to be an absurd assumption to make for mobile telephone licences. For many years, the mobile telephone market has been considered to be one of the fastest-growing sectors of the economy,

[79] See Power Auctions LLC. *Rebate Calculation for GSM License Liberalisation in Ireland: A Review and Recommendation,* Executive Summary

implying a high growth rate in the annualised value that can be imputed to spectrum licences; and

- Why would DotEcon include both an adjustment for the time value of money and an adjustment for inflation? It seems that only an adjustment for the time value of money is appropriate, assuming that 10.21%, the weighted average cost of capital of eircom set by ComReg in 2008, is based on nominal euro, not on real euro.

9.3 DotEcon commentary

231. First, in relation to eircom Group's notion of an "upgrade" value, ComReg's proposals have always been based on the basis that Meteor would be relinquishing its existing spectrum usage rights in "exchange" for liberalised spectrum. This means a reimbursement of fees on existing licences, and the purchase of liberalised spectrum paying the fees set by the auction. The process consists of two separate (although co-dependent) transactions, the hand back of one licence (rebate based on fees for that licence) and the purchase of another licence (and pay fees as set by auction).[80]

232. In particular, as a user of the spectrum, rather than an owner, the rebate should not be calculated on the basis of any notional market value of a technology-specific GSM licence. Equally, the existing licence should not be valued on a deprival basis to the licensee (even if this could be estimated), as the licensee is not giving up anything, but rather gaining an enhanced right to use liberalised spectrum.

233. In relation to eircom's detailed comments on the calculation of rebates, we have considered eircom Group's submission and have reviewed the Power Auctions report commissioned by it. Here we provide comment on the issues raised and outline a revised methodology to calculating the rebates to be issued in the presence of early liberalisation.

9.3.1 Irreproducibility of calculations in ComReg document 11/58

234. In Section 9.4 of ComReg document 11/58, we outlined a methodology for calculating rebates for relinquishing the tail end of licences within the auction in exchange for receiving liberalised licences for the same time period. The value of this rebate was defined as the notional savings in licence fees a licensee would have enjoyed had it bought a shorter licence.

235. To calculate the rebate, we first amortised the licence fee paid at the start of the licence into a notional annual stream, assumed to be paid at the start of the year. This is akin to calculating an annual "rent" for the usage right of the licence. The rebate is then simply the value of this stream over the period of the licence that would be curtailed. In ComReg document 11/58 we calculated the discounted net present value of this stream and applied an uplift for the

[80] This has been expressed previously in Section 9.3 of ComReg document 11/58 and paragraph A6.435 of ComReg document 11/60a.

time value of money using a nominal WACC of 10.21% and adjusted for inflation.

236. Note here that Power Auctions was unable to reproduce our calculations as they amortised the licence fee into monthly streams rather than annual streams. Given the different timing of payment streams assumed, it is not surprising that Power Auctions derived a different set of rebate values as the two calculations are similar, but not equivalent. There is no unique correct approach in terms of a monthly or annual amortisation, given the licence fees were effectively an upfront payment and this is a purely notional exercise. Both approaches should nevertheless give similar answers provided discount rates are not too large. For consistency and comparability to Power Auction's proposals, in our updated rebate calculations below, we will adopt a monthly amortisation of the licence fee. This approach provides a clearer treatment of partial years.

9.3.2 Revisiting our methodology for calculating rebates

237. A number of modifications to our rebate calculations in ComReg document 11/58 are required to deal adequately with inflation. Some of these have been pointed out by Power Auctions in Appendix 2 of Meteor's response to ComReg document 11/60. We set out our proposed rebate calculations and explain what these modifications are and why they are required below.

238. A 15-year licence consists of 180 months. The one-off licence price paid at the start of the licence term (period 0) for a licence with a term of 180 months will be denoted L_{180}^{0} (sub-script defines term of licence in months and the super-script defines the period in whose terms prices are expressed). This can be amortised into a constant *real* stream of monthly payments (π) as follows:

$$\pi = {L_{180}^{0}} \Big/ \sum_{t=0}^{179} \frac{1}{(1+r-i)^{\frac{t}{12}}}$$

where π is a constant real stream of monthly payments;

L_{180}^{0} is the licence price paid at the start of the licence term (in period 0 prices);

r is the *nominal* weighted average cost of capital (nominal WACC); and

i is the inflation rate.

239. Unlike previously, here we have included the inflation rate in our discount rate. The use of a real weighted average cost of capital allows us to derive a constant real stream of monthly payments rather than a constant nominal stream that we had derived in our calculation in our report (published as ComReg document 11/58) using a nominal WACC. Therefore, the implicit assumption here is that the equivalent stream of monthly payments are indexed with inflation, rather than remaining constant in nominal terms.

240. We note that Power Auctions has used a nominal WACC in its calculations, not accounting for the impact of inflation on the amortised value of monthly payment. By itself, this would result in Power Auction's calculation undervaluing the rebate. However, Power Auctions has also assumed a

positive growth rate on the value of the notional stream of monthly payments, which counters this effect.

241. The justification given for assuming that the stream of monthly payments is growing is that the value of spectrum should be increasing with the growth of demand of mobile services. However, this is not an appropriate assumption as we are not concerned with the market value of a licence, only the payment made by the licensee and to impute part of this payment to the tail end of the licence. Movements in the market value are not relevant in this regard.

242. A good analogy can be made with SUFs. The imputation method we are using in effect supposes that rather than a single up-front payment, a licence was paid for with a monthly charge indexed to inflation. This spreads the payment over time and allows us to allocate part of that payment to the tail end of the licence. However, there is no good reason why those payments should be increasing faster than inflation, just as SUFs are simply indexed with inflation rather than increasing at any faster rate. Therefore, the approach we are taking here is consistent with ComReg's general approach on SUFs. In addition, Power Auctions also argues that the period over which the rebate calculations are made should be shortened to the period where Meteor is actually providing services. Again here, the period over the licence term to which Meteor provides service has no bearing to the licence price that would have been paid when the licence was issued.

243. We re-emphasise that we are simply trying to identify how a spectrum access fee *already* paid for a licence would reasonably have been different if that licence had been shorter. Growth in demand for mobile services derived from that licence or whether a licence is actually in use or not are irrelevant factors to such a calculation. Furthermore, we do not include the €1.9m administrative fee (to cover the costs of the award process) that Meteor paid as part of its initial spectrum fees in June 2000 as this was not related to the licence duration and thus would likely still have been charged regardless of the proposed duration of the licence. In support of this point we note that administrative fees were also excluded when calculating the fees payable by Vodafone and O2 for interim GSM 900 licences.[81]

244. If the licence was curtailed to end in period T, then the difference in the initial price that should have been paid would be the terminal value of monthly payments that would be lost due to curtailment:

$$C_T^0 = L_{180}^0 - L_T^0 = \pi \times \sum_{t=T}^{179} \frac{1}{(1+r-i)^{\frac{t}{12}}}$$

where L_T^0 is the discounted net present value of the constant real stream of monthly payments (π) from period 0 to period T.

245. Note that this value (C_T^0) has been discounted back to period 0 and is in period 0 prices; this is the change in the payment that should have been made when

[81] See Section 4.3.2 of ComReg document 11/29

the licence was first awarded. Any rebate additionally needs to consider the time value of money since the licence was awarded.

246. If the rebate was offered in period N, then C_T^0 value should be uplifted for the time value of money between period 0 where the licence was purchased and period N when the rebate was offered to account for the interest charges lost during this period from having bought a longer licence. For this uplift of the time value of money, the use of a nominal WACC (real weighted average cost of capital less inflation) would bring the rebate value to period N prices.

$$C_T^N = C_t^0 \times (1 + r)^N$$

247. Here we acknowledge that applying an uplift for the time value of money using a nominal WACC would already incorporate inflationary effects between period 0 and period N and therefore there is no need to apply any additional mark up for inflation as doing so would double count the impact of inflation between period 0 and period N.

248. In Table 4 below, we present our rebate calculation assuming that the rebate was offered in June 2011, there is a nominal WACC of 10.21% and then present sensitivities around assumed inflation rates of 2%, 3%, 4% and 5%. Note that the level of rebates presented in Table 4 below are not our recommended rebates (which are found in Table 5); Table 4 presents rebates calculated using our proposed methodology but for the same period as alternative rebate proposals presented in the same table for the sake of comparability.

Table 4: Rebate calculation values

	Vodafone	Telefonica	Meteor
DotEcon present calculations with inflation rate of 2%	€1.58m	€1.58m	€3.40m+€0.43m = €3.83m
DotEcon present calculations with inflation rate of 3%	€1.70m	€1.70m	€3.65m+€0.46m = €4.11m
DotEcon present calculations with inflation rate of 4%	€1.83m	€1.83m	€3.92m+€0.49m= €4.41m
DotEcon present calculations with inflation rate of 5%	€1.96m	€1.96m	€4.20m+€0.52m = €4.72m
ComReg document 11/58 (assuming rebate offered in June 2011)	€0.81m	€0.81m	€3.51m+€0.35m = €3.86
Rebate proposals in ComReg document 11/60	€1.37m	€1.37m	€3.41m
Power Auctions recommendations (assuming rebate offered in June 2011)	€2.73m	€2.73m	€6.99m+€0.73m = €7.72m

249. Our modified calculations suggest a higher rebate value than our calculations in ComReg document 11/58 and the values ComReg has proposed in ComReg document 11/60. This is the result of the explicit treatment of inflation detailed above. However, these are substantially lower than Power Auction's recommendations. This is because Power Auctions adopt a 10% annual growth rate in licence value as well as making adjustments to the period over which the calculations were made to reflect when the service was launched. While we do not know the actual real WACC faced by MNOs at the time of the issue of their licences, we believe that the sensitivities on inflation rate we have presented covers the plausible range of this real WACC.

250. To calculate inflation it would seem most appropriate to use the overall CPI (as this is ComReg's proposed measure for adjusting the SUFs in line with inflation). For the time period considered in order to calculate the average inflation we would consider it appropriate to take a relatively long period, for example, dating back to the issue of the licence. We note that the average annual inflation between 2000 and 2011 is about 2.6%, which suggests taking

the lower case amongst the sensitivities presented. Given the minor differences amongst the values presented, assuming that inflation expectations of the licensees were correct at the beginning of the licence period, we consider that using an inflation rate of 2.6% when calculating the rebates would be an appropriate figure to use. Table 5 presents the rebate values based on an inflation rate of 2.6% and on the rebate being paid in June 2012.

Table 5: DotEcon recommendation on rebates

	Vodafone	Telefonica	Meteor
DotEcon present calculations with inflation rate of 2.6%	€1.82m	€1.82m	€3.91m+€0.49m = €4.40m

251. Therefore, we propose that the rebate value for Vodafone and Telefonica be set at €1.82m for their 1800MHz spectrum. Meteor's rebate should be set at a total of €4.40m comprising €3.91m for the 900MHz and 1800MHz licences issued in July 2000, and €0.44MHz for the 900MHz licence issued in January 2001. Assuming a 1:1 ratio of fees between 900MHz and 1800MHz spectrum for Meteor's licence issued in July 2000, (that is the price per MHz is the same for 900MHz and 1800MHz), Meteor's rebate can be presented as €1.47m for its 900MHz spectrum and €2.92m for its 1800MHz spectrum. (These amounts will be updated taking into account the actual date on which rebate is offered when this is known).

252. As an aside, we note that the period over which we have considered inflation was characterised by a number of years of relatively high growth followed by a number of years of low/negative growth. It is exactly for this reason that we consider a long-run rate of inflation for our calculations; while relatively short-run rates of inflation are prone to volatile changes, a long-run average rate of inflation smoothes over such dramatic changes. It is reasonable to assume, given the duration of spectrum licences, that it is the expectation of the average level of inflation over the licence period that operators concern themselves with in evaluating their value of a spectrum licence relative to its cost. This longer-run average rate is also less prone to being dramatically different from reality than estimates based on inflation over relatively short time periods.

10 Implementation of the early liberalisation option

10.1 DotEcon's stated views and recommendations to date

253. In Section 10 of ComReg document 11/58 we discussed the implementation of the early liberalisation option. We refer the reader to that section for a full description of our views on the key issues. In this section, we focus specifically on three issues:

- Bidding procedure for a bidder with no existing licences in the relevant bands in the first time slice – both prior to and during the auction;
- Bidding procedure for bidders with existing licences in the relevant bands in the first time slice – both prior to and during the auction;
- Determining winners and prices to take account of the possible liberalisation of existing GSM licences where existing licensees had bid a sufficient amount that there would be no alternative user prepared to pay more.

254. Since the publication of ComReg documents 11/58 and 11/60, the Draft Information Memorandum[82] has been published in which Section 2.4.1 outlined further detail on how the early liberalisation option would be included in the award process. The rules provide for an existing GSM licensee to have the option of bidding for party-specific lots which, if won, lead to liberalisation of existing GSM licences. There would be two party-specific lots for which Meteor can bid in the 900MHz band and three party-specific lots in the 1800MHz band for each of the existing licensees in the band.

10.2 Respondents' views

255. Only one respondent to ComReg document 11/60 passed comment on this issue. eircom Group notes that the early liberalisation option is a critical component of the proposals and it has no objection to the option in principle. This is based on its understanding that the winner determination algorithm will be designed to ensure that eircom Group will only be successful in seeking to avail of the early liberalisation option if its bid exceeds the opportunity cost of the spectrum in question. As such eircom Group must pay the market price for the spectrum.[83]

256. In its response to ComReg document 11/75, Telefonica commented that the current proposal does not provide a sufficient incentive to liberalise existing GSM licences, and contrary to spectrum assignments, it would seem likely to produce an outcome in the 900MHz band whereby one of the seven lots remains only partially used during the first time slice. Telefonica is concerned that if Meteor decides not to liberalise its partially occupied block, there will only be five lots available to meet the demand (other than Meteor's own

[82] ComReg document 11/75

[83] See Page 12 of eircom Group's response

demand), which could artificially increase contention during the auction, and leave unsatisfied demand at the conclusion of the auction. In addition, this lot would remain under-utilised throughout the first time slice, when it is likely to be of greatest value.[84]

257. Furthermore, in its response to ComReg document 11/75, Telefonica claimed to have identified a "*potential flaw*" in the winner and price determination mechanism where in particular it believed there are circumstances where the auction mechanism can produce an incorrect result, failing to liberalise party-specific lots, or where the winner and price determination might have no solution. Telefonica claimed that this is caused by the inclusion of distinct lot categories to allow liberalisation on GSM licences at so called "*fair market prices*" and provided an illustrative example **[**Confidential text removed**].**

10.3 DotEcon commentary

258. The Draft Information Memorandum[85] has given further details of how the early liberalisation option would be implemented whereby an existing GSM licensee has the option of bidding for party-specific lots that, if won, would lead to liberalisation of existing licensed spectrum. For further details, we refer the reader to Section 2.4.1 of ComReg document 11/75**.** Chapters 3 and 4 of the Draft Information Memorandum give further details on the treatment of these party-specific lots within the award process, including winner and price determination. We will provide consideration of comments received in regard to ComReg document 11/75 in a subsequent document.

259. In regard to Telefonica's comments relating to spectrum scarcity in the 900MHz band for the first time slice, if Meteor do not liberalise, we do not consider that this objection is valid. In particular, the number of lots available to bidders other than Meteor is not affected by whether Meteor liberalises or not. There are two scenarios. If Meteor bids a sufficient amount for its party-specific lots that it would win these in hypothetical open competition (i.e. lumping the party-specific lots in with the other 900MHz lots for the first time slice) then there will be seven lots available, of which Meteor will receive two. Therefore, there are five lots available for other bidders. If Meteor does not bid a sufficient amount to win its party-specific lots in open competition, then it retains its existing GSM licence and there are still five lots available to other bidders.

260. A key feature of the proposals is that those liberalising existing licences must bid for, and pay, a sufficient amount so that there is no implicit subsidy to incumbent licensees, as these licences would in any case be won in open competition. We note that these measures potentially have greatest effect on Meteor and that eircom is in broad agreement with this approach.

[84] See page 18 of Telefonica's response to ComReg document 11/75

[85] ComReg document 11/75

261. In considering responses received to ComReg document 11/75, in particular that from Telefonica, we have identified a deficiency in the detail of the pricing algorithm described. In particular, at present, the calculation of opportunity costs is achieved by the hypothetical elimination of one or more bidders and then the recalculation of the winning bidders. When recalculating the winning bidders, it is important that the supply scenario – the situation with regard to the allocation of party-specific lots, determining the total number of lots available – is not changed to an alternative scenario that was initially infeasible when the winning bids were originally determined. At present, the Draft Information Memorandum suggests that the supply scenario should be re-optimised along with the winning bids in these hypothetical situations without any further constraint, which is incorrect. We apologise for any confusion that this may have created.

262. In the interim, ComReg has requested that, in the interests of transparency, we provide in this document a description of the winner determination and pricing method appropriate when party-specific lots are present, including some simple examples. This is set out in Annex A. We will finalise this in our report considering comments on the Draft Information Memorandum which will be submitted to ComReg for consideration in finalising the Information Memorandum. With the proposed adjustment,, we do not believe that the example provided by Telefonica illustrates a deficiency in the pricing algorithm, nor do we believe that there is any deficiency in the procedures for determining whether or not liberalisation will occur.

11 Full assignment stage

11.1 DotEcon's stated views and recommendations to date

263. Section 11.1 of ComReg document 11/58 sets out a history of our thinking on the implementation of a full assignment round.

264. Having previously considered an 'all or nothing' approach, under which existing 1800MHz spectrum holders would not be permitted to liberalise a subset of their existing frequencies, but rather they would have the option to liberalise the entirety of their existing holdings, we identified a number of drawbacks to this approach. As an alternative, we considered a 'full assignment round', that would involve the inclusion of all spectrum in the band in a frequency assignment process (whether or not liberalised). Within this option, frequencies linked to existing 1800MHz licences from 2013 onwards would be determined within the auction. A number of significant advantages with the 'full assignment round' approach were identified**.**

265. In ComReg document 10/105a we concluded that the 'full assignment round' approach would be the best option for the assignment of 1800MHz frequencies to bidders from the beginning of 2013. This had the following significant advantages:

- As the entire band is available for award, it is possible to guarantee that only contiguous blocks of spectrum are awarded;
- Given the assurance of contiguous frequencies, this approach alleviates the problem of an inefficient auction outcome resulting from bidders placing different values on contiguous and non-contiguous spectrum assignments.

266. Furthermore, we considered the suitability of this approach for the 900MHz band. We noted that there were also benefits of ensuring a contiguous assignment of spectrum and that there is an additional benefit to imposing a consistent approach across spectrum bands.

267. We did note that there might be some additional relocation costs required in certain circumstances but considered that any such costs were likely to be small. In ComReg document 10/105, ComReg proposed the provision of reimbursement to a GSM licensee, in either band, for relocation costs that would otherwise have been avoided, but not where the costs were simply brought forward. ComReg maintained this position in ComReg document 11/60.

268. For clarity, we re-iterate the proposed rules restricting the frequency assignments that bidders may bid for. In a band, bidders may only bid for contiguous frequency ranges corresponding in size to the number of lots won in the main stage of the auction and/or retained as unliberalised spectrum in that band. In the case of bidders being assigned the same number of 2x5MHz blocks in both time slices, there is a further restriction that they must bid for the same frequency ranges across both time slices. These restrictions ensure that all bidders receive contiguous frequencies in both time periods. Bidders with the same number of blocks in both time slices will then receive a common contiguous range of frequencies for both periods.

11.2 Respondents' views

269. In their responses to ComReg document 11/60, two respondents passed comment on the full assignment round option, with both respondents expressing support for the proposal for a full assignment round. However, each requested clarification on certain issues.

270. eircom seeks clarity on Section 3.3.5 of ComReg's Draft Decision. Section 3.3.5 notes that an auction process would incorporate, "*a constraint whereby only assignment options that ensured contiguous spectrum assignments across [Time Slice] 1 and 2 for Eligible Bidders winning the same amount of spectrum rights in [Time Slice] Lot 1 and 2 would be presented to Eligible Bidders.*"

271. eircom submit that this appears to unfairly exclude un-liberalised assignments as the constraint only applies to liberalised spectrum won across the time slices.[86] Subsequently, eircom offer an amendment such that the condition would read *"...for Eligible Bidders ~~winning~~ with rights to ~~the same amount~~ equivalent quantities of spectrum ~~rights~~ blocks in [Time Slice] 1 and 2...."*

272. eircom Group also request clarity on the impact of the advanced commencement option on its options in the full assignment round. It submits that any restriction on eircom's options in the full assignment round if they choose not to, or fail to acquire liberalised-use licences in the 900MHz band in time slice 1 would not be acceptable.

273. In addition, Telefonica takes the view that compensation should be made to an operator who incurs additional cost as a result of the full assignment round. In its August 2011 consultation (ComReg document 11/60), whilst maintaining its general policy that costs of relocation brought forward as opposed to unavoidable relocation costs will not be compensated for, ComReg recognises that there are a small number of cases where costs would certainly otherwise be avoided or incurred later given existing licences:

a) In the case an existing GSM licensee does not avail of early liberalisation in the first time slice and does not win any spectrum in the second time slice (in which case relocation costs would not otherwise be incurred at all); and

b) In the case an existing GSM licensee does not avail of early liberalisation in the first time slice and wins spectrum in the second time slice (in which case the licensee would be forced to bring forward its relocation which it otherwise could defer until the expiry of its existing licence).

274. In the former case, costs would be compensated for in full. In the latter case, whilst recognising that it would be appropriate to compensate the licensee for

[86] "*By way of illustration if an Existing GSM Licensee in the 1800MHz band exited the award process with 2x14.4MHz of unliberalised spectrum in Temporal Lot 1, effectively occupying three lots in the band, and won three lots of liberalised spectrum in Temporal Lot 2, there is clearly a justifiable case for the assignment round to facilitate a contiguous holding of three blocks across the Temporal Lots.*" See page 10 of eircom Group's response to ComReg document 11/60

those aspects of the costs that result from having to relocate earlier than would otherwise be necessary, ComReg notes that the licensee should not be compensated for the entirety of the relocation costs themselves, as these would have to be borne in any event.[87]

275. Telefonica argues that there could in fact be a situation where no relocation of the GSM network occurs as a result of any decision by the operator. Any need to relocate its GSM network during the first time slice would be as a result of the assignment round. In its example, an existing GSM 1800MHz operator wishes to operate its existing licence to termination, then wins some liberalised 1800MHz spectrum in the second period to roll-out LTE or other technology in the second period. Telefonica submits that it would not simply be bringing forward the date when the cost is incurred, and should therefore be entitled to appropriate compensation for the costs involved.[88]

276. Telefonica re-states its position in its response to ComReg document 11/75, in which it commented that any forced move within a band must take account of the impact and practical implementation considerations of such a move, and the licensee must be appropriately compensated.[89]

11.3 DotEcon Commentary

277. In relation to eircom Group's request for clarity on the impact of the advanced commencement option on its options in the full assignment round, we agree that eircom's interpretation of the proposed rules is desirable. In particular, if a bidder needs to be assigned a frequency range of the same size in a band in both time slices, then these should be at the same frequencies, regardless of whether the frequencies to be assigned arise from lots won in the main stage of the auction or retained unliberalised spectrum. The intention of this cross-period frequency matching rule was to avoid unnecessary relocation, regardless of whether this arises in regard to liberalised or unliberalised spectrum.

278. Telefonica's point that relocation due to release of existing licences may be an entirely new cost rather than advancing an existing anticipated cost is debateable. In accordance with ComReg's previous reasoning , existing

[87] See paragraph 4.115 of ComReg document 11/60

[88] *"If ComReg proceeds with the auction as proposed including two temporal lots, then it would be entirely reasonable for one of the existing licensees to want to operate their existing licence to termination, but also to bid to buy liberalised 1800MHz spectrum in the second licence period for some or all of their 1800MHz spectrum. In the event that the operator was successful in their bidding, then they might roll-out an LTE or other network for operation in the second period. In this case no re-tuning of the GSM network occurs as a result of any decision by the operator – they would expect to continue to operate the GSM network as licensed in T1, and would have an entirely different network in T2.*

If however, the operator is forced to re-tune its GSM network during T1 as a result of the outcome of the assignment round for T1 then the operator should be entitled to appropriate compensation for the costs involved. This is not simply bringing forward the date when the cost is incurred, it is a new cost caused only by the use of a full assignment round in T1." See page 37 of Telefonica's response to ComReg document 10/61

[89] See page 9 of Telefonica's Response to ComReg document 11/75

licensees will have anticipated the need to acquire further spectrum in a band as existing licences expire and that there is no commitment that any such spectrum will be at the same frequencies as existing holdings (if available at all). Regardless, the operator will need to make transitional arrangements at the end of the licence. In this case, releasing the tail of an unliberalised licence simply brings forward that cost in the event that the operator does not retain the same frequency range at the assignment stage. For Telefonica's point to be valid, it must be that an existing 900MHz or 1800MHz licensee anticipates that it will continue to retain access to its existing frequency range beyond the term of existing licences, otherwise there would be some anticipation of costs at the end of the licence term. On balance, we consider ComReg's assumption more reasonable.

279. However, there may be some situations that require further consideration. For example ,consider the case where an existing 1800MHz operator wishes to continue to operate their existing licence to termination at the end of 2014 (Telefonica and Vodafone) or mid 2015 (Meteor) but also to bid for liberalised 1800MHz spectrum in the second time slice. If the operator is required to relocate its GSM 1800MHz network in the first time slice as a result of the assignment round, the extent to whether this cost is new or simply brought forward depends on the operator's plans for the second time slice. However, as the frequencies that are currently operated on are incompatible with use of spectrum on a liberalised basis, any move to liberalised use would require one or more operators to move frequencies and this cannot be avoided. Therefore, it is perfectly possible that such costs of relocating are simply brought forward as opposed to being a new and otherwise avoidable cost.

280. On balance, we consider it may be reasonable for ComReg to offer compensation where an operator can prove that costs of relocating were incurred due to the assignment round, and were otherwise avoidable.

12 Accommodating network sharing agreements in the assignment stage

12.1 DotEcon's stated views and recommendations to date

281. In our most recent proposal detailed in ComReg document 11/58 we recommended that the 'full assignment round' be implemented for both the 900MHz and 1800MHz spectrum. However, these proposals did not make any special provision for parties intending to create shared networks by subsequently pooling spectrum won in the auction to obtain adjacent blocks in the assignment stage.

282. As noted in responses to ComReg document 11/60, there may be efficiency benefits of allowing operators in (or intending to form) a Network Sharing Agreement (NSA) to acquire adjacent spectrum holdings within spectrum bands. Allowing operators in an NSA to express their preferences for contiguous spectrum in the assignment stage may be desirable in extracting maximum benefit from limited spectrum.

283. Below we consider comments provided on this issue as presented by respondents' to ComReg document 11/60. We propose some modifications of the procedures for the assignment stage in order to facilitate the assignment of frequency ranges by negotiation amongst winning bidders.

12.2 Respondents' view

284. Four respondents to ComReg document 11/60 passed comment on the need to accommodate assignment of contiguous spectrum for Network Sharing Operators. Amongst their arguments in favour of such an option they commented that:

- Current proposals mean that parties seeking to share or pool spectrum would find that their spectrum assignment would not be adjacent to one another and that resulting spectrum efficiencies, and particularly end user benefits from improved services and service availability, would not be able to be realised;
- Under the current proposal, network sharing bidders would not have information about each other's bidding during the auction and it would not be possible to ensure a contiguous allocation;
- Contiguous spectrum would allow for more efficient network operation and spectrum use; and
- Mechanisms to accommodate NSAs in the assignment stage will enhance efficiency of spectrum allocation.

285. To accompany its response, eircom Group provided a report from Power Auctions that identifies four potential mechanisms to accommodate network sharing agreements in the assignment stage of the proposed award process. The report discusses four alternative approaches to accommodating the social benefits of NSAs in the assignment stage. The options presented include:

- Unconditional direct implementation: only assignments that realise the synergistic values created by NSAs are considered during the assignment stage;
- Conditional direct implementation: all assignments are considered in the assignment stage, but assignments that realise synergistic values of NSAs are given a monetary bonus in the selection (representing an estimate of the realised social value);
- Authorisation of communication and coordination among NSA partners but otherwise use existing proposed rules for the assignment stage; and

286. Winners in a given band bid on the entire vector of allocations in the assignment stage (as opposed to bidding only on their own allocation).In addition, Vodafone commented that welfare maximising outcomes in terms of spectrum sharing and pooling may be achieved if there was a mechanism within the auction process where operators would have an opportunity to reach common agreement on the positioning of operators in the band to maximise the scope for spectrum sharing and pooling.[90] Vodafone submitted an example of how this might work, suggesting that the assignment round could be completed, but the results not released. Bidders would then be allowed some time to agree amongst themselves the most preferable allocations. In the absence of a negotiated agreement being reached, the final allocations would then be announced based on the outcome of the actual assignment round.[91]

287. On 24 February 2012, H3GI submitted a letter to ComReg enclosing an independent report by Copenhagen Economics in relation to network sharing agreements and the upcoming Irish auction. In particular, Copenhagen Economics were asked to consider the accommodation of NSAs in the assignment stage of the auction and to assess the proposals put forward by Vodafone and eircom Group in their responses to ComReg document 11/60.

288. Copenhagen Economics considered that there are large potential benefits arising from NSA partners sharing infrastructure and rolling out new networks more efficiently. They noted that granting NSA partners contiguous spectrum can facilitate a more efficient use of spectrum through lower network costs incurred which ultimately benefit the consumers in the market.[92]

289. Copenhagen Economics considered that with respect to eircom Group's proposals, the first, second and third proposals all had serious flaws and would not ensure efficiency. Further, it was considered that these proposals favour existing NSA's over potential NSAs. While in favour of eircom Group's fourth option on grounds of efficiency and fairness, it was noted that the proposal

[90] See page 10 of Vodafone's response to ComReg document 11/60

[91] See page 10 of Vodafone's response to ComReg document 11/60

[92] See Chapter 1 of Copenhagen Economics "Network Sharing Agreements and the Irish Spectrum Auction" Prepared for Hutchison 3G Ireland Limited, 22 February 2012

would expand the possibilities for 'harassing bidding' whereby bidders could express preferences against a 'good outcome' for certain rivals.

290. With respect to Vodafone's proposed option, Copenhagen Economics considered the benefits of a negotiation stage whereby bidders can express preferences that take other bidders' positions into account. However, it was acknowledged that if the prices paid in the case of a negotiated outcome were dependent on the bids given in the bidding phase, incentives to bid truthfully in the assignment round would be distorted.

291. Copenhagen Economics recommended that ComReg adopt the Vodafone approach, but with a slight modification whereby the prices paid in the negotiation outcome are whatever the bidders can agree on. Only in a situation where a negotiation solution is not reached would the bids from the previously held assignment round come into force.

12.3 DotEcon commentary

292. We have considered each of the options proposed by Power Auctions LLC, Vodafone and Copenhagen Economics and provide our comments on each.

293. Under the unconditional direct implementation option, we agree with Power Auctions that the disadvantage of such an approach is that the outcome of the assignment stage will be inefficient in the case that the synergistic value of the NSA is relatively low in comparison with the value of different frequency alignments. By considering only those assignments that realise the synergistic values created by NSAs, there is a significant risk that, in ignoring all other possible options and the value associated with these values, the final assignment is in fact inefficient. As such, we do not consider this to be a justifiable alternative to the current approach.

294. The conditional direct implementation, although dealing with the above disadvantage that only a subset of all possible assignments are considered, this option relies heavily on the auctioneer's estimate of the NSA value. We consider that there is a significant risk of error inherent in outcomes resulting from this proposed assignment stage option. Estimating the social value of a NSA would be very difficult to measure, and any error in this prediction could result in an inefficient allocation of spectrum. Such an approach is simply not practical and may give rise to potential for complaint about discriminatory treatment favouring the NSA bidders or even complaints about state aid. Allowing for the outcome of the assignment stage to rest on the auctioneer's prediction of social value of the NSA allows significant scope for inaccuracy in this calculation resulting in inefficiency of spectrum allocation. We do not find merit in this approach and it does not rest well with the market-based approach taken in the main stage of the auction.

295. Power Auctions further propose that bidders should be allowed to bid on the entire vector of frequency allocations for each winning bidder (i.e. a full band plan). However, this permits much more complex bidding strategies than those required simply to address the question of NSA parties winning adjacent spectrum. An NSA bidder's value for a certain assignment in a competitive award should only depend on the frequencies associated with this assignment and the relative position of its partner in the band. Therefore, there is no need to allow such a bidder to bid on entire band plans, which also prescribe

assignments for unrelated winners of spectrum in the band. Indeed, there is a significant risk that such an assignment stage would lead to bidders trying to push certain competitors into potentially less favourable parts of the band. This is a significant problem with this proposal. Furthermore, it potentially leads to a large increase in the number of bids that a bidder could make in the assignment stage, creating a significant increase in complexity.

296. The last remaining option brought forward by Power Auctions is to authorise communication and coordination among NSA partners in the assignment stage. We interpret this to mean that NSA partners should be allowed to bid for joint assignments that are determined on the notion of them as a single combined winner. This approach strikes a better balance between realising the value of contiguous assignments of NSA partners and at the same time ensuring that bidding in the assignment stage on entire band plans is avoided.

297. In fact, both the third and fourth options presented by Power Auctions have previously been considered by ComReg and DotEcon. The fourth option (bidding for band plans) was rapidly dismissed due to the problem of bidders seeking to harm competitors and its greater complexity. We also considered the possibility of joint bid vehicles for the assignment stage, but at that point the benefits of such arrangements for bidders were uncertain relative to the clear additional complexity that this would create. In particular, that anti-collusion rules need to be formulated differently for the main stage and assignment stage of the auction, with the need to create a clear demarcation between permitted and prohibited communications.

298. The response of eircom makes a stronger case for the benefits to operators in a NSA of gaining contiguous spectrum. However, we consider that option one two and four proposed by Power Auction encompass significant disadvantages that could result in inefficient allocation of spectrum or facilitate gaming behaviour in the assignment stage. For these reasons, we do not find merit in any of these three options proposed and would not recommend the implementation of any of these assignment stage options.

299. In relation to a joint bidding option, similar to that proposed in the third of Power Auctions' suggestions, we understand that ComReg is conscious of the potential for collusion and anti-competitive behaviour that this may lead to in the assignment stage of the auction. As noted above, it is likely that such an option would require significant adjustments of the anti-collusion rules and could result in significant additional complexity for the legal framework within which the award process functions. Further, ComReg would likely have no wish to provide artificial stimulus for the creation of new or modified NSAs. In line with ComReg's concerns on the issue and the potential for further complexity and adjustments, we are minded not to pursue this option further.

300. Vodafone also submitted an alternative assignment round procedure in which it suggests that following the conclusion of the assignment stage, but prior to publication of the outcome, successful bidders would have the opportunity to reach common agreement on the positioning of operators in the band to maximise the scope for spectrum sharing and pooling.

301. We have carefully considered Vodafone's suggestion and believe that this may represent a valid approach. However, this approach is not without its problems. For example, for an outcome to be negotiated prior to release of

results would require all parties in the band to agree on their frequency allocation. Finding such an outcome by verbal negotiation in a short space of time may prove difficult in practice, and there may be an incentive for at least one of the parties to 'hold up' the process even if others agree.

302. Furthermore, Vodafone suggested that once a negotiated settlement was agreed, "*bidders would then pay the price they submitted as part of the assignment round*"[93]. We are not entirely clear whether Vodafone is proposing that bidders pay the bid associated with actual negotiated outcome (bearing in mind that they may not have submitted a bid for that outcome) or what would have been their winning bid had the assignment stage of the auction been run without modification. In either case, there are perverse incentives arising from such an arrangement. Bidders may be incentivised to submit a lower (or even zero) bid in the assignment stage if they consider that negotiation is likely to be fruitful. Therefore, assignment stage bids may cease to represent true preferences and may no longer provide a good basis for determining the band plan if negotiation is unsuccessful. There would be no further opportunity for re-allocation of spectrum despite a potentially inefficient allocation resulting from the assignment round due to distorted valuations and bids submitted based on expectations about the results of the negotiation.

303. However, Copenhagen Economics' 'modified' approach may address the issue of distorted bidding incentives in the assignment round by ensuring that the bids from the assignment round will only come into force if a negotiated agreement does not occur. In the case where a negotiated solution is met, the prices paid will be those agreed by the bidders, whereas there will be a commitment to the bids from the previously held assignment round if a negotiated settlement is not reached. However, we note that there still remains the threat of 'hold up' from the negotiated round even under the 'modified' proposal suggested by Copenhagen Economics for H3GI.

304. Having considered both Vodafone's original proposal, and the modified version suggested by Copenhagen Economics, we would consider there would be merit in a modified approach similar to Vodafone's proposal, but with a different order of events. Following the running of the assignment stage and the determination of winning bids and additional prices to be paid as currently proposed, these results would be released to all winners to form the starting point for further negotiation with each other. This negotiation could occur prior to the issuing of licences for specific frequencies. This has the significant advantage that agreement need not necessarily be reached amongst *all* parties, as bilateral or trilateral deals could be made. Such an approach leaves the currently proposed assignment stage implementation unchanged and would encourage bidders to submit bids based on their valuations, whilst still allowing the re-organisation of the band by private negotiation prior to the issuing of licences.

[93] See page 10 of Vodafone's response to ComReg document 11/60

305. In summary, following a consideration of the proposed revisions to the assignment stage options, and the specific options provided by Power Auctions, Vodafone and Copenhagen Economics, we would agree that there may be benefits from allowing operators to be in a position to express their preferences for spectrum contiguous to the spectrum holdings of a potential or actual network sharing operator. We believe there is merit to Vodafone's approach with a 'negotiation stage'. However, in order to mitigate negative consequences that may arise from distorted bidding incentives in the assignment round, or operators wishing to 'hold up' any re-organisation of allocations where there is need for all parties to agree on the final outcome, we recommend that this negotiation stage is only carried out following the completion of the assignment round and release of results, including additional prices to be paid, which would not be affected by the outcome of negotiation. A subsequent negotiation phase would occur prior to grant of licences, where some or all winners could swap frequencies. Notice that this negotiation phase would then only require the consent of those parties shifting frequencies, which might not be all parties; unaffected winners from the assignment stage would have no power to block the negotiated outcome.

306. This proposal is very similar to that suggested by Copenhagen Economics, in that negotiation is allowed to create an efficient outcome without distortion to the assignment stage auction. However, it differs from the Copenhagen Economics proposal in that winners pay the additional price determined in the assignment stage of the auction. We consider that this approach is appropriate in order to allow competition between operators for preferred frequencies (including potentially the A and B lots in the 900MHz band that may in some cases allow for advanced commencement). To the extent that particular frequencies provide an advantage in subsequent negotiation, this would create fair competition for those frequencies.

13 Spectrum sharing

13.1 DotEcon's stated views and recommendations to date

307. In ComReg document 11/58, we considered how entities with a view to potentially sharing spectrum in the future could bid in the auction if ComReg was to decide that spectrum sharing would be permitted. We noted that it would be possible for parties to pool their bidding interests (subject to appropriate competition scrutiny) and use a bid vehicle to bid on their collective behalf during the auction. However parties would not be able to bid as both individuals and as part of a joint bid vehicle. Eligibility and activity rules would be such that bidders bidding through a joint bid vehicle would not obtain unfair advantages by joint bidding. Furthermore, spectrum caps for any such bid vehicle would be the same as those set for any other bidder.

13.2 Respondents' views

308. A large number of views regarding spectrum sharing were in relation to the need to allow for parties to a Network Sharing Agreement to gain access to contiguous spectrum in the assignment stage. We have already discussed this issue in Section 12 of this report.

309. In addition to these comments, there were some additional points raised by respondents surrounding ComReg's policy on spectrum sharing and pooling.

310. H3GI welcomes ComReg's acknowledgement that spectrum sharing can in principle bring benefits such as reduced costs and improved quality of service and supports ComReg's intention not to include restrictions in the licences that would inhibit such sharing after the award process. However, it considers that it is probable that as a result of the current design of the auction, some operators may not be in a position to spectrum share by virtue of their location within the spectrum bands to be auctioned. (Note that this concern with the ability of operators to share spectrum in practice is dealt with in Section 12.)

311. Further, in its response to ComReg document 11/75, H3GI comments that the proposed auction structure and spectrum caps are likely to lead to three operators obtaining 2x20MHz of sub-1GHz spectrum, and one operator obtaining 2x5MHz of sub-1GHz spectrum, placing that operator in a much weaker position in terms of its ability to negotiate spectrum trading and/or spectrum sharing arrangements.[94]

312. eircom Group called for further clarity in respect of spectrum trading and spectrum pooling, on the basis that a continuing lack of clarity would undermine the ability of potential bidders to form a view of the value of spectrum to be awarded.[95]

[94] See page 28 of H3GI's response to ComReg document 11/75

[95] See the Executive Summary of eircom Group's response

313. In addition, eircom Group was of the opinion that there was no need for a blanket requirement for competition approval of spectrum pooling agreements as proposed by ComReg. It commented that, whilst understanding that spectrum pooling may potentially give rise to competition law issues, it did not believe that this constitutes a legitimate obstacle to including with the licence conditions the right to pool and/or share spectrum. A blanket requirement for competition approval would create an unnecessary degree of uncertainty as to when operators can co-operate in respect of the provision of rural broadband.[96]

314. Telefonica disagreed with the proposal to set spectrum caps for a joint bid vehicle at the same level as those for an individual bidder. Whilst welcoming that joint bidding would be permitted by means of a joint bid vehicle, Telefonica expressed its concern that by stipulating that spectrum caps may not be adjusted, ComReg would effectively prevent joint bidding by any combination of existing operators.[97]

315. Telefonica referred back to its response to ComReg document 10/71 where it "specifically highlighted" a call for either no caps, or combined caps for a joint bidder and comments that ComReg's recommended position runs contrary to its own obligations and objectives for the following reasons:

- Inhibiting more efficient use of spectrum by existing operators;
- Inhibiting the efficiency of network sharing;
- Discrimination between operators and new entrants;
- Preventing the freeing up of spectrum for new entrants;
- Failing to take account of market demand in setting caps; and
- Artificially propping up demand and prices.

316. Furthermore, in its response to ComReg document 11/75 Telefonica seeks clarification from ComReg that, subject to the general provisions of competition law, "*the licence will allow licensee A to have their apparatus transmit on the spectrum assigned to operator B without a requirement for any kind of prior permission.*"

13.3 DotEcon commentary

317. We refer the reader to our commentary provided in Section 12 where we propose some adjustments to the assignment stage option. These address

[96] See page 7 of eircom Group's response

[97] "*Dotecon recommends that collective bidding should be permitted by means of a joint bid vehicle. This is welcome, although Telefonica notes that legally, ComReg would have no basis for prohibiting such an applicant. However Dotecon and ComReg then go on to effectively prevent joint bidding by any combination of the existing operators, by stipulating that the caps, which are set on the basis of demand of a single operator, may not be adjusted to reflect the greater demand inherent in joint bidding by two operators.*" See page 21 of Telefonica's response to ComReg document 11/60

many of the concerns above about how spectrum sharers obtain access to contiguous spectrum.

318. In response to H3GI's comments in relation to an operator who obtains only 2x5MHz of sub-1GHz spectrum being in a weaker position to negotiate spectrum trading or sharing agreements, we refer to our comments made earlier on the spectrum caps. Specifically, a bidder can only be assigned such an amount of spectrum if they bid for it. In order to be assigned only 2x5MHz of sub-1GHz spectrum, a bidder would have to bid for *only* 2x5MHz in the sub-1GHz bands. As explained previously, bids are mutually exclusive so a bidder would win at most one of the packages for which he placed a bid. Bids are thus made on the basis of there being a positive business case if that package of lots was indeed won.

319. In response to respondents' calls for further clarity on ComReg's position on spectrum sharing and pooling, we note that ComReg has recently published its "Strategy for Managing the Radio Spectrum: 2011-2013".[98] In Section 4.4 ComReg outlines its position on collaboration between wireless operators, including its view of spectrum sharing and pooling.

320. ComReg comments *"… spectrum sharing and pooling can, in principle, bring benefits such as reduced costs and improved quality of service. At the same time, ComReg is aware of the potential regulatory policy concerns, particularly in relation to competition. In addition, it is not possible for ComReg to give blanket assurances that spectrum sharing and pooling agreements will be permitted because the benefits and disadvantages arising from any particular agreement will depend on the specifics of the arrangement and the application of relevant telecommunications and competition law to those specifics."*

321. Spectrum sharing arrangements are subject to the general *ex post* disciplines of competition law regardless of any policy set by ComReg. Therefore, eircom's comment that competition approval might create an obstacle to pooling or sharing spectrum needs to be considered against the fact that, at the very least, the parties to a spectrum sharing arrangement will need to assure themselves that competition law is not being broken.

322. In ComReg document 11/89, ComReg sets out that its examination of a collaboration proposal will consider potential issues and concerns in relation to:

- competition issues arising from proposed collaboration between actual and potential competitors;
- the impact of collaboration proposals on efficient spectrum use and effective spectrum management; and/or
- whether any potential restriction on competition (and other potential draw- backs) would be more than compensated for by the cost savings and other benefits that would be passed on to final consumers.

[98] ComReg document 11/89

323. Furthermore, ComReg notes that although it cannot be said to have a firm view, at this moment in time, on the issue of spectrum rights sharing (or pooling), it would look more favourably on agreements that do not overly restrict competition and deliver demonstrable benefits that are shared with final consumers.[99]

324. In response to Telefonica's objection to applying the same spectrum caps to a joint bid vehicle as those applied to individual bidders, we consider that maintaining the same caps for all bidders is essential to prevent anti-competitive outcomes in the auction process whereby bidders in an NSA could bid to gain a significant amount of spectrum for a single entity relative to competing operators. As such, they would be in a far superior position to provide capacity and advanced data services in the downstream market.

325. In particular, the difficulty with Telefonica's proposal is that it assumes that there would be no effect whatsoever on downstream competition from a NSA between two operators. Whilst it is possible to conceive of arrangements for NSAs that might have limited negative competitive effect (e.g. network sharing only in costly-to-serve rural areas by an arm's length network operating company), there are also many arrangements that could effectively lead to a reduction in the number of independent national networks able to wholesale. Therefore, we cannot assume that joint bidding by two operators with a sub-1GHz cap of 2x40MHz will produce an outcome equivalent for downstream competition to two separate bidders each with caps of 2x20MHz. Clearly the level of caps have been set on the basis that each bidder who wins spectrum will operate as a separate entity with regard to pricing, service innovation and capacity decisions. Caps that are appropriate under the assumption that winners act in an uncoordinated manner in downstream markets are inappropriate if they then act as a co-ordinated entity. Under these circumstances we can only adopt a prudential approach that a NSA bidder is treated just like any other bidding entity and each bidding entity – be this a joint bidder or an individual bidder – is subject to the same cap.

326. Relaxing caps for joint bidders also raises serious issues about discrimination and unfair treatment. For example, if bidder *A* bids alone, then it is subject to a cap of 2x20MHz. However, what if it forms an NSA with bidder *B* that would not have won any spectrum had it bid independently? The form of the agreement with bidder *B* would allow bidder *A* to relax the spectrum cap. Clearly additional restrictions on relaxing the cap could be put in place to try to avoid this situation, such as requiring that both *A* and *B* are existing network operators; however, this would then arguably discriminate against those bidders who are not existing network operators.

327. In contrast, a simple approach for enabling NSAs is to require that the participants to the NSA bid for spectrum separately in the main stage of the auction, but to make appropriate modifications to the assignment stage. A pre-existing NSA does not breach the activity and anti-collusion rules of the

[99] See Section 4.4 of ComReg document 11/89

auction providing it does not co-ordinate the bidding strategy of the parties. This approach also permits the participants to express their individual valuations for spectrum, which may differ. (Note that even if the NSA participants had bid as a consortium, we might reasonably expect that the members of the consortium could have different valuations and might need to restructure the terms of their participation as lot prices increase.) The proposal for a negotiation phase following the assignment stage of the auction would permit NSA participants to seek to acquire contiguous spectrum.

328. Telefonica's suggestion for relaxed caps would also create the perverse situation where there was a strong incentive to form NSAs simply to reduce competition for spectrum. In particular, if an NSA bidder obtained the sum of the caps of the individual participants, then it would be able to purchase exactly the same amount of spectrum as if the participants had bid separately. However, the overall effect would be that there would be a single bid from the NSA bidder, rather than individual bids from the participants. This completely eliminates competition for spectrum between the participants.

14 Licence conditions

14.1 DotEcon's stated views and recommendations to date

329. In Section 14 of ComReg document 11/58 we provided a discussion of issues related to the proposed licence conditions including:

- Use-it-or-lose it conditions;
- Service quality and performance standards;
- Provision of emergency services;
- Penalties and performance bonds; and
- Reporting and compliance conditions.

330. However, our focus was primarily on coverage and roll-out obligations where we provided a detailed discussion of heterogeneity, specification and level of coverage and roll out obligations. Furthermore, we considered how coverage obligations should be measured.

331. We concluded that coverage obligations should be homogenous across all licences, that there should be a symmetric coverage obligation of 70% population coverage but with differing roll-out periods (3 years for incumbents and 7 years for new entrants). We expected competition between operators to deliver significantly higher coverage levels than the minimum requirements of the licences.

332. Below we discuss those issues that remain contentious based on respondents' comments to ComReg document 11/60.

14.2 Respondents' views

14.2.1 Technology and service neutrality

333. In its response to ComReg document 11/60, H3GI commented on ComReg's proposal to require licensees to give six months notice of its intention to terminate the provision of services using one technology, which the licensee intends to provide with another technology.

334. H3GI disagreed with this proposal. They commented that companies in all sectors change technology every day. They do so without the actual or perceived need for regulation. H3GI submitted that ComReg's proposal is disproportionate and contrary to regulation 10 (2) of the European Communities (Electronic Communications Networks and Services)(Authorisation) Regulations, 2011 (the "Authorisation Regulations").

335. H3GI returned to this issue in its response to ComReg document 11/75 and again in its letter to ComReg dated 22 December 2011, in both cases re-stating the above position. In addition, H3GI called for ComReg to provide clarification as to what circumstances might be necessary for ComReg to exercise its

discretion and "exceptionally" choose to admit a notification less than six months in advance of the proposed termination date for the technology concerned.[100]

336. In addition, Vodafone commented on this point in its response to ComReg document 11/75. Vodafone commented that the Draft Regulations reserve the right for ComReg to issue directions requiring a licensee to continue to use a particular technology within a liberalised-use band. Vodafone submits that there is no objective justification for this measure as it is potentially discriminatory and it fails to take into account the provisions of the General Authorisation in respect of withdrawal of service.[101]

14.2.2 Coverage and roll-out

337. In response to the coverage level eircom Group was in agreement with the proposal to set a 70% demographic coverage level. However, one respondent, Vodafone, while agreeing that this proposal was reasonable and consistent, they considered a geographic coverage obligation would be superior.

338. Vodafone expressed its agreement with the proposal for a minimum 70% population coverage requirement to apply to all licensees stating that it is reasonable and consistent with the key objectives of promoting efficient infrastructure investment and providing the necessary incentives for licensees to pursue competitive differentiation on the basis of coverage levels.[102] However, Vodafone considered that a minimum 70% geographic coverage requirement would strike a superior balance between the relevant objectives such as promoting competition, investment and consumer welfare.

339. Furthermore, two respondents (Vodafone and Stephen Minch) suggested that a higher coverage requirement should be set:

- Vodafone believes that the full benefits to end users of provision of innovative services in these bands would be most effectively achieved if this higher effective coverage requirement were set.
- Stephen Minch proposed ComReg maintain or increase the current level of 92% mandated coverage of the national area for voice and text and, subject to an evaluation of the benefits of a mandatory shared rural or national network, require data coverage in 92% of national area within 5 years.

340. Furthermore, Vodafone and eircom Group restated their views regarding the currently proposed asymmetric roll-out obligations. In support of its arguments the respondents considered:

- An asymmetric roll-out obligation risks distorting the basis of competition in the market;

[100] Page 7 of H3GI's response to ComReg document 11/75

[101] See page 7 of Vodafone's response to ComReg document 11/75

[102] See page 11 of Vodafone's response to ComReg document 11/60

- Asymmetric licence conditions may undermine the integrity of the auction process. Such an approach yields a situation where two bidders are effectively competing for different but mutually exclusive lots. This gives rise to differential valuations being assigned not by virtue of the "value" the bidders believe they can extract from a given lot but rather by virtue of the fact that the lots themselves are different;
- H3GI clearly has an existing mobile network and it would be unjustifiably discriminatory if it was afforded a longer roll-out period. The term "New Entrant" must be correctly defined in the proposed licence.

341. Vodafone proposed a symmetric roll-out obligation on all licensees to meet the coverage obligation within 3 years of licence award.

342. Furthermore, Vodafone referred to its previous views that if ComReg was to proceed with an asymmetric roll-out approach between existing network operators and new entrants then it would be more consistent with ensuring efficient utilisation of spectrum to require new entrant licensees to meet progressively higher roll-out targets by specified dates prior to achieving the proposed final target coverage requirement within 7 years of licence award. However, they considered that ComReg's modified proposal in paragraph 5.87 of ComReg document 11/60 that an interim coverage level of half of the target coverage requirement be met by a new entrant licensee within 3 years of licence award is a positive step, and somewhat mitigates their previously expressed concern that under ComReg's original proposal a new entrant licensee would only be required to achieve a very low level of coverage for up to the first 6 years of the licence.

14.2.3 Quality of Service (QoS)

343. In their responses to ComReg document 11/60, respondents expressed their agreement with a number of ComReg's proposals, including:

- ComReg's view that it would not be appropriate to impose minimum broadband QoS conditions;
- ComReg's intention to remove licence conditions in relation to international roaming, billing obligations (being addressed as a separate process), non-ionising radiation and access to the emergency services as these matters are already or will be provided for by the General Authorisation.

344. However, some respondents also highlighted concern with some aspects of the proposed Quality of service obligations. Including:

- The proposal to apply QoS licence conditions to all relevant services of the licensee, defined as including those provided by any third parties such as a MVNO on the licensee's network;
- ComReg's suggestion that it may make the QoS obligations attached to the licences subject to periodic review. ComReg may feel entitled to do so under EU directives but such a position generates significant regulatory uncertainty for potential bidders at this time. Auction participants will value the spectrum based on a known set of licence conditions and

obligations and not some future unknown set which may be applied by ComReg

345. Vodafone stated its strong disagreement with the application of QoS licence conditions to all relevant services of the licensee on the basis that:

- It is not tenable for ComReg to expect licensees to monitor and ensure that the minimum QoS standards are being observed by third parties such as MVNOs hosted on licensed operator's network when many factors that determine the QoS experienced by the customers of those MVNOs are not under the control of the licensee.
- In the case of national roaming (NR) partners there is further complication in the form of services such as in-call handover and requirement for handover between 2G and 3G networks on the host network. The quality of these services can be dependent on the quality of the network data in both the host and NR partner. The level of faults in the latter's network or commercial decisions by the partner as to the NR services they wish to purchase influence the QoS experienced by their own customers both on their own and the roamed network. These decisions cannot be subject to monitoring or cannot be enforced by the host networks.

346. Both Vodafone[103] and H3GI[104] also made reference to this issue in their responses to ComReg document 11/75.

14.2.4 Performance Guarantees

347. In their responses to ComReg document 11/60, two respondents passed comment on the proposed introduction of performance guarantees on coverage and quality of service obligations.

348. eircom Group has previously raised objections to the imposition of performance guarantees in respect of quality of service targets commenting that they represent an unnecessary overhead. Whilst commenting that it remains of this view, in its response to ComReg document 11/60, eircom notes that if a performance guarantee scheme is to be imposed it must be done so in an efficient and proportionate manner and further clarity must be provided in terms of the operation of the scheme. In its response eircom Group provide further comment on the cost efficiency of the scheme, proportionality of the scheme and consistency of the scheme. [105]

349. Furthermore, H3GI asks for further clarification on the issue of performance guarantees, enquiring if it is intended that payment to ComReg, following a failure to meet Coverage / QoS conditions will apply without recognition of, for example, the level by which the Licensee has failed to meet the relevant

[103] See page 7 of Vodafone's response to ComReg document 11/75

[104] See Page 30 of H3GI's response to ComReg document 11/75

[105] See page 29-30 of eircom Group's response

obligations. i.e. if it only just failed to meet them, will all of the €2m / €1m be payable on demand?

350. Although further details regarding performance guarantees were outlined in the Draft Information Memorandum[106] there were still some outstanding issues raised by respondents to ComReg document 11/75.

351. For example, respondents commented that:

- the proposed performance guarantees represent a non-trivial sum that could be better invested in rolling out network services;
- a more pragmatic approach to maintain financial guarantees would be to establish that the Licence may be suspended or withdrawn in the event that a Licensee fails to pay sums due on demand within 30 days of the demand being issued, in the event of failing to achieve either the coverage or QoS obligations;[107]
- there is not any legislative basis which would allow ComReg to specify a regime for administrative fines which circumvents requirements of the Authorisation Regulations; and
- there must be some degree of proportionality in the penalty.

14.2.5 Non-exclusive licence use

352. In their responses to ComReg document 11/75, three respondents passed comment on the issue of non-exclusive licences. Respondents commented that:

- The possibility that other wireless telegraphy apparatus be authorised in the auctioned bands would significantly affect spectrum value and is a matter where absolute clarity is required;
- ComReg should clarify whether it would be possible that other licenses could be issued for operator in a geographical area where the licensee does not have a service at any particular point in time;
- This is a significant limitation to the licence, one which cannot easily be quantified, and one which is specified in no other mobile licence issued by ComReg to date.

14.3 DotEcon commentary

14.3.1 Technology and service neutrality

353. This issue is a policy matter for ComReg and covered in ComReg's Response to Consultation and Decision.

[106] See pages 190 and 192 of ComReg document 11/75

[107] See page 5 of eircom Group's response to ComReg document 11/75

14.3.2 Coverage and roll out obligations

354. In relation to respondents' comments that there should be a higher coverage requirement, we would note that we covered this issue in significant detail in our report published as ComReg document 11/58 and would refer the reader to Section 13 of that report.

355. Specifically in relation to the proposal that data coverage should also be required to reach 92% of national area, we re-stress a number of previously made points. We considered that in order to achieve very high coverage levels, it is in fact typical to use "not spot" obligations instead. These obligations specify particular locations where services should be available. The Rural Broadband Scheme can be considered to tackle this issue and is provided in addition to the National Broadband Scheme, which aim to ensure the availability of broadband to all households in Ireland. In addition, we considered that the precise level of coverage is not especially critical, as a wide range of alternative levels would probably equally well achieve the objectives of ensuring that 'cherry picking' of solely high-density urban areas does not occur, without enforcing inefficient duplication of rural networks.

356. Furthermore, coverage is an important competitive differentiator, and all operators have an incentive to provide coverage to as many customers as possible. This can also be shown by the fact that operators are exceeding existing coverage obligations, which are already set at a relatively high level. On this basis, we do not consider the risk of roll-back of voice coverage to be significant for the reasons outlined in Section 13.1.3 of ComReg document 11/58.

357. On the issue of asymmetric roll-out obligations, we consider that these are necessary to allow new entrants[108] sufficient time to build their network and a period over which they can improve and expand their network to reach the proposed coverage levels. However, in order to ensure a sufficiently high coverage level for provision of voice and advanced data services we should set a shorter time period for operators with a network already in place. This does not create two classes of lot – one for entrants and one for incumbents – and, as claimed, in some way pollute the auction due to lots being valued on a different basis. Rather, lots are clearly defined and it is for each bidder – entrant or incumbent – to value these lots on the basis of the coverage obligations applying to that bidder, which are clearly identified.

358. In addition, we would note that ComReg's decision to set the coverage obligation on the basis of a population figure is based on a figure that should ensure coverage for the majority of the population, and in the areas where it is most likely that mobile phone usage will be prevalent. In ComReg document 11/60, ComReg noted that a demographic coverage level of 70% equates to

[108] We note that in ComReg document 11/60 the term "new entrant" was used in two places (the draft Decision in chapter 8, and the coverage obligation in chapter 5) and the meaning of new entrant was different in each place. In relation to the coverage obligation this term refers to a "new entrant to the mobile market" and we note that ComReg has clarifies this distinction in its Decision.

the population of the 5 major cities in Ireland, and every town with over 50 inhabited houses.[109]

359. As such, our recommendations on coverage obligations remain unchanged relative to those outlined in ComReg document 11/58.

14.3.3 Quality of Service obligations

360. In relation to Vodafone and H3GI's comments about QoS applying to all relevant services of the licensee, and their disagreement that this should apply to MVNOs and network roaming agreements, we refer the reader to ComReg's position expressed in its Response to Consultation and Decision.

14.3.4 Performance Guarantees

361. In relation to performance guarantees, we refer the reader to ComReg's position expressed in its Response to Consultation and Decision.

14.3.5 Non-exclusive Licence use

362. In relation to non-exclusive licence use, we refer the reader to ComReg's position expressed in its Response to Consultation and Decision.

[109] See Paragraph 5.80 of ComReg document 11/60

15 Issues related to spectrum fees

363. In this section, we consider two sets of issues:

- The split of any minimum payment between annual SUFs and a reserve price for lots in the auction;
- The basis of indexation of the SUFs.

364. Issues relating to the value for the recommended minimum price ranges provided in previous reports and the associated methodology are also addressed in our companion report on benchmarking (published as ComReg document 12/23).

15.1 Split between upfront and subsequent payments

15.1.1 DotEcon's stated views and recommendations to date

365. In our most recent report, ComReg document 11/58, following a review of the responses to ComReg documents 09/99, 10/71 and 10/105, we maintained our view that licences awarded in the auction would have two payment components; an upfront payment, due within a short time after the release of the auction results and a series of subsequent payments, spectrum usage fees, due annually for the duration of the licence. The upfront payment paid by a bidder will consist of the sum of the base price and additional price outstanding for that bidder, less its deposit and less any rebates resulting from the relinquishment of licences in the first time slice in either the 900MHz or 1800MHz bands.

366. As discussed in full in our December 2009 report (published as ComReg document 09/99c), the split of payments must be such that there is a balance between ensuring that licensees consider the opportunity cost of holding spectrum while at the same time acknowledging that awarding spectrum on fees predominantly due in the future risks the possibility of default where a spectrum winner's inability to pay for its licence only becomes apparent after some time after the auction. On this basis we recommended that 50% of the minimum price be paid through annual spectrum usage fees.

367. Whilst a methodology is needed for setting SUFs, it is important to recognise that provided SUFs are predictable, a bidder valuing spectrum on the basis of discounted cash flow analysis will subtract SUFs from expected future cash flows, decreasing the upfront value of spectrum accordingly. How SUFs impact on spectrum valuations depends on the discount rate used by the bidder, which will vary from bidder to bidder and cannot be second-guessed. Our concern is to ensure that, in combination with the reserve prices set for the auction, SUFs are not set so high as to discourage participation by serious bidders. In this regard, it is more relevant to consider cases in which the bidder's cost of capital is relatively low and the effect of SUFs in depressing licence value is greater. For this reason, we subsequently present some sensitivity analysis on the assumed cost of capital.

15.1.2 Respondents' views

368. eircom Group notes that while the methodology used in the calculation of reserve prices and SUFs from the minimum price is appropriate, there is an error in the calculations such that its proposed reserve prices are overstated relative to the proposed minimum price. The difference between the methods comes in calculating the discount factor for the half-year elements of the proposed time slice.

369. Taking the first time slice as an illustrative example, over the two and a half year period, eircom Group notes that the following approach was proposed to calculate the NPV, using an annual discount rate of 10.2%:

Table 6: Proposed calculation of NPV for time slice 1

Year	1	2	2.5
Calculation	1	$\frac{1}{(1+0.102)} = 0.90744$	$\frac{0.90744}{(1+0.102)^{0.5}} = 0.86443$

NPV of constant cash flow of €1/year for the 2.5 year period February 2013 – July 2015 = 1 + 0.90744 + 0.86443 = **2.77**

370. On this basis, eircom submits that in calculating the half-year elements the approach has the effect of over-inflating the numerators in subsequent calculations as the denominator is derived from annual discount factors. In proposing its correction, whilst continuing to use an annual discount rate of 10.2%, eircom Group differs in its proposed calculation for the half-year period which it considers ensures consistent numerators and denominators, while making a proportionate adjustment to the Year 3 discount factor. eircom Group proposes the following:

Table 7: eircom Group's proposed calculation of NPV for time slice 1

Year	1	2	2.5[110]
Calculation	1	$\frac{1}{(1+0.102)} = 0.90744$	$\left[\frac{0.90744}{(1+0.102)}\right] \cdot 0.45 = 0.37055$

NPV of constant cash flow of €1/year for the 2.5 year period February 2013 – July 2015 = 1 + 0.90744 + 0.37055 = **2.28**

371. Furthermore, Telefonica raises the issue that the discount rate used in the calculation of SUFs is eircom's nominal cost of capital in 2008 (i.e. 10.2% per annum). However, the SUFs calculated by this method are then subject to indexation using the CPI. Telefonica argues that this amounts to double-

[110] We note that eircom Group use (13Jul15 – 01Feb15)/365 = 0.45.

counting of the effects of inflation, as inflation has already been included in the discount factor.

372. Vodafone also raised issue with the application of SUFs for the entire licence period. Vodafone commented that it is neither justified nor proportionate to impose spectrum usage fees at least after the first three years of the licence within which time spectrum trading should have been fully implemented.[111]

15.1.3 DotEcon commentary

Calculating the reserve price and SUFs

373. Having reviewed our current approach to calculating the NPVs for the half-year elements, and having considered eircom Group's proposed correction, we consider that the methodology that should be applied depends on when exactly the SUF is to be paid. A different discounting approach is required depending on whether the SUF is to be paid at the start of the period in advance of that period, or at the end of each period. This issue is the source of much of the disagreement.

374. Our previous calculations assumed the SUF is to be paid at the end of the period. Upon further consideration, we note that it is ComReg's standard practice that SUFs are paid at the beginning of each period.

375. Thus, for example, for a licence period of 3 years, we should take the following approach to calculating the NPV of a three year licence:

$$\text{NPV of the three year licence} = \frac{\pi}{\sum_{t=0}^{2}(1+r)^2} = \pi\left[1+\frac{1}{(1+r)}+\frac{1}{(1+r)^2}\right]$$

where:

D_3^0, equal to $\left[1+\frac{1}{(1+r)}+\frac{1}{(1+r)^2}\right]$ is the fixed discount factor of a three year period;

r is the nominal weighted average cost of capital of 10.21%;

π represents the stream of annualised licence values.

376. However, for the first time slice, we need to calculate the NPV of a two and a half year licence. We consider that it is appropriate to apply eircom Group's proposed correction assuming payments are made at the start of each period. Therefore, based on a revised methodology, to calculate the NPV of the 2.5 year licence we apply the following formula:

$$NPV\ of\ the\ 2.5\ year\ licence = \pi + \frac{\pi}{(1+r)} + \left[0.5 \cdot \left(\frac{\pi}{(1+r)^2}\right)\right]$$

Where $D_{2.5}^0$ is the fixed discount factor for the 2.5 year period based on the revised methodology, equal to

[111] See page 9 of Vodafone's response.

$$1+\frac{1}{(1+r)}+\left[0.5\cdot\left(\frac{1}{(1+r)^2}\right)\right]$$

where

r is the nominal weighted average cost of capital of 10.21% and

π represents the stream of annualised licence values

377. That is, in the third year, only half the annualised licence value for the third year is assumed to be paid. Based on this (revised) methodology, we derive the following fixed discount factors to be applied**:**

	Fixed discount factor
First 15 years NPV	8.29
Discount factor for Feb 2013 - July 2015	2.32
Discount factor for July 2015 - July 2030	6.51

378. Based on minimum fees proposed in ComReg document 11/60, assuming a 50:50 split between reserve prices and SUFs, and applying the above methodology, the values for the reserve prices and SUFs are as follows:

Table 8: Implied reserve prices and SUFs for sub-1GHz spectrum

Sub-1GHz spectrum	Value
Value of a 15 year licence starting year 1	€20m
Implied value for Time slice 1 (Feb 2013 – July 2015 licence)	€5.6m
Implied value for Time slice 2 (Jul 2015 – Jul 2030)	€15.71m
Implied annual fee (SUF)[112]	€1.21m
Implied reserve price for Time slice 1	€2.80m
Implied reserve price for Time slice 2	€7.85m

[112] The value presented sets out the year 1 SUFs only. The implied annual fee for subsequent years would be subject to CPI.

Table 9: Implied reserve prices and SUFs for 1800MHz spectrum

1800MHz spectrum	Value
Value of a 15 year licence starting year 1	€10m
Implied value for Time slice 1 (Feb 2013 – July 2015 licence)	€2.8m
Implied value for Time slice 2 (Jul 2015 – Jul 2030)	€7.85m
Implied annual fee (SUF)[113]	€0.6m
Implied reserve price for Time slice 1	€1.4m
Implied reserve price for Time slice 2	€3.93m

379. Furthermore, in order to reduce the need to have a mix of full year and half year SUFs, we considered the use of six-monthly SUF payments for the duration of the licence and calculated the associated reserve prices and SUFs. We note that this slightly different payment schedule did not result in significantly different payment values and is inconsistent with the annual payment schedule proposed by ComReg.

380. Based on our above analysis, and considering our revised approach to calculating the reserve prices and SUFs based on the minimum price we recommend that ComReg follow the revised methodology. However, noting comments based on the treatment of inflation in our calculations, we must consider this issue further and we outline our views on this issue below.

Taking account of inflation

381. Telefonica is correct to raise the issue of how inflation is treated in the imputation of SUFs from benchmarked minimum prices[114], but it is important to understand the context in which these calculations are being used. In particular, we do not know what discount rate a bidder might apply to future SUFs. Therefore, what is important is that SUFs and reserve prices are not set so high that, in combination, the likely value of spectrum for a serious bidder falls below the reserve price. In this regard, the lower the discount factor used by the bidder, the greater the impact of SUFs in lowering the value of the spectrum to that bidder. Therefore, if being conservative in setting minimum prices, it is reasonable to consider the case of a bidder with a relatively low cost

[113] The value presented sets out the year 1 SUFs only. The implied annual fee for subsequent years would be subject to CPI.

[114] See page 56 of Telefonica's response to ComReg document 11/60

of capital for the purposes of determining the SUF from benchmarked minimum prices.[115]

382. In this regard, there is a case for performing some sensitivity analysis around the discount rate previously used for the SUF calculations. The value used in previous analysis has been a nominal cost of capital for eircom. Inflation needs to be subtracted to give a real rate of return.

383. The tables below present some alternative scenarios on the real discount rate. The impact of alternative assumptions on inflation are relatively modest. Lower discount rates reduce the SUF, but increase the reserve price for the second time slice.

Table 10: SUFs and reserve prices for sub-1GHz spectrum - discount rate sensitivities

Real discount rate	SUFs (€m) for year 1	Reserve T1 (€m)	Reserve T2 (€m)
12%	1.31	3	7.54
11%	1.25	2.89	7.71
10.2%	**1.21**	**2.80**	**7.85**
9%	1.14	2.66	8.07
8%	1.08	2.55	8.26
7%	1.03	2.43	8.45
6%	0.97	2.32	8.65

[115] `Notice that exactly the opposite conclusion applies to the treatment of annual payments in the benchmarking analysis. In this case, if we include both initial one-off payments and recurrent annual payments to estimate an overall equivalent up-front price, then higher discount rates provide more conservative estimates of licence value.

Table 11: SUFs and reserve prices for 1800MHz spectrum - discount rate sensitivities

Discount rate	SUFs (€m) for year 1	Reserve T1 (€m)	Reserve T2 (€m)
12%	0.66	1.50	3.77
11%	0.63	1.44	3.86
10.2%	**0.60**	**1.40**	**3.93**
9%	0.57	1.33	4.03
8%	0.54	1.27	4.13
7%	0.51	1.22	4.22
6%	0.49	1.16	4.32

384. Calculating the average annual CPI over the period from 2000 to the end of 2011, gives a figure of about 2.6%. We would recommend that a real cost of capital in the range 7% - 9% be used for determining SUFs. We note that this will correct for the issue of double counting as raised by respondents previously. At the same time, it is important to reflect the unavoidable uncertainty about these assumptions in a conservative approach to reserve price setting. We do not consider that, within the range of 7-9% considered, different levels of SUFs will have any material effect on bidder behaviour or licensee performance. What is more important is that bidders have certainty over the real value of future SUFs so that these can be reflected in licence valuations (as is being provided with the indexation proposals).

SUFs in the presence of spectrum trading

385. In principle, spectrum trading exposes a licensee to the opportunity cost of holding spectrum. Therefore, if there is another party with a higher value for that spectrum, holding on to spectrum would be a lost opportunity.

386. However, without a spectrum trading regime, the only alternative available to a licensee not using spectrum is to hand it back to ComReg. Recovering a reasonable part of the minimum price through the SUF was justified in part through the need to give incentives to return unused spectrum. This is less relevant with spectrum trading as the opportunity cost of holding spectrum provides an incentive to ensure it is used. Nevertheless, it is still the case that making actual payments for holding a licence is likely to be a more tangible and immediate incentive to giving up unused spectrum than the notional cost associated with failing to transfer to another party who might value it more. This is particularly the case when there may be strategic impediment to the full realisation of spectrum trading in the Irish context, as discussed in ComReg documents 11/88 and 11/89. Therefore, there may be still be a case for SUFs to encourage licensees to give up unused spectrum, albeit a lesser case than if spectrum trading were not possible. Spectrum trading reduces the need to

use SUFs to encourage optimal use of spectrum; however, it does not eliminate it.

387. Therefore, we do not disagree with the general point made by Vodafone that spectrum trading reduces the role of SUFs in encouraging efficient use of spectrum. However, it does not eliminate its consideration of usefulness in this regard, and SUFs may have other useful effects such as encouraging participation in the award process by effectively back-loading a part of the overall payment for spectrum.

15.2 Indexation of SUFs

15.2.1 DotEcon's stated views and recommendations to date

388. We first proposed the indexing of SUFs against inflation given the long time scale of the proposed licences as part of our December 2009 report (published as ComReg document 09/99c). ComReg first consulted on the use of indexation as part of its proposal to introduce interim licences (in ComReg document 10/71). ComReg took the view that the communications sub-component of the CPI is inappropriate as it refers only to price trends in a very limited part of the economy and does not reflect overall price changes in the wider economy.

389. In our August 2011 report (published as ComReg document 11/58) we remained of the view that the CPI is an appropriate basis for setting the level of inflation, as operators' revenues will depend on consumer inflation.

390. We further noted the similar view taken by other regulators in terms of adjusting annual fees to take account of inflation and the use of CPI to do so. Furthermore, ComReg has adopted this principle of updating licence fees to reflect inflation over a certain period using the CPI in the past.[116] Therefore, the use of CPI for indexing annual fees would be consistent with its approach elsewhere.

15.2.2 Respondents' views

391. In their responses to ComReg document 11/60, three respondents hold the view that SUF's should not be indexed to inflation, for the following reasons:

- It introduces an unacceptable level of uncertainty into the bidding process (H3GI);
- There is no justification for indexing SUFs (Vodafone); and
- By using a nominal WACC when calculating the annuity for the SUF, CPI has been accounted for in the level of the proposed SUF – further indexation would result in double counting and is erroneous (eircom).

[116] Most recently updating fees for Telefonica and Vodafone's GSM licenses for the period from May 2011 up to January 2013 at the latest.

392. Three respondents comment, that if ComReg are to index SUFs, then they should not use the overall CPI component. The respondents comment:

- CPI is a very broad measure of inflation in the Irish economy and does not accurately reflect operators' revenues as claimed (TIF);
- There is no correlation between CPI and mobile communications pricing, let alone spectrum valuation (Telefonica);
- CPI is not appropriate for use in respect of forms of investment, which spectrum is, because CPI relates to consumer expenditure (Telefonica);
- The most accurate measure of inflation with respect to the communications industry must be used (Vodafone);
- The CPI is not a relevant index to apply to spectrum licences, it is a measure of changes in consumer pricing and has little or no bearing on the value of an operator licence. (Telefonica)
- There is international case law and even legislation that recognises that the use of an inflation index must only take account of economic factors having a direct and specific relationship to performance of the contract or subject matter in question. It is internationally accepted that the index must be constructed to encompass a large sample of relevant items while still bearing a logical relationship to the type of cost being measured. (Telefonica)

393. These respondents call for the use of the communications sub-components of the overall consumer price index to be used, with TIF specifically referring to the CPI sub-index on 'telephone and telefax equipment and services'.

15.2.3 DotEcon commentary

394. ComReg has previously considered and rejected use of the telecoms sub-component of the CPI as an alternative basis for indexation, due to the fact that it refers only to price trends in a very limited part of the economy and does not reflect overall price changes in the wider economy. ComReg concluded that the use of overall CPI was most appropriate. In addition, we note that in the recently published "Strategy for Managing the Radio Spectrum: 2011 – 2013",[117] ComReg commented that, "*to ensure that annual spectrum usage fees continue to incentivise efficient spectrum use during the licence term it will become increasingly important for such fees to be updated on an annual basis to account for the general rate of inflation. Such indexation will keep the value of these usage fees constant in real terms and, as such, maintain proper incentives for firms to continually assess whether they should continue to hold particular spectrum usage rights.*"[118]

395. We recognise that it is important to ensure that annual fees should be subject to inflation, and amongst a wide range of differing measures we believe that

[117] ComReg document 11/89, 22 November 2011.

[118] See Section 7.1.1 of ComReg document 11/89.

the CPI is an appropriate measurement of inflation and note that this is an approach used by many regulators in adjusting annual fees. This has been documented in section 4.3.2 of ComReg document 11/29, and re-stated in paragraph 513 of ComReg document 11/58, but we feel it is important to stress cases where licences are indexed to inflation (UK, USA, Australia and Sweden) and the use of CPI for updating licence fees.

396. Overall, what is most important is that SUFs are reasonably predictable, so that bidders can factor future SUFs into any discounted cash flow analysis they may undertake to value licences. In this regard, indexation based on a broad measure of inflation, such as CPI, is likely to be more satisfactory than the use of narrow sub-baskets, which are likely to be more volatile.

397. We also consider that, where possible, ComReg's approach should remain consistent. Given that ComReg has used CPI to update licence fees in the past and in the recent issue of the 900MHz interim licences for Vodafone and Telefonica, and in the proposed early liberalisation rebates[119] we do not believe that ComReg should change its proposed approach.

[119] With which most MNOs agree.

Annex A Pricing methodology with party-specific lots

A.1 Introduction

398. As noted previously, in considering responses received to ComReg document 11/75, we have identified a deficiency in the detail of the pricing algorithm described. ComReg has therefore requested that, in the interests of transparency, we provide in this document a description of the winner determination and pricing method appropriate when party-specific lots are present, including some simple examples. This is set out below. We will finalise this in our report considering comments on the Draft Information Memorandum which will be submitted to ComReg for consideration in finalising the Information Memorandum.

Approach in previous combinatorial auctions

399. With the exception of issues arising from existing GSM licensees liberalising spectrum already held, the proposed approach for determining winners and prices for the multiband auction is very similar to that used in previous combinatorial auctions, including the Irish 26GHz auction and previous CCA auctions run in the UK, Holland and Switzerland (amongst others). In particular, these previous auctions shared the features that:

- All bids made throughout the auction[120] are considered as potential winning bids when determining winners;
- For each bidder, at most one bid is selected as a winning bid;
- It is possible to satisfy the winning bids from the available lots;
- Subject to these requirements, the total value of winning bids is maximised.

400. The prices paid by winners are then determined using a "second price" rule. This requires that each winning bidder and each group of winning bidders pay at least their (individual or collective) opportunity cost; this is so-called *core pricing*. Subject to the floors set by opportunity costs, total revenue (i.e. the sum of the prices paid by winners) is minimised. Informally, this can be interpreted as bidders paying the least amount needed to win their winning packages of lots, rather than the amount of their bids.[121] This approach typically provides good incentives for straightforward bidding behaviour.

401. In the event that these conditions for minimum revenue core prices do not determine a unique winning price for each winner, a further condition is specified to resolve any remaining indeterminacy; however, this is not a critical aspect of the rules. The proposed approach for the multiband auction (as for

[120] The Irish 26GHz auction was a sealed bid auction, but the other auctions mentioned above were all CCAs with bidding over multiple rounds.

[121] If the winners' winning bids were reduced to their opportunity costs, and each bidders other bids reduced by the same amount as that bidder's winning bid (subject to a floor of zero) then the winners would still win the same packages.

these previous auctions mentioned above) is to minimise distance[122] from the Vickrey prices (i.e. the individual opportunity cost of each bidder).

Liberalisation of existing GSM licences

402. The additional feature of the multi-band auction relative to these previous examples of combinatorial auctions is the ability of existing GSM licence holders to give up the tail of an existing licence in order to win liberalised spectrum. The general principles for determining the winning bids and prices to be paid by winners for the main stage of the auction have already been detailed in Section 10.3 of our report of August 2011 (ComReg document 11/58). In particular:

- Any existing licensee releasing the tail of a licence should be able to link this release to the acquisition of a corresponding right to liberalised spectrum (as two separate unlinked steps would create unacceptable risk of losing access to sufficient spectrum);
- A liberalised licence should only be awarded in place of an existing GSM licence in the case that the winner would have won that licence in open competition with other bidders demanding similar lots.

403. Therefore, although an existing GSM licensee cannot be displaced by another bidder from spectrum held under a licence in force, the existing licensee cannot use this provision to shelter from competition for liberalised spectrum. Whilst existing licensees receive a guarantee that they will not lose existing access to GSM spectrum unless they win replacement liberalised licences, they do not gain any advantage relative to other bidders due to this guarantee.

404. These broad principles are implemented through *party-specific lot* categories, which are described in detail in the Draft Information Memorandum. These are categories for which only one specified bidder is permitted to bid. A bid for a certain number of lots in a party-specific category is treated as a bid to liberalise a certain amount of spectrum held within an existing GSM licence. Therefore, winning a party-specific lot is notionally equivalent to:

- the release of unliberalised spectrum with an associated rebate; *together with*
- the award of a corresponding amount of liberalised spectrum.

405. It is helpful to think in these terms when considering the auction rules, but these two actions are indivisibly linked; the first cannot occur without the second.

406. In the absence of any bids to liberalise existing GSM licences (i.e. bids for packages containing *party-specific lots*), winning bids would be chosen to maximise the total value of winning bids subject to accepting at most one bid from each bidder and not allocating more lots than available. Therefore, absent such bids for party-specific lots, the approach is identical to the winner

[122] Distance is measured by the sum across bidders of the squares of the price differences.

determination and pricing methods used in the previous combinatorial spectrum auctions mentioned above.

A.2 Winner determination

407. We start by summarising the process for winner determination. This is exactly as described in our report accompanying the Draft Decision (specifically, Chapters 9 and 10 of ComReg document 11/58) and detailed in the Draft Information Memorandum (specifically, Chapter 4 of ComReg document 11/75).

408. The process is based on considering the various possible cases – which we call *notional release scenarios* - for whether or not party-specific lots are released and won back by the relevant bidder. We analyse each of these scenarios separately; for each scenario, we check whether or not every bidder notionally releasing spectrum would win back that spectrum in open competition. To achieve this, when assessing winners, *we pool party-specific lots with the corresponding category of lots open to all bidders*. If those bidders do not win back notionally released spectrum under these conditions, then we exclude this infeasible scenario from any further consideration. Finally, we then select the feasible scenario that maximises the overall value of winning bids.

Notional release scenarios

409. Formally, we implement this process through ***notional release scenarios*** (which we will also just call 'scenarios' for brevity). A notional release scenario is simply a specification of a certain number of party-specific lots for each relevant bidder (i.e. for each bidder able to bid for such lots). For example, one scenario is:

- two lots from Meteor in category 900/1/MET; and
- no lots in any of the 1800MHz party-specific categories 1800/1/MET, 1800/1/TO2 and 1800/1/VOD.

410. As each party-specific lot can only be won by a specific bidder, a scenario is a *complete* specification of the allocation of the party-specific lots.

411. For the category 900/1/MET, a scenario could specify 0, 1 or 2 lots. For each of the other party-specific categories 1800/1/MET, 1800/1/TO2 and 1800/1/VOD, a scenario could specify 0, 1, 2 or 3 lots. Therefore, there are 192 (=3x4x4x4) possible notional release scenarios.

412. Winner determination is performed separately for each notional release scenario and then, subsequently, the ***winning scenario*** is selected. These steps are described in turn below.

Bids compatible with a particular notional release scenario

413. Given a particular notional release scenario, we filter the bids to be considered in the winner determination. We only include those bids that are ***compatible*** with the scenario.

414. For bidders able to bid for party-specific categories, their compatible bids are:

- bids for packages containing *exactly* the number of lots specified in the scenario in every category of party-specific lots for which the bidder can bid;

- A zero bid for no lots in any category (representing the bidder losing entirely).

415. For all other bidders unable to bid for any party-specific lots, all of their bids are compatible with every possible scenario.

416. Taking the example of a notional release scenario given above, Meteor's compatible bids are for packages containing exactly two lots in the 900/1/MET category and no lots in the 1800/1/MET category (regardless of how many lots are included other categories) or else the zero bid. For Vodafone and Telefonica, their compatible bids are for packages including no lots in the 1800/1/VOD and 1800/1/TO2 categories respectively.

Matching categories

417. For each party-specific lot category, there is a ***matching category*** of lots open to all bidders which have the same frequency band and time period. Table 10 in the Draft Information Memorandum (reproduced below) lists the matching categories for each party-specific lot category. This implements the principle that GSM licensees need to win spectrum in open competition; a bid for a party-specific lot will be treated as a bid for a lot in the matching 'open' category when determining whether bids win or not and also to determine winning prices.

Party-specific Lot Category	Category determining Round Price (Matching category)
(7) 900/1/MET	(3) 900/1
(8) 1800/1/MET	(5) 1800/1
(9) 1800/1/TO2	(5) 1800/1
(10) 1800/1/VOD	(5) 1800/1

Table 10: Round prices for Party-specific Lot categories

418. A particular scenario specifies the existing spectrum held by GSM licensees that is notionally released and available for award to any bidder in open competition. As a result, the number of lots available in the matching categories must be increased accordingly. For example, with the notional release scenario above, the number of lots available in the 900/1 category is increased from 5 to 7 due to the notional release of two lots by Meteor.

419. Therefore, each notional release scenario has an associated ***notional supply*** of lots in the categories open to all bidders, consisting of those lots made available by ComReg in those categories, augmented by the matching party-specific lots that are presumed released by that scenario. The table below shows some examples of scenarios and associated notional supplies. The notional supply specifies the number of lots available to be allocated within the six categories of lot open to all bidders.

Notional release scenario	Party-specific lots specified within the notional release scenario				Notional supply for this notional release scenario					
ID	*900/1 MET*	*1800/1 MET*	*1800/1 TO2*	*1800/1 VOD*	*800/1*	*800/2*	*900/1*	*900/2*	*1800/1*	*1800/2*
0	0	0	0	0	6	6	5	7	6	15
1	1	0	0	0	6	6	6	7	6	15
2	2	0	0	0	6	6	7	7	6	15
3	0	1	0	0	6	6	5	7	7	15
…										
190	2	3	3	2	6	6	7	7	14	15
191	2	3	3	3	6	6	7	7	15	15

Flattening packages including party-specific lots

420. Any compatible bids for packages including party-specific lots are now 'flattened' and treated as bids for the corresponding number of lots in the matching category. The party-specific lot categories are then ignored; the 'flattened' package only consists of the six categories of lots open to all bidders.

421. For example, suppose that Meteor made a bid for the following package:

900/1 MET	*1800/1 MET*	*800/1*	*800/2*	*900/1*	*900/2*	*1800/1*	*1800/2*
2	0	1	1	0	2	0	0

The party-specific lots are then treated as being a demand for lots in the matching category. The corresponding 'flattened' package is then

800/1	*800/2*	*900/1*	*900/2*	*1800/1*	*1800/2*
1	1	2	2	0	0

422. This process of 'flattening' out the party-specific lot categories and treating them as a demand in the matching category open to all bidders ensures that any winners of party-specific lots do so in open competition with all bidders.

Winner determination within a notional release scenario

423. The next step is to take all of the compatible bids *for a particular notional release scenario* and determine ***scenario-specific winners***. After the flattening process, these are bids for packages consisting only of the six categories of lots

open to all bidders. Therefore, for existing GSM licensees releasing spectrum within the scenario, after the flattening process we consider their demand to win the corresponding liberalised spectrum, but as a bid for lots in the matching category.

424. For each notional release scenario, winners are determined by picking one compatible bid for each bidder (which might be the zero bid, representing the possibility that that bidder does not win anything) in order to maximise the total value of winning bids, subject to the constraint of allocating no more lots than are available in this scenario. For this purpose, the supply of lots will be the *notional supply* in this particular scenario (i.e. will have been augmented to include the party-specific lots notionally released in the scenario).

425. It is possible that the winner determination for a scenario could have tied optimal combinations of winning bids. However, all ties yield the same optimal total value of winning bids. We will refer to this as the ***value of the scenario***.

Notional release scenario feasibility

426. In order for this scenario to be ***feasible***, it is necessary that each bidder notionally releasing spectrum win this back again (possibly with additional lots open to all bidders). This requires that there is at least one optimum of the winner determination for this scenario in which every bidder notionally releasing some spectrum in the scenario wins a *compatible bid other than its zero bid*.

427. Notice that every compatible bid - other than the zero bid, which is a compatible bid in every scenario - will entail a bidder who notionally releases spectrum in the scenario winning this back; this follows directly from the earlier definition of a compatible bid. Therefore, it is sufficient simply to check that a notional releaser of spectrum does not lose entirely (i.e. is not allocated its zero bid).

428. For the scenario to be feasible, we require that there is at least one tie in which every bidder notionally releasing spectrum in this scenario wins back at least that spectrum. If every optimum of the winner determination involves at least one bidder notionally releasing spectrum being assigned its zero bid, then the scenario is ***infeasible***.[123]

[123] Notice that if a bidder is presumed to release a certain number of party-specific lots in each party-specific category within a particular release scenario but makes no bid for a package including exactly these party-specific lots, then the bidder's only compatible bid is the zero bid. Therefore, unless the scenario specifies zero party-specific lots in each category for that bidder, it cannot be a feasible scenario. This means that we do not need to conduct winner determination on each and every possible scenario, but rather only those scenarios that are present given the bids made including party-specific lots. This simplifies the implementation of the overall winner determination, but does not otherwise affect the description of the process given in the text above.

Selection of winning scenario

429. Next, we choose a notional release scenario from amongst the *feasible* scenarios in order to maximise the value of the scenario. This is the ***winning scenario***.

430. Notice that there is always at least one feasible scenario. The scenario in which no party-specific lots are allocated (and no existing spectrum released) is always feasible as there is no requirement in this case for any notionally released spectrum to be won back (as there is no notionally released spectrum).

431. It is possible that there are a number of feasible notional release scenarios with equal greatest value. In this case, a tie-breaking rule is needed to select from amongst those feasible scenarios with equal greatest value:

- First, we select the scenario with the greatest total amount of spectrum (measured in MHz) allocated as party-specific lots.
- Second, if a tie still remains, we select a scenario at random from amongst the remaining tied scenarios satisfying the first condition.

Overall winning combination

432. The overall winning bids are then an optimum to the winner determination for the winning scenario. This is called the ***winning combination*** of bids.

433. If the winner determination for the winning scenario has tied optima, then we only consider those ties in which every bidder with party-specific lots in the winning scenario wins at least those lots. As the winning scenario is feasible, there is always at least one tie satisfying this condition. If there is more than one tied optimum to the winner determination satisfying this condition, then the tie is broken at random.[124]

A.3 Price determination

434. In this section, we discuss the determination of base prices to be paid by winners of the principal stage.

Opportunity cost and winner re-determination

435. The central issue for price determination is the definition of the *opportunity cost* of allocating spectrum to particular individual winners and groups of winners. To define opportunity cost, we must consider the counterfactual situation that arises if lots were *not* allocated to a particular winner (or group of winners) but rather made available for allocation to other bidders. The alternative use of these lots in this counterfactual situation determines the opportunity cost for those winners.

[124] Note that the condition that the winning combination of bids ensures that the notional released lots in the winning combination are won by the relevant bidders for party-specific lots is not explicitly stated in the Draft Information Memorandum (see paragraph 4.182) though implicit in the proposed rules (see the earlier paragraph 4.178e). This will point will be clarified in the Information Memorandum.

436. In a simpler situation without party-specific lots, the counterfactual defining opportunity cost is clear. If lots are not awarded to a particular winner or group of winners then they are available for award to any other bidder (subject to spectrum caps). Therefore, to calculate opportunity cost – either individually for one winner or collectively for a group of winners – we need to consider hypothetically excluding some bidders and then re-determining the winners. The change in the value of the winning bids on re-optimisation determines the opportunity cost.

437. Specifically, given some set of winning bidders S, their collective opportunity cost $\alpha(S)$ is equal to

$$\alpha(S) = V(I \setminus S) - \left[V(I) - \sum_{i \in S} \beta_i^\star\right]$$

where:

- $\beta_i^\star$ is the winning bid amount of bidder i;
- $V(I)$ is the total value of the original winning bids including the entire set of bidders I;
- $V(I \setminus S)$ is the re-optimised total value of winning bids on excluding the bidders in the set S.

438. This formula has a simple interpretation. Having excluded the bidders in S from the winning combination, the opportunity cost is then how much of the lost value associated with those winning bids can be recovered by re-determining the winning bids. For example, if the value lost by excluding some bidders cannot be recovered at all by re-determining winning bids, then the opportunity cost of those bidders is zero. Conversely, if there were some other losing bidders with exactly the same bids as the excluded winners (suppose they lose on a tie-break) then we could simply include those bids into the winning combination (in place of the excluded winning bids) and the opportunity cost would be the full amount of winning bids of the excluded winners.

Opportunity cost with party-specific lots

439. The introduction of party-specific lots creates a number of additional complications for defining the counterfactual situation.

440. First, in defining the opportunity cost of some set of bidders S, we need to consider the potential for reallocation of any party-specific lots within the winning package of bidders in S to other bidders. The principle to be applied is clear: the price paid by winners of party-specific lots should be determined by open competition with other bidders demanding similar spectrum (i.e. against competing demands for lots in the matching category corresponding to a party-specific lot).

441. Therefore, in the counterfactual situation that we exclude all bidders in the set S, we must suppose that any existing GSM spectrum associated with party-specific lots won by these bidders is available for award to other bidders (i.e. bidders not in the set S) and that there is no requirement that the bidders in the set S win back released spectrum associated with party-specific lots. Therefore, the guarantee that a GSM licensee releasing spectrum wins at least

the corresponding amount of liberalised spectrum must *not* be applied in the counterfactual situation considered to determine the opportunity cost for such a GSM licensee.

442. Second, in the counterfactual situation considered to determine the opportunity cost for some set of bidder S, there is no requirement that other GSM licensees not in the set S must liberalise the same amount of existing spectrum. Rather, in this counterfactual situation we should allow for other possible situations in which GSM licensees not in the set S liberalise a different amount of existing spectrum, otherwise competition between GSM licensees for spectrum will not be properly taken into account (as one of our later examples demonstrates).

443. However, in considering alternative counterfactual scenarios for the release of existing licensed spectrum by bidders not in S, it is important that we limit the alternatives considered to notional release scenarios that are feasible (as determined in the initial winner determination process). It would be unreasonable for the price to be paid by a bidder winning a party-specific lot to be increased by competition arising from a demand for spectrum from another GSM licensee that could never be feasibly met in the winning outcome as that bidder could not win back one of its notional released lots within that package bid.[125]

444. Third, when re-determining the winning outcome in the counterfactual where some set of bidders S is excluded to determine the opportunity cost associated with the winning bids made by bidders in S we should maintain the requirement that any notional release of spectrum by bidders not in S is matched by those bidders winning back at least a corresponding quantity of spectrum. This is the same feasibility that we applied when determining winning bids initially, but now applied to the counterfactual situation when bidders in some set S have been excluded.

Notional release scenarios and the re-optimisation recipe

445. In order to define opportunity cost for a set of bidders S, we need to specify the procedure to be used for calculating $V(I \setminus S)$, the counterfactual value on excluding the bidders in S and re-determining the winning bids. The procedure described below conforms to the three principles discussed above:

- that the notionally released lots of the bidders in the set S (whose opportunity cost is being calculated) should be available for allocation within the relevant release scenario to all bidders not in the set S of excluded bidders;
- that the release of existing spectrum corresponding to party-specific lots won by bidders not in the set S should be re-determined in this

[125] Furthermore, unless we restrict attention to notional release scenarios that are feasible in the initial winner determination, there is the potential that opportunity cost (as defined) could exceed the winning bid. This would be nonsensical and arises only because such a definition of opportunity cost is incompatible with the principles adopted for the initial determination of winners, namely that any bidder notionally releasing spectrum wins at least this amount of spectrum back.

counterfactual situation, but subject to the requirement that only notional release scenarios that were initial feasible (i.e. feasible in the original determination of winners) will be considered;
- we maintain a requirement that any bidders not in the set S notionally releasing spectrum win back a package including this spectrum (as in the initial determination of winners).

446. In this procedure for calculating $V(I \setminus S)$, we consider each notional release scenario that:

- was initially feasible when we determined the overall winning bids;
- specifies no more party-specific lots for each of the excluded bidders in the set S than they have actually won.

Call these the ***counterfactual release scenarios*** for the set of excluded bidders S.

447. Notice that the set of counterfactual release scenarios may vary depending on the set of bidders S whose opportunity cost we are calculating. There is always at least one counterfactual release scenario, as the winning scenario (from the original determination of winners) is always a counterfactual release scenario for *any* excluded set of bidders S. However, in some cases (depending on the set S considered) there may be additional counterfactual release scenarios other than the original winning scenario.

448. The counterfactual release scenarios consider all the various possible releases of spectrum for bidders *not* in the excluded set S. However, every scenario supposes that the party-specific lots won by bidders in S are always available (as lots in the matching categories) for allocation to other bidders (and so is a 'counterfactual' scenario). We only consider counterfactual release scenarios that would have been feasible when we initially determined the winners.

449. Notice that we allow for counterfactual scenarios in which the bidders in the set S release as many or fewer party-specific lots than they actually won. This reflects the potential that we could leave some or all of those lots released by the excluded bidders in the set S unallocated when re-determining the winning bids in the counterfactual situation.

450. Next, for each of these counterfactual release scenarios in turn, we perform a ***counterfactual winner determination*** excluding the bidders in the set S. Specifically:

- winners are determined for this scenario (flattening bids for party-specific lots into matching categories), but taking only the compatible bids of bidders not in the set S;
- any bidders not in the set S who are presumed to have released spectrum in this scenario must all win back their party-specific lots in at least one optimum of the counterfactual winner determination, otherwise the counterfactual release scenario is *infeasible*.

451. Finally, we find the feasible counterfactual release scenario with greatest value (i.e. total value of winning bids in the winner determination for that scenario). This defines the counterfactual value $V(I \setminus S)$ when bidders S are excluded.

452. Notice that this procedure is very similar to the initial determination of winners, but with demands for lots from excluded bidders in the set S and the

requirement that they need to win any notionally released party-specific lots back ignored.

Relationship to Draft Information Memorandum

453. In considering the responses to ComReg document 11/75, it came to our attention that the detail of the procedures for pricing described in the Draft Information Memorandum is deficient. This arises because they fail to restrict attention to the initially feasible scenarios only when considering the exclusion of bidders as a counterfactual to determine opportunity cost. As a result of this deficiency, it is possible to create examples where opportunity cost for a bidder exceeds the winning bid of that bidder, as the counterfactual situation may involve scenarios that were initially infeasible when determining winners and which have a value exceeding that of the winning scenario. This issue is resolved by the definition of counterfactual release strategies given above. As noted above, we will finalise this in our report considering comments on the Draft Information Memorandum which will be submitted to ComReg for consideration in finalising the Information Memorandum.

A.4 Two simple examples

454. We now present two simple examples to show the procedures above in operation. For simplicity and clarity of explanation, we restrict attention to simplified examples in which there are fewer lots (and lot categories) than in the actual auction, but the principles remain the same.

When do bids for party-specific lots win?

455. Suppose that there are three bidders, with bids as given below. There are two open lots available for award with a reserve price of zero. Only bidder A has existing spectrum and makes a bid to liberalise this spectrum without demanding any additional spectrum. Bidder B is interested in either 1 or 2 lots. Bidder C has a high value for just one lot.

Bidder	Open lots (2 available)	Bidder A specific lots	Bid amount
A	0	1	7
B	1	0	5
B	2	0	15
C	1	0	30

456. There are two notional release scenarios according to whether or not bidder A releases its existing lot. These are shown in the table below. The winning outcome is that B and C each win one lot, and A does not liberalise its existing lot.

Scenario ID	A releases	Notional supply	Winning bids for scenario	Feasible?	Value
0	***0***	***2***	***1 lot to B, 1 lot to C***	***Yes***	***35***
1	1	3	2 lots to B, 1 lot to C	No	45

457. Notice that A does not win back the lot it releases in scenario 1, so this scenario is infeasible even though it has higher value. This is because bidder B has a large incremental value for a second lot (i.e. 10 = 15 – 5) that exceeds A's bid of 7. Therefore, A would not be able to win a lot in open competition with B.

458. The counterfactual winner determination for bidder B is summarised in the following table. We will only consider scenario 0 as this is the only initial feasible scenario.

Scenario ID	A releases	Notional supply	Winning bids for scenario	Feasible?	Value
0	***0***	***2***	***1 lot to C***	***Yes***	***30***

459. To determine the opportunity cost for bidder B, we exclude all the bids of bidder B. The only non-zero compatible bid for scenario 0 is thus bidder C's bid of 30 for a single lot. Therefore B's opportunity cost is 0 (=30 -35 + 5), as on excluding B the value of the re-optimised bids falls by the entire amount of B's winning bid.

460. The counterfactual winner determination for bidder C is summarised in the following table. We will only consider scenario 0 as this is the only initial feasible scenario.

Scenario ID	A releases	Notional supply	Winning bids for scenario	Feasible?	Value
0	***0***	***2***	***2 lots to B***	***Yes***	***15***

461. To determine the opportunity cost for bidder C, we exclude C's bids. This leaves two non-zero compatible bids for scenario 0 which are bidder B's bids of 5 and 15 for one and two lots, respectively. Bidder B would win his bid for two lots in the counterfactual scenario, which generates a total value of 15. Therefore, C's opportunity cost is 10 (= 15 – 35 + 30).

462. This example demonstrates that in the counterfactual situation in which we exclude a bidder to determine its opportunity cost, we must only consider the initially feasible release scenarios identified when determining winners. Suppose that we excluded bidder B and then considered (incorrectly) that Scenario 1 was a possible alternative outcome for this counterfactual. In Scenario 1, bidder A and C will win their bids if B is excluded. The value in the counterfactual case would rise to 37, suggesting (incorrectly) that B's opportunity cost was 7 (=37 – 35 + 5). This exceeds the value of B's winning bid for one lot (i.e. 5).

463. This example can be interpreted in the following way. Bidder A must compete with the other bidders (including with B's demand for a second lot) to win back liberalised spectrum. In this case, A's bid is insufficient that it would win back spectrum, so fails to liberalise. However, bidder B's opportunity cost should not be affected by A's failed bid to liberalise, as bidder A is not demanding any spectrum that conflicts with bidder B's demands.

Why re-optimise across feasible notional release scenarios?

464. It is important that when we re-optimise the winning bids having excluded some bidders, we consider alternative release scenarios (provided these are feasible). If we do not do this, then we can create a situation in which it is possible for a winner of a package including one or more party-specific lots to have an artificially low opportunity cost, as we would have failed to take into account competition from other winners of party-specific lots for incremental spectrum.

465. A simple example demonstrates the point. For simplicity, consider the following example with three bidders. There is one category of lots open to all in which 1 lot is available with a reserve price of zero. Two of the bidders (A and B) also have one existing unliberalised lot, on which they could potential bid to upgrade. The third bidder (C) has no existing spectrum.

Bidder	Open lots (1 available)	Bidder A specific lots	Bidder B specific lots	Bid amount
A	1	1	0	10
B	1	0	1	9
C	1	0	0	1

466. There are four notional release scenarios, given in the following table, according to whether A and B each release their one existing lot (or not). For each of these scenarios, we calculate the notional supply, which is the one open lot available to all, plus the lots notionally released by A or B.

Scenario ID	A releases	B releases	Notional supply	Winning bids for scenario	Feasible?	Value
0	0	0	1	C	Yes	1
1	***1***	***0***	***2***	***A***	***Yes***	***10***
2	0	1	2	B	Yes	9
3	1	1	3	A and C	No	11

467. In each scenario, we consider allocating the notional supply amongst the compatible bids:

- For scenario 0, the only non-zero compatible bid is C's bid, who wins the one available lot;
- For scenario 1, A has a non-zero compatible bid for two lots, C has a non-zero compatible bid for one lot, but B's only compatible bid is the zero bid (as it does not release any lots). A wins both available lots. As A wins back the lot it released, this is a feasible outcome.
- Scenario 2 is similar to scenario 1, but with the roles of A and B reversed;
- In Scenario 3, both A and B notionally release their lots and demand two lots each. However, both bids cannot be accommodated within the available three lots, so A and C win. Because B does not win back its released lot this scenario is infeasible.

468. Therefore, the overall outcome is that A wins its bid of 10 for the one available lot and liberalises its existing lot. Bidder B is unable to liberalise its existing lot, as it linked this with acquiring one additional lot in a package bid. However, B was not prepared to pay enough for the open lot for this bid to succeed.

469. To determine the price that A must pay, we consider the counterfactual situation in which bidder A is excluded, but we suppose that its one released lot is still available to be allocated in the corresponding initial feasible supply scenario.

470. The counterfactual release scenarios are those that were initial feasible and in which A releases no more than 1 lot. Therefore, scenarios 0, 1 and 2 are counterfactual release scenarios. Winning bids are re-determined omitting bidder A. The following table summarises the counterfactual winner determination.

Scenario ID	A releases	B releases	Notional supply	Winning bids for scenario	Feasible?	Value
0	0	0	1	C	Yes	1
1	1	0	2	C	Yes	1
2	***0***	***1***	***2***	***B***	***Yes***	***9***

471. For scenarios 0 and 1, only C has a non-zero compatible bid which is its bid of 1 for one lot. Bidder C wins this package in both scenarios. This counterfactual scenario is deemed feasible as A is not required to win back its notional release in this counterfactual.

472. For scenario 2, we need to check the feasibility of the outcomes, which amounts to checking that any party-specific lot released by B is won back. The highest value for any feasible counterfactual release scenario is 9. Therefore, bidder A wins and pays 9.

473. Notice that the counterfactual case where bidder A is excluded involves a different scenario to the original winning scenario (i.e. B now releases and wins back a party-specific lot rather than A). However, this still corresponds to an initial feasible release scenario. For this reason, the optimised value of the winning bids can only fall on omitting bidder A.

474. If we had not considered alternative scenarios for the release of party-specific lots in the counterfactual case that bidder A is omitted, then bidder A would have been able to 'leverage' its bid to liberalise its own spectrum. In particular, in the original winning scenario (Scenario 1) the value drops to just 1 on omitting bidder A, as we would not be able to accommodate bidder B. Therefore, in order to allow competition between bidder A and bidder B for the one open lot to determine prices, we must allow the scenario to change in the counterfactual case, subject to the requirement that the scenario must be one of the initial feasible scenarios.