



Commission for
Communications Regulation

Multi Band Spectrum Award

DotEcon Report

Assessment of responses to consultation on Draft Decision

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Assessment of responses to consultation on Draft Decision

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Executive Summary

This report has been prepared by DotEcon at the request of ComReg to consider economic and auction design issues arising from responses to ComReg's consultation on its Draft Decision on a proposed Multi Band Spectrum Award for the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz bands (ComReg 19/124). It considers the substantive features of the award.

The detailed rules implementing the award are specified in the Draft Information Memorandum and Draft Regulations (ComReg 20/32), which is subject to a separate consultation. Whilst this report considers the methodology for setting minimum prices, we expect to update our previous benchmarking analysis closer to the award in the light of any new market information available.

Objectives

Throughout our assessment, we have taken into account ComReg's statutory objectives, which in this context are primarily: achieving efficient allocation and use of spectrum; ensuring that the award process is based on objective, transparent, non-discriminatory and proportionate selection criteria; and ensuring the procedure is fair, reasonable, open and transparent to all interested parties.

Whilst it is likely that the three MNOs will be keen bidders, this award process offers a variety of spectrum bands and there is potential for interest from other parties. Therefore, we have been careful to ensure that the award design choices do not preclude or discourage participation of parties other than the existing MNOs.

The consultation process

The consultation process leading to the Draft Decision has been involved, with ComReg first consulting over which bands to include, then setting out an initial award format proposal, leading to a further consultation on ComReg's Draft Decision. During this consultation on the Draft Decision, ComReg issued a further Information Notice on various auction format options, inviting further submissions which were themselves published for further comment. In parallel, there has been a consultation on the Draft Information Memorandum (IM) and Regulations.

Many aspects of the proposed Combinatorial Clock Auction (CCA) are similar to the auction format used for ComReg's 2012 MBSA and the 2017 award of 3.6 GHz spectrum. However, the

Draft IM proposed to provide additional information to bidders during the clock stage. So-called “exposure prices” would provide a round-by-round assessment of the prices that a bidder might pay if its clock bid eventually won under certain simplifying assumptions.

Main contended issues

Given the extensive nature of the consultation, this summary does not cover all points raised in the main report and focusses only on the main contended issues. These are:

- the sub-1 GHz cap and its interaction with the CCA;
- time slices; and
- the auction format and price transparency.

Sub-1 GHz cap and interaction with the CCA

The sub-1 GHz cap

The sub-1 GHz competition cap proposed by ComReg in its Draft Decision is intended to prevent excessively asymmetric outcomes amongst the three MNOs if, as is likely, they share the six available 700 MHz lots. Such outcomes could adversely impact downstream competition in the model services sector.

The sub-1 GHz cap is not unduly restrictive, as it allows an increase in asymmetry across MNOs. Within this cap, the difference across MNOs in the number of 2x5 MHz blocks (i.e. 10 MHz in total) held below 1 GHz can increase from the current one block to two blocks of all 700 MHz lots are won by MNOs. This approach allows all three MNOs exactly the same opportunities to reach a certain number of blocks in total across the 700, 800 and 900 MHz bands.

Because of the small amount of sub-1 GHz spectrum available overall, just 190 MHz following the addition of the 700 MHz band, and the critical need for this spectrum to deliver wide-area coverage, a cap at any higher level can be readily ruled out. An 80 MHz cap would allow one MNO to hold double the sub-1 GHz held by another. This scale of difference would very likely to lead to significant differentiation in attainable service quality and network capacity and in cost structures, handicapping the MNO with least spectrum and lessening downstream competition.

Three has larger existing spectrum holdings both below and above 1 GHz than Vodafone or Eir. As a result, Vodafone and Eir can acquire up to three blocks of 700 MHz spectrum, whereas Three can acquire only two. However, taking into account

existing holdings at 800 and 900 MHz, this means that all three MNOs have the same opportunities to compete for up to seven blocks in total below 1 GHz.

Three's concerns

Three initially raised concerns about the sub-1 GHz cap and proposed that a symmetric cap be applied to spectrum acquired in the auction and that differences in existing spectrum holdings be ignored. This is untenable, as it is MNOs' post-auction spectrum portfolios in total that affect conditions of downstream competition, rather than only the particular spectrum acquired in this award.

Three's concerns have subsequently narrowed to focus on the particular issue of the consequences of the sub-1 GHz cap within the context of the proposed auction format, a combinatorial clock auction (CCA). Indeed, Three says that it would not object to a CCA if the cap were changed, nor object to the cap if a different format were used.

Second pricing rule in the CCA

The CCA uses a second-price rule, in which winners pay not the amount of their winning bids, but rather the least amount possible compatible with those bids being winning. This approach has the merit of providing good incentives for bidders make bids reflective of their valuations and avoids problems with suppressing incentives for bidders to compete for larger amounts of spectrum that can arise with other formats. Therefore, this is an attractive approach for a multiple band award given ComReg's objective for efficient allocation.

Three's contention is that because it cannot compete for a third lot of 700 MHz, within the context of a CCA this translates into lower prices for Vodafone and Eir. In contrast, Vodafone and Eir can compete for third lots of 700 MHz and this competition contributes to what Three needs to pay. Put another way, given the cap, Eir and Three can acquire at most five 700 MHz lots between them from the available six, meaning that Vodafone would be able to win one lot without competition if there was no interest other than from MNOs. A similar argument applies to Eir (reversing the role of Vodafone and Eir). However, Vodafone and Eir between them can acquire all six lots, so Three must compete for every lot it wins.

Three's concern about what Vodafone and Eir might pay is not a relevant consideration for the auction design, as the objectives are primarily to ensure that downstream competition be maintained and that spectrum be efficiently awarded. Three has made various counterproposals to remedy this claimed unfairness (discussed below), all of which undermine ComReg's

objectives and create unfair and unjustified restrictions on other parties' ability to compete for 700 MHz lots within the award.

How caps are set

Spectrum competition caps need to be set to exclude award outcomes that could damage downstream competition. Therefore, the design of caps and competition measures is a precursor to the design of auction format. Three makes proposals to change the caps to modify the prices paid by winning bidders in the auction format, which upends this logical progression.

Three's counterproposals

Three has advanced three specific proposals in its submissions:

- A joint cap of five lots of 700 MHz spectrum across any two winners, which we considered unjustified on competition grounds. This advantages Three unfairly by eliminating the possibility of Three ending two blocks behind the other MNOs in terms of total sub-1 GHz holdings;
- A similar joint cap, but applying only to counterfactual situations used to calculate opportunity costs for the purposes of applying the second-price rule to determine winning prices. This can lead to situations in which losers are prepared to pay more than winners actually pay. It also creates an incentive for Three to overstate its value for two 700 MHz lots leading to possible inefficient outcomes; and
- A cap on the incremental value that bidders can express for third blocks of 700 MHz through their bids set by the final clock price in the CCA. This approach potentially greatly handicaps any bidder finishing the clock rounds with three 700 MHz lots from expressing their true value of retaining these lots (amongst other problems).

These three proposals have the common feature that they inhibit Vodafone's and Eir's ability to compete for a third 700 MHz lot and protect Three's current spectrum advantage. There is no justification for such approaches as one or both of Vodafone and Eir winning three lots of 700 MHz spectrum does not lead to any significant concerns about lessening of downstream competition.

Three made a further counterproposal (in December 2020) that it be allowed to bid for up to three 700 MHz lots if it offers a legally binding obligation to divest one of its existing 900 MHz lots if it acquired three 700 MHz lots in the award. This proposal is fraught with difficulties as:

- There is no requirement that Three offer a released 900 MHz block to the other two MNOs, as it could sell it to another party. This creates the possibility that Three could

end up with a three-block advantage over another MNO in terms of sub-1 GHz holdings, whereas the current proposals allow any MNO to have at most a two-block advantage (assuming that the 700 MHz band is won only by MNOs). Furthermore, only Three would be in a position to end up three blocks ahead; the best feasible outcome for other MNOs would be two blocks ahead (by winning three 700 MHz blocks if Three wins none). Therefore, the proposal treats other MNOs unfairly.

- More fundamentally, even if a released block were returned to ComReg directly (which is not Three's proposal), any subsequent re-award of a returned 900 MHz block would face other bidders will fundamental problems in valuing 700 MHz spectrum and knowing how to bid in the current auction. They would not know whether or not the 900 MHz block, which is a substitute for a 700 MHz block, would be available, as this depends on Three winning three 700 MHz blocks.
- Integrating bids for a contingently available 900 MHz block into the MBSA2 process would be extremely complex and, in our view, largely infeasible for this reason. Furthermore, if Three were given the opportunity to release existing spectrum contingent on winning other spectrum within the award process, this option would need to be made available to all bidders.

For these reasons, we believe that none of Three's counterproposals have any merit and all would be unfair to other bidders.

*NERA report for
Three*

Three submitted a confidential report from NERA that presents a number of worked examples that claim to support Three's case that it is being unfairly treated. In our view, the examples are overinterpreted and do not demonstrate what is claimed. There is an implicit normative assumption throughout NERA's examples that Vodafone or Eir competing for a third 700 MHz lot is somehow a bad thing, potentially as it might have anti-competitive intent. This assumption is wrong, as there is unlikely to be an adverse impact on downstream competition from such outcomes. Indeed, if Vodafone and Eir were prevented from bidding for a third 700MHz lot this would make Three's current advantage in sub-1 GHz holdings unassailable.

Time slices

Eir's existing 2.1 GHz licence

The award process includes the 2.1 GHz band which is partly encumbered by Eir's existing licences running to 2027. It is not feasible simply to extend Vodafone and Three's existing licensing to make them coterminous, as this would require a long extension and would deny other parties a fair opportunity to compete for the spectrum. Therefore, this difference in termination dates needs to be accommodated by the award process.

In the Draft Decision, ComReg proposed that access to 2.1 GHz spectrum be split into two time periods – "time slices" – before and after 2027. There would be additional lots available in the second time slice once Eir's existing licence had expired. Because the 2.3 GHz and 2.6 GHz bands are likely substitutes for 2.1 GHz, it was proposed that these be time sliced as well, thereby allowing for possible reconfiguration across all three bands in 2027.

Other than Three, respondents are generally satisfied with time slicing in the 2.1 GHz band. Vodafone notes that, although the auction could be simplified if time slicing was removed, it is necessary if Eir does not hand back its existing 2.1 GHz licence prior to the award.

Short and long licences

Three's counterproposal was that short and long lots be created for the 2.1 GHz band, with Eir's current 2.1 GHz spectrum forming the short lots starting later in 2027. We have serious concerns about this proposal. Although all 2.1 GHz spectrum after 2027 is essentially identical, it would be arbitrarily split into some lots bundled with a right to use before 2027 and some without. Clearly, even for a licence commencing in 2022, most of its value comes from the usage right it conveys after 2027. Therefore, the proposal of long and short licences undermines neutral competition between the MNOs for 2.1 GHz usage rights after 2027. Once differentiated into short and long licences, certain licences become the preserve of particular bidders and tacit collusion within the auction could be facilitated.

2.3 GHz and 2.6 GHz time slicing

All respondents disagree with time slicing the 2.3 GHz and 2.6 GHz band, but for a variety of reasons. Three considers that additional time slicing would create aggregation risks if a different auction format (such as an SMRA initially favoured by Three) were used, thereby forcing the use of a CCA. Vodafone considers that timing slicing creates unnecessary complexity. Eir considers that time slicing these bands is of little use except in a

uniform price format. Imagine considers that these bands are not very substitutable.

Despite these comments from respondents, we consider that there is a good case for time slicing the substitutable bands. Not to do so rules out the possibility of any rearrangement across licensees in these bands in 2027 once Eir's current licence expires and, therefore, limits the extent to which the auction can explore different (possibly more efficient) outcomes. Whilst there is some additional mechanical complexity in running the auction, any bidder who wants an identical amount of spectrum across both time slices can simply bid on this basis. There is only a need for bidders to value each time slice separately to the extent that they may wish to avail of the additional flexibility that time slicing provides.

Auction format

Vodafone was content with the use of CCA with exposure pricing and consider this format necessary if time slicing is used. Both Three and Eir made other proposals, but for different reasons.

Three's counterproposals

Three's main counterproposal was to use an "enhanced" simple clock auction, though it also proposed that a CCA could be used if caps applied symmetrically only to spectrum acquired in the auction (and so disregarded existing holdings). Earlier it proposed a hybrid SMRA (simple multiple round auction), but this would require the use of short/long licences.

The key concern with the use of a simple clock auction for this award is that it imposes a uniform price on each lot category, with all winners paying the same per lot. This may not support efficient outcomes where lots are subject to synergies, as the value of lots may depend strongly on which other lots they are combined with. This approach also gives rise to incentives for bidders to moderate their competition for additional lots within a category, as this may lead to an increase clock price which they pay even if they subsequently reduce the number of lots demanded. This incentive is largely absent in CCAs due to the second price rule, which provides much cleaner incentives to bid in line with valuation and so is likely to lead to more efficient outcomes.

In the context of this specific award, the main impact of Three's alternative format proposal would be to reduce the incentive for Vodafone and Three to compete for third lots. Again, slanting

competition in this manner is not consistent with a reasonable view of impacts of acquiring 700 MHz lots on downstream competition and tends to reduce the extent that Three's current spectrum advantage would be competed for by the other MNOs. We also note that this would reduce the incentives for entrants to compete for larger amounts of spectrum.

A hybrid SMRA raises additional concerns about aggregation risk and is largely incompatible with the use of time slicing. As discussed above, the use of short/long licences risks fragmenting demand for 2.1 GHz and facilitating tactic collusion. This approach is also subject to the same problems arising from price uniformity undermining bid incentives and efficient allocation.

Eir's concerns

Eir's concern was primarily around the fact that the CCA, by minimising what bidders eventually pay subject to this being consistent with them winning, creating uncertainty about their eventual financial exposure when making bids. Put simply, a bidder might make a bid that wins but pays a lesser amount, which creates complications for budget constrained bidders.

Eir accepted that ComReg's proposal, made in the Draft IM, to increase the information available in the clock rounds would go some way to mitigating this concern, but considered that this measure was insufficient. Therefore, Eir's preference was for a format in which winning bidders would pay the amount of their winning bids, making a specific proposal for a form of clock auction. Failing that, Eir made proposals for modifications to the CCA; these are quite specific and complex, but might in summary be described as an iterative combinatorial auction, with some similarities to a CMRA (a combinatorial multiple round auction). We consider that this approach is significantly more complex than a CCA and is untested. It does not obviously address Eir's underlying concern as it would still contain a second-price element. Therefore, we recommend that ComReg maintain the current proposals to address Eir's concerns through exposure pricing.

Liberalisation of Eir's 2.1 GHz licence and licence extensions

Liberalisation fee for Eir

Eir's existing 2.1 GHz licence is not technologically neutral and ComReg proposes that it be given an option to liberalise this prior to the award. However, in the event that the auction indicated a market price for this spectrum in excess of what Eir

is currently paying, a surcharge would need to be paid. Eir was concerned both about the risk created by exercising its liberalisation option prior to knowing the terms, and also the mechanics of how any surcharge would be calculated.

Having reviewed the submissions, we remain firmly of the view that Eir would be unlikely to face such a surcharge if it exercised its option to liberalise prior to the award. Therefore, we recommend that the proposed approach be maintained. Eir has the option to wait until after the award if it considers this risk too high.

We initially recommended that an estimate of the value of 2.1 GHz spectrum be constructed as an average of inferred first and second time slice prices established by the auction, correcting for the longer length of the second time period. This was proposed out of an abundance of caution about the possibility of other bidders trying to inflate the price used to determine Eir's liberalisation fee (if any). Eir considered this unreasonable, as most of the value of a licence from 2022 onwards may relate to the second time period. We accept Eir's point and also consider that our concern about driving up the reference price may in practice be quite limited. Therefore, we recommend that ComReg modify the procedure to use only the first time slice price in the calculation. Full details will need to be included in the subsequent Information Memorandum.

Eir also suggested that inferred prices for 2.3 and 2.6 GHz bands in the first time slice be averaged with that for the 2.1 GHz band for these purposes, on the basis that these are substitutes. We do not recommend this approach, as there are likely to be differences in how these bands are used in the short-run that can be expected to create differences in first time slice prices, even if they are all substitutes in the longer run.

*Extending existing
2.1 GHz licences*

Finally, there is some need to offer Three interim 2.1 GHz licences for a short period to make them coterminous with Vodafone's existing licence and allow for new licences to have the same start dates without potential disruption to existing services. Whilst there was no disagreement about the interim licences themselves, Three complained that setting fees for the interim licences based on the fees it is paying for its current 2.1 GHz licences would be excessive. Three argued that having licences with different start dates would be better than the proposed approach, even if this makes the award more complex. However, it suggested that a better solution would be to use a price estimated based on the auction outcome, similar

to the approach to be used for determining any liberalisation fee to be paid by Eir.

We consider that licences with many different start dates lead to similar issues as short/long licences, as different licences would target specific MNOs and segment demand within the auction, subverting efficient outcomes. With regard to Three's suggestion to base extension fees on the auction outcome, this has some merit, but not sufficient to warrant ComReg deviating from its established practice that short technical extensions maintain current licence terms, including payments. The need for licence extensions can arise in many contexts, not just leading up to a new award process, so ComReg needs a procedure that is of general applicability and provides reasonable certainty for licensees.

1 Introduction

1.1 Background

Consultation on the Draft Decision and other key documents

This report sets out DotEcon's economic and auction design assessment of responses to ComReg's consultation on its Draft Decision on a Proposed Multi Band Spectrum Award for the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz bands (ComReg 19/124). It has been prepared at the request of ComReg to assist it in considering those responses.

ComReg's Draft Decision sets out the substantive features of the award. The detailed rules implementing the award are specified in the Draft Information Memorandum and Draft Regulations (ComReg 20/32, hereafter the Draft IM), which is subject to a separate consultation process.

In the Draft Decision, ComReg proposed to use a combinatorial clock auction (CCA) for this spectrum award, with two competition caps to limit the bidders immediate post-auction spectrum holdings (an overall cap and a sub-1 GHz cap). Due to significant differences in the termination dates of existing 2.1 GHz licences, ComReg has proposed to award rights of use for some of the available spectrum in two time periods ('time slices'). As a result, the activity rules for the auction are in essence the same as those used in the 2012 MBSA award, which also featured time slices and used a CCA.

Relative to previous CCAs run by ComReg (such as the 3.6 GHz auction concluded in 2017), ComReg proposes a new feature for this award – exposure pricing – aimed at increasing the information bidders have available during the clock rounds for assessing the eventual prices they might pay. The principles of exposure pricing and some simulations showing their effects have been set out in a recent technical report prepared by DotEcon for ComReg, included as Annex 12 to the Draft IM.

Further Information Notice

In July 2020, ComReg also published an Information Notice (ComReg 20/56) that sought further comments on a range of potential alternatives and modifications to the auction format proposed in the Draft Decision. ComReg published the non-confidential responses to this document (ComReg 20/78) and invited further comments in response (themselves published as ComReg 20/94).

1.2 Scope

- Scope of this report* This report focusses on the substantive features of the award discussed in the Draft Decision. We respond to comments related to the matters considered in DotEcon's report to ComReg on auction design published alongside the Draft Decision (ComReg 19/124a). Although there is some degree of overlap between consultations on the Draft Decision and also the Information Notice, this report focuses on the broad features such as competition measures, auction format and so on. Implementation through the detailed auction rules will be the subject of a subsequent report responding to the consultation on the Draft IM.
- Exposure pricing* This said, the proposal to modify the information policy of the award by providing exposure prices to bidders in each clock round was first made by ComReg in the Draft IM. Nevertheless, we consider the substantive issue of the information policy for a CCA in this document. Technical details about the exact implementation of exposure pricing will be provided in our subsequent report responding to comments on the Draft IM.
- Reserve prices* This report considers comments received on the methodology for setting reserve prices. However, an update of our previous benchmarking analysis in the light of any new market information will be provided subsequently.
- Statutory objectives* In our first report (ComReg 19/59a) we summarised our understanding of the statutory objectives against which ComReg should consider its choice of auction format and other award rules. In the context of allocating licences in this award, the key objectives remain as previously described:
- to achieve an efficient assignment of spectrum and to ensure spectrum is subsequently used efficiently (including ensuring that downstream competition is promoted where this is affected by spectrum assignment);
 - to grant licences on the basis of selection criteria that are objective, transparent, non-discriminatory and proportionate; and
 - where a competitive procedure is to be used, to ensure that such a procedure is fair, reasonable, open and transparent to all interested parties.

2 Consultation process

Given that discussion of the key features of the award and comments by stakeholders is spread across multiple documents, we first provide a brief overview of the key steps in the consultation process, highlighting the main points raised by consultees in chronological order. This overview is not intended to substitute for the detailed discussion in subsequent sections or to be exhaustive, but rather to orient the reader. We conclude this section with an overall summary of the main matters of contention following the various consultation steps.

2.1 Which bands to award - ComReg 18/60

Proposed bands

ComReg consulted a number of times from 2014 onwards on which bands should be included in future award process. A preliminary plan was set out for comment in ComReg 18/60, suggesting that the following bands be included:

- 700 MHz (as paired FDD spectrum);
- 2.1 GHz, in which the MNOs all currently hold licences but where spectrum will become available for re-award as these expire;
- 2.3 GHz (as unpaired TDD spectrum); and
- 2.6 GHz split into TDD and FDD categories.

The availability of spectrum in the 2.1 GHz band is complicated by existing licences expiring at different times:

- Three's A licence expires on 24 July 2022, and its B licence expires on 1 October 2022;
- Vodafone's licence expires on 15 October 2022; and
- Eir's licence expires significantly later, on 11 March 2027.

These existing 2.1 GHz licences are not technologically neutral and restrict licensees to using the spectrum for UMTS (3G), reflecting the prevailing policy when awarded in 2002 or, for Eir's licence, 2007. However, EC Decision (2012/688/EU) has since harmonised the 'paired terrestrial 2 GHz band' for electronic communications services (ECS) on a technologically neutral basis. In response, ComReg is set to offer an early liberalisation option to the current 2.1 GHz licence holders.

Substitutes and complements

ComReg noted in ComReg 18/60 that the 2.1 GHz, 2.3 GHz, and 2.6 GHz bands are likely substitutes for many potential users, as all provide capacity at broadly similar frequencies with similar

propagation characteristics. All three bands are compatible with current mobile handsets, even if there are some differences in how these bands are deployed within mobile networks. All of these bands are also potentially usable for FWA services.

In contrast, the 700 MHz band is a potential complement to these higher frequency bands for MNOs, owing to its superior propagation characteristics and near global harmonisation. This complementarity might be particularly important for any new users wishing to acquire a mix of coverage and capacity spectrum rights, who would face aggregation risk if the bands were to be awarded sequentially. Therefore, ComReg considered it was appropriate to include these various bands in the same award to promote competition by providing opportunities for entry where possible.

2.2 Proposed auction format - ComReg 19/59R

Provisional decision on included bands

ComReg 19/59R provided a response to the comments on which bands to award. It set out ComReg's preliminary view that:

- the four bands set out above should be included; and
- there was no rationale to include further bands (such as 1.4 GHz or 26 GHz bands).

It also set out a draft Regulatory Impact Assessment (RIA) on the proposed bands to include in the award. This RIA noted the significant societal and economic benefits from the timely release of 700 MHz as a key band for 5G and also the benefits of releasing these four bands in an integrated award to maximise opportunities for different types of bidders, including possible entrants.

Given this preliminary conclusion on the bands to include, ComReg 19/59R then set out initial proposals regarding the proposed format of the award for further consultation. This was accompanied by a report from DotEcon (ComReg 19/59a) setting out our recommendations to ComReg on the auction design.

Key auction features

Regarding the lot structure and other measures relating to the alignment of licence dates, ComReg 19/59R proposed that:

- the 2.1 GHz band be awarded in two time slices to accommodate Eir holding some of this spectrum until 2027

(which is approximately 5 years longer than Three's and Vodafone's current licences in that band);

- the 2.3 GHz and 2.6 GHz bands, being substitutes for the 2.1 GHz band, should also be awarded in two time slices to facilitate switching between the three bands if their relative prices change during the auction;
- splitting the bands into more than two time slices (to accommodate modest differences in the expiry dates of Vodafone's and Three's existing 2.1 GHz licences) would add unnecessary complexity and, instead, Three should be provided with the option of applying for an interim licence to continue access to the spectrum on similar terms in the short period of a few months between the expiry of its current licence and the start of the licences in this award; and
- all MNOs should have an early liberalisation option for their current 2.1 GHz licences, allowing these to become technologically neutral;
- Eir, due to the much longer period for which its current unliberalised 2.1 GHz licence runs and to avoid potential distortions to competition, might be subject to an additional liberalisation fee in the event that the auction established a market value for liberalised 2.1 GHz spectrum that exceeded what Eir had already paid for its current unliberalised licence, reflecting the increased market value of the licence on removal of the technological constraint.

Competition caps

In order to avoid highly asymmetric outcomes in terms of spectrum holdings that could compromise the effectiveness of competition in downstream markets, two competition caps were proposed: an overall cap, and a sub-1 GHz cap. The rationale was as follows:

- Absent competition caps, the valuations for spectrum expressed by bidders might include expected anti-competitive rents from downstream markets and so excessively concentrated award outcomes are a risk.
- Given that spectrum holdings affect downstream competitive conditions, it is appropriate to take into account existing spectrum holdings alongside spectrum acquired in the auction and to limit acquisitions that lead to an ex-post auction distribution of spectrum that is excessively asymmetric. A limit on spectrum acquired in the auction applying uniformly across all bidders was inappropriate, as this would fail to take into account the very different amounts of spectrum that MNOs hold prior

to the award.¹ The caps would apply solely for the purposes of the award, rather than being a long-term constraint, with any subsequent spectrum acquisition or transfer being considered on its merits in the light of market conditions at that time.

- The particular importance of the sub-1 GHz spectrum in providing wide-area mobile network coverage justified a separate cap for this spectrum (as has been commonly used in other jurisdictions).
- The level of a sub-1 GHz cap was well-determined from simple considerations. Any cap lower than 70 MHz was inappropriate as it would risk spectrum going unsold if only the MNOs bid for 700 MHz lots. A cap of 70 MHz would make it possible that asymmetry in sub-1 GHz holdings could increase relative to the current position, but not to an extent that would likely materially limit the ability of a third MNO to compete. Finally, a cap of 80 MHz or more would allow outcomes that were so strongly asymmetric that there would be a severe risk of competition being adversely affected. These conclusions rested only on an assumption about minimum amounts of spectrum below 1 GHz needed to compete credibly in various hypothetical outcomes, not any detailed analysis of current competitive conditions in the mobile market.
- The overall spectrum cap was set based on limiting the worst-case asymmetry as a percentage of spectrum available to MNOs, calculated assuming no other bidders won spectrum. There was a range of potential values for this overall cap, any of which was consistent with this objective.

Auction format

DotEcon's report on the award format (ComReg 19/59a) recommended the use of a CCA (combinatorial clock auction), which has been used successfully in Ireland for the 2012 MBSA and 2017 award of 3.6 GHz spectrum. The key reasons for this choice were that it:

- removes aggregation risk (which may arise for bidders through complementarities across and within the bands available in the award, and because of the need to combine time slices) and facilitates switching of demand for multiple lots between substitutable bands;

¹ Currently, Three holds rights of use for 50 MHz of sub-1 GHz spectrum, whereas Vodafone and Eir hold 40 MHz each. Total spectrum holdings across all bands are 230 MHz for Three, 185 MHz for Vodafone, and 145 MHz for Eir.

- discourages strategic demand reduction that could result in inefficient outcomes;
- includes an open stage that allows bidders to assess the combinations of lots they might win in light of information received about the demand of other bidders; and
- through the use of a pricing rule that minimises what winners need to pay, encourages bidding in line with valuations which in turn promotes an efficient outcome.

We also explained how a benchmarking methodology would be used to set minimum prices to balance the risks of tacit collusion and speculative participation if prices are set too low, against the risk of choking off demand by setting minimum prices too high. Uncertainty in the estimation of market prices using outcomes from other awards necessitated a conservative approach, giving more weight to the risks of choking off demand and not setting minimum prices too high within the range of forecast prices.

Responses from stakeholders

These initial proposals on auction design presented in ComReg 19/59R raised the following main issues from respondents:

- all MNOs suggested the reserve prices were too high;
- eir requested that ComReg commit to not charging an early liberalisation fee for the remaining term of its 2.1 GHz licence (to 2027), given that a fee is unlikely to be required;
- Vodafone and Three suggested that time slicing could be avoided if existing 2.1 GHz licences (in particular, Eir's) were handed back early;
- Three suggested 2.1 GHz licences with different start dates running through to a common end date could be used instead of time slicing, creating differentiated lots within the auction;
- Several respondents suggested that, even if time slicing is used for the 2.1 GHz band, it is not necessary to time slice the 2.3 GHz and 2.6 GHz bands.
- Three requested caps on the spectrum acquired in the auction that applied uniformly to all bidders and which ignored differences in existing spectrum holdings;
- Three claimed that the proposed caps and use of a CCA could result in asymmetric prices that could be discriminatory; and
- eir raised concerns that a lack of price transparency in a CCA creates governance issues for budget-constrained bidders and expressed a preference for a pay-as-bid format.

2.3 Response to consultation and Draft Decision - ComReg 19/124

Key features of the proposed award

In December 2019, ComReg published its Draft Decision on the award format (ComReg 19/124), as well as its own and DotEcon's assessment of the responses to the previous award format consultation.

The key features of the award format proposed in the Draft Decision were as follows:

- Existing 2.1 GHz licences could be liberalised from the point of the substantive decision on the award. Any potential early liberalisation fee for Eir would be determined by the 2.1 GHz clock prices established by the auction (where this exceeds what Eir has paid for its current unliberalised licence, adjusting for the remaining term);
- The 2.1 GHz, 2.3 GHz, and 2.6 GHz bands, which are substitutable, would be awarded in two time slices with a combined duration of 20 years for the 2.3 GHz and 2.6 GHz bands and correspondingly shorter for 2.1 GHz due to existing licences expiring in 2022. In contrast, there would be one lot category for 700 MHz spectrum. This gives bidders similar opportunities to compete for the longer and more valuable second time slice and avoids gaming opportunities; in contrast, use of differentiated lots with common end dates but differing start dates might provide a means by which bidders could tacitly agree not to compete against each other for spectrum if certain bidders can be assumed likely to bid for certain lot types. It was considered that using time slices did not create excessive complexity for bidders, as a bidder interested in spectrum in both time slices could simply bid only for packages containing both time slices (and so need not value each time slice separately if had no interest in acquiring spectrum in just one time slice);
- A CCA would be used, which offers benefits irrespective of the need for time slicing. These benefits included removing aggregation risk for bidders aiming to win in multiple bands, being suitable for potential entrants (as demonstrated by the outcome of the 3.6 GHz award) and incentivising truthful bidding;
- Acquisition of spectrum within the award would be subject to a sub-1 GHz cap of 70 MHz, and an overall spectrum cap of 375 MHz on post-auction spectrum holdings. The overall

cap would be set at the lower end of the range proposed in the award format consultation documents because the 'worst case' asymmetry between MNOs could be more severe if bidders other than MNOs win spectrum; and

- Minimum prices would be set conservatively based on a benchmarking methodology.

Main points of response

The main comments made in response were, in outline, as follows:

- Three alleged that the combination of the sub-1 GHz cap with a CCA discriminated against it. Because of differences in existing spectrum holdings, Eir and Vodafone could compete for up to three of the seven available 700 MHz blocks, whereas Three could compete for at most two blocks. Three was concerned that this meant that winning a second block of 700 MHz required it to outbid both Eir's and Vodafone's demand for third blocks, which could lead it to paying a higher price than the other MNOs. In contrast, Eir and Vodafone would only need to compete with each other for a third block (assuming no bidders other than the MNOs for 700 MHz spectrum).
- Vodafone agreed with the use of a CCA, and that the competition caps should include existing holdings. It disagreed strongly with Three's suggestion that 2.1 GHz licences of different lengths could remove the need for time slicing and, with that, a CCA. However, Vodafone also reiterated its view that time slicing the 2.3 GHz and 2.6 GHz bands added unnecessary complexity, in particular to the valuation exercise bidders would have to carry out ahead of the award.
- eir again suggested that the uncertainty over prices paid within a CCA would be a concern for budget-constrained bidders and that it faced uncertainty over its early liberalisation fee for 2.1 GHz given the proposed mechanism for determining this from the auction outcome.
- Imagine remained of the opinion that time slicing was only necessary in the 2.1 GHz band.

2.4 Draft IM and Regulations - ComReg 20/32

ComReg published its Draft Information Memorandum (ComReg 20/32) in May 2020. This set out the proposed rules

for a CCA, including the detailed activity rules governing the bidding process. It also proposed the introduction of exposure pricing, as additional information to be provided to bidders in the course of the clock rounds of the CCA. ComReg also noted that the COVID-19 temporary licences (provided to the MNOs in between the publication of the Draft Decision and the Draft IM) were granted without prejudice to this award process.

Exposure pricing

The new exposure pricing feature in the proposed CCA would involve bidders being informed of their applicable bidder-specific 'discount' in each clock round; this discount is the minimum difference between a bidder's clock bid amount and the price it would pay for the package bid for if this were the final clock round and there were no unallocated lots in that round. This discount, which is specific to each bidder, can be subtracted from the bid amount to calculate an 'exposure price' for each package. This is a new feature for the CCA, and our report on exposure pricing in CCAs was included as an annex to the Draft IM to explain how the procedure might work.

Responses on exposure pricing

Lack of price transparency was one of the respondents' main concerns about the use of a CCA. Therefore, they generally welcomed the addition of exposure pricing information as a material improvement to the format in their responses to the Draft IM. Nevertheless, Eir commented that this measure did not fully resolve its concern that a bidder might need to submit a knockout bid below its valuation, but in excess of its budget, in order to secure its final clock package.

Three maintained its concerns about discrimination

Three again claimed it would be placed at a material disadvantage by the proposed format and that ComReg must adopt its proposed changes (i.e. use of a different auction format or make changes to the caps).

Vodafone was generally supportive of the CCA and wants a timely award

Notwithstanding its belief that time slicing the 2.3 GHz and 2.6 GHz bands adds complexity to bidders' spectrum valuation exercise (which could result in mistakes and therefore inefficient outcomes), Vodafone remained supportive of the use of a CCA. Vodafone noted that, except for the inclusion of exposure pricing (which it considered an improvement), the format would be very similar to the 2012 MBSA and 2017 award of 3.6 GHz spectrum, both of which were successful. Therefore, and in light of the important role telecommunications has and will play in the economic recovery from the COVID-19 crisis, Vodafone strongly believed that ComReg should adhere to the timeline for awarding this spectrum.

2.5 Information Notice on auction format options - ComReg 20/56

In the responses to ComReg 19/124, ComReg received proposals for a variety of adjustments to the CCA or alternative auction formats, as well as a request from Three to conduct a RIA on the auction format. In response, ComReg published an Information Notice (ComReg 20/56) requesting views from stakeholders on the need for an award format RIA and input on the relevant set of options to consider.

ComReg's proposed options for consideration

ComReg set out its preliminary observations and requested views from respondents on the following alternative auction formats:

- Option 1 – a CCA with exposure pricing (ComReg's current preference as set out in 19/124 and 20/32);
- Option 2 – an SMRA either with the current proposed lot structure or with two 2.1 GHz categories (with different start dates), but no time slicing;
- Option 3 – a simple clock auction (SCA) with relaxed activity rules;
- Option 4 – a combinatorial multiple round auction (CMRA);
- Option 5 – a modified CCA (relative to Option 1), split into seven sub-options.

Modified CCA sub-options

The first three sub-options under Option 5 were those suggested by Three in response to ComReg 19/124, and consisted of:

- a joint cap of 2 x 25 MHz in the 700 MHz band for any two bidders, for the purpose of winner and price determination (Option 5a);
- the same joint cap, but applied for the purpose of price determination only (Option 5b); or
- a cap on the marginal value that a bidder can express for a third 700 MHz lot at the final clock price (Option 5c).

ComReg also included in the Information Notice four further potential modifications to the CCA for consideration:

- Option 5d – increasing 700 MHz reserve prices;
- Option 5e – placing a higher value on unsold lots in the price determination;
- Option 5f – introducing non-linear 700 MHz reserve prices; and
- Option 5g – using weighted Vickrey nearest prices.

Return of spectrum by Three ComReg also noted that Three had the option of returning a block of sub-1 GHz spectrum before the award, which would relieve its concerns about the proposed caps having asymmetric effects due to MNOs having different initial spectrum holdings. Interactions between these caps and the auction format choice had been Three's main concern with the use of a CCA expressed in its response to ComReg 19/124.

Eir's proposals In its response to ComReg 20/56, Eir reiterated its view that exposure pricing is a welcome addition, but insufficient to address its concerns about a CCA, and that it would prefer Option 3 (a simple clock auction, with relaxed activity rules). Eir now also suggested that ComReg should consider awarding the 700 MHz band separately. Eir did not support any of the sub-options under Option 5, but proposed its own changes to the CCA, namely:

- setting bid amounts equal to exposure prices; and
- use of a what it called an 'iterative CCA', an alternative auction format where the supplementary bids round of the CCA is replaced by one or more additional rounds in which bidders can place headline and additional bids.

Eir suggested that, although these changes to the CCA could be adopted independently of one another, ComReg should implement both.

Imagine broadly supported the CCA option

Imagine supported performing a RIA on the auction format options, but stressed that this should not delay the award process. It submitted that it considers the CCA to be a suitable format, but:

- cautioned that any measures to address issues that affect the 700 MHz band (i.e. in relation to Three's complaints on asymmetric caps and the associated Option 5 rule changes set out above) or the 2.1 GHz band (whether time slicing is used) should not have a detrimental effect on the remaining bands; and
- does not support any changes to the proposed CCA which would add further complexity or might have a disproportionate effect on smaller operators.

Further options proposed by Three

Three contended that its suggestions in response to ComReg 19/124 (i.e. Options 5a – 5c above) were potentially viable and that either 5a or 5c would eliminate the claimed discrimination against it (and that either of these would be improved by also implementing change 5c). However, Three also suggested further options that it would prefer to any CCA (whether ComReg's proposal or under Three's proposed amendments):

- if there were two 2.1 GHz lot categories instead of time slicing, then Three asserts that a hybrid SMRA would be suitable;
- if the current lot structure remains in place, then Three proposes a form of clock auction that it terms the 'enhanced SCA' (eSCA), based on the simple clock auction but with exit bids, switching restrictions, and additional rounds (where necessary) to allocate any lots that remained unsold at the end of the clock rounds; or
- if ComReg was to use a CCA as proposed, then Three suggests defining spectrum caps based only on spectrum in the award (i.e. allowing Three to bid for a third 700 MHz lot, or preventing all bidders from bidding for a third 700 MHz lot).

CCA acceptable for Vodafone, but SMRA might be option if no time slices

Vodafone again emphasised the need to maintain the timelines for the award, particularly as ComReg has already produced a long and comprehensive series of consultations. It agreed with the use of a CCA, but considered that an SMRA could be used if time slices were removed. In relation to Three's claims about discrimination, Vodafone also pointed to the 2012 MBSA, where Three effectively won a lot at reserve price due to the implications of the caps; Vodafone believed that Three could not reasonably complain now that positions were reversed with Three starting the upcoming award with more sub-1 GHz spectrum.

On the other options set out in the Information Notice, Vodafone considered that:

- options 3 and 4 (the SCA and CMRA) came with significant unknowns and lacked transparency;
- options 5a – 5c (Three's proposed caps and limit on the bid amount for a third 700 MHz lot) were "*an evident attempt by Three to distort the auction in their favour, seeking to guarantee their continued spectrum advantage*"²; and
- options 5d – 5g (adjustments to the reserve prices or pricing rules put forward by ComReg) would increase prices, reduce transparency, and are not proportionate to any issues identified with the auction process.

Vodafone also supported the suggestion of Three returning a block of sub-1 GHz spectrum, which would mean all MNOs started from the same point regarding sub-1 GHz spectrum.

² ComReg 20/78, Section 5, Vodafone Ireland Ltd response to ComReg 20/56

2.6 Further comments on auction format options - ComReg 20/78 and 20/94

ComReg published non-confidential versions of the responses submitted on the Information Notice (ComReg 20/78). Eir and Three submitted further comments on these responses, and ComReg published the non-confidential versions of these in ComReg 20/94.

Three's concerned about asymmetric treatment

Throughout the consultation process, Three's main concern has been that the caps, in combination with the CCA, may lead to asymmetric prices in a way that constitutes discrimination against Three. It observed that particular auction mechanisms may suit some respondents more than others, but ComReg's decisions must be objectively justified, proportionate, and non-discriminatory, rather than based on "*a simple 'vote' of self-interest*"³. Three disagreed with both Eir and Vodafone that its proposed caps seek to give it an advantage, claiming that it only sought to have its price in the auction determined on an equal basis to its competitors.

Three's new concerns

Three also claimed that:

- neither ComReg nor any respondent had put forward a reasoned argument for the sub-1 GHz cap;
- the exposure pricing proposals already addressed Eir's concerns, and Three disagreed with Eir's proposed amendments to the CCA;
- eir's suggestion that the 700 MHz band could be awarded separately would be an improvement to the proposed CCA, but it should be awarded in a separate stage of the same auction, to avoid delays;
- the current level of spectrum asymmetry is not a concern, therefore Vodafone's comments around Three having a significant spectrum advantage arising from the Three/O2 merger are mistaken;
- Vodafone's comparison to the 2012 MBSA (it suggested that Three was effectively guaranteed a 900 MHz lot at reserve price, and that it cannot reasonably complain if the situation is reversed) was not relevant because in that award, time slices were such that spectrum could not count towards its cap beyond the licence's expiry; and

³ ComReg 20/94, Comments on ComReg 20/78 from Three, Section 1. General comments

*Eir's views on
Three's proposals*

- Vodafone's opposition to a sub-1 GHz cap in the UK suggested it is not considering the matter objectively.

Eir continued to claim that a SCA is appropriate and stood by its proposed amendments to the CCA if ComReg continues with that format. It also made a number of comments on Three's suggestions, in particular that:

- ComReg's proposed caps have resulted from a detailed consultation process which considered all available options (contrary to Three's claim that there was no reasoned argument to support them);
- Three's hybrid SMRA proposal would expose bidders to substitution and aggregation risks;
- eir had no objection to time slicing the 2.1 GHz band in its SCA, whereas the lot structure proposed in Three's hybrid SMRA would not address Vodafone's concerns about time slicing without use of an auction format without package bidding; and
- as Three's enhanced SCA was not a true package format, it may be appropriate to increase the size of the lots in some categories if that were used.

2.7 Key issues identified

We conclude this section with a summary of the main issues arising from the various consultations, which are analysed in turn in subsequent sections. We emphasise that this is not an exhaustive list, but rather focuses on the key matters in contention.

2.7.1 Time slicing

*Licence alignment
in the 2.1 GHz
band is needed to
promote
competition*

Supporting competition for the 2.1 GHz band is complicated by the significant difference in the expiry dates of the existing licences. Some licence alignment measures are required to allow bidders to compete for the spectrum currently held by Eir on a neutral basis along with the rest of the 2.1 GHz spectrum, and the other bands in the award.

*Extensions of 2.1
GHz licences can
be ruled out*

There is a period of circa five years between the expiry of Vodafone's existing rights of use in the 2.1 GHz band and Eir's. Extending existing rights would very likely require ComReg, at minimum, to make some assessment of potential demand for other parties, which would need formal consultation.

Offering extensions of that duration to Three and Vodafone without them paying a market price for spectrum access is not a viable option. This would treat Three and Vodafone preferentially relative to Eir and risks distortion of downstream competition. It is not feasible to set a reasonable charge for spectrum access administratively, as there would be significant uncertainty in any estimation of likely market price; using the auction outcome to determine such a charge would risk distorting bidding incentives and would in any case require some process to convert prices for spectrum sold at auction into commensurate terms for an extension licence. Furthermore, regardless of ComReg's ability to set such a charge for an extension administratively, potential entrants would be denied the opportunity to compete for this spectrum until 2027.

Return of Eir's 2.1 GHz licence

The main proposal from respondents for dealing with different end dates of licences was to propose that Eir hand back its 2.1 GHz licence around the time that Vodafone's and Three's licences terminate. However, this is Eir's decision and cannot be imposed. To date, Eir has not indicated any willingness to return this licence; therefore, the award design must accommodate this significant difference in end dates.

Time slices vs different length licences

The other contended issue is the lot design and whether it is better to have time slices (i.e. licences for an initial period up to 2027 and then a longer period from 2027 onwards) or, as Three propose, differentiated long and short licence durations (i.e. licences from 2021 onwards and 2027 onwards). We discuss this issue in Section 4.2 below.

In summary, there are strong reasons why time slicing is likely to lead to more efficient outcomes, as it provides flexibility for rearrangements of spectrum holdings when Eir's current licence expires. This permits neutral competition for spectrum usage from 2027 onwards, undistorted by Eir's incumbency, and provides additional opportunities for entrants relative to the long/short licence approach.

2.7.2 Competition caps

ComReg's objective with this award is to achieve efficient assignment and use of the available 700 MHz, 2.1 GHz, 2.3 GHz, and 2.6 GHz spectrum. An efficient outcome requires downstream competition to be promoted, by preventing excessively asymmetric outcomes in which the disparity between spectrum holdings prevent a bidder from being able to

provide a competitive service. Furthermore, permitting outcomes in which a bidder would likely be able to exercise downstream market power could create incentives for bidders to deny rivals sufficient spectrum, by bidding above their intrinsic value for the spectrum to earn rents.

Effective downstream competition does not require symmetry

As has been clearly stated by ComReg, promotion of downstream competition does not mean that all competitors need closely similar spectrum holdings, but rather that there are a sufficient number of competitors each with sufficient spectrum to compete effectively.⁴ Therefore, caps and similar measures should be aimed at excluding outcomes that fail to achieve this requirement, rather than imposing symmetry.

Proposed caps

ComReg is proposing the use of two caps: one for spectrum below 1 GHz and an overall cap. Spectrum below 1 GHz is particularly important for coverage, which is a significant issue for Ireland because of its low population density and limited clustering of its rural population (relative to other European countries). At the same time, the supply of sub-1 GHz spectrum is limited, with the 700, 800 and 900 MHz constituting the entire supply suitable for mobile use for the foreseeable future. Therefore, how the 700 MHz spectrum in this award is split amongst MNOs is especially important for downstream competition.

Objections to these caps

Initially, Three objected strongly to the form of the cap, especially the sub-1 GHz cap, in that it takes into account both existing spectrum holdings and spectrum acquired in the auction. In Three's view a cap should only apply to spectrum acquired in the auction, rather than taking into account the significant differences in current holdings. We discuss this issue in Section 5. However, Three's later comments have shifted, as it submits in response to the information notice that, "*importantly, both the Hybrid SMRA and the eSCA can be run with ComReg's proposed sub-1 GHz cap without creating the price discrimination against Three*"⁵ and now emphasise that it "*has not objected to ComReg's proposed spectrum caps on their own, it is the combination of the caps and the CCA*"⁶, and the implications of this for what different MNOs might expect to pay, to which we turn next.

⁴ See ComReg 19/59R, §7.185

⁵ Three response to ComReg 20/56, p. 12, published in ComReg 20/78

⁶ Three response to ComReg 20/78, p. 2, published in ComReg 20/94

2.7.3 Interaction between auction format choice and caps

A large part of the Three's responses concerned the matter of the proposed 70 MHz cap on post-auction holdings of sub- 1 GHz spectrum. This has the effect of limiting Three to acquisition of at most two lots from the six available 700 MHz lots, whereas Vodafone and Eir can acquire up to three lots due their smaller initial holdings.

Three's objection to the combination of a CAA with the proposed caps

Three believes that the combination of the proposed competition caps and the use of a CCA (which uses opportunity cost-based pricing) discriminate against it. Later submissions clarify that Three is not opposed in principle to the use of a CCA, though it is not Three's preferred format, or to the proposed competition caps, if ComReg proceeded with only one of the two. For example, in its response to the Information Notice, Three states that "*it is not specifically the use of a CCA auction on its own or the use of spectrum caps on their own that causes the price discrimination, but the specific combination that ComReg proposed to use*".⁷ In the same response, Three proposes both an enhanced SCA (simple clock auction) that could operate with ComReg's proposed caps and lot structure (which it describes as an appropriate format), and a CCA with 'symmetric in-auction caps' on spectrum acquired, in which the rules are otherwise as proposed (which it describes as potentially viable and non-discriminatory). Therefore, our interpretation is that Three's main concern is now with the interaction of the proposed caps (especially the sub-1 GHz cap) with the CCA format, rather than either the auction format or the caps *per se*.

Relative prices paid by MNOs for 700 MHz

Under ComReg's current proposal, Three suggests that Eir and Vodafone would pay too little. The basis for this concern is that, in the case that only three MNOs competed for the 700 MHz spectrum, both Vodafone and Eir would each win a 700 MHz lot at reserve, as each would face competing demand for at most five lots (i.e. at most two lots from Three and at most three lots from the other MNO). In contrast, Three would pay the opportunity cost expressed by rival bidders for all 700 MHz lots it won, as Vodafone and Eir could together express demand for all the available 700 MHz lots. Therefore, the essence of Three's concern – though Three does not express it in these terms – is that the sub- 1 GHz cap leads to Vodafone and Eir paying less

⁷ ComReg 20/78, Section 4, Response to Document 20/56 from Three

for winning two lots than had Three had the ability to bid for a third block, as Vodafone and Eir have.

Three's proposals to reduce the claimed relative price disparity

Therefore, Three has proposed a number of options that would increase price uniformity in various ways. Three has proposed a joint cap of at most five 700 MHz lots being won by any two winners. This would offer Three a similar possibility to win a 700 MHz lot at reserve price, by restricting Eir and Vodafone's ability to compete for third lots. Alternatively, the increase in price uniformity could be achieved by removing the opportunity to win a lot at reserve price from the other MNOs, by either relaxing the sub-1 GHz cap on Three, or by using a different auction format. Three also proposes a modification of the pricing rule for the proposed CCA (which would leave other features, including the caps, unchanged), which would (assuming no competition from non-MNOs for the 700 MHz lots) lower the price paid by Three if it won two 700 MHz lots. A further alternative proposed by Three is to cap the bids that Vodafone and Eir can make for third blocks of 700 MHz. As we discuss subsequently in Section 6, all these various suggestions from Three have the common feature of restricting or disincentivising competition from Vodafone and Eir for third lots of 700 MHz spectrum.

Vodafone opposes Three's proposed changes

In contrast, Vodafone agrees with ComReg that a CCA is the appropriate auction format in the presence of time slicing. It suggests that an SMRA would also be a suitable format if time slicing were removed but recognises that time slicing is necessary if Eir does not surrender its 2.1 GHz licence prior to the award. Vodafone also disagrees with Three's proposal for long and short 2.1 GHz licences.

Similarly, Vodafone is opposed to Three's proposed modifications to the CCA, which it believes are aimed at protecting Three's existing spectrum advantage. Vodafone considers that ComReg's proposed competition caps that take existing holdings into account are appropriate and consistent with international best practice.

Imagine is concerned about changes that benefit MNOs over smaller operators

Imagine agrees that a CCA is a suitable format for the award, but suggests the overall process as operated for the 3.6 GHz award disadvantages smaller operators (although its earlier comments relate to the need to pay the auction fee up front, rather than over the course of the licence, which is not a result of using a CCA but rather how payments by licensees are structured). It believes measures to address specific issues in the 700 MHz and 2.1 GHz bands should not affect the other bands, and it is opposed to any further amendments to the format that

would increase complexity, have a disproportionate effect on smaller operators, give an advantage to MNOs, or result in higher prices for smaller bidders.

2.7.4 Price transparency

Eir suggests budget constrained bidders need price transparency

Eir's primary concern is that, in a CCA, the uncertainty over the price it will ultimately need to pay presents a serious problem to budget constrained bidders, in that eventual payments may be significantly lower than winning bids due to the second price rule. It believes that the addition of exposure pricing information is helpful in improving price transparency, but is insufficient, as a bidder might still need to submit a bid above its budget to win its preferred package, whose price could ultimately be below that budget.

To address this issue, Eir has proposed its own changes to the CCA, but would prefer a pay as bid format⁸, in particular one based around a simple clock auction (SCA). Eir has suggested that such a SCA should have relaxed activity rules, and it also sees merit in Three's eSCA. However, it disagrees with Three's suggestions that a hybrid-SMRA would be preferable to a SCA, and that the caps, which Eir notes are the outcome of a detailed consultation process, could ignore existing holdings. Therefore, Eir favours retaining the package bidding aspect of the CCA even though it would prefer to move to an SCA as it is a pay as bid format.

In the absence of a move to its proposed SCA, Eir proposes significant changes to the CCA. In our view, there is some lack of clarity around Eir's proposals (as discussed in Section 6), but the essence is to replace the supplementary bids round in the CCA (which is a one-off round in which bids can be raised and additional bids made, subject to limits set by the clock round bids) with an iterative bidding process, but to retain the second price rule within the CCA. In the absence of such a change, Eir asks for additional summary information to be provided at the end of clock rounds that would facilitate making supplementary bids at below a bidder's valuation.

⁸ In a pay as bid format, winners pay the amount of their winning bid, rather than any lower amount.

3 Early liberalisation and licence alignment

3.1 Introduction

Existing licences and available spectrum for award

A source of complexity for this award is the inclusion of the 2.1 GHz band where current licences have different expiry dates. Specifically:

- Three currently has access to 2x30 MHz of the available 2.1 GHz spectrum, split into two non-contiguous 2x15 MHz blocks. These comprise three 2x5 MHz spectrum rights in the 'A Licence', which expire on 24 July 2022, and three 2x5 MHz spectrum rights in the 'B Licence', which expire on 01 October 2022. Each of Three's 2x15 MHz blocks include spectrum associated with the A Licence and spectrum associated with the B Licence. The A Licence was initially assigned to Hutchison, and the B Licence to Telefónica; when the two companies merged, Three acquired all of their combined 2.1 GHz spectrum.
- Vodafone has a licence for a contiguous 2x15 MHz block of 2.1 GHz spectrum, which expires on 15 October 2022.
- Eir has access to a contiguous 2x15 MHz block of 2.1 GHz spectrum, and its licence expires on 11 March 2027.

This means that:

- 2x45 MHz of 2.1 GHz spectrum will become available in 2022 (though at various times); and
- an additional 2x15 MHz will be available from 2027.

Differences in Vodafone's and Three's 2.1 GHz expiry dates

The variation in licence expiry creates issues for ComReg's preference to align the terms of the new rights of use issued as much as possible. In particular, the small difference in expiry dates of Vodafone's and Three's licences creates complications when determining the start date of the new licences for this spectrum. There is a benefit to having the new rights of use

start at the same time but maintaining continuity of service⁹ requires further measures to fill the gaps in licences that would then result. For these reasons, ComReg has proposed:

- to give Three the option to take on interim licences for some or all of the 2.1 GHz spectrum it is currently assigned that run from the point of expiry of the current (relevant) licence up to the expiry date of Vodafone's current licence (15 October 2022); and
- that if Three uses the option to take on the interim licence(s), it would be liable to pay a pro rata fee based on the amount of spectrum associated with the interim licence(s) and the fees it is paying for its current licences.

All of the new rights of use for the frequencies currently assigned to Vodafone and Three could then start together on a common date of 16 October 2022. Rights of use for all of the 2.1 GHz spectrum available for award can be given the same expiry date.

Eir's 2.1 GHz licence

Clearly a similar solution cannot be applied with regards to the much larger difference between the expiry dates of Eir's current licence and the licences of the other two MNOs. Nevertheless, there is likely to be an efficiency benefit from resolving the allocation of all blocks within the band in a common process, rather than re-awarding the spectrum subject to Eir's expiring licence in a separate award after 2027.

A clean solution would be for Eir (and potentially the other licensees) to return its current licence early and for all of the 2.1 GHz band to be included in the award with a common start date. Of course, no licensee can be compelled to return any of its rights of use early. Assuming Eir does not wish to relinquish its current 2.1 GHz licence early, it is then unavoidable that the award needs to accommodate new rights of use in the 2.1 GHz band with different start dates (i.e. some starting in 2022 and others starting later in 2027).

Proposals

ComReg proposes to deal with the different expiry dates of current 2.1 GHz licences and align new rights of use as follows:

⁹ The earliest feasible common start date for new rights of use for the spectrum currently assigned to Vodafone and Three would be 16 October 2022 (i.e. when all current rights licensed to the two operators have expired). If Three were to win new rights of use, this would lead to a period between expiry of Three's current licence and the start of its new licence in which it could not use the spectrum and would need to suspend its services or migrate them to an alternative band.

- Provide Three with an option to prolong its existing 2.1 GHz rights of use so that they expire at the same time as Vodafone’s licence (15 October 2022) through the issuing of new interim rights of use, with an appropriate fee (as discussed above);
- Make available new 2.1 GHz rights of use for those expiring in October 2022, for the period 16 October 2022 to 11 March 2027 (to coincide with Eir’s current licence expiry);
- Make available new 2.1 GHz rights of use for the full 2x60 MHz available in the 2.1 GHz band, for the period 12 March 2027 until a common expiry date (currently expected to be 30 November 2041).

Liberalisation option

ComReg has also decided to provide current 2.1 GHz licensees with the option to liberalise their licences to allow the spectrum to be used for services other than UMTS (as is the requirement under the current licence terms). Under ComReg’s current proposals, the MNOs would be allowed to take up the liberalisation option at any time between publication of ComReg’s final substantive decision on the award and the expiry of their licence. For the period up to 15 October 2022 there would be no associated liberalisation fee (over and above the existing licence fees), given the expectation that it should not create any distortions to competition. However, complications again arise due to the much later expiry date of Eir’s licence, since Eir’s liberalisation option would cover the five-year period 2022–2027 (in addition to the period between the substantive decision and October 2022, in which all three MNOs could liberalise existing licences).

To mitigate the risk of creating a competitive distortion through allowing Eir access to liberalised spectrum on unduly favourable terms compared with the other MNOs, ComReg has provisionally determined to charge Eir a liberalisation fee for the period 2022 – 2027, but only in the event that the market price of liberalised 2.1 GHz spectrum (as indicated by the outcome of the award) is above the current fees being paid by Eir for the spectrum. This approach does not seek to capture the additional business value that Eir might itself enjoy from liberalisation, only the increase in the market price of that licence caused by removing the technological restriction.

The specific proposed methodology for calculating Eir’s liberalisation fee is set out in ComReg 19/124a, but in essence Eir’s current licence fee would be compared with an estimate of the market price for 2.1 GHz spectrum derived from the auction and a liberalisation fee would be applicable if the estimated

auction price were higher. Otherwise Eir would not be required to pay anything above its existing fees.

Issues raised in response

ComReg's proposals to deal with both licence alignment and early liberalisation have received a number of comments throughout the consultation process. The most recent (previously unaddressed) comments are predominantly in relation to:

- the timing of when the early liberalisation option would become available;
- the liberalisation fees that might apply for Eir; and
- the fees that Three would be required to pay for any interim licence(s).

These are discussed in turn in the subsections below.

3.2 Timing of early liberalisation

3.2.1 Views of respondents

Timing and terms of early liberalisation option

In the draft Decision, ComReg proposed to allow early liberalisation at any point from the publication of the final decision to the expiry of a licence. All three MNOs commented on the timing of this option in their response to the draft decision.

Vodafone agreed with ComReg's proposed timing for liberalisation. It noted that Eir's comments that the current spectrum imbalance in the 2.1 GHz band is an obstacle to liberalisation, and agreed that spectrum imbalance remains an issue, but supports ComReg's proposal, on the basis that there will be approximately six weeks between the publication of the final decision and that of the IM and auction timetable.

Three agreed more strongly that the early liberalisation option should be available from the publication of the final decision. It noted the European Commission decision that the 2.1 GHz band should be liberalised from 2014, unless this would result in competitive distortions, and suggested that, as ComReg has concluded that there would be no competitive distortions, there are no grounds for further delays to liberalisation.

However, Eir believes that the early liberalisation option is of no use to it until the fee is known. It suggests that there may potentially be a long period of time in between the publication of the decision and the conclusion of the award process,

particularly if some aspect of the award were subject to a legal challenge. In this period, other MNOs could exercise the early liberalisation option at no risk, while Eir would face uncertainty over the fee for which it would be liable. Eir believes the liberalisation option is not of any use to it for that period as a result. Therefore, if ComReg does not change its proposal for the determination of an early liberalisation fee, Eir suggested that no operator should be allowed to exercise the early liberalisation option until the end of the early liberalisation process.

*Effect of temporary
ECS licences*

In response to the COVID-19 crisis, ComReg provided temporary licences that gave operators access to spectrum in the 700 MHz and 2.6 GHz bands and allowed MNOs to use their 2.1 GHz spectrum on a liberalised basis. In total, the initial and further temporary spectrum management measures will, subject to a three-month review, allow operators to use liberalised 2.1 GHz spectrum until 1 April 2021. Any extension beyond this date would be subject to consultation and require further Regulations to be made. Therefore, there is no automatic roll-over of these temporary arrangements and further temporary access would be considered on its merits.

Eir suggested in its response to ComReg's consultation on further temporary spectrum management measure that, on the grounds of administrative efficiency, temporary licences could run until the conclusion of the MBSA2 award process, but also noted that the expiry of existing temporary licences would be closely aligned with the award process based on the current timetable, so this was not a major concern at that time.¹⁰

ComReg noted that, in its response to the draft IM, Eir suggested that the liberalisation of the 2.1 GHz band should not be included in the renewed temporary licences. We understand that ComReg assumes that the common request to renew the licences implies that the MNOs were content with the current licensing framework, and that they agreed the temporary liberalisation, in light of the need to alleviate capacity concerns, would not give any MNO a material advantage over its rivals.

3.2.2 Assessment and recommendations

Under the proposals set out for consultation, existing licensees would be given the option to liberalise their licences at any time

¹⁰ ComReg 20/88

from the publications of ComReg's Final Decision up to the expiry date of their licence. However, the significant difference between the expiry dates of Eir's 2.1 GHz licences and those of Vodafone and Three means that Eir would unavoidably be in a very different position compared to the other two in terms of the early liberalisation option. In particular, Eir's liberalisation option would run to 2027, whereas Vodafone and Three would need to acquire new rights of use to have access to 2.1 GHz spectrum on a liberalised basis over the period 2022-2027.

Position of Eir

Therefore, whilst we do not see any need to charge a liberalisation fee to any of the licensees over the period up to the expiry of Vodafone's and Three's licences, due to the short time that this would have effect, the same cannot necessarily be said of the period between that and the expiry of Eir's licence. Specifically, if Eir gained access to liberalised 2.1 GHz rights during the period 2022-2027 but paid for that spectrum access at below market price, this could give rise to concerns over a material distortion to competition.

To avoid such a scenario, we have proposed a mechanism under which Eir might be required to pay a fee for liberalising its 2.1 GHz spectrum over the period 2022-2027, but *only* in the event that the results of the multiband award were to demonstrate that the prevailing market value of the liberalised spectrum is above the licence fees that Eir is already paying. The level of the fees would be based on the extent to which the market value of liberalised 2.1 GHz spectrum implied by prices in the auction exceed Eir's current fees. This methodology was designed to ensure that Eir's access to liberalised spectrum is not given on unduly favourable terms but also to, as far as possible, maintain Eir's incentives to make use of the liberalisation option where efficient to do so.

Risks to Eir

We cannot rule out that Eir might need to make a payment for liberalisation under this approach, as we do not know what prices will be set by the auction. However, on the basis of prices achieved elsewhere in comparable auctions, in our previous report¹¹ we judged that it is unlikely that Eir would need to pay such a surcharge given what Eir has paid for its current licence. Eir would, presumably, be able to make a similar assessment of its likelihood of such a surcharge.

A consequence of this approach is that any liberalisation fee to be paid by Eir would not be known until after the award. In this regard, Eir's key concern over the timing of when the

¹¹ See ComReg 19/59a, section 3.3.4.

liberalisation option becomes available appears to be that, while Vodafone and Three would be able to liberalise their own spectrum and make use of it on improved terms (up to 2022) without risk, Eir would be faced with having to decide between:

1. liberalising its spectrum without knowing the extent of any fees it might then be liable to pay after the award, and when there is a risk that competitors may seek to artificially inflate prices in the award to manipulate the liberalisation fee; and
2. waiting until after the award to liberalise (or not) when the fee would be known, but consequently not being able to use the liberalisation option until that point (when its competitors could).

On that basis, Eir suggests that if ComReg continues with its proposed approach to setting a liberalisation fee for Eir, the option to liberalise should only be available (to all operators) after the award when the additional fee (if any) would be known.

Costs from delayed access to liberalised spectrum

In response to this suggestion, we recognise that there is some risk to Eir if it liberalises (or indeed not liberalising) prior to the award. However, delaying the option to liberalise until after the award process for all operators would, in our view, be a disproportionate solution. There is potentially a relatively long period of time between publication of the Final Decision and the end of the award; preventing use of the spectrum on a liberalised basis over that period could inefficiently defer the economic benefits that could be achieved (both for consumers and operators).

In addition, and as stakeholders (including Eir) have pointed out, the changes in demand resulting from the COVID-19 situation have placed additional strain on telecommunications services and access to suitable spectrum to manage this (as evidenced by the take-up of temporary 700 MHz and 2.1 GHz liberalised licences). It would, therefore, seem that allowing the MNOs to liberalise their 2.1 GHz licences as soon as possible may be more important than ever, and any delay to that would prevent realisation of a clear and immediate benefit.

Trade-off between avoiding delay and risks to Eir

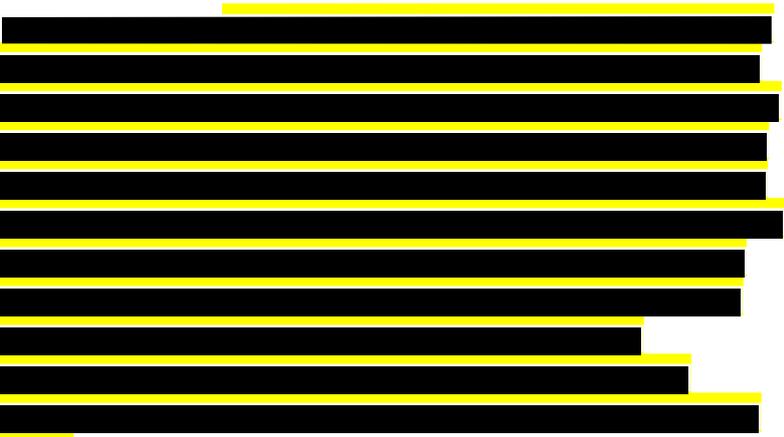
We recognise that the current proposal leaves Eir facing some risk, but under the circumstances created by the significant asymmetry in licence expiry dates, we do not believe there is a perfect solution that still allows ComReg to make the spectrum available on a liberalised basis as soon as possible. Therefore, a trade-off must be made between allowing liberalisation as soon

as possible versus placing Eir in a situation where it lacks certainty about the implications of liberalisation.

In our view, the risks created for Eir by the proposed approach are minor. Although we cannot provide any guarantees, our expectation is that the current fees being paid by Eir are above the current market value of the spectrum, so the risk faced is relatively low. Our benchmarking report¹² (an updated version of which will be published alongside the IM) shows that 2.1 GHz award prices in the last ten years have been significantly lower than Eir's current licence fees.

Furthermore, this opinion seems to be implicitly echoed by Three's request for its interim licence fees to be calculated using the same methodology as for Eir's liberalisation fee, rather than on a pro rata basis using the fees for current licences; it would be surprising if Three were to request use of a process that was likely to increase the amount it would have to pay, suggesting that Three believes the auction prices are unlikely to be higher than the current fees.

Moreover, we do not believe that Eir is in as unique a position as it seems to believe in relation to the risk of liberalising before the award. We do not claim that Vodafone and Three are in exactly the same situation as Eir. Nevertheless, utilising the liberalisation option will be linked to some committing investment in the band, and an expectation of continued use of the spectrum in the future to justify changes in how the spectrum were used. Liberalising before the award would therefore carry some risk and exposure to the (at the time unknown) auction price for obtaining new licences.

[✕  ✕]

¹² ComReg 19/59b

3.3 Liberalisation fees for Eir

3.3.1 Views of respondents

Three and Vodafone have no objection to ComReg's early liberalisation proposals, and in particular Three agrees with the principle underlying the methodology to charge the lowest amount possible subject to not distorting incentives, as well as with the proposed methodology for implementing this.

Furthermore, Three states that it is confident that an early liberalisation fee will not apply for Eir (i.e. that the price of 2.1 GHz spectrum will have fallen relative to the previous award).

Eir's concerns about the liberalisation fee

Eir, the operator that will potentially pay an early liberalisation fee, believes that the proposed fee is disproportionate. While it agrees with the principle of charging a fee based on the going market price for liberalised spectrum, it does not believe that a fee based on 2.1 GHz final clock prices in both time slices follows that principle. Eir suggests that a fee can only be described as fair if it:

- takes into account the value of the spectrum for the period of time covered by the first time slice; and
- does not create scope for competitors to [redacted] [redacted].

On the first point, Eir notes that new technology such as 5G will go through a period of adoption before it reaches mass-market appeal. Therefore, the business case benefits of the spectrum for 5G purposes will likely be delayed and applicable to the second time slice only. Therefore, it does not believe that the second time slice spectrum should be included in the calculation of its liberalisation fee.

Eir recognises that the nature of a combinatorial auction is that bidders express valuations for a combination of lots, and suggests this creates opportunities for [redacted] [redacted] [redacted]. Although it does not believe there is any easy solution to this, it believes also considering 2.3 GHz and 2.6 GHz time slice 1 spectrum in the fee calculations, because the bands are substitutes for the 2.1 GHz band, would mitigate the problem. Eir has also suggested that further safeguards against [redacted] [redacted] could be included, such as applying a pro rata liberalisation fee to Vodafone and Three.

Finally, Eir is concerned that DotEcon has dismissed its concerns by suggesting that the fee is unlikely to apply, and if that is the case, then no fee should be charged. Eir also believes a description of the liberalisation fee methodology should have been included in the Draft IM, as it believes any liberalisation fee should be reflective of the value of the liberalised spectrum up to 2027, and the outcome of a consultation process.

3.3.2 Assessment and recommendations

Trade-off between using narrow comparators and risks of gaming

In terms of the principles for setting an early liberalisation fee, we are largely in agreement with Eir in that the fee should reflect the value of the spectrum over the period of the first time slice (relative to an imputation of what Eir is currently paying for it on unliberalised terms). We also agree the approach adopted should not create gaming opportunities within the auction. However, there is no perfect way of setting these fees, as there is a trade-off between trying to estimate a value for liberalised spectrum by taking account of only the most relevant comparable lot category with the auction, at the risk of then creating incentives for other bidders to try to increase the price of this lot category, versus minimising scope for gaming by averaging across a number of lot categories, some of which may be less accurate comparators. Eir's proposals for changes to the method for calculating the liberalisation fee in essence takes a different view about this trade-off, rather than there being any fundamental disagreement about guiding principles.

Use of first time slice or an average of first and second time slices?

Our proposed approach, where the liberalisation fee (if any) would be based on the combined auction price of the 2.1 GHz lots across both time slices, was primarily driven by concerns over preventing opportunities for competitors to drive the price of lots for the first time slice in an attempt to influence the liberalisation fee for Eir. In response to this, Eir has expressed its view that including the 2.1 GHz second time slice price in the calculation would be inappropriate as the value of the spectrum in the two time slices would be different. We consider that Eir's argument has some merit.

The inclusion of the second time slice price in the proposal method for calculating the liberalisation fee was the result of an abundance of caution in mitigating the risk of distortion to the 2.1 GHz first time slice price. However, if only the first time slice price were included in the calculation, we would expect there to be a fairly low risk of competitors being able to [X ██████████]

[REDACTED]
 [REDACTED] ✂], predominantly because:

- to have any affect, it would require [✂ [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED] ✂] (which we would expect given available estimates of market value); and
- we do not see any obvious direct and immediate benefit for Vodafone or Three that could be achieved by [✂ [REDACTED] ✂], so there would seem to be little incentive to engage in such a strategy in the first place (in particular given the risks involved).

With this in mind, and taking into account Eir’s strong (and reasonable) view that the 2.1 GHz second time slice price should not be taken into account, we recommend that ComReg amend the proposed calculation of the early liberalisation fee to only use the first time slice price.

Using of other bands for averaging

However, we do not believe that it would be appropriate to include the 2.3 GHz and 2.6 GHz prices in the calculation, as was also proposed by Eir. Although the bands are likely to be long term substitutes for the 2.1 GHz band, we have never claimed that they are perfect substitutes; short-run differences in how they might be used may create differences in valuations. Basing the value of 2.1 GHz liberalised licences on the price of the 2.3 GHz and 2.6 GHz first time slice licences is, therefore, not likely to provide a more precise estimate of the short-term 2.1 GHz value. We are recommending that only the first time slice be considered to set the liberalisation fee as the risk of gaming is not serious. The same reasoning then applies to averaging with other first time slice lot categories (i.e. including the 2.3 GHz and 2.6 GHz bands would not improve the value estimate and is unnecessary for mitigating gaming options). We therefore do not believe there is a justification for including these additional bands in the calculation.

Moreover, including these lot categories and averaging would do little to effectively mitigate any gaming opportunities as they are substitutes for the 2.1 GHz band rather than complements. Notwithstanding our view that the risk of such gaming is in fact relatively small, other bidders seeking to push the price of first time slice spectrum [✂ [REDACTED] ✂] could use the same strategy irrelevant of whether the 2.3 GHz and 2.6 GHz first time slice lots are included in the calculation; if

they were included, the strategy would just need to be applied more broadly to push the price of all higher frequency first time slice lots rather than just focussing on 2.1 GHz. For the inclusion of additional lot categories to be an effective deterrent to gaming, it is necessary to include lots across both time slices (as we had initially proposed) so that others would need to increase prices in both time slices to affect Eir's liberalisation fee, which would be risky if they also want a licence for the full term in the relevant band(s).

Liberalisation fee for Vodafone and Three

We also see little merit in Eir's suggestion to apply a liberalisation fee to Vodafone and Three based on auction prices. The currently proposed approach is fair to all three MNOs as in the unlikely event that Eir were to pay a liberalisation fee, this would only be charged in regard of the period from the start of newly issued 2.1 GHz licences to Vodafone and Three (assuming they win these) to the end of Eir's current licence, even if Eir were to exercise its option to liberalise prior to the start of these new licences. Therefore, none of the MNOs are being charged for liberalisation in the period up to the start of the first time slice. Furthermore, we do not have a directly determined price for comparable liberalised spectrum running prior to the start of the first time slice.

3.4 Fees for interim licences

3.4.1 Views of respondents

ComReg's proposals involve tidying over operators with licences terminating before the start of the first time slice with interim licences with fees based on what were paid for those existing licences.

Vodafone believes that the proposals for licence alignment are fair and reasonable. Similarly Eir has no complaints about the proposal for interim licences.

Three's complaints

However, Three believes that the current proposals for interim licence fees are excessive, and would lead it to take up the option for only a subset of the spectrum it currently holds. Three submits that it might 'switch off' some of its 2.1 GHz equipment, only to switch it on shortly after, if it chooses to take up interim licences that only cover a subset of its current holdings in the band. It may do this if the price is too high, which would leave spectrum inefficiently unused for a time.

Three submits this might also lead it to make inefficient investments to provide continuity of service with less spectrum.

Three suggests it would be better to award licences with different start dates than to continue with the current approach, even though that would add complexity to the award process. Its main suggestion is that fees for interim licences are set similarly to those for early liberalisation. It notes that ComReg and DotEcon have explained that fees should be set based on opportunity cost, rather than the value of spectrum, given ComReg's aim for an efficient award. Therefore, it suggests that the interim licence fee should make use of estimate of the opportunity cost of the spectrum available as a result of the auction, by setting the fees using a similar methodology to that for Eir's early liberalisation fee. Fees based on existing prices, on the other hand, would be inconsistent with the argument that the licence prices are likely to have fallen since the previous award.

Three also suggests that there are a number of other issues or inconsistencies in the current approach, because:

- it is unclear what CPI values should be used given that the start dates for Vodafone and Eir's licences were significantly different;
- there is no index to adjust Vodafone's fees to match Eir's;
- the terms and conditions differ between A and B licences; and
- ComReg would be skipping over recent information (i.e. the opportunity cost of licences established in the auction).

3.4.2 Assessment and recommendations

Difference between extensions and Eir's liberalisation

There is no simple solution to the problem of setting licence fees for roll-over of existing licences. The auction provides information about the market value of broadly comparable spectrum, but this is from the first time slice onwards so does not directly cover the period in question. Therefore, the issue is not directly comparable to that of assessing any liberalisation fee that Eir pays, as here ComReg needs to assess the value of liberalised spectrum over a period *not* covered by licences awarded by the auction. This is an important difference. Therefore, there is no direct analogy with the question of how Eir's liberalisation fee should be set.

In essence, we have a situation in which there is:

- an established value for expiring licences (namely that set by the payment terms entered into by the licensees);
- a potential estimated market value for comparable spectrum in the first time slice (though likely only established as a range due to the combinatorial nature of the auction and the ambiguity of imputing the value expressed for packages of different lots to individual lot categories); and
- a short gap in between the expiry of Three's existing licences and the start of new licences without an immediate reference point for establishing its value.

Given this, both the value of existing licences and the value of new licences assist in estimating the value of spectrum during the gap, assuming some stability of market value over time. It is not the case, as Three suggests, that the auction is so informative about value during this gap that we can entirely discount what existing licensees are currently paying. If the only issue were making the best estimate of the value of spectrum in the gap period, this would suggest some form of average of these early and later valuations. We disagree with Three that it would be best only to use the later value.

There is merit in using a consistent approach

However, there are also important practical issues to consider. In particular, the issue of short technical extensions to licences is a potential issue in other contexts, not just MBSA2, and there is merit in ComReg using a consistent approach across all these contexts. This provides predictability for licensees, as they then know when acquiring a licence what terms will likely apply if a short technical extension occurs subsequently.

Basing interim licence fees on current licence fees is the approach taken by ComReg in the past. For example, this was how interim licence fees for 1800 MHz spectrum were set for Telefonica over an approximately 6½ month period across 2014-15.¹³ We note that Three supported this methodology at the time.

We recommend ComReg maintain its existing approach

Given the value of ComReg adopting a consistent approach, there needs to be *sufficient* reason to use a different approach now. However, the proposed extensions are short and only Three has raised concerns, with both Vodafone and Eir having no complaint. In the absence of a clear benefit to adopting a different approach, we recommend that ComReg maintain its

¹³ See ComReg 19/59R, Annex 5

previous approach and set payments for short extensions by reference to the payments for the existing licence.

4 Spectrum packaging

4.1 Inclusion of the 700 MHz band

4.1.1 Views of respondents

Separate award of 700 MHz spectrum

Eir now suggests that the RIA should include the option of awarding the 700 MHz spectrum in a separate auction from that used to award the 2.1 GHz, 2.3 GHz, and 2.6 GHz bands. This separate 700 MHz award should use a simple, uniform price format, according to Eir, and the award of the other bands could also then be simplified.

While Eir does not accept that Three's expressed concerns over asymmetric pricing (discussed in Sections 5 and 6 below) are material or relevant, it suggests that the separate award of the 700 MHz band would resolve them, as they relate specifically to prices in that band. In Eir's view, this would be preferable to any of Three's proposed tweaks to a CCA, which would risk distorting the outcome either directly or via distorted bidding incentives.

Three agrees that Eir's proposal to award the 700 MHz band separately is preferable to the proposed CCA. However, it suggests that, if this option were considered, it should be a separate stage of the same auction, to avoid delaying the use of the spectrum.

4.1.2 Assessment and recommendations

Efficient benefits of an integrated award

As resolved in ComReg 18/60, there are complementarities between the 700 MHz band, which has favourable propagation characteristics and will be an important coverage band, and the higher frequency capacity bands. This means that there is significant aggregation risk that bidders will only be able to mitigate if the bands are awarded simultaneously.

This aggregation risk will be a particular problem for a potential new entrant who requires spectrum in multiple bands. Even if such an entrant is unlikely to participate or win spectrum, it is still appropriate for ComReg to support competition by providing the opportunity for entry. If anything, this is even more important than was previously argued, as the increased

licence duration means there will be fewer opportunities for entry in future. We note that the proposal for separation of the award comes from existing market players (and Three, who would benefit most from the proposal, also holds the greatest amount of spectrum in existing licences both above and below 1 GHz).

We recommend that the 700 MHz not be split off into a separate award or stage within this award

For this reason, we strongly recommend that the 700 MHz band should not be awarded separately from the other bands, regardless of whether this would allow ComReg to simplify the award, or whether it would resolve Three's concerns (which we agree with Eir, are not material, as discussed in Section 5 and 6 below).

Likewise, while awarding the band in a separate stage of the same award may well be preferable to running separate auctions, it would make it impossible to avoid aggregation risk. Therefore, there is no significant difference between multiple awards and multiple stages in one award with regard to the adverse impact for bidders wanting complementary spectrum separated into different stages or different awards.

4.2 Time Slices

4.2.1 Views of respondents

Long/short licences Three does not believe that time slicing is the appropriate method for dealing with the 2.1 GHz band. It has instead suggested having lot categories for long and short 2.1 GHz licences, with different start dates and a common end date. Three initially disagreed with DotEcon's concerns with a short/long licence approach, suggesting that:

- gaming would be unlikely, because Eir would have a clear defensive strategy in switching to the longer licences; and
- the risk of MNOs identifying a natural split of 2.1 GHz spectrum, leading to potential tacit collusion, is not dependent on lot structure, and is small in any case as ComReg intends to set robust reserve prices.

Vodafone, however, strongly believes that the lot structure put forward by Three is not a good solution to the issues arising in the 2.1 GHz band. It points to an auction in Germany where a similar lot structure was used, and notes that the issues raised by DotEcon played a significant part in the auction, with bidders

bidding for lots desired by others, which lead to significant distortions in that award.

Three has subsequently recognised the risk of strategic bidding under its preferred lot structure, although it suggests that the strategic behaviour of bidders in the German auction was linked to genuine competition between four bidders wishing to acquire 2.1 GHz spectrum. Three notes that it is exposed to the same risk of price driving behaviour in the 2.1 GHz band as Vodafone, but having considered the trade-off between potential gaming behaviour under its preferred approach, and introducing complexity and aggregation risk using time slicing, Three believes that, on balance, using long and short licences is preferable to time slicing the 2.1 GHz band.

Eir, on the other hand, thinks that the incentives and opportunities for gaming are the same under time slicing and Three's long/short licences approach, although there could be an advantage for time slicing in a uniform price auction. Therefore, in Eir's view ComReg should assess all combinations of auction format and spectrum packaging options. Eir also rejects the suggestion that there is a natural split of 2.1 GHz spectrum that would be acceptable to MNOs (potentially increasing the risk of tacit collusion), and notes that it has an interest in increasing its 2.1 GHz holdings in the first time slice.

Other than Three, respondents are generally satisfied with time slicing in the 2.1 GHz band. In particular, Vodafone has noted that, although the auction could be simplified if time slicing was removed, it is necessary if Eir does not hand back its existing licence prior to the award.

*Time slicing the
2.3 GHz and
2.6 GHz bands*

However, all respondents disagree with time slicing the 2.3 GHz and 2.6 GHz bands. Firstly, Three suggests that extending time slicing to these bands to facilitate switching only makes sense in an auction format with package bidding, and otherwise it needlessly extends aggregation risk.

Vodafone notes that time slicing bands without incumbent licensees is unprecedented, and suggests that the gains in simplicity from not time slicing the 2.3 GHz and 2.6 GHz bands outweigh the risk of gaming, especially as Eir (who the current time slicing proposals aimed to protect), is opposed to time slicing the other bands. It highlights that equipment has very limited flexibility across bands and operators are likely to purchase band specific equipment, therefore, because a single time slice is too short to make efficient use of equipment. As a

result, options for moving from band to band between time slices are limited.

Moreover, Vodafone does not agree that the complexity arising from time slicing the 2.3 GHz and 2.6 GHz bands falls solely on the auctioneer, as bidders are free to bid only as for packages containing the same lots in each time slice. It is possible that significant price differentials could arise between spectrum in different time slices, and bidders need to understand the value of different combinations of lots in order to respond to these price differences in the auction, should they arise. This valuation exercise will be difficult for all bidders, and should they make mistakes as a result, and therefore bid on the basis of inaccurate valuations, then this could lead to an inefficient outcome.

Eir notes that it was aware of the issues relating to the bands being substitutable, and the interaction of the caps with the lot structure that could lead to gaming (that disadvantages Eir) that have been put forward as reasons to time slice the 2.3 GHz and 2.6 GHz bands. However, it judged that the simplicity gained by only time slicing the 2.1 GHz bands outweighs those issues.

Eir also believes that, in a CCA, the option of switching into other bands if the price of second time slice spectrum in the 2.1 GHz band increases is of little use to it and does not resolve concerns over gaming. As DotEcon has recognised, bidders are likely to bid for packages with the same spectrum in each time slice. Therefore, in Eir's view, bids where Eir [✂ [REDACTED] [REDACTED] [REDACTED] [REDACTED]] because the corresponding first time slice spectrum would be valued at reserve price for the purposes of winner and price determination. The only potential advantage is the possibility of [✂ [REDACTED] ✂] in the 2.3 GHz or 2.6 GHz band, but this seems unlikely to have a material impact on the outcome.

However, Eir submits that there would be a stronger case for time slicing these bands in a uniform price auction. In this case, if Eir were to switch between bands in the second time slice, it would [✂ [REDACTED] [REDACTED] ✂].

Eir suggests that there is a further risk that reserve prices for the first time slice spectrum are high relative to the value of that spectrum in the first time slice, as estimated at the time of the award. This could lead to spectrum going inefficiently unsold, as demand could be below supply, only for bidders to later realise that they did have a valuable use for the spectrum over that

period. Overall, it is Eir's view that ComReg should not time slice the 2.3 GHz or 2.6 GHz bands, as this would add significant complexity to the award for little gain, particularly if this was the deciding factor in using a CCA instead of a simple clock auction.

Imagine does not believe that time slicing is necessary or appropriate for the 2.3 GHz or 2.6 GHz bands. In general, it suggests that measures taken to address issues specific to the 2.1 GHz band (or the 700 MHz band) should not affect the remainder of the bands in the award, and it questions whether it is appropriate to assume that TDD spectrum in the 2.3 GHz and 2.6 GHz bands is substitutable for FDD spectrum in the 2.1 GHz band, which is the basis for time slicing these bands.

4.2.2 Assessment and recommendations

Need for time slicing

Licensees are able to hand back 2.1 GHz licenses before the award. Under the assumption that they (or at least Eir) do not choose to do so, some measure to accommodate the different end dates of 2.1 GHz licences is unavoidable.

It is not efficient to extend existing 2.1 GHz licences by five years, as this which would distort the market, conferring significant advantage on existing licensees. A later process to re-award some 2.1 GHz spectrum as Eir's existing licence expires is clearly inefficient, as then part of the 2.1 GHz band would be awarded in MBSA2 and part in a subsequent award process, despite this spectrum being perfectly substitutable. It is not feasible for ComReg to compel Eir to surrender its licence; there would be no grounds in terms of spectrum management given that it is possible to accommodate the differing termination dates of 2.1 GHz (as shown by the MBSA2 proposals).

Therefore, we consider that accommodating Eir's 2.1 GHz incumbency is a requirement of the award process and this means that the auction design needs to be able to award licences of different lengths. Through the use of short extensions, small differences in the date of termination of existing licences can be accommodated. This reduces the complexity significantly, as we then need only to distinguish two relevant time periods (before and after 2027).

ComReg has proposed time slicing to address this issue, which does not create unnecessary risk or complexity for bidders if a package bidding format (such as a CCA) is used, but to be clear, this is not the only reason to use a CCA for this award. Even if a different auction format were used, then the timing difference

in the availability of different portions of the 2.1 GHz would still need to be accommodated.

*Long/short licences
segment demand*

Regardless of the choice of auction format, Three's alternative suggestion of long and short 2.1 GHz licences creates potential for segmentation of demand. Although all 2.1 GHz spectrum after 2027 is essentially identical, it would be arbitrarily split into some usage rights bundled with a right to use before 2027 and some without. Clearly even for a licence commencing in 2022, most of its value comes from the usage right it conveys after 2027. Therefore, the proposal of long and short licences undermines neutral competition between the MNOs for 2.1 GHz usage rights after 2027, as once differentiated into short and long licences, certain licence become the preserve of particular bidders.

Therefore, choosing short and long licences over time slicing would stifle competition, by restricting switching opportunities, create opportunities for tacit collusion, by making it easier for bidders who have a natural interest in a certain lot category to coordinate, and would therefore risk an inefficient outcome. Time slicing avoids this problem, as then all 2.1 GHz spectrum after 2027 is offered as identical lots and artificial distinctions are avoided.

*Fundamental
concerns about
demand
segmentation*

We strongly emphasise that the segmentation of demand for post 2027 usage rights at 2.1 GHz is *in itself* problematic, and our concerns about using long and short licences are not limited to gaming opportunities resulting from the interaction of this lot structure with the caps and it not dependent on the use of a CCA. For example, Eir would clearly be more interested in the short licences than its rivals, which makes tacit collusion more likely as there is a natural divide in the lot categories that the bidders would be bidding in. This 'natural split' in lot categories of interest increases the risk of tacit collusion even if Eir wishes to win additional 2.1 GHz spectrum. Although Three has noted that robust reserve prices offer a means of restricting incentives for tacit collusion, we see no reason why ComReg would provide scope for facilitating tacit collusion via other award design features.

*Opportunities to
drive up Eir's price*

We have previously identified that Three's preferred lot structure, combined with the caps, would create opportunities for gaming, because others may bid up the price of (short) lots Eir is naturally interested in, but they do not expect to win themselves. We do not agree with Three that Eir has an effective strategy to mitigate this issue.

First, if Eir bids at the cap in both time slices, it is not true that such a defensive strategy as described by Three exists, because bidding at the cap is only possible if it continues to bid on the short licences. Therefore, any retaliatory strategy assumes that Eir is bidding below the cap. Second, even if some retaliation is possible, to ensure that there is no gaming behaviour, other bidders' anticipation of Eir's response would have to be sufficient to prevent them instigating such gaming behaviour. We do not think this is the case because such a strategy is not as straightforward as Three suggests. Third, regardless of any conclusion about whether such gaming is likely or not, we consider that the auction design should not create gaming opportunities when there are reasonable methods available to avoid them (in this case, time slicing).

Vodafone has highlighted that gaming behaviour was a significant issue in the recent German award that used a similar lot structure, and bidders had a predictable interest in certain lot categories.

Time slicing the 2.1 GHz band is no more complex than using long/short licences

In response to this comment from Vodafone, Three has admitted that there would be a risk of price driving with long and short licences, but this is worth tolerating, in its view, to simplify the auction. However, this seems to be based on the misapprehension that a CCA has only been proposed because of time slicing, and that otherwise an SMRA would be used, and further that price driving would be unlikely in that format. Of course, this is not the case: we have not proposed a CCA only to deal with aggregation risks associated with time slicing and even if an SMRA were used, the issue of demand segmentation due to short and long lots would be present.

Fundamentally, we do not agree that time slicing is any more complex than having long and short licences in the 2.1 GHz band. In both cases bidders would have to consider their valuations, and surplus, from licences of difference length as prices evolve in the auction for the second period only as well as the full 19 years and 1.5 months. If a long licence became expensive relative to a short one (or vice versa), a bidder might substitute one type for the other. A bidder might decide to, say, bid only for long licences and not to even consider or value short licences. However, it could do exactly the same with time slicing, as it could only ever bid on packages containing the same number of lots in both time slices.

Time slicing substitute bands

While all respondents other than Three are satisfied with time slicing the 2.1 GHz band, they disagree with time slicing the 2.3 GHz and 2.6 GHz bands.

Given the need to time slice the 2.1 GHz band, also time slicing the substitute bands is desirable as it maximises potential for competition and any rearrangement across the various supra-1 GHz bands on expiry of Eir's existing licence. This is not to say a different arrangement of spectrum above 1 GHz in the two time slices is probable. However, to impose the constraint that the arrangement be the same before and after expiry of Eir's 2.1 GHz licence through the auction design would be both unnecessary and arbitrary.

Efficiency benefits of flexibility

It may be in the interests of all MNOs to avoid destabilising a settled arrangement of spectrum holdings above 1 GHz once Eir's 2.1 GHz licence expires in 2027. In this scenario, competition for first time slice lots at the same time settles second time slice lots. This avoids a further element of competition regarding the second time slice. However, *imposing* such an outcome is contrary to ComReg's objective of efficient allocation and use of spectrum. We cannot rule out that the ending of Eir's 2.1 GHz in 2027 might allow some rearrangement to occur which could involve substitute bands. Nor do we want to rule out opportunities that this might create for parties other than the three MNOs; for example, what if the additional flexibility post 2027 could accommodate an entrant alongside the three MNOs?

The appropriate approach given ComReg's objectives to provide the maximum flexibility within the award process to allow competition between bidders to determine the allocation of spectrum, subject to the requirement that this does not cause excessive complexity for bidders in terms of the decisions they must make or the mechanics of bidding.

Are the bands substitutes?

Imagine has questioned whether the bands are indeed substitutes, referring back to its previously expressed view that the 2.1 GHz band is used in FDD mode, and an existing mobile 3G band, and therefore it is inappropriate to infer substitutability between this band and the TDD spectrum in the award (which Imagine submitted is suited to 5G FWA services). It has not explicitly recognised or responded to our view¹⁴ that, because all supra-1 GHz FDD and TDD spectrum has similar propagation characteristics, it will likely be used for similar purposes in the long run, and therefore all of these bands should be considered substitutes. Moreover, although legacy issues may affect the use case of the 2.1 GHz band for MNOs (but not other bidders) in the short run, Imagine's

¹⁴ Expressed in ComReg 19/124a, paragraph 66

characterisation of the bands is not appropriate in an award of technology and service neutral licences.

Promoting competition regardless of whether Eir is bidding at the cap

We have raised the issue that, if only the 2.1 GHz band were time sliced, and Eir was bidding within 30 MHz of the overall competition cap in both time slices, then it would not be able to switch out of the band in response to price changes, and we remain of the opinion that this would restrict switching opportunities and competition within the award. Eir agrees that this is a potential issue, but on balance suggests that it would be better to simplify the award, by not time slicing these bands. In particular, Eir claims the opportunity to switch between bands would be of little use to it in a CCA, as bids for packages containing different spectrum in each time slice may be unlikely to become winning bids. However, while it is true that Eir cannot unilaterally change the outcome by switching in one time slice only, it is perfectly possible that such a bid could be included in a winning combination of bids.

We cannot be presumptive about the results of the auction, or what would constitute an efficient outcome. Bidders are not starting from a symmetric position in terms of the total amount of spectrum licensed to them. As the relative supply of spectrum between the 2.1 GHz, 2.3 GHz, and 2.6 GHz bands is different in the first time slice compared to the second, it is plausible that the relative prices between these bands will not be constant across time slices, and therefore bidders could want different mixes of each between time slices. Time slicing all supra-1 GHz bands effectively provides two opportunities for competition on the most equal basis possible.

No downside to time slicing in combinatorial formats

Time slicing all supra-1 GHz bands avoids imposing the significant restriction that their allocation is the same before and after 2027, when Eir's licence for a significant amount of 2.1 GHz will end. Providing flexibility for changes in spectrum distribution across the time slices comes with no significant downside.

Our statement that bidders could concentrate on packages containing the same spectrum in each time slice *if they wished* was an observation that time slicing all of these bands need not add any material complexity to the award; it was not a statement that this could be assumed to be the efficient outcome as some bidders might wish to respond to differences in the relative prices of different bands across the two time slices. The auction design provides this flexibility and it is up to bidders themselves whether or not they wish to avail themselves of this.

Moreover, there is no downside to time slicing the bands in any format with package bidding, including the simple clock auction (with or without relaxed activity rules), which is Eir's preferred format. Provided the auction features package bidding, so as not to create aggregation risk for bidders, then time slicing these bands provides the most possible flexibility, and it is entirely at the discretion of the bidder whether to exploit this.

Complexity of bidding decisions

Vodafone's argument is essentially that, although bidders may intend to bid only for packages containing the same spectrum in each time slice, they must be prepared to respond to large price differentials that could in theory arise. As a result, a bidder's preferred package at round prices could include different amounts of spectrum in one time slice compared to the other.

Why might an MNO want time period bundled?

Vodafone is essentially saying that it would prefer the first and second time slices to be bundled together for these substitute supra-1 GHz bands, so separate prices for the two time periods cannot be seen. Hypothetically, imagine that we run the proposed CCA, but only reported a total price for, say, 2.6 GHz FDD lots across the two time periods as Vodafone only ever wanted to bid for the same number of both time periods. Vodafone would have then given up its opportunity to respond to differences in the relative prices of bands across the two time periods. At first sight this appears to make Vodafone unambiguously worse off as compared with knowing separate prices in the two time periods. However, the benefit is that bundling the two time periods avoids opening a new front of competition in the auction for different outcomes across the two time slices. Therefore, whilst the MNOs may have reasons to propose removing the time slicing for substitute bands to suppress competition within the auction, this is contrary to ComReg's objectives for efficient allocation.

Investment horizons

We do not agree that time slicing the 2.3 GHz and 2.6 GHz bands creates any problem in that regard. If it is the case that a time slice is too short to make economic use of equipment, this can be resolved entirely by never bidding for packages without spectrum in a band in both time slices. On the other hand, Vodafone is also concerned about mistakes in the relatively complicated valuation process leading to an inefficient outcome. However, we are not convinced that this is a significant issue, because:

- it is always the case that if bidders do not know their valuations, we cannot discover an efficient outcome, but

ComReg has proposed an open auction to mitigate this;
and

- if valuations for some packages are inherently uncertain, we would expect cautious bids for these, which would be less likely to affect the outcome.

*Unsold first period
lots*

Eir has made a related point, that uncertainty around valuations for spectrum in the first time slice, combined with relatively high reserve prices, could lead to spectrum going inefficiently unsold. However, if the reserve price for a package of lots covering the same spectrum for the full 20 years is low enough (as seems likely in Eir's scenario), package bidding is still an effective means of preventing this issue as bidders will primarily be concerned about the sum of reserve prices across the two time slices for each spectrum band.

5 Competition caps

5.1 Background

Initial views on caps

ComReg set out its preliminary views on measures to protect downstream competition in its consultation document ComReg 19/59R. DotEcon's associated report (ComReg 19/59a) provided an analysis of various options for caps.

In the absence of any restrictions on the quantities of spectrum that bidders could obtain, ComReg considered that there was a risk of bidders acquiring spectrum with a view to lessening downstream competition within mobile services, making caps (or similar measures) necessary. Spectrum below 1 GHz is likely to have a particular role in determining the cost to network operators of delivering wide-area services, especially in rural areas. This justified a sub-1 GHz cap, alongside an overall cap on spectrum holdings. ComReg considered that caps should be set at a level that excludes allocations of spectrum amongst the existing MNOs that are excessively asymmetric, but that there was no necessity for all MNOs to have equal holdings.¹⁵ Caps would apply only to limit the acquisition of spectrum within the award process; they would not apply to any subsequent spectrum transactions (which would be considered by ComReg in the light of the prevailing circumstances if and when they occurred).

Existing spectrum asymmetry

In ComReg 19/59a (Table 2 of Section 5, reproduced below) we set out the relative positions of MNOs in terms of current holdings of spectrum. Three holds the most spectrum, both overall and under 1 GHz, where it has an additional 2x5 MHz block of 900 MHz relative to Vodafone and Eir. In ComReg 19/59R, ComReg considered that these current differences in spectrum holdings are not excessive or likely to have an adverse impact on competition.

¹⁵ See Section 7.7 of ComReg 19/59R.

Table 1: Current spectrum holdings of MNOs

Band	Three	Vodafone	Meteor
800 MHz	20 MHz	20 MHz	20 MHz
900 MHz	30 MHz	20 MHz	20 MHz
Total sub-1 GHz	50 MHz	40 MHz	40 MHz
1800 MHz	70 MHz	50 MHz	30 MHz
3.6 GHz*	100 MHz	105 MHz	85 MHz
2.1 GHz FDD	60 MHz	30 MHz	30 MHz
Total supra-1 GHz	230 MHz	185 MHz	145 MHz
Total	280 MHz	225 MHz	185 MHz
Total (exc. 2.1 GHz)	220 MHz	195 MHz	155 MHz

*We count existing 3.6 GHz holdings as the maximum bandwidth in any region, as holdings vary across regions

Initial cap proposals

ComReg 19/59R set out preliminary proposals for the sub-1 GHz and overall caps, with the key features being that:

- caps apply to spectrum acquired in the award plus existing holdings, as downstream competition between MNOs depends on post-auction spectrum holdings;
- a 70 MHz (2x 35 MHz) cap on sub-1 GHz spectrum is appropriate – a lower cap would unduly restrict outcomes and risk spectrum being inefficiently unallocated, whereas any higher cap would risk excessively asymmetric post-award holdings; and
- an overall cap in the range of 375 – 420 MHz would be suitable, again to avoid excessive asymmetry in post-award spectrum holdings whilst not unduly restricting competition within the award process.

Whilst not reaching any specific conclusion on where within this range the overall cap should be set and inviting comments from stakeholders, ComReg noted that the lower end of the range would limit any increase in asymmetry relative to the current position.

Caps proposed in the Draft Decision

The Draft Decision maintained the initial proposal for a sub-1 GHz cap of 70 MHz (including current holdings in the 800 MHz and 900 MHz bands) and proposed an overall cap of 375 MHz (including current holdings in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 3.6 GHz bands).

5.2 Views of respondents

5.2.1 Main issues

Caps are not dependent on the auction format

By way of introduction, we reiterate the principle expressed by ComReg in ComReg 19/59R and our report (ComReg 19/59a) that caps should be used to prevent outcomes where the spectrum distribution is excessively asymmetric and risks causing a significant lessening of downstream competition. Subject to this requirement, caps should be set as loosely as possible to allow the award process to explore a wide range of potential outcomes and achieve an efficient allocation of spectrum.

While most respondents were satisfied with the caps, Three claims that the *combination* of the proposed sub-1 GHz cap with a CCA discriminates against it. Therefore, at least in part, Three's concerns relate to the *interaction* of caps with the choice of auction format rather than the caps *per se*. However, any such interaction is not relevant to the determination of the caps, as:

- caps may have an effect on the choice of auction format (and its detailed rules) through their effects on competition for spectrum; but
- the auction format does not affect the appropriate level or structure of the caps, because the auction format does not affect the set of outcomes that are consistent with protecting competition downstream.

Therefore, the appropriate sequencing is first to consider issues relating to the caps independently of the award format, because the caps are designed to prevent outcomes that are likely to harm downstream competition. Indeed, the analysis of caps set out in our first report (ComReg 19/59a) was made independent of, and prior to, any consideration of the auction format. For this reason, in this section we consider Three's counterproposals on caps primarily through the lens of what impact they would have on downstream competition. To the extent they also raise issues about auction design, we consider these in Section 6

below, when discussing the choice of award format in the light of the design of caps, and also in Annex A which responds to a report by NERA on behalf of Three.

5.2.2 Level of the overall cap

The overall spectrum cap

Respondents generally accepted the overall spectrum competition cap of 375 MHz. Eir said that the cap should not be any higher than this, whereas Vodafone noted that, while it agreed with the previously proposed range for the cap (375–420 MHz), it disagreed with ComReg’s reasoning for setting the cap at the lower end of this range.

Vodafone considered that ComReg should focus on the proportion of available spectrum held by different parties, which it suggests had been used previously by ComReg as the basis of setting the level of competition caps, rather than asymmetry between larger and smaller spectrum holdings across operators. However, this concern appears primarily methodological, as Vodafone did not then draw out any implication for the level of the overall cap.

Imagine observed that the proposed 375 MHz cap addresses the possibility of an effective duopoly emerging between two existing MNOs, and avoids exacerbating asymmetry between Eir and Three. However, Imagine favoured a lower cap, as this would reduce the chance of the MNOs acquiring the majority of the available spectrum, at the expense of entrants and other operators (particularly FWA operators).

Three noted that it is not for ComReg to pick winners, and claimed that having a preference for avoiding certain outcomes is in conflict with the objective of achieving an efficient outcome through competition for spectrum between bidders. It cited the reasoning for setting the cap at 375 MHz, which it describes as “*protection of Eir in circumstances where there is competition in bidding from new entrants*”¹⁶, as an example of this.

5.2.3 Three’s complaints about the sub-1 GHz cap

The need for formal competition analysis

As mentioned above, Three alleges that the combination of the sub-1 GHz cap and a CCA discriminates against it by preventing it from bidding for a third 700 MHz lot and guaranteeing the

¹⁶ ComReg 20/56s, page 52.

other MNOs a 700 MHz lot at reserve price if there is no demand for 700 MHz from bidders other than the three existing MNOs.¹⁷ Therefore, Three asked that ComReg identify the specific outcomes it has deemed will cause harm to downstream competition, and to demonstrate that its proposals are proportionate in addressing this issue.

In particular, Three does not believe that it is appropriate to apply this sub-1 GHz cap without formal competition analysis, as in its view ComReg has neither identified any issue with the current level of asymmetry, or demonstrated that there would be any harm to competition if a bidder held more than 2x35 MHz of sub-1 GHz spectrum. Three notes that a number of completed or proposed 700 MHz awards in Europe allowed (or will allow) for an operator to acquire 2x40 MHz or more of sub-1 GHz spectrum (e.g. Denmark, Germany, Switzerland and the UK). It claims that no analysis has been offered by ComReg as to why the other MNOs should be allowed to express a value for a three 700 MHz lots, but Three should not.

Three also noted that certain specific outcomes are ruled out by the cap without sufficient reasoning being offered by ComReg. It claims that ComReg is precluding outcomes that could theoretically harm competition, but has not identified any actual harm, and therefore Three submits this is a 'precautionary' cap. In response to ComReg's observation that Three's proposed joint cap would rule out the outcome in which it wins no 700 MHz lots, and the outcome is that Vodafone and Eir hold 70 MHz of sub-1 GHz spectrum each, while Three holds 50 MHz, it observes that the proposed cap prohibits an outcome in which one of Eir and Vodafone ends up with 80 MHz, the other with 60 MHz, and Three with 50 MHz. Three also observes that ComReg has previously stated that a cap above 70 MHz risks there being only two 700 MHz winners, before expressing a concern that the joint cap precludes an outcome in which Vodafone and Eir are the only winners in the band and it notes that its joint cap guarantees three winners.

Even if ComReg had identified outcomes that were a threat to competition, Three does not believe the cap would necessarily

¹⁷ Under the proposed cap, Vodafone and Eir limited to acquiring at most 3 lots and Three at most 2 lots of the 6 available 700 MHz lots. Therefore, if there is no demand from other bidders, Vodafone and Three can jointly demand at most 5 blocks, implying that Eir is able to win one block without competition. The same argument applies swapping Vodafone and Eir. However, this does not apply to Three, as Vodafone and Eir could between them compete for all 6 available 700 MHz lots.

be effective. It highlights that the cap only applies during the auction, and there is nothing to prevent it from subsequently acquiring more spectrum. Three also noted that Virgin Media has an option to acquire some of the spectrum currently licensed to Three as a result of undertakings given in the Telefónica/Hutchison merger.

Ignoring existing holdings

Three says that it is not opposed *per se* to the proposed competition caps on their own, but only in combination with a CCA as, in Three's view this is likely to lead to discriminatory outcomes in terms of the amounts likely to be paid by the three MNOs.¹⁸ One of Three's proposed solutions to the alleged discrimination is to ignore existing spectrum holdings (i.e. to set a cap on 700 MHz acquired, instead of a sub-1 GHz cap). This would also be on the grounds that if the 800 MHz and 900 MHz bands are substitutes for the 700 MHz band over the long run, then in Three's view it is inconsistent to apply a cap based on all three, given that the existing licences expire ten years before the expiry of 700 MHz licences to be awarded. In relation to this, Three submits that:

- the only way to deal with this under the current rules would be to add a further time slice; and
- ComReg has given no assurances as to how the fact that licences for most of the existing holdings that count towards the competition caps will expire half way through the new licences will be dealt with in the current or any future award.

Vodafone comments that spectrum caps based on existing holdings are common in other countries and have been supported by Three elsewhere. Given Ireland's low population density, Vodafone suggests that the sub-1 GHz spectrum is particularly important, and this spectrum should be distributed between operators to support competition. It agrees with ComReg that use of competition caps is appropriate to avoid extreme asymmetric outcomes, and supports both the use of

¹⁸ Three has made its position clear in multiple responses that it is not opposed to the cap *per se*, but rather the use of a CCA with the proposed cap. In its response to ComReg 19/124 (at page 2), Three says that "[The problems] would not arise if ComReg adopted an SMRA format with its proposed cap." In its response to ComReg 20/56 (at page 2), Three say that "[i]t should be noted that it is not specifically the use of a CCA auction on its own or the use of spectrum caps on their own that causes the price discrimination, but the specific combination that ComReg has proposed to use." Three's response to ComReg 20/78 (at page 2) again clarifies that Three "has not objected to ComReg's proposed spectrum caps on their own, it is the combination of the caps and the CCA."

separate sub-1 GHz and overall caps and the proposed levels of the caps.¹⁹

Vodafone notes that caps asymmetrically affect users with larger existing spectrum holdings, but that this has been a feature of previous awards in Ireland and elsewhere. In particular, in its response to ComReg document 20/56, Vodafone notes that Three was effectively offered a 900 MHz lot at reserve price in the 2012 MBSA due to the effect of the caps used then²⁰, and it cannot reasonably complain now that the situation is reversed.

However, Three does not accept that comparison to the previous MBSA is relevant, because the time slices in that award were such that spectrum could not count towards the cap beyond a licence's expiry. It also suggests that Vodafone is not considering the proposals objectively, because it accepts the interpretation of the caps implying an offer of a lot at reserve price but does not believe this should be extended to Three, and because Vodafone has opposed a sub-1 GHz cap in the UK.

Eir rejects the suggestion that the cap could ignore existing 800 MHz and 900 MHz holdings, and notes that the caps are

¹⁹ See ComReg 20/56s, page 85.

²⁰ The 2012 MBSA included spectrum in the 800 MHz, 900 MHz and 1800 MHz bands, awarded in two time slices. The four existing MNOs at that time - Vodafone, Telefónica O2, and Meteor - all had existing holdings covering the first time slice. All four had 2x15 MHz in the 1800 MHz band, while Meteor also held an existing 2x10 MHz block of 900 MHz spectrum. The existing licences restricted use of the spectrum to GSM, but the associated frequencies were included in the award as "Party-Specific" 2x5 MHz lots for liberalised licences, where each Party-Specific lot was available only to the associated current licensee; all Party-Specific lots were won by the respective existing licensee, so we can count these lots as being available for the purposes of understanding the implications of the caps.

Including Party-Specific lots, a total of six 2x5 MHz lots in the 800 MHz band, seven 2x5 MHz lots in the 900 MHz band and fifteen 2x5 MHz lots in the 1800 MHz band were available in each time slice. Spectrum caps were 2x20 MHz across the sub-1 GHz bands (800 MHz and 900 MHz) and 2x50 MHz across all three bands (800 MHz, 900 MHz and 1800 MHz) for each time slice. A further cap of 2x10 MHz in the 900 MHz band also applied for the first time slice only. These caps included existing holdings. Therefore, there were 13 lots available in total below 1 GHz, of which any one bidder could obtain at most four. Three of the MNOs could obtain at most 12 lots and, provided there was no competition from parties other than the existing MNOs, leaving one sub-1GHz block uncontested. Similar logic applied to the 900 MHz lots in the first time slice, as three MNOs could obtain at most 6, leaving one lot uncontested if there were demand only from the MNOs.

the outcome of a detailed consultation process that considered all available options.

Both Eir and Vodafone have observed that Three has an option to hand back a block of sub-1 GHz spectrum before the award and that if Three did so, this would resolve its concerns about the effects of the proposed sub-1 GHz cap. However, Three believes that there are various other methods to remove discrimination from the auction process, set out below.

5.2.4 Three's counterproposals

Three has proposed a joint 700 MHz cap

Three has made a number of proposals for additional measures that could be applied alongside the competition caps proposed by ComReg, in particular:

- a joint cap of at most five 700 MHz lots between any two winners for the purposes of both winner and price determination;
- a joint cap of at most five 700 MHz lots between any two winners for the purpose of price determination only (but not applied for determining winners); or
- a cap on the marginal valuation that can be expressed for a third 700 MHz lot, such that it cannot be higher than the final clock price for 700 MHz – Three suggest that this could be implemented via a requirement that bidders bidding for packages containing three 700 MHz lots also submit a supplementary bid for otherwise identical packages with two 700 MHz lots, with a price difference no greater than the final clock price for 700 MHz.

Three only advocates these measures in the context of a CCA (which is not its preferred format) in order to mitigate the alleged discrimination in terms of winning prices within a CCA. Three does not make any suggestion that the joint cap is needed to rule out outcomes that would harm downstream competition.

Eir suggests that any version of this additional cap could lead to an inefficient outcome. Irrespective of the merits of Three's claims, Eir considers that there are no grounds for preventing two bidders from winning all available 700 MHz spectrum, subject to the already proposed sub-1 GHz cap. Applying the cap only for the purpose of price discrimination would prevent Three from having to pay the full opportunity cost of the spectrum it won, which would allow it to bid above valuation, and potentially inefficiently win additional spectrum as a result.

Conversely, a cap on bids that could be made for a third lot might inefficiently prevent one of the other bidders from winning a third 700 MHz lot.

Vodafone suggests Three's proposals serve only to maintain its existing advantage

Vodafone suggests that Three's proposed amendments to the caps are designed to avoid outcomes in which Three finishes the award process with less spectrum than the other MNOs, so are unfairly favourable to Three. Vodafone considers that it would be inappropriate for ComReg to introduce rules specifically to guarantee any bidder a certain number of 700 MHz lots; Vodafone considers that Three's proposed modifications (set out above) protect Three's spectrum advantage and serve no purpose other than reducing the price it will have to pay. Rather than removing discrimination, changes to the caps would discriminate against other bidders, and "*copper fasten Three's very significant spectrum advantage gained by the o2/Three merger process*".²¹

However, Three claims that Vodafone is wrong to suggest it is only attempting to maintain its existing advantage, and comments that ComReg has judged there currently to be no significant disparity in spectrum holdings, prior to the proposed award. Moreover, Three claims that it is only seeking to compete in the auction on an equal basis to other bidders, and accuses Vodafone of attempting to revisit issues in relation to the Telefónica/Hutchison merger that have previously been settled.

5.2.5 Comparison with MBSA

Three (in its response to ComReg document 20/78) also addresses Vodafone's comparison with the situation in the 2012 MBSA, where Vodafone considers Three benefited from a cap in limiting competition for the spectrum Three won. Three considers that there is a significant difference between MBSA and the proposed award, in that the time slices in 2012 coincided with the expiry of existing licences and so there was no scope for current spectrum licences contributing towards a spectrum cap beyond their expiry. This is not the case under ComReg's proposals for the MBSA2. In Three's view, it would require additional time slicing (i.e. an additional boundary in 2030 when the current 900 MHz licences are due to expire) in order for the effect of a spectrum cap not to extend beyond the

²¹ See page 81 of Vodafone's response to the Information Notice, ComReg 20/78.

period of current licences. Three argues that Vodafone is wrong *“to suggest that the rules adopted by ComReg in 2012 somehow disqualify Three from seeking equal treatment in the current award”*.²² Three also points out that Vodafone’s comments appear to indicate that it accepts the idea that ComReg’s current proposals confer an advantage on Vodafone in the award process.

5.2.6 Three’s offer to release spectrum conditionally

On 3 December, after Three wrote to ComReg to make a further proposal that it be allowed to bid for a third block of 700 MHz spectrum on the condition that if it won a third block, then it would divest itself of a block of sub-1 GHz spectrum within a reasonable time after the auction.

Three’s Proposal is (quoting from Three’s letter) that it would give, in advance of the award commencing, a binding commitment to ComReg as follows:

- *“Three will identify and agree with ComReg 1 lot (2x5MHz) of its existing sub-1GHz spectrum that Three is willing to divest itself of, subject to the conditions below. The lot to be divested will be specifically identified and agreed with ComReg and will be in the 900MHz band (“the Divestment Lot”);*
- *The divestiture of the Divestment Lot would be triggered if Three wins more than 2 lots of 700MHz in the upcoming spectrum auction;*
- *The two 900MHz FDD lots left will need to remain contiguous in the band*
- *Three will divest the Divestment Lot within a reasonable time following the spectrum award (the Transition Time), such period to be agreed with ComReg but which could be 3 months;*
- *The Transition Time would allow Three to migrate its use out of the Divestment Lot (to ensure continued service to consumers), and would also include a specified period for Three to offer to transfer the spectrum through a sale of rights, such period to be agreed with ComReg, following which if no agreement for sale can be reached, then the Divestment Lot would be surrendered to ComReg and*

²² Three’s comments on ComReg 20/78, page 5, published as ComReg 20/94, page 14.

available for re-licensing in a new award lot where Three would not be entitled to participate;

- *The Divestment Lot would not count against Three's bidding cap in the upcoming spectrum award such that Three would be permitted to bid for up to 3 lots of 700MHz spectrum in the upcoming spectrum auction."*

Given the very specific offer made by Three and its confidential aspects, we limit discussion in the main text below to the broad issues raised by conditional release of substitutable spectrum depending on how many 700 MHz lots a bidder won. A detailed analysis of Three's specific proposal is provided in Annex B

5.3 Assessment and recommendations

5.3.1 Focus on the sub-1 GHz cap

Focus on sub-1 GHz cap

The focus of the responses is on the implications of the sub-1 GHz cap. Three disagrees with this cap due to its effects on competition for spectrum within a CCA. Other respondents recognise that the proposed caps are the outcome of an extensive consultation process by ComReg, and that setting a cap based on existing holdings is well established by international precedent. Eir and Vodafone raise significant concerns about Three's counterproposals regarding the cap.

Three's concerns do not obviously relate to downstream competition

As noted above, Three's objection to the sub-1 GHz cap is – in the main – based on the effect of that cap on the prices paid by winners within the context of the CCA format, which in turn hinges on the use of a second-price rule (as we will explain below). Although relaxing the cap to allow Three to bid on a third 700 MHz lot would immediately address Three's criticisms, Three does not appear to be concerned that the sub-1 GHz cap is set too tight because it excludes outcomes that do not risk lessening downstream competition. Indeed, Three's proposals for a joint cap of five lots of 700 MHz across two winners are *additional* to the proposed 70 MHz sub-1 GHz cap and so are *more* restrictive, ruling out outcomes that would be possible under ComReg's proposals (such as two winners with three lots of 700 MHz spectrum each, providing neither exceeds 70 MHz of spectrum below 1 GHz in total).

Therefore, there is some tension in Three's arguments in that it argues that an elaborated competition analysis is needed before setting caps, yet its counterproposal for a joint cap would

impose tighter restrictions on possible outcomes than those proposed in the Draft Decision.

5.3.2 Determining the level of the sub-1 GHz cap

In considering the overall design of the award, it is entirely appropriate to start with the question of whether particular outcomes would entail an excessive degree of asymmetry and should be prevented. Logically, this question comes before any consideration of auction format.

Existing spectrum holdings

Ignoring existing holdings is untenable, because the reasoning for the cap is based on avoiding excessively asymmetric outcomes that are likely to harm downstream competition. Clearly, all of the spectrum available to an operator is relevant to its ability to compete effectively, and it follows that the cap must take existing holdings into account.²³ Where a network operator has a large spectrum disadvantage, this will tend to raise its incremental costs of deploying capacity, as it needs more network investment to compensate. It may face an unavoidable quality of service disadvantage, as availability of spectrum may limit the peak speeds it can offer. This may render that network operator less able to impose competitive constraints on those operators with greater amounts of spectrum.

Ruling out excessively asymmetric outcomes

ComReg has been clear that this concern about excessive spectrum asymmetry does not mean that the three MNOs need identical spectrum holdings in order for downstream competition to be effective. Different operators have different commercial strategies and different numbers of customers. Therefore, ComReg's objective of promoting the efficient allocation and use of spectrum is best met by allowing a range of potential outcomes for the allocation of spectrum, limited *only* where there are material risks that downstream competition would be adversely affected. The proposed competition caps are intended to be no more restrictive than required to ensure that downstream competition is protected against excessively asymmetric outcomes amongst the three existing MNOs.

²³ We note that some spectrum awards may use a cap on spectrum acquired and disregard existing spectrum. This is reasonable if there are no significant asymmetries between existing players that need to be taken into account.

Whilst the auction has been designed to provide opportunities for bidders other than the existing MNOs to compete on a fair basis, we need to consider the scenario in which the awarded spectrum – especially the 700 MHz band, which is important for providing coverage – is divided amongst only the three existing MNOs. The existing MNOs have significant incumbency advantages in competing for spectrum and, given its key importance in enhancing wide-area 4G mobile coverage in the short to medium term (and 5G in the medium to longer term) and the strong business cases that the existing MNOs will have in consequence, are more likely to win spectrum in the band than potential entrants. Caps need to be set with the worst case for downstream competition in mind, and this involves the six available blocks of 700 MHz being shared by the existing MNOs in a manner that would lead to one of them being so far behind the others in terms of spectrum holdings that downstream competition was lessened.

Lack of robustness claims and the level of the cap

Therefore, we do not agree with Three's assertion that the setting of the caps, especially the sub-1 GHz cap, lacks robust analysis. As set out above, the principles for establishing the cap are clear. In terms of implementing these principles, the relatively small amount of sub-1 GHz spectrum, and 700 MHz for award in particular, means that there is very little leeway in how an appropriate sub-1 GHz cap should be set, as we explain below. Therefore, this is not a debate about choosing within grey areas. Indeed, we note that Three's primary objection relates to the interaction of the chosen auction format with this cap, rather than the effectiveness of the proposed cap in screening out uncompetitive downstream scenarios properly from competitive.

At present there is a one-block asymmetry between the three MNOs, with Three holding one additional block of 10 MHz (2x5 MHz) at 900 MHz relative to Vodafone and Eir. The proposed sub-1 GHz cap would allow a modest increase in asymmetry from 10 MHz to 20 MHz, if only the three MNOs bid for spectrum in the band. However, any cap at a higher level (80 MHz or more²⁴) would allow asymmetry to increase to four times its current level, potentially leaving one MNOs with double the sub-1 GHz spectrum of another. Fine judgement is not needed to see that this would risk lessening downstream competition because of the scale of the asymmetry across important sub 1GHz coverage spectrum. Therefore, 70 MHz

²⁴ Note that we need only consider caps at some multiple of 10 MHz, as all spectrum is allocated in blocks of this size (i.e. 2x5 MHz).

(seven blocks) is the upper bound for a reasonable level of the cap.

Setting the sub-1 GHz cap at any lower level would entail precluding competition for 700 MHz spectrum entirely if only the existing MNOs were to bid. A cap at 60 MHz would then leave one block unsold (as Vodafone and Eir could acquire at most two blocks, and Three a single block). Leaving a block fallow would be clearly contrary to ComReg's objective to ensure efficient use of spectrum. Therefore, 70 MHz (seven blocks) is also a lower bound for the level of the sub-1 GHz cap.

These two considerations tightly determine the 70 MHz cap. If there was a gap between this upper and lower bound, there would be scope for argument about the appropriate level, but this is not the case. We discuss subsequently that release (or contingent release) of some existing 900 MHz or 800 MHz spectrum might affect what amount of 700 MHz spectrum existing MNOs might be able to bid for. However, it is also clear that even if other sub-1 GHz spectrum were to come into play for reallocation, then regardless of the details, this cannot change the consequences of the fundamental scarcity of sub-1 GHz spectrum. Across the 700 MHz, 800 MHz and 900 MHz bands there are 19 blocks of 2x5 MHz in total. A 7-block cap with three MNOs limits the most asymmetric outcome to a 7/7/5 split. An 8-block cap allows an 8/7/4 split and one MNO having double the holding of another MNO.

Preventing Three from bidding for a third block of 700 MHz to prevent distortion

The consequence of the 70 MHz cap on overall sub-1 GHz holdings is that, given current holdings at 800 MHz and 900 MHz, Vodafone and Eir can potentially acquire three blocks, whereas Three can acquire at most two. We are not concerned that this prevents Three from bidding for a third 700 MHz lot. Outcomes in which Three wins three 700 MHz lots would leave it with by far the largest sub-1 GHz holdings. Three would have eight blocks in total. Assuming the remaining three blocks of 700 MHz split between Vodafone and Eir, possible outcomes are either a 8/7/4 block split or a 8/6/5 split. The latter case involves one of Vodafone or Eir taking a single block of 700 MHz spectrum, which is likely to be inefficient, as single blocks are subject to significant technical limitations in the throughput they can achieve and so are of limited value. Therefore, there is a good likelihood that Three winning three blocks would lead to an 8/7/4 outcome and a 4-block asymmetry would result.

When bidding for three blocks, Three might expect some anti-competitive gains arising from gaining some potential downstream market power, as the current three-player market

would fragment, with a higher-quality/lower-cost duopoly and a differentiated weaker player limited by its much smaller holding of spectrum. If Three was allowed to bid for three blocks of 700 MHz, then its valuation may contain some anticipation of gaining excess profits through weaker downstream competition. Allocating spectrum to Three based on a valuation inflated by anti-competitive rents would not be efficient.

Role of a competition analysis

Three claims that ComReg has failed to provide a detailed competition analysis to support the setting of the sub-1 GHz cap. However, the derivation of the level of the sub-1 GHz cap requires very few assumptions. It arises as an immediate consequence of the scarcity of sub-1 GHz spectrum and an assumption that a 100% spectrum holding advantage of one MNO over another is too much given that a three-player outcome involving only the current MNOs is likely.

ComReg has already assessed that extreme asymmetry in sub-1 GHz spectrum holdings would be detrimental to competition, and therefore a sub-1 GHz cap is required. Given that the level of such a cap can be derived under simple assumptions, and is tightly determined by few considerations, there is no need for ComReg to undertake a further, separate competition analysis.

Three's assertion that a detailed review of the current conditions of competition in the mobile services market is required is beside the point. The level of cap is set to exclude certain *hypothetical* outcomes of the award that can reasonably be expected to lead to a lessening of downstream competition. This is a very different question to that of determining the *current* state of competition in mobile services.

Furthermore, the proposed caps (both overall and sub-1 GHz) do not force any reduction in asymmetry amongst the existing MNOs. As seen above, the sub-1 GHz cap could allow the difference between smaller and largest holding to increase to two blocks. Therefore, it is not the case that ComReg has determined that the current intensity of competition in downstream markets is insufficient and has then imposed an intervention (through a tight cap or other measure) aimed at reducing existing spectrum asymmetry. To the contrary, the proposals in the Draft Decision allow an increase in spectrum asymmetry, provided this is limited. Therefore, the setting of caps is not based on an implicit assumption about current downstream competitive intensity being too weak.

Outcomes excluded by the 7-block cap

Finally, Three has raised a specific point about which outcomes are included and excluded under the proposed cap. In response

to ComReg's observation that Three's joint cap would rule out the outcome in which Three wins nothing and Vodafone and Eir split the 700 MHz equally between them, leading to a 7/7/5 outcome, Three questions why an 8/6/5 outcome, in which Three wins nothing and Vodafone and Eir have a four to two split of the six 700 MHz lots is ruled out. The difference between these cases is clear: in the 8/6/5 case there is an asymmetry of three blocks, whereas if Vodafone and Eir win three 700 MHz lots each the asymmetry is only two blocks. If we were to set a cap at 80 MHz to allow the 8/6/5 outcome, this would also permit an 8/7/4 outcome with an asymmetry of four blocks.

5.3.3 Counting of existing spectrum towards caps

Three raises two issues which relate to how operators' existing holdings should be assessed for the purposes of applying the proposed competition caps:

- whether termination of existing rights of use for 800 MHz and 900 MHz prior to termination of newly issued 700 MHz means that it is not appropriate to treat all three bands similarly when applying a sub-1 GHz cap; and
- whether undertakings that Three have given in context of the Telefónica/Hutchison merger mean that a block of 900 MHz should be considered as encumbered and not counted towards Three's current holdings.

We consider these two issues in turn.

Termination of 800 and 900 MHz licences prior to that of new 700 MHz licences

Existing 800 MHz and 900 MHz licences held by the MNOs were allocated in the MBSA process in 2012 and run until 2030. The period from the commencement of the 700 MHz licences to 2030 is a significant period of time, in which all of the sub-1 GHz spectrum held by an MNO will be relevant to its ability to compete with its rivals. In particular, the 700 MHz band will likely be used in the short to medium term for enhancing 4G services and also for wide area coverage for 5G services over time, so can be expected to come into use soon after award. The 800 MHz and 900 MHz bands can be used flexibly for LTE Advanced, legacy 2G and eventually 5G use. Therefore, holdings across all three bands are relevant to competitive conduct in near term and all three bands become closely substitutable in the longer run, as legacy usage patterns become less relevant.

Beyond 2030, we expect that ComReg will not leave spectrum subject to expiring licences unallocated. A new award of 800

MHz, 900 MHz and 1800 MHz spectrum will be necessary, and competition caps will likely be set in accordance with similar underlying principles to those used in previous awards. Existing licensees would have incumbency advantages due to their existing use of the spectrum and complementary network assets, making it likely that they win spectrum back. Therefore, the termination of existing 800 MHz, 900 MHz and 1800 MHz licences is not a cliff edge facing the current MNOs.

Three appears to suggest that existing 800 MHz and 900 MHz licences should be somehow discounted for applying the sub-1 GHz cap as they become fully substitutable with 700 MHz only in the long term. Three submits that the only way to deal with the issue of existing holdings expiring mid-way through the licence term of new rights of use under the current rules would be to introduce further time slicing for the sub-1 GHz spectrum within the auction, in effect having a new lot category giving a right to use 700 MHz only after 2030. Presumably, this distinction would then allow outcomes with a greater concentration of 700 MHz spectrum after 2030 on the basis that no operator would already hold rights to use spectrum at 800 MHz and 900 MHz after 2030 when bidding for 700 MHz lots.

We strongly disagree with Three's argument for multiple reasons.

- First, current 800 MHz and 900 MHz licences run to 2030, and in any case overlap for a significant period with the proposed new licences for 700 MHz spectrum. The distribution of spectrum across the three bands will affect downstream competition during this period. We cannot ignore the possibility of adverse competition effects from spectrum becoming excessively concentrated during this period just because there might be an opportunity to reallocate 800 MHz and 900 MHz spectrum in 2030. Prior to 2030, there will be roll-out and uptake of 5G services and the distribution of sub-1 GHz will shape these developments.
- Second, whilst all three sub-1 GHz bands will increasingly become closely substitutable for operators, it is not that this happens *only* in the far future. As legacy uses are eliminated (primarily 3G use) operators can choose how to use the three bands together to deliver services of different types. All three bands contribute to determining network speed and capacity, especially outside urban areas. Consumers do not know or care which spectrum band delivers their service. Therefore, there is significant

substitutability that progressively increases to give close substitutability, as the governing physics means all three bands have similar propagation characteristics.

- Third, Three's argument ignores the strong likelihood that incumbent operators would have strong business cases for retaining 800 MHz and 900 MHz spectrum in any subsequent re-award.
- Fourth, we can see no good reason why ComReg would want to create an additional time slice to allow for greater concentration in the distribution of 700 MHz lots after 2030 than it would allow in the period prior to 2030. This would be tantamount to saying that re-award of 800 MHz and 900 MHz spectrum from 2030 onwards could be used to rectify any excessive concentration in 700 MHz holdings. As discussed above, there is a fundamental limitation created by the limited availability of sub-1 GHz lots across the 700 MHz, 800 MHz and 900 MHz bands, and this would very likely still apply in 2030 as it does now. Therefore, if a bidder wanted to hold additional 700 MHz spectrum after 2030 than is currently allowed by the 70 MHz cap, this would most likely be at the cost of being able to acquire fewer 800 MHz or 900 MHz lots when they were re-awarded due to the spectrum cap that would likely be set at that time.
- Fifth, to the extent that any reorganisation of 700 MHz lots was warranted when 800 MHz and 900 MHz lots are re-awarded around 2030, this could be achieved through either secondary market trading of current 700 MHz licences, or through integration of reallocation of 700 MHz spectrum into the award process for 800 MHz and 900 MHz. Therefore, there is no particular need to allow for the possibility of some different distribution of 700 MHz lots from 2030 onwards, as if there were good reason that operators needed such flexibility it could be accommodated at the time by other means.

Therefore, in our view Three's argument has little merit. There is a strong case for including the 700 MHz, 800 MHz and 900 MHz bands in a sub-1 GHz cap despite the differing termination dates for licences.

*Encumbrance of
Three's 900 MHz
spectrum due to its
merger
undertakings*

The second issue raised by Three relates to undertakings²⁵ given to the European Commission in 2014 to achieve clearance of the Telefónica/Hutchison merger and their implications for assessment of Three's current spectrum holdings. During its merger with O2 Ireland (Telefónica), Three offered an undertaking to allow divestment of spectrum to up to two MVNOs who had entered into capacity agreements and been approved by the European Commission (the "MVNO entry commitment"). This takes the form of an option for qualifying MVNOs to acquire two blocks in the 1800 MHz band, two blocks in the 2.1 GHz band and one block in the 900 MHz band (the "Divestment Spectrum"). The option remains open until January 2026. It is the option for purchase of the 900 MHz block that is most relevant here.

Exercise of the option is conditional and requires the MVNO to demonstrate a "concrete business plan to use the Divestment Spectrum to become an MNO within a reasonable period of time"²⁶. The purchase prices for the various spectrum blocks are set out, but redacted, in the undertakings. If the acquiring MVNO subsequently sought to transfer the spectrum rights to a third party, then Three would have the right to re-acquire it at the same price the MVNO originally paid to Three. Therefore, the MVNO does not obtain an unfettered usage right over the spectrum that could be traded on.

We understand from ComReg that Virgin Media is the only MVNO to have a capacity purchase arrangement with Three under the terms of the undertakings and, therefore, is able to exercise this option to acquire spectrum. However, Virgin Media's market share has fallen since the merger and currently stands at [X [REDACTED] X] by revenue, including all voice, mobile broadband and machine-to-machine revenues, or 2.2% by subscriptions²⁷, excluding mobile broadband and machine-to-machine subscriptions. Given the fixed purchase price, this strongly suggests that Virgin Media would not choose to use its option to purchase the Divestment Spectrum in the near future given that it has not already done so already.

Moreover, the available Divestment Spectrum is insufficient of itself to provide a long-term progression to providing 5G

²⁵ A non-confidential version of the undertakings is available at https://ec.europa.eu/competition/mergers/cases/additional_data/m6992_4894_3.pdf

²⁶ §13(e) of the undertakings.

²⁷ ComReg 20/119, p.6.

services, or even 4G services as a network operator with competitive speed and capacity, as the largest contiguous spectrum block it would give access to is only 2x20 MHz. Virgin Media did not acquire spectrum in ComReg's 2017 award of 3.6 GHz spectrum, which is key to initial deployment of 5G; the three MNOs acquired contiguous blocks of 80–105 MHz and so Virgin Media could not be competitive on speed and quality of service without acquiring significant amounts of spectrum elsewhere, or making significant network investment to compensate. Furthermore, there is no incentive for Virgin Media to acquire this spectrum in the anticipation of being able to re-sell the usage rights later, as Three has the option to re-purchase at the original price paid.

The existence of this purchase option raises two questions relevant to the setting of the caps:

- Whether the undertakings make the prospect of a credible fourth MNO likely, as the setting of caps is based on a reasonable worst-case assumption that spectrum (especially the 700 MHz lots) is distributed amongst the existing MNOs;
- Whether it is appropriate to count spectrum held by Three that is encumbered by the purchase option created by the undertakings in the same way as other unencumbered spectrum for the purposes of applying a cap.

VM's purchase option does not change the assessment of the worst-case competitive scenario for setting a sub-1 GHz cap

On the first issue, there is no evidence that Virgin Media is likely to become a credible fourth player on the back of its spectrum purchase option within the foreseeable future. For the purposes of evaluating the effect of a strong asymmetry in spectrum holdings between the three existing MNOs, even if there were (hypothetically) a significant probability of the spectrum purchase option being exercised, there would still be the question of whether an MVNO transitioning to become an MNO could gain access to sufficient additional spectrum to make a competitive offer as a network provider within a reasonable timescale. Indeed, it might not even be possible to exercise the purchase option because the undertakings require the MVNO to have a credible business case, which in turn is very likely to need a plan for access to additional spectrum. Therefore, there are very substantial hurdles to entry of a direct competitor to the existing MNOs. The most relevant scenario for the setting of the sub-1 GHz cap remains that 700 MHz lots are shared amongst the three existing MNOs.

Clearly the possibilities for entry are not limited solely to use of this purchase option by Virgin Media to compete directly as an

MNO with the three existing MNOs. It is possible that any of the spectrum within the award could be acquired by a party other than the three existing MNOs. However, this does not mean that such a party would become a full-service MNO with service offerings comparable to and competitive with the existing MNOs. The outcome of the 3.6 GHz auction illustrates this, as Airspan won spectrum nationally, but apparently with the intention of providing wholesale services to other operators (including existing MNOs) through a small cell network. In such a case, entry occurs upstream of the existing MNOs and so does not fundamentally change downstream competitive conditions between MNOs. There may be similar possibilities for entrants to acquire spectrum in the MBSA2 award, either for fixed wireless access services or other applications (as Airspan has done for small cell wholesale services). However, this is more likely in the 2.3 GHz and 2.6 GHz bands; the 700 MHz band has very limited supply and indicated for initial 5G deployment by mobile operators, making it unlikely other types of use would trump mobile operators' strong business cases. Therefore, these possibilities for entry do not change the need to consider the setting of the sub-1 GHz cap on the basis that downstream competition remains effective if 700 MHz lots are acquired only by the existing MNOs.

Should blocks subject to divestment obligations be counted toward caps?

The second issue is related to the first, but distinct. Even having concluded that the option to purchase the Divestment Spectrum is not relevant to setting the structure or level of caps, there is a further question of whether the existence of the option precludes Three from enjoying its usage rights to a sufficient extent that this spectrum should be ignored or downrated when calculating Three's existing spectrum holdings for the purposes of applying caps. This is related to the probability of the purchase option being exercised, which appears to be low for the reasons above. Therefore, we can conclude directly that there is no reasonable case for treating spectrum subject to this obligation differently.

Furthermore, even if there were some chance of the purchase option being exercised, there are strong arguments that ComReg would need to assess this possibility cautiously. If, hypothetically, Three's sub-1 GHz holding was counted as four blocks (of 2x5 MHz) rather than its current five due to the effect of the undertakings, then this would allow Three to win three blocks of 700 MHz under a 70 MHz sub-1 GHz cap. This would take Three to eight blocks and an 8/7/4 split of the 19 available sub-1 GHz blocks across the 700 MHz, 800 MHz and 900 MHz bands is then possible. This is a high level of asymmetry

between Three and the weakest MNO. Therefore, if Three's current sub-1 GHz holding were treated as reduced by one block, but the purchase option was not exercised by Virgin Media, then there would be a severe risk to downstream competition. This sets a high threshold: to justify discounting one block of Three's current sub-1 GHz holdings, it would have to be highly probable that the purchase option would be exercised, which is not the case.

5.3.4 Three's counterproposals

Limiting Eir's and Vodafone's ability to compete for third blocks

All of Three's other suggestions limit its MNO rivals' ability to compete for third blocks in various ways, and often make part of Three's current spectrum advantage unassailable. Any measure that protects Three's current spectrum advantage is highly concerning, as it is discriminatory in Three's favour.

Three has submitted a report by NERA that considers, through a sequence of worked examples using assumed valuations for bidders, the claimed consequences of the proposed sub-1 GHz cap within a CCA and Three's various counterproposals. Three has claimed confidentiality over the specific examples in this report. Therefore, we respond separately to the specific examples provided by NERA in a confidential annex to this report (Annex A). However, the counterproposals themselves are not confidential, so we discuss them below.

Implications of caps for prices paid

Three's primary concern is about the *relative* prices paid by the three MNOs if each wins two 700 MHz lots. Three focusses on the case in which demand for 700 MHz lots comes primarily from MNOs and where winners' prices are determined by MNOs' losing bids for 700 MHz lots additional to those they win. Ignoring for the moment other lot categories and the possibility of bids other than those from the MNOs, the opportunity cost of awarding two lots to each MNO would be set in the following way:

- Vodafone pays reserve price for one 700 MHz lot and then, for the other lot, the incremental value expressed by Eir for a third 700 MHz (i.e. the difference in bid amounts for three and two 700 MHz lots), or the reserve price if this is higher. This is because in the counterfactual where Vodafone is not awarded any lots, Eir could take one additional lot and one lot would go unallocated, as Three would be unable to take an additional lot due to the sub-1 GHz cap;

- Eir pays a price determined in the same way as for Vodafone, but with the roles of Eir and Vodafone exchanged;
- Three would need to pay the sum of Eir's and Vodafone's incremental values for third 700 MHz lots (or the reserve price if either bidder's incremental value of a third block were lower than the reserve price). This is because the counterfactual where Three does not receive any lots would entail both Eir and Vodafone receiving one extra lot, which is possible within the sub-1 GHz cap.

These rules for determining winning prices are grossly simplified, and in practice prices might be affected by bids from other bidders and from the MNOs making package bids across other lot categories reflecting synergies, in which case competition for 700 MHz lots cannot be considered in isolation from competition from other lots. Nevertheless, they serve to illustrate the implications of the caps when a second price rule is used.

Relative pricing

Three's complaint is primarily about the *relative* price paid by winners, rather than about the price it pays itself. The CCA format uses a second price rule that minimises the amount that each winner pays, subject to each winner (and group of winners) paying the opportunity cost caused for other bidders by it being allocated lots (so called minimum revenue core pricing). Therefore, winning bid amounts are set as low as possible subject to paying a sufficient amount that no other winner (or group of winners) would be prepared to pay more. Therefore, Three's concern about the relative prices paid by different winners in the scenario above relates to Vodafone and Eir paying too little, in Three's view, because they do not face competition from Three for a third 700 MHz lot.

Within a CCA, winning prices are set using a minimum revenue core pricing rule in order to give bidders incentives to bid in line with their valuations for spectrum. Therefore, there is a clear rationale for the approach taken to determining winning prices to promote efficient allocation of spectrum. Equalisation of the price paid per lot is not an objective; indeed, imposing such a requirement could be inefficient, as we discuss in Section 6 when considering the auction format.

Why do relative prices matter?

Moreover, Three has not offered any credible explanation of why it considers that it would be harmed by Vodafone and Eir paying the minimum amount compatible with winning what lots they win (we explain why we disagree with the reasons Three has put forward in section 6.2). It is very difficult to see how

increasing the amount that Vodafone and Three pays would be justifiable given ComReg's objectives, which are efficient allocation of the awarded spectrum, rather than revenue raising. Equally, if Three's winning payment were reduced below its opportunity cost, there could be other bidders within the auction who had bid more for Three's lots than Three itself would be paying for them. Any such modifications – regardless of the details – would also undermine the beneficial property of the minimum revenue core pricing rule in providing good incentives for bidders to bid straightforwardly in line with value.²⁸

Therefore, in our view Three's complaint about the relative prices that might prevail if the 700 MHz lots were split equally across the three MNOs is without merit. There would be no justification for ComReg seeking to re-engineer the award process – whether through changing the format or using additional rules within a CCA - to promote winners paying a similar price per lot across all bidders. Reducing differences in *relative* prices across winners is not a proper objective; ComReg's duty is to promote efficient allocation and use of spectrum, and to ensure that downstream markets are effectively competitive. Furthermore, we consider that Three, through the NERA report, has overstated the magnitude of any price differences that might result, as we explain in the annex.

Allowing Three to bid for a third block

When discussing the rationale for the sub-1 GHz cap above, we showed that there are good reasons why Vodafone and Eir can bid for a third block of 700 MHz, whereas Three cannot. These reasons are *entirely* based on the potential impact on downstream competition. If Three were permitted to bid for a third block of 700 MHz, this would clearly address Three's complaint about relative prices in a 2/2/2 outcome for 700 MHz lots. However, this puts the cart before the horse, as the caps are to protect against uncompetitive outcomes. If Three could bid for a third block of 700 MHz, there is a significant risk that its valuation for a third block might include an anticipation of profits from a lessening of competition. If Three won three blocks and the remaining 700 MHz blocks were split across

²⁸ Formally, it can be shown that MRC pricing has the property of minimising the incentives of bidders to deviate from bidding at valuation (measured by the sum across bidders of each bidder's maximum gain for unilaterally deviating from bidding at true valuation) subject to the requirement that all bidders pay at least opportunity cost. See Day, Robert W., and S. Raghavan (2007) "Fair Payments for Efficient Allocations in Public Sector Combinatorial Auctions." *Management Science*, 53:9, 1389–1406.

Vodafone and Eir, the outcome would be an 8/7/4 or 8/6/5 split of sub-1 GHz spectrum. The former case is probably more likely, due to diminished value of winning a single 700 MHz block on its own in the latter case.

Three's counterproposals

Three proposes a number of amendments to the auction rules to reduce this perceived problem with relative prices. These are two versions of a joint cap and a limitation on what Vodafone and Eir can bid for a third 700 MHz lot. All of these proposals reduce the ability of Vodafone and Eir to compete for a third lot of 700 MHz and bias towards outcomes in which Three retains a greater amount of sub-1 GHz spectrum than the other MNOs.

Joint cap on winner determination

Three's first proposal is a joint cap, where any two winners can win at most five blocks of 700 MHz spectrum. This would be an additional constraint alongside the 70 MHz cap on sub-1 GHz holdings. This would be implemented as a constraint on the selection of winning bids within the winner determination algorithm.²⁹

There are a number of serious problems with Three's joint cap proposal.

Joint cap not justified on competition grounds

First, it further restricts the potential outcomes of the award process, but is not justified by any need to exclude further outcomes (amongst those allowed by the proposed 70 MHz cap) to protect downstream competition. Indeed, Three proposes the joint cap not to address any particular downstream competition concern, but rather to affect the outcome of the proposed auction (in particular pricing in an outcome where the 700 MHz blocks are shared equally amongst the existing MNOs). This goes against the principle that restrictions on outcomes of the award process should be kept to the minimum necessary to protect downstream competition, then the auction given full reign to determine an efficient allocation of spectrum with this limit.

A joint cap unfairly advantages Three

Second, a joint cap is unfair to bidders other than Three, as it gives Three a guarantee about its relative spectrum holding position post award that other bidders do not have. It rules out the case in which Vodafone and Eir each win three blocks of 700 MHz and Three wins nothing. However, this means that Three has a guarantee that it ends up no more than one block behind

²⁹ Winner bids are determined by maximising the total value of winning bids, subject to accepting at most one bid from each bidder and awarding no more lots than are available. As this is a constrained optimisation, we can add additional constraints to the selection of winner bids, such as the proposed joint cap.

the MNO with the most sub-1 GHz spectrum (assuming 700 MHz is shared by the existing MNOs). However, Vodafone and Eir do not have this guarantee.

Table 2 below shows all 10 potential outcomes for how the six available 700 MHz blocks could split across the three MNOs with no blocks unallocated. It can be seen that the effect of the 70 MHz cap is to limit the asymmetry in the eventual outcome to two blocks, but otherwise all outcomes are permitted. Notice also where any particular outcome for the overall distribution of sub-1 GHz blocks is allowed (e.g. 7/7/5) then all similar outcomes where the identities of the MNOs are exchanged are also allowed (i.e. 5/7/7 and 7/5/7 are also possible).

Table 2: All potential outcomes for splitting 700 MHz lots between MNOs

		Excluded by 70 MHz cap				Allowed by 70 MHz cap					
700 MHz lots won	Three	3	3	3	3	0	2	2	1	1	2
	VF	3	0	2	1	3	3	1	3	2	2
	Eir	0	3	1	2	3	1	3	2	3	2
Sub-1 GHz blocks post award	Three	8	8	8	8	5	7	7	6	6	7
	VF	7	4	6	5	7	7	5	7	6	6
	Eir	4	7	5	6	7	5	7	6	7	6
Asymmetry		4	4	3	3	2	2	2	1	1	1

Adding a joint cap would exclude only the outcome where Three won no 700 MHz lots (shown in bold in the table). Assuming all 700 MHz blocks are shared by the MNOs, the worst outcome for Three would be winning 1 block of 700 MHz, leading to Three having six blocks of sub-1 GHz spectrum in total, and Eir and Vodafone having six and seven blocks (in some order). Therefore, Three can finish no worse than one block behind, provided all 700 MHz lots are taken by the existing MNOs. Vodafone and Eir do not have this guarantee, as they can finish with five blocks in total, two behind.

Joint cap not rationalizable as the result of applying an equitable competition metric

Third, there is no reason why just one outcome out of the three potential outcomes with an asymmetry of two blocks should be excluded. This treats the three MNOs unequally and cannot be justified on grounds of protecting downstream competition. Outcomes with a given level of asymmetry should be either all included or else all excluded; it is logically inconsistent to exclude just some of them.

Notice that this argument does not depend on the use of any particular metric for downstream competition (such as the asymmetry measure equal to the difference between largest and smallest numbers of blocks held). The only significant assumptions being made here are that (i) the relevant case for assessing downstream competition is where the MNOs share the available six blocks of 700 MHz and (ii) where outcomes are either allowed or prohibited, similar outcomes that differ only by swapping around the identities of the three MNOs should be treated similarly. Therefore, any self-consistent analysis of downstream competition will draw a boundary such that either the 7/7/5, 7/5/7 and 5/7/7 are all included, or all excluded. We see no case to exclude them as the level of asymmetry is modest.

Fourth, even if our competition analysis was incorrect and there was a case for being setting tighter restrictions to protect downstream competition than just the 70 MHz cap below 1 GHz, we would want to rule out all 7/7/5 type outcomes, not just some of them, and limit the asymmetry of the outcome to a single block. However, this restriction cannot be implemented as a simple cap and would need to be expressed as a floor of winners obtaining at least six blocks if just the existing MNOs won. Such competition floors have been used in some awards, but lead to a complex auction design.³⁰ Notwithstanding the practical complexities of implementing this, we would still have a situation in which Vodafone and Eir would be permitted to bid for three blocks of 700 MHz spectrum and Three only two. Therefore, a *consistent and equitable* application of tighter restrictions to protect downstream competition would leave open exactly the same situation as Three complains about, in terms of limitations on Three's ability to compete for 700 MHz

³⁰ Competition floors were used within an CCA format in the UK's 4G auction. Whilst it is straightforward to add complex constraints to the winner determination and pricing algorithms, the difficulty is that the clock stage may also need adjustment so that the prices reported to bidders reflect the implications of whatever additional constraints are imposed on outcomes.

lots against Vodafone and Eir due to its larger initial spectrum holding.

Therefore, we conclude that Three's proposed joint cap is ruled out by its unequal treatment of the three MNOs and its lack of rationale as an equitable and consistent measure to protect downstream competition.

Joint cap for price determination purposes

Three's next counterproposal is to apply the same joint cap of five blocks of 700 MHz across any two winners, but only for the purposes of determining prices paid by winners, not for determining winning bids. To see how this might work, suppose, as above, that we have an equal split of two 700 MHz lots going to each of the existing MNOs, and that only the MNOs compete for 700 MHz lots. Ignore interactions with other bands and consider how opportunity costs would be calculated. We apply the joint cap when considering the counterfactual situations that define opportunity costs in which each MNO gives up the 700 MHz lots it has won.

We assume that the 70 MHz cap would continue to apply in these counterfactual situations; in any case the calculation of prices starts from the bids received, which in this case would all be subject to the 70 MHz cap. Therefore, the joint cap is additionally imposed when re-determining winning bids in counterfactual situations. This means that, critically assuming no other competition:

- If Three hypothetically gives up the two lots it has won, then one can be allocated to one of Vodafone or Eir. The other needs to go unallocated, as otherwise the 5-block cap across Vodafone and Eir would be violated. Therefore, Three pays reserve price for one block, plus the greater of Eir's or Vodafone's third block value.
- If Vodafone hypothetically gives up its two lots, then one lot can be allocated to Eir and one lot must go unallocated. It is not possible to allocate a released block to Three instead of Eir, as this would violate the 70 MHz cap given Three's larger initial holdings. Therefore, Vodafone pays reserve for one block, plus Eir's third block incremental valuation for its other block.
- By the same logic as for Vodafone, Eir pays reserve for one block, plus Vodafone's third block incremental valuation for the other block.

With prices set on this basis, Three will pay less than the true opportunity cost it imposes on Vodafone and Eir. Therefore, the joint cap reduces the amount that Three pays (relative to what it

would pay under ComReg's current proposals i.e. a 70 MHz cap and without a joint 5-block cap for price determination). However, Vodafone's and Eir's prices are unaffected by applying a joint cap to the counterfactual situations that determine prices.

Perverse implications of Three's proposed pricing rule

Applying the joint cap to the counterfactual situations that determine prices creates the possibility of a situation in which Three wins two lots, but the price it pays is *less* than the amount that Eir and Vodafone are in total prepared to pay for third lots. This creates various perverse effects.

First, Eir and Vodafone would have cause to complain that Three is being allocated two lots, but they had *already* offered more for these lots through their three block bids than Three was now paying. It is very difficult to see how such a counterintuitive outcome could be justified.

Second, Vodafone and Eir do not enjoy similar opportunities to win two lots and pay less than others have bid for them. Therefore, the MNOs are not being treated equally.

Third, and potentially of greatest significance, Three will have an incentive to overbid its true valuation for two blocks. This is because of the inconsistency between the criterion for determining winning bids (where the joint cap is not applied) and that for determining the prices that winning bidders will pay (where it is).

To understand this incentive issue, it is useful first to restate why a second price rule prompts bidding in line with valuations. With a second price rule, what a bidder pays typically does not depend on what it bids, but rather what its rivals bid. We can see that above when describing how prices would be determined for 700 MHz under simplifying assumptions. Given this, a bidder will want to choose its bid amount such that it loses if it would need to pay more than its valuation and wins if it would need to pay less than its valuation; therefore, it is best to bid in line with valuations.³¹

³¹ For exposition, this explanation is simplified and is strictly only true if prices are determined by individual opportunity – so-called Vickrey prices – rather than joint opportunity costs across a number of bidders, as is possible under the minimum revenue core pricing approach. However, this complication is not relevant to the simplified situations discussed in the main text where we look at the 700 MHz band alone.

For ease of explanation, suppose that Three just bids for two lots, so either wins two lots or nothing. Under Three's modified pricing rule we have a situation where:

- Three wins two blocks provided that it bids more for two blocks than an amount X equal to the *sum* of Vodafone's and Eir's incremental value for third blocks; but
- If Three wins it then pays an amount Y equal to reserve for one block, plus the *greater* of Vodafone's and Eir's incremental value for a third block.

Vodafone and Eir must express a value for a third block at least equal to the reserve price for that block, otherwise they will never be allocated that block by the winner determination algorithm. Therefore, if Vodafone and Eir make any bids with the intention of winning a third block, the quantity X above – the minimum amount Three needs to bid to win – is greater than the quantity Y (or equal if Vodafone or Eir do not express a value above reserve price for the lot) – the amount that Three will pay if it wins. The difference $X-Y$ is equal to the amount by which the smaller of Vodafone's or Eir incremental value for a third block exceeds the reserve price. Therefore, there is an incentive for Three to bid in excess of its valuation depending on the likely size of the difference $X-Y$. In effect, this is as if Three were being given a bidding credit. Again, Vodafone and Eir do not enjoy this benefit.

Fourth, the existence of this overbidding incentive for Three, but not Eir or Vodafone, leads to the possibility that Three could inefficiently win lots when Vodafone and Three in fact value them more. This is clearly contrary to ComReg's objective of efficient allocation. This also tends to handicap Vodafone and Eir in attempting to win more lots. It also unreasonably favours Three if there is any competition from any entrant for 700 MHz lots.

Fifth, if Three wins inefficiently because of the inconsistency between how winning bids are determined and how prices are determined, then Three could sell its two blocks – one to Vodafone and one to Three – at a profit in the secondary market. Again, this possibly does not arise for Vodafone or Eir.

These are serious problems that undermine the integrity of the proposed auction process, treat the three MNOs in an unfair manner and risk spectrum being inefficiently assigned. These issues rule out Three's proposal to apply a joint cap only to the pricing algorithm.

Capping expressed value for third blocks

Three's third counterproposal is to limit the incremental value that Vodafone and Eir can express for third blocks, such that it cannot be higher than the final clock price for 700 MHz. Three make a very specific proposal:

"...a cap on the marginal valuation that can be expressed for a third 700 MHz lot, such that it cannot be higher than the final clock price for 700 MHz – Three suggest that this could be implemented via a requirement that bidders bidding for packages containing three 700 MHz lots also submit a supplementary bid for otherwise identical packages with two 700 MHz lots, with a price difference no greater than the final clock price for 700 MHz."³²

As Three recognises, in order to implement this approach, it is necessary to create an obligation that whenever a bidder bids for a package containing three 700 MHz lots (and lots in other categories) it would be obliged to make a supplementary bid for a corresponding package with two 700 MHz lots but the same number of lots in other categories, otherwise the cap could be readily circumvented by not bidding for less than three 700 MHz lots.

Three claims that the benefits of this approach would be that it would prevent bidders from making inflated bids for third lots of 700 MHz. It would also *"ensure that there is a rich set of supplementary bids for the purposes of setting prices, thus making it less likely that the CCA produces highly asymmetric price outcomes as a result of so-called 'missing bids'".³³*

Legitimacy of competing for third blocks

Before making a detailed assessment of this proposal, we make two general observations:

- Adding Three's proposed cap on third block bids would be a remarkably detailed and specific intervention into the auction process, and may well be consequential for the outcome of the auction in terms of whether Vodafone and Eir win third blocks. Given the highly specific and unprecedented nature of the intervention, there is a significant burden to be overcome in showing that this does not rule out reasonable bidding behaviour. We show below that Three's proposal clearly fails this test.
- Three seems to believe that a distinction can be made between reasonable and unreasonable competition for a third block of 700 MHz. Three says that the proposal will

³² Page 22 of Three's response to ComReg 20/56.

³³ Ibid.

"prevent bidders from expressing inflated values for a third lot of 700 MHz, for gaming purposes".³⁴ As discussed in Section 5, if Vodafone, Eir or any other party compete for three blocks of 700 MHz and win them, this is compatible with effective downstream competition being maintained. This is also true if two bidders each win three blocks of 700 MHz and Three wins none. It is impossible to define any notion of an *"inflated"* valuation for a third 700 MHz block other than by reference to a bidder's true business case valuations, which are clearly unknowable. We re-emphasise that there is nothing unreasonable in bidders other than Three competing for third blocks of 700 MHz spectrum and impeding this clearly protects Three's current advantage in sub-1 GHz spectrum holdings.

In order to analyse Three's proposal, it is helpful to consider two main cases for how the auction might progress:

- A bidder finishing the clock stage of the CCA bidding on a package containing exactly two lots of 700 MHz spectrum alongside some number of lots in other categories; and
- A bidder (other than Three) finishing the clock stage bidding for package containing exactly three lots of 700 MHz spectrum alongside lots in other categories.

We see below that, although the mechanics differ in the two cases, there is a restriction in the ability of a bidder to compete for a third block of 700 MHz spectrum.

Taking the first case, where the bidder finishes the clock stage of the CCA bidding on a package that contains two lots of 700 MHz, the impact of Three's proposal varies across various packages according to their size:

- There will *in any case* be a limit on the extra amount that the bidder can bid to add a third lot to its final clock package due to the auction activity rules that is *already* at least as restrictive as Three's proposal. The incremental value that can be expressed in a supplementary bid for adding a third 700 MHz lot to its final clock package is limited to at most the final clock price for 700 MHz lots (due to the final price cap) and will most probably be strictly less (set by the clock price in some previous round when the bidder reduced eligibility and became ineligible to bid for the package with a third 700 MHz lot). Therefore, Three's proposal has no additional effect in constraining the

³⁴ Ibid.

amount bid for a package adding a third 700 MHz lot to the final clock package.

- For a package containing two lots of 700 MHz with eligibility strictly exceeding that of the final clock package similar logic applies. The extra amount that can be bid for adding a third lot to this package will be limited by the clock prices in some previous round, which cannot exceed the final clock price. Therefore, Three's proposal has no effect in this case either, as the auction activity rules impose a tighter constraint.
- For a smaller package containing two lots of 700 MHz, but with eligibility not exceeding that of the final clock package, then if the bidder also bids for the corresponding package with three lots of 700 MHz, Three's proposed rule then sets a floor on the bid for the package with two 700 MHz relative to the package with three 700 MHz lots.
- Finally, where a bidder (other than Three) has made a clock bid for a package containing three 700 MHz lots in the course of the clock rounds, Three's proposed rule will oblige that bidder to make a corresponding supplementary bid for a package containing two 700 MHz lots, but the same number of lots in other categories. This bid is subject to a floor.

Therefore, in summary if a bidder finishes the clock rounds with a final clock package containing two 700 MHz lots, the bidder's ability to compete in the supplementary bids round to add an additional 700 MHz lot to its final package is in any case constrained by the auction activity rules (and Three's proposal has no additional effect). Often, the bidder can expect to win its final clock package (and can guarantee doing so if it bids a sufficient amount for this package). Therefore, the effects of Three's proposed rule are limited to the situation in which the supplementary bids lead to a significant revision of the outcome in the final clock round (for example because there are significant numbers of unallocated lots in the final clock round that can be allocated with some rearrangement). In this situation where there is competition within the supplementary bids round, the Three proposal has the effect of limiting the ability of bidders (other than Three) to compete for third blocks of 700 MHz spectrum.

Turning to the second case, where a bidder finished the clock rounds bidding for a package containing three 700 MHz lots, the main effect of Three's rule is to oblige that bidder to make a corresponding supplementary bid for a package containing two 700 MHz (with the same number of lots in other categories),

with a floor on this bid equal to the amount of its bid for its final clock package, less the final clock price of one 700 MHz. Notice that this floor for the smaller package is equal to the highest amount that the bidder can bid for this package under the auction activity rules, due to the final price cap. Therefore, Three's rule in essence requires a bidder finishing the clock round bidding for three 700 MHz lots to make the highest possible bid under the auction rules for two 700 MHz lots.

Structure of incremental valuations

These restrictions on relative bid amounts imposed by Three's rule are unreasonably tight. To see this, we first need an aside to review what assumptions it is reasonable to make about valuations and what these imply for bidding behaviour. Consider four packages differing only in terms of the number of 700 MHz lots they contain, as set out in the table below.

Package	Number of 700 MHz lots	Value of package
A	0	V_A
B	1	V_B
C	2	V_C
D	3	V_D

These valuations then imply incremental valuations for *adding* each additional 700 MHz lot conditional on how many 700 MHz lots the bidder *already* has. Whilst all of these valuations may be conditional on which lots from other categories are included, we are holding these the same and only comparing different numbers of 700 MHz lots.

	Incremental value
First 700 MHz lot	$v_1 = V_B - V_A$
Second 700 MHz lot	$v_2 = V_C - V_B$
Third 700 MHz lot	$v_3 = V_D - V_C$

Synergies and declining incremental valuations

It is usually thought that a single 2x5 MHz lot in a sub-1 GHz band is of limited value to an MNO, as this is insufficient spectrum to allow technically efficient operation providing reasonable speed and capacity. Therefore, we can reasonably expect that the marginal valuation of the first block, v_1 , is smaller than that the second block, v_2 . We can interpret this as there being a synergy between the first and second blocks.

This synergy between first and second blocks implies that if the price of 700 MHz lots reached a level where it is unprofitable for the bidder to acquire two blocks, then the bidder would also find it unprofitable to acquire a single block. The bidder drops back from two 700 MHz blocks to no 700 MHz blocks when the price of 700 MHz blocks exceeds the average value $(v_1 + v_2)/2$ of first and second lots.

Once a bidder reaches two 700 MHz lots, this technical inefficiency may be overcome. Adding additional lots beyond a second lot can be expected to have a declining marginal benefit to the bidder. Therefore, it is reasonable to expect that $v_3 < v_2$. However, this is not an absolute certainty and depends somewhat on how the bidder intends to use the spectrum. Beyond this, we have no particular expectations about the structure of bidders' valuations.

Implications for demand as price increases

Under these assumptions ($v_1 < v_2$ and $v_3 < v_2$), there are two cases for how the demand of a surplus-maximising bidder will contract as the price of lots is increased:

- If $v_3 < (v_1 + v_2)/2$, so the value of a third block is not too high, the bidder contracts from three to two lots as the price per lot increases, then drops back from two lots to zero lots at a higher price (as at this price it is not profitable to buy just one lot);
- If $v_3 > (v_1 + v_2)/2$, so the value of a third block is high, but still less than v_2 , then if the price is high enough for the bidder to prefer two lots rather than three lots (i.e. above v_3), then it would also prefer no lots to two lots (as the price is also above $(v_1 + v_2)/2$). In this case, the average per lot value of three lots is greater than two lots (i.e. $(v_1 + v_2 + v_3)/3 > (v_1 + v_2)/2$) so that the bidder drops directly from three lots to no lots at all when the price reaches $(v_1 + v_2 + v_3)/3$.

The assumption of a declining incremental valuation beyond two lots (i.e. a third lot is valued less than a second lot) is not by itself enough to rule out the possibility that a bidder might drop out directly from three lots to no lots as the price increases. This behaviour can be an indirect consequence of the synergy between first and second lots. Because the effect of the synergy between first and second lots in boosting the incremental value of a second lot, it is entirely possible to have declining incremental values for the second and third lots (i.e. $v_3 < v_2$) and at the same time for the average value per block to increase on gaining a third block (i.e. $(v_1 + v_2 + v_3)/3 > (v_1 + v_2)/2$), leading to this behaviour.

Implications of Three's third block valuation cap when the final clock package contains three 700 MHz lots

Returning to consider the implications of Three's proposal, consider first the case of a bidder finishing the clock rounds bidding for three 700 MHz lots. We know that the price of 700 MHz lots has not increased sufficiently to cause the bidder to reduce its demand to just two lots. Therefore, the final clock price, p , of 700 MHz lots can be no more than the bidder's third block valuation v_3 and is likely less. The bidder could have a very much higher value for a third block than the final clock price, as the price has not increased sufficiently to force that bidder down to a smaller number of lots (either two or none, depending on its valuation structure). However, Three's restriction requires that the bidder places a bid for two 700 MHz lots at an amount equal to its bid for three 700 MHz lots less the final clock price p . Therefore, the largest incremental valuation that the bidder can express for its third lot is limited to the final clock price p , which may be very much less – potentially even a fraction – of its true value v_3 for a third block. Therefore, Three's proposal unreasonably restricts this bidder from expressing its valuation for a third lot, potentially being forced to understate its value for a third lot by a very great deal.

Notice further that if a bidder finishes with a final clock package containing three 700 MHz lots, it is unreasonable to require that bidder to make a corresponding bid with two 700 MHz lots even *without* the proposed floor on the bid amount for the two 700 MHz lot package. If the bidder places an incremental value on a third 700 MHz lot exceeding the final clock price, then if it did not raise its final clock bid, expressing its true relative value for two or three 700 MHz lots might require a bid amount below reserve (or even negative) for the package with two 700 MHz lots, which is not allowed. Therefore, an obligation to make a bid for the two 700 MHz lot package may force the bidder to have to increase the bid for its final clock package, potentially to unnecessarily high levels, as it might be likely to win its three block bid anyway.³⁵

Implications of Three's third block valuation cap when the final clock package contains two 700 MHz lots

In the alternative case that a bidder finishes the clock rounds bidding for just two 700 MHz lots, we can reasonably infer that the clock price has risen above its third block valuation v_3 , but is still not more than its average valuation of two lots, $(v_1 + v_2)/2$, otherwise the bidder would have dropped out entirely. We can also infer from the clock round behaviour that $v_3 < (v_1 + v_2)/2$,

³⁵ For example, this issue might force the bidder to have to increase its final clock bid above any knock-out level.

otherwise the bidder would have dropped out directly from three lots to zero, rather than dropping from three to two lots.³⁶

Three's proposed rule does not constrain the bidder's ability to make a supplementary bid adding back a third 700 MHz lot to its final clock package, as the activity rules for supplementary bids already caps this bid. The bidder can express its true incremental value v_3 for adding a third block to its final clock package as this is less than its final clock price.

However, Three's proposed rule does affect other packages containing three 700 MHz lots, as corresponding bids with two 700 MHz lots need to be made, with the difference between these bids not exceeding the final clock price p . The worst-case scenario (in terms of Three's value cap being most restrictive) is if the clock rounds have closed because of this bidder's contraction in demand from three to two 700 MHz lots. In this case we would have $p=v_3$.³⁷ This is necessarily true for one bidder in the case that the clock rounds close last in the 700 MHz category.

As explained above, for packages larger in eligibility than the final clock package, there will be constraints from the auction activity rules that are at least as tight as Three's proposed cap if additional 700 MHz lots are added. Therefore, there are two main effects from Three's proposed third-block value cap rule:

- Where a bidder has made clock bids for packages larger than its final clock package that include three 700 MHz lots, that bidder is now required to make supplementary bids that limit its expressed incremental valuation for a third lot to v_3 , the value of a third 700 MHz in the final clock package. However, if lots in other categories are complements with 700 MHz lots (as might be expected for entrants), then the incremental value of 700 MHz lots in packages larger than its final clock package will be larger than v_3 and such a bidder will not be able to express its incremental valuation.
- Three's cap will bite on adding 700 MHz lots to create packages smaller than the final clock package. If a bidder

³⁶ Note that this is an inference from the observed bidding behaviour. We cannot rule the possibility that even if a bidder has declining incremental valuations beyond two lots, it could still have $v_3 > (v_1 + v_2)/2$ and so drop out directly from three lots to zero.

³⁷ This would hold exactly if clock prices increased continuously – in practice the price increments mean that the final clock price could be slightly above v_3 , but the general point holds because the difference would necessarily be small.

has other lot categories that are substitutable with 700 MHz, then dropping other lots may increase its incremental valuation of a 700 MHz lot and then the bidder may find itself unable to express its valuation for a third 700 MHz lot.

Summary of effect of third-block value cap

The analysis above shows that there are significant adverse effects from Three's proposed cap on the expressed value for a third 700 MHz lot set by the final clock price for 700 MHz lots:

- If a bidder reaches the end of the clock rounds bidding on three 700 MHz lots because it has a value for a third 700 MHz lot much higher than the final clock price, it would be forced to make a bid for a corresponding package with only two 700 MHz lots at an amount lower by the final clock price for one 700 MHz lot. Therefore, such a bidder would be entirely unable to express its value for retaining a third lot.
- If a bidder reaches the end of the clock rounds bidding on two 700 MHz lots, Three's cap has no effect on adding back a third 700 MHz lot to its final clock package. However, for a bidder who has valuation interactions between 700 MHz and other lot categories, it may not be able to express its true valuations for adding/removing a third 700 MHz lot to packages other than its final clock package. In practice, the most significant problem is likely to be that an entrant with complementarities across lot categories might not be able to express its full value for adding a third 700 MHz to larger packages.

Conclusions on Three's alternative proposals

Overall, the most concerning effect of Three's proposal is to handicap Vodafone's and Eir's ability to compete for third 700 MHz blocks. As such it might be thought of as being a half-way house before simply capping Vodafone and Eir to two blocks of 700 MHz.

This third block handicap is not indicated by the competition analysis, as outcomes in which one or both of Vodafone and Eir obtain three blocks of 700 MHz do not lead to excessive asymmetry. Because Three already has an additional block of 900 MHz relative to Vodafone and Eir, this would result in Three being at most two blocks behind whoever had most sub-1 GHz spectrum, which is not an excessively level of asymmetry and is unlikely to create any significant lessening of downstream competition. Therefore, we can see no justification for handicapping Vodafone and Three in this manner on competition grounds. This would deny Eir and Vodafone reasonable opportunity to overturn Three's current spectrum advantage.

Given that there is no good reason that Vodafone or Eir to be prevented from bidding for three 700 MHz lots on competition grounds, any handicapping measure that disfavoured them winning three blocks risks creating inefficient outcomes. One or both of Vodafone and Eir might fail to win three blocks even though it was more efficient for them to do so.

Again, Three's proposal appears to be aimed at modifying the auction outcome by disavouring outcomes unfavourable to Three and lowering price it might pay for winning two lots. Therefore, we can see no merit in any of Three's three counterproposals.

5.3.5 Precedent from other countries

Looser caps in other countries are not an argument for changing the structure of ComReg's competition caps

Three mentions in its response that a number of European countries have completed or proposed 700 MHz auctions that allow a single operator to acquire 2x40 MHz or more sub-1 GHz spectrum (specifically Switzerland, Germany, Denmark, and the UK). The table below summarises the bands included in each of these auctions, the existing sub-1 GHz holdings of the MNOs, and the sub-1 GHz caps that were applied.

We do not consider that any of the situations in these other countries supports Three's assertion that ComReg has set too tight a cap for sub-1 GHz spectrum (for reasons set out below). If anything, these comparators illustrate that ComReg has taken a light-touch approach and not overly restricted outcomes.

Table 3: Sub-1 GHz caps in European awards

Country	Bands in the auction	Existing sub-1 GHz holdings prior to award	Sub-1 GHz caps
Switzerland	700 MHz FDD	800 MHz: 20 MHz (Swisscom, Sunrise, Salt)	30 MHz in the 700 MHz FDD band
	700 MHz SDL	900 MHz: 30 MHz (Swisscom, Sunrise), 10 MHz (Salt)	50 MHz joint cap on two winners in 700 MHz FDD band
	1400 MHz SDL		25 MHz SDL
	2.6 GHz		
	3.6 GHz		
Germany	700 MHz	800 MHz: 20 MHz each (Vodafone, O2, T-Mobile)	30 MHz in the 900 MHz band
	900 MHz		No 700 MHz cap
	1500 MHz		
	1800 MHz		
Denmark	700 MHz FDD	800 MHz: 40 MHz (TDC), 20 MHz (TTN)	40 MHz across 700 MHz FDD and 900 MHz
	700 MHz SDL	900 MHz: 10 MHz (Hi3G)	OR
	900 MHz		Up to 70 MHz with additional coverage obligations ³⁸
	2.3 GHz		No cap on 700 MHz SDL
UK	700 MHz	800 MHz: 20 MHz (O2, Vodafone), 10 MHz (H3G, BT/EE)	No sub-1 GHz cap
	700 MHz SDL		
	3.6 GHz	900 MHz: 34.8 MHz (O2, Vodafone)	

³⁸ A first stage offered up to three 2x10 MHz coverage obligation lots ('A lots') in either the 700 MHz or 900 MHz band, with a cap of one per bidder. Unsold coverage obligation lots went into the second stage, and at that point were only for 700 MHz spectrum. Standard 2x5 MHz lots in the 700 MHz ('B lots') and 900 MHz ('C lots') bands were also offered in the second stage. The cap was four lots across the A, B, and C lot categories. A bidder could only obtain an additional 70 MHz in the award in the unlikely scenario that no other bidder won a coverage obligation lot in the first stage and it was able to pick up the unsold coverage obligation lots in the second stage. When the auction was run, all coverage lots were in fact sold in the first stage.

In particular, this argument does not support Three's proposed joint cap (which is much more restrictive than Three suggests is the case elsewhere), or imply that existing holdings are irrelevant to competition and therefore the cap. If anything, it would be an argument for setting a more liberal cap (i.e. 80 MHz), however, we are of the view that the specific circumstances in Ireland give cause to taking a more cautious stance.

In each of these cases it would be possible for a bidder to acquire more than 70 MHz of sub-1 GHz spectrum, but none of them offer an argument for changing the structure of the proposed competition caps.

Importance of sub-1 GHz spectrum in Ireland

First, Ireland's low population density and the distribution of the population in rural areas means that sub-1 GHz spectrum is likely to be particularly important in order to provide rural coverage. Ireland is exceptional amongst European countries in terms of the proportion of population in rural areas and that this population tends not to be clustered into villages, but rather spread as isolated dwellings.³⁹ This makes rural mobile deployment more challenging and increases the importance of sub-1 GHz spectrum relative to other countries. Therefore, there is more reason to be concerned about the distribution of sub-1 GHz spectrum and its consequences for downstream competition in Ireland. Indeed, Vodafone raised exactly this point.

Spectrum available varies across awards

Second, all four comparator awards feature additional spectrum relevant for 5G deployment as compared with the MBSA2. This may be additional 700 MHz SDL spectrum (Switzerland, Denmark and the UK) or 900 MHz (Germany and Denmark). We cannot simply read across any approach to sub-1 GHz caps if the amount of spectrum below 1 GHz on offer is different. The UK 5G auction and the Swiss auction also included a very large amount of spectrum in the 3.6 GHz band (120 MHz in the UK, 300 MHz in Switzerland), which alongside 700 MHz is a key band for initial deployment of 5G services; the very much

³⁹ Ireland's population density in 2018 of 70.9 persons per km² was significantly lower than the overall population density of the EU of 118 persons per km² (<https://ec.europa.eu/eurostat/databrowser/view/tps00003/default/table?lang=en>) A 2018 study by Oxa for ComReg on Future Mobile Connectivity in Ireland indicates that (based on data from the 2016 Census), approximately 37% of the population in Ireland live in rural areas, and the population density in rural areas was 27 persons per km² (ComReg document 18/103c).

greater amount of spectrum on offer allows a more liberal approach to caps.

Three's advantage both above and below 1 GHz

Third, we note that Three also has an advantage over the other two MNOs in Ireland in terms of *both* overall spectrum holdings and its holdings below 1 GHz. In contrast, in the UK, the amount of sub-1 GHz held by an MNO is negatively correlated with the amount of spectrum above 1 GHz that it holds.⁴⁰ In the other countries mentioned, the relationship is less pronounced. Nevertheless, there is particular reason in Ireland to be more concerned about the smallest operator's ability to compete following an extremely asymmetric distribution of sub-1 GHz spectrum given that the operator with least sub-1 GHz spectrum is likely to also be the operator with the least spectrum overall.

Although there was no cap on the number of 700 MHz lots a bidder could win in Germany or the UK, in that case there was an overall spectrum cap and, as discussed, a negative correlation between the amount of high and low frequency spectrum held by bidders. We note that no stakeholder is suggesting there should not be a cap on 700 MHz spectrum in this case.

Denmark trades off asymmetry with coverage

Fourth, there were clear policy objectives behind the different structures of the cap that applied elsewhere. In Denmark, this related to the need to improve coverage, which meant that more asymmetric outcomes were allowed in the interests of selling the coverage obligation lots. In effect, the regulator indicated a preference to impose new coverage obligations and was prepared to tolerate an increase in asymmetry amongst MNOs to accommodate this.

The joint cap in Switzerland tightened restrictions

In Switzerland, the joint cap acted purely as a measure to reduce potential asymmetry in outcomes, with every MNO required to win at least one block of 700 MHz FDD spectrum if these lots were shared amongst the three MNOs. As we have discussed at length above, if we were to use such a joint cap on acquired 700 MHz lots in MBSA2, because of the differences in spectrum holdings below 1 GHz in Ireland, the joint cap would not affect the maximum asymmetry (it would stay at 20 MHz), but just rule out the case where Three was the MNO with the least spectrum; it would have an asymmetric effect.

⁴⁰ https://www.ofcom.org.uk/_data/assets/pdf_file/0020/192413/statement-award-700mhz-3.6-3.8ghz-spectrum.pdf

5.3.6 Comparison with the MBSA process

Finally, we consider Vodafone's comments (and Three's response) in relation to Three effectively being guaranteed a 900 MHz lot at reserve price in the 2012 MBSA as a consequence of the caps in force. Whilst Vodafone is broadly correct in its assertion, there are some differences between the two situations.

Second time slice much more important than the first in MBSA

In the 2012 MBSA award, there were two time slices and competition caps applied separately to each time slice. The existing holdings of Vodafone, Meteor and Telefonica only spanned the first time slice and, for these, only Meteor had existing holdings in the sub-1 GHz spectrum. The first time slice was also relatively short (just over 2 years). For the second time slice, which covered much of the overall licence term, all pre-existing 800 MHz, 900 MHz and 1800 MHz licences would have expired, so bidders had no existing holdings that would count towards the competition caps. Therefore, for the second time-slice, all bidders would have had symmetric opportunities in terms of what they could bid for and the implications of the caps for the prices they (and others) would pay.

Implications of the caps in MBSA

There were 13 lots available in sub-1 GHz categories, with each bidder able to acquire at most four. Therefore, in the second time slice each MNO faced demand from the other three MNOs of at most 12 lots, meaning that each of the four MNOs should be able to acquire a lot uncontested if there were competition only from other MNOs, the two sub-1 GHz categories (800 MHz and 900 MHz) were treated as perfect substitutes and ignoring (for the moment) linkages across to the first time slice. This applied equally to all MNOs in the second time slice.

In the first time slice, if we ignore the Party-Specific lots, there were 11 lots available for bidders to increase their holdings below 1 GHz. Vodafone, Telefónica and Three could acquire up to four of these lots, whereas Meteor, due to its existing spectrum could acquire at most two. Therefore, each of Vodafone, Telefónica and Three faced a competing demand of at most 10 lots from other MNOs, and these three MNOs should have been able to win one lot uncontested if the two lot categories below 1 GHz were treated as perfect substitutes and there was no competition for sub-1GHz lots other than from the MNOs.

Caveats around the pricing impact of caps in MBSA

In practice the situation is likely to have been more complex. First, there may have been preferences for either 800 MHz or 900 MHz bands that would lead to additional competition for

MNOs to get their preferred lots. If this were the case, we would also need to consider the effect of the cap of two 900 MHz blocks in the first time slice, which may have limited the ability of Vodafone, Telefónica and Three to bid for additional lots beyond those they won. Second, further considerations apply if there are synergies across lot categories, in which case it may be over-simplistic to consider competition for sub-1 GHz lots within each time in isolation.

The prices set in the 2012 MBSA were package prices and cannot be broken down by lot and lot category. Furthermore, the number of bidders and the specific bids submitted were not disclosed after the auction, so we cannot assess the opportunity cost of awarding Three its 900 MHz lot independently of the 1800 MHz lots it was awarded. Therefore, we do not believe that any definitive conclusions can be made about what Three paid for the 900 MHz lot.

Potential for some MNOs to gain one lot at reserve

Nevertheless, it is possible that the caps *could* have contributed to a scenario in which Three paid less for the 900 MHz lot it won than it would have done were the caps more relaxed. Bidders were clearly restricted in their ability to express valuations for lots in excess of the four lot sub-1 GHz limit, so there may be some opportunity cost of awarding Three the 900 MHz lot that could not be accounted for in the bids submitted by others. Other bidders may have enjoyed similar benefits from the caps in reducing the prices paid, but this need not have been symmetrical. In particular, Vodafone, Telefónica and Three may have benefitted from Meteor being able to acquire fewer lots in the first time slice due to existing its spectrum holdings.

Under the proposals for the current award, Three's existing holdings limit the number of 700 MHz lots it can bid for over both time slices by relative to other bidders. We, therefore, cannot say that the two situations are entirely equivalent. Nevertheless, the 2012 MBSA provides a precedent for caps taking into account existing holdings and this leading to MNOs being able to acquire different number of lots. The effect of this in the first time slice was also asymmetrical across MNOs because of Meteor's existing holding.

Treatment of bidders in different positions

In any case, how the current situation and proposals compare with those in the 2012 MBSA does not impact on the proposals for the design of the upcoming award. Our arguments for the recommendations we are making are self-standing and specific to this award and the current market conditions, and in no way rely on precedent set by previous awards.

Nevertheless, it is helpful, as Vodafone has done, to recognise that bidders can face different situations in different awards in terms of what they can bid for and how they are affected by the caps relative to other bidders. This does not represent any unfairness, but rather reflects relevant differences between bidders at the start of the award and the need to protect or promote downstream competition. This situation is in fact fairly common within spectrum awards, with the 2012 MBSA providing an example.

Clearly there have been significant changes to the Irish mobile market since 2012, with the Telefónica/Hutchison merger reducing the number of MNOs to three and leaving Three with a historic advantage in terms of spectrum holdings. Therefore, Three is in a materially different starting position for the MBSA2 award to the other two MNOs. This is accounted for in the proposed award rules, and while these do confer tighter restrictions on what Three can bid relative to Vodafone and Eir, this is simply the result of the asymmetry in starting positions across the three MNOs rather than an unfairness in the award that favouring Eir and Vodafone over Three. The rules themselves do not distinguish

5.3.7 Three's proposal for contingent return of one block

Three submitted a further proposal that it be allowed to bid for a third block of 700 MHz spectrum, but that it would offer an undertaking that if it won a third block of 700 MHz spectrum it would divest itself of a 2x5 MHz block of 900 MHz spectrum within a reasonable time after the auction.

A discussion of this proposal is set out in Annex B. However, we recommend that ComReg reject this proposal as:

- it creates considerable difficulties for bidders other than Three in valuing 700 MHz lots, as they do not know whether a substitute 900 MHz lot will become available nor what price it might fetch;
- equitable treatment of the three MNOs would appear to require offering all three equal opportunities to release existing sub-1 GHz spectrum⁴¹ contingently on winning 700 MHz, which would lead to a highly complex process and

⁴¹ There would be no particular reason to restrict the spectrum that could be released in return for winning additional 700 MHz lots to only the 900 MHz band, and bidders would also need to be given the option in relation to their 800 MHz blocks.

significant uncertainty for bidders in terms of knowing what spectrum would be available; and

- it would allow for more asymmetric outcomes amongst the MNOs, as if Three won three blocks of 700 MHz it could deny the released 900 MHz to the MNO with least sub-1 GHz spectrum.

5.3.8 The overall cap

The structure and the level of the overall cap is not contested

Although no respondent objected to the overall cap, Vodafone disagreed with the methodology used to set it at the lower end of the previously proposed range (it agreed with this range but had a preference for the higher end). The metric we use to inform the level of the competition caps is based on the asymmetry between the largest and smallest holdings, as a proportion of the total spectrum available. We expect the amount of spectrum held by an operator to affect its long run marginal cost, such that too great a disparity could prevent another operator with a smaller amount of spectrum from being able to compete effectively.

Our understanding of Vodafone's suggestion is that it would be better to place a cap on the proportion of the available spectrum that could be held by any one bidder. It is unclear to us which award Vodafone is referring to when recommending ComReg "use market percentages as were used previously",⁴² and we note that for the 3.6 GHz award, we recommended that ComReg set caps to ensure a minimum number of winners of the spectrum would be able to compete effectively, while also ensuring bidders could express a reasonable level of demand.⁴³ An alternative metric based on the proportion of spectrum that a bidder could hold would need to be set at a level determined by similar considerations about the ability of winning bidders to compete after the award, and therefore would probably be a less direct way of applying the same principles.

⁴² Vodafone response to ComReg 19/124, p. 9, published as ComReg Document 20/56s

⁴³ ComReg 15/71, paragraphs 103 -113

6 Award format

6.1 Background

Our recommendations to ComReg on the award format are the result of a careful and considered assessment of the various options available, in light of the award objectives, expected demand, and the current conditions in the relevant market(s).

During the consultation process for the award, ComReg has received a number of comments on the auction format proposals, as well as suggested alternative format that stakeholders believe would be more appropriate. ComReg has listed various options that could be assessed as part of a RIA. In this section we set out each of auction formats proposed, either by us, ComReg or by stakeholders in their consultation responses. Some of the options have already been assessed at some stage during the consultation process, whereas others have been proposed more recently and not yet addressed in our previous reports.

Some factors need to be taken as given

When determining the most appropriate format to use, there are a number of factors that are independent of the auction model chosen and simply need to be taken as requirements that the auction format must meet:

- **The available spectrum** – the spectrum included in the award has been determined as part of a long consultation process in advance of the design of the award process, and the auction format needs to be determined based on the premise that the frequencies available are fixed.
- The fact that there is a **difference in expiry dates** across the current 2.1 GHz licences, including a significant difference in the expiry date of Eir's licence relative to those of Three and Vodafone, means that (in order to align the expiry dates of future licences across the band) some form of time slicing or differentiation in starting dates is necessary – this cannot be avoided, unless some of the spectrum is removed from the award or ComReg issues new rights of use in the 2.1 GHz band with different expiry dates, both of which would seem to be unattractive options.
- The **auction needs to be fair to entrants** – although the spectrum available is likely to be important for the MNOs looking to improve and expand their mobile services, we

cannot rule out the potential for new entrants to the mobile market, or interest from other parties looking to utilise the spectrum (in particular the higher frequencies) for alternative services such as fixed wireless access, or deployment of small-cell networks (e.g. for provision of wholesale capacity to MNOs). In this regard we highlight the outcome of the Irish 3.6 GHz award, where Imagine (a FWA operator) and Airspan were both awarded spectrum alongside the three MNOs. In line with ComReg's statutory objectives, the auction format therefore needs to provide fair and sufficient opportunity for parties other than the MNOs to participate and be awarded spectrum where efficient to do so.

- The auction needs to **reflect and work with any competition caps** applied by ComReg. As discussed above, competition caps are designed to protect downstream competition and are set independently of the auction format, and the decision on the auction format needs to account for the cap(s) as given and predetermined parameter.

Initial award of frequency-generic lots where possible is beneficial

In our original award format recommendations report, we considered a number of auction models that are frequently used for allocating spectrum and considered their suitability for this particular award. This assessment was completed on the assumption that the available frequencies will first be assigned to the greatest extent possible as frequency-generic lots, with specific frequency assignments established in a follow-up assignment stage. Initially offering spectrum as frequency-generic lots supports efficient assignment as it allows for maximising the extent to which winners can be assigned contiguous frequencies, and simplifies the process for bidders by reducing the number of different lot combinations bidders need to consider when making their bid decisions. However, the extent to which lots in a given band can be offered on a frequency generic basis relies on them being of sufficiently comparable value. In that regard, whilst most of the spectrum is likely to be suitable for award on a frequency generic basis:

- the top 10 MHz of the 2.3 GHz band is subject to power restrictions and cannot be considered as a direct substitute for other 2.3 GHz lots – we recommended allocating these frequencies as a single frequency-specific lot since there is unlikely to be interest in a smaller block of spectrum isolated at the top of the band;
- the bottom 30 MHz of the 2.3 GHz band could potentially be affected by the current (regional) Rurtel licences, and we

recommended that these frequencies be offered as a frequency specific lot if this is still the case at the time of the award; and

- the top and bottom 5 MHz blocks in the 2.6 GHz unpaired band are subject to power restrictions and likely to have a different value to the rest of the band, and on that basis we also recommended that these lots should be awarded as two frequency-specific lots (2570 – 2575 MHz and 2615 – 2620 MHz).

We also set out our view that, to support an efficient assignment, where possible the spectrum should be made available in lots consisting of small frequency blocks that bidders can then aggregate into a bandwidth that meets their requirements. This provides maximum flexibility for bidders to acquire bandwidths in line with their specific usage requirements, supports efficient assignment of the frequencies, and avoids arbitrary administrative decisions. Based on this premise, and the recommendations and guidelines set out in the relevant CEPT and EU, we saw little reason to deviate from ComReg's intention to award the majority of the spectrum in 5 MHz blocks. The exceptions to this were the bottom 30 MHz and the top 10 MHz in the 2.3 GHz band which, as noted above, we recommended should be awarded as larger frequency-specific lots. The need to differentiate the bottom of the 2.3 GHz band has now been eliminated, as we discuss below.

On this basis, and under the assumption that the 2.1 GHz, 2.3 GHz and 2.6 GHz bands would be offered in two time slices, the *initially* proposed lot structure for the award is set out in Table 4 below. This gives a total of 103 distinct lots, split into 17 lot categories.

Table 4: Previously proposed lot categories

Cat. ID	Band	Frequency range	Time slice	Lot size	No. generic lots
1	700 MHz	703 – 733 MHz / 758 – 788 MHz	1	2x5 MHz	6
2	2.1 GHz	1920 – 1980 MHz / 2110 - 2170 MHz	1	2x5 MHz	9
3	2.1 GHz	1920 – 1980 MHz / 2110 - 2170 MHz	2	2x5 MHz	12
4	2.3 GHz	2300 – 2330 MHz	1	30 MHz	1
5	2.3 GHz	2300 – 2330 MHz	2	30 MHz	1
6	2.3 GHz	2330 – 2390 MHz	1	5 MHz	12
7	2.3 GHz	2330 – 2390 MHz	2	5 MHz	12
8	2.3 GHz	2390 – 2400 MHz	1	10 MHz	1
9	2.3 GHz	2390 – 2400 MHz	2	10 MHz	1
10	2.6 GHz paired	2500 – 2570 MHz / 2620 – 2690 MHz	1	2x5 MHz	14
11	2.6 GHz paired	2500 – 2570 MHz / 2620 – 2690 MHz	2	2x5 MHz	14
12	2.6 GHz unpaired	2570 – 2575 MHz	1	5 MHz	1
13	2.6 GHz unpaired	2570 – 2575 MHz	2	5 MHz	1
14	2.6 GHz unpaired	2575 – 2615 MHz	1	5 MHz	8
15	2.6 GHz unpaired	2575 – 2615 MHz	2	5 MHz	8

16	2.6 GHz unpaired	2615 – 2620 MHz	1	5 MHz	1
17	2.6 GHz unpaired	2615 – 2620 MHz	2	5 MHz	1

During the consultation process we received few objections to the split of lots into frequency-generic and frequency-specific lots, indicating that, in general, stakeholders are in agreement with the proposed approach. In response to the award design consultation, Eir suggested that the 700 MHz band could be awarded as 2x10 MHz lots rather than 2x5 MHz lots. In response to this, DotEcon and ComReg highlighted that making this change would not be compatible with the 70 MHz cap on sub-1 GHz spectrum as it would artificially prevent Eir and Vodafone from bidding for more than 2x10 MHz of 700 MHz spectrum (whereas they could bid for up to 2x15 MHz under the proposed lots structure). On this basis we are of the view that maintaining 2x5 MHz lots in the band is preferable. Three has also made proposed some minor amendments to the lot structure, but our understanding is that these are specifically related to its suggested alternative auction formats (which we discuss later), rather than an objection to our recommended lot categories proposals per se.

New changes to the lot structure

Since the publication of the Draft Decision and the Draft IM, we understand that there have been developments in relation to the transition of Eir's RurTel services out of the 2.3 GHz band to the extent that ComReg is of the view that the frequencies 2300 – 2330 MHz can now be included as frequency-generic lots along with 2330 – 2390 MHz. This means that the whole of the 2.3 GHz band would be made available as frequency-generic lots, apart from the top 10 MHz which would remain a fixed frequency lot due to the lower applicable power limit. Although (as things stand) there would still be some usage restrictions on the lower 2300 – 2330 MHz part of the band due to continued operations of RurTel in the Donegal area, the affected population is relatively small (approximately 270,000) and the restrictions are likely to be temporary, with unencumbered use of the spectrum expected in the future. Therefore, ComReg is of the view that the difference between the value of these frequencies and the rest of the band (other than the top 10 MHz) is likely to be sufficiently small such all frequencies in the 2300 – 2390 MHz range can be considered substitutable. This changes the lot structure set out in the table above in that:

- the 2.3 GHz frequency-generic lot categories will include 18 lots (rather than 12); and
- there will no longer be fixed frequency lots for the frequency range 2300 – 2330 MHz.

Following these changes, there will be a total of 113 distinct lots, split into 15 lot categories. However, to be clear, the changes have no bearing on the award format recommendations or considerations discussed in this section below.

Formats considered in our original recommendations report

On the basis of the proposed split into frequency-generic and frequency-specific lots, our initial award format report considered the following auction formats:

- the combinatorial clock auction (CCA);
- the combinatorial multiple round ascending auction (CMRA);
- the sealed bid combinatorial auction (SBCA);
- the simple clock auction (SCA); and
- the simultaneous multiple round ascending auction (SMRA).

Of these, we shortlisted the CCA and CMRA as reasonable candidates, on the basis that a combinatorial auction format with an open stage was likely to be most appropriate, predominantly to mitigate aggregation risk and substitution risk, and to help bidders to focus/adjust their bids on packages/lots they believe they are likely to win in light of information received about the demand for others. Our analysis of these formats in Document 19/59a remains valid.

Need for a combinatorial auction format

Aggregation risk arises when there are synergies between lots (i.e. when the value of multiple lots together is greater than the sum of the individual value of the lots), and there is a risk to a bidder bidding for multiple lots of only winning a subset of those lots at a price that is below the value of that subset of lots. For example,

- bidders may have a minimum bandwidth requirement that is only achieved with several lots, so that winning fewer lots than they bid for is useless;
- some bidders might want to increase their bandwidth in steps greater than the lot size;
- there may be technical efficiencies from larger bandwidths that may give rise to increasing returns to scale from acquiring additional lots (at least for some bandwidths); or
- bidders may wish only to acquire spectrum if they can obtain a portfolio that includes spectrum in different bands, for instance to provide support to different devices or to obtain a combination of low frequencies for a coverage layer and high frequencies for additional capacity – this might be particularly relevant for new entrants.

Importantly, combinatorial auctions allow bidders to make package bids, where each bid is for a selection of lots at a specified price, and a bidder will only ever win one of the packages it bids for in its entirety (or nothing at all). This eliminates aggregation risk as bidders know they can bid for a package without the possibility of only winning a subset of the lots included (unless they explicitly submit another bid for an alternative package of lots including that subset).

The downside of combinatorial auctions is that they can be mechanically more complex than non-combinatorial formats, both in terms of the evaluation of bids (and determination of prices if a second-price rule is used), and in terms of activity rules in the case of open, multi-round combinatorial auctions. Additional complexity can increase the risk of bidders making mistakes or not fully understanding the implications of their bids, and may discourage inexperienced bidders from participating, so should only be used where there are material benefits from doing so e.g. when bidders might otherwise face significant aggregation risk. Our award format report set out our view that in this award, aggregation risk is likely to be a significant factor as we anticipate strong complementarities across lots for at least some potential bidders:

- The proposed lot size (mostly 5 MHz or 2x5 MHz) represents the smallest building block suitable for the range of likely uses, and in reality we would expect operators to want/need larger blocks of contiguous spectrum to support higher speeds and capacity requirements. We therefore expect there to be synergies across lots within a given band.
- It is likely that some or all bidders will wish to acquire a mix of lots across different bands, and that holdings in these bands may be complementary. In particular, any new mobile entrant who does not already hold spectrum in other bands might wish to acquire a combination of sub-1 GHz frequencies (for coverage and in-building penetration) and higher frequencies (for additional capacity in high traffic areas).
- It is likely that there will also be strong synergies arising from having access to the spectrum over the course of both time slices. For example, acquiring spectrum rights of use for time slice 1 only may not be of much use if the operator then became capacity constrained and had to reduce/compromise services accordingly when those licences expired. On the other hand, an operator might struggle in the downstream market if it acquired licences

for time slice 2 only and had to wait for those to come into force before it was able to effectively compete with other operators that were able to take advantage of the spectrum much earlier.

Combinatorial auctions also help to mitigate substitution risk, which arises when lots (or combinations of lots) in the award are substitutable but bidders face a risk of winning one combination of lots when they would have preferred another at given prices. Substitution risk can be an issue, for example, if there are impediments to bidders' ability to switch their demand between different lots in response to price changes. This may be exacerbated if there are also synergies across lots, since bidders will likely want to switch demand for multiple lots across lot categories at the same time (rather than on an individual lot basis). Where bidders are unable to express demand for their preferred lots at given prices, this is not only bad for the individual bidder, but also creates a risk of an inefficient allocation of the available spectrum. Combinatorial auctions help to mitigate substitution risk by providing bidders with an opportunity to submit a range of mutually exclusive bids that represent their valuation structure; if this is supported by a winner and price determination mechanism that maximises bidder surplus given the bids received, a bidder can express its valuations for a number of alternatives and then rely on the auction mechanism to select the most preferred outcome against those valuations.

Our expectation for this award is that there will be significant degree of substitutability between lots, in particular across the higher frequency bands. Therefore, bidders may be subjected to substitution risk if there are impediments to switching. On this basis, and more significantly because of the expected aggregation risk in the award, we formed the view that using a combinatorial auction format is likely to be beneficial and that the anticipated efficiency gains would outweigh the risks arising from the additional complexity, in particular if potential bidders were provided with sufficient training and guidance in advance of the award. This in turn meant that we discounted SMRA-based formats and the SCA on the basis that:⁴⁴

- SMRA-based formats would be likely to expose bidders to material aggregation risk and create impediments for

⁴⁴ Note that there are other issues with the SMRA and SCA in the context of this award, which are detailed in our award design recommendations report (ComReg document 19/59a) and summarised below.

bidders to switch across different portfolios of interest in response to price changes; and

- although the simple clock format can support package bidding to mitigate aggregation risk, when there are different lot categories (as for this proposed award) bidders may be exposed to substitution risk (if the activity rules limit the extent to which bidders can switch between alternative portfolios of interest).

Of the auction formats considered, the CCA, SMRA and SBCA are all combinatorial auction formats that support package bidding and could be considered suitable for this award. However, the SBCA was also ruled out as an option on the basis that a format with an open stage is likely to be important.

Benefits of a format with an open stage

Open auctions can be useful when there is common value uncertainty, as they allow bidders to “pool” their knowledge of the value of the spectrum and revise their bids/valuations in light of the information received from others. For this particular award we are of the view that common value uncertainty may be less relevant than in previous awards (such as the 2012 MBSA), given:

- the expectation that much of spectrum valuation will come from existing operators using it for improving/expanding existing services (so valuations are less uncertain and more likely to be operator-specific); and
- the potential for the spectrum to be used for a variety of uses cases with different business models means that the extent to which information about the value for a specific use case can be separated out is likely to be difficult – the spectrum is likely to be important for the initial deployment of 5G, which is new for all operators, so in that respect there may be an element of common value uncertainty, but using the open stage to mitigate this might not be feasible in light of other anticipated use cases.

However, a more important point for this award is that, with a SBCA (or any other sealed-bid format), the absence of an open stage means that bidders must make their final set of bids without having an opportunity to mitigate any initial uncertainty about the final outcome and which bids might be compatible with the demand of others. This is a particular problem in the context of the proposed award as the large number of available lots means that a restriction on the number of alternative packages each bidder can bid for would likely be necessary, to keep the computational complexity of determining winners and prices manageable. Without the benefit of an open stage, it may

be difficult for a bidder to know which lots/packages are more likely to be compatible with the demand of others, and which it would therefore stand a good chance of winning. In a sealed bid auction where bidders are limited in their ability to express valuations over all possible combinations of lots, a bidder might fail to win anything simply because every one of its package bids conflicts with a winning bid of another bidder when it could (in an efficient outcome) have been awarded a package that it did not submit a bid for.

For this reason, we recommended using an auction format with an open stage, meaning that the CCA and the CMRA were shortlisted as two candidate auction formats. Of these, we judged the CCA to be the better option. Both formats allow for package bidding (eliminating aggregation risk) and for bidders to submit multiple mutually exclusive bids for alternative options (removing switching impediments and helping to mitigate substitution risk), and both have an open stage (helping bidders to focus bids on packages they have a chance of winning and, to the extent possible, mitigating any common value uncertainty).

The CCA was deemed more appropriate than the CMRA

The recommendation to use a CCA over a CMRA ultimately was the result of the key differences between the two formats and the implications in the context of the specifics of this award. The CMRA uses a pay-as-bid rule, which can be simpler for bidders than the second-price rule adopted in the CCA (and which is the source of a number of criticisms of the CCA), in particular if bidders face budget constraints or have issues with internal governance when there is uncertainty over final prices. However, as with all pay-as-bid auctions, the benefits come at the cost of providing some incentives for bidders to strategically reduce demand or shade bids, which might be relevant for this award due to the fact that the large supply of lots might allow bidders to form a tacitly collusive outcome with a view to settling at low prices.

In contrast, the second-price rule used in the CCA (along with the sealed-bid aspect of the supplementary bids round) reduces the opportunities strategic demand reduction and provides incentives to submit bids at valuation. From a mechanical point of view, the CMRA is also likely to be less practical than the CCA for bidders that wish to bid for a wide range of packages, as it would require those bidders to update and submit a large number of bids in every round which could prove challenging. Given the relatively large number of lots in this award, this may be a significant factor. The CCA, on the other hand, requires

bidders to submit just a single bid per round in the open stage and only prepare and submit a longer list of final bids when demand has been resolved in the clock stage and bidders have more information about demand from others. Furthermore, the CCA is a tried and tested format that has been used in Ireland before (for the 2012 MBSA and the more recent 3.6 GHz awarded) and is proven to be entrant friendly (as evidenced by the outcome of the 3.6 GHz award), whereas the CMRA is still a relatively new format. Whilst both formats have pros and cons, on balance we formed the view that the CCA would be the most appropriate option.

*Introduction of
exposure pricing to
the CCA*

We have always been open about the fact that the CCA is not a perfect auction format, and that there are some downsides, especially in terms of complexity. However, taking into account the key factors and considerations for the award, this was the format that we felt was most suitable for meeting ComReg's objectives. One significant criticism of the CCA is that the (opportunity-cost based) second-price rule means there can potentially be a large difference between what bidders need to bid for a package and what they will end up paying. This can create problems for internal governance and can be an issue for budget constrained bidders who may not be able to express their valuation for some packages of interest and need to determine how best to bid without knowing what they would ultimately be required to pay.

In this regard, along with the draft Information Memorandum, subsequently proposed a new feature ('exposure pricing') whereby in each clock round bidders would be told the *minimum* difference between their clock bid amount and the price they would have to pay (their bidder-specific 'discount') in the event that the clock rounds were to end with no excess supply and that bid became a winning bid. Although this does not perfectly resolve the uncertainty issues associated with the CCA, we believe that it should provide bidders with significantly improved information about what they could ultimately expect to pay for a package if there were to win it. We note that in response to this proposed new feature, ComReg generally received positive comments from stakeholders who raised no objections to introducing it for this award.

*Other formats /
modifications
proposed*

At various stages of the consultation process, ComReg received comments from stakeholders on the award formats considered as well as various proposals for alternative formats (whether adjustments to the CCA, or different auction formats entirely). Some of these have been previously assessed, whereas others

are newly discussed in this report. In light of the comments received on the award format, ComReg also published an Information Notice (ComReg document 20/56) requesting stakeholder views on the need to conduct a RIA on the award format and the relevant options that should be considered.

The alternative proposals set out in the stakeholder consultation responses and ComReg's Information Notice are as follows:

- CCA with a joint 700 MHz cap of 2x25 MHz – proposed by Three in its response to ComReg 19/124 (and included as an option in ComReg's Information Notice).
- CCA with a joint cap for price determination – proposed by Three in its response to ComReg 19/124 (and included as an option in ComReg's Information Notice).
- CCA with a cap on the value that bidders can express for a third 700 MHz lot – proposed by Three in its response to ComReg 19/124 (and included as an option in ComReg's Information Notice).
- CCA with increased reserve price for the 700 MHz lots – proposed as an option in ComReg's Information Notice.
- CCA with an increased value of unsold 700 MHz lots in the price determination process – proposed as an option in ComReg's Information Notice.
- CCA with non-linear reserve prices for the 700 MHz lots – proposed as an option in ComReg's Information Notice.
- CCA with a weighted Vickery-nearest pricing rule – proposed as an option in ComReg's Information Notice.
- CCA with bid amounts in each clock round set to exposure prices (total price at round prices less the bidder's discount) – proposed by Eir in its response to the Information Notice.
- Simple clock auction with relaxed activity rules – proposed by Eir in its response to ComReg 19/59R, and previously assessed as part of the Draft Decision⁴⁵ and DotEcon's accompanying report.⁴⁶
- Enhanced simple clock auction (eSCA) – proposed by Three in its response to ComReg's Information Notice, along with draft rules for how the format would work.
- Hybrid SMRA – proposed by Three in its responses to ComReg 19/59R and the Information Notice, along with draft rules for how the format would work.
- Iterative CCA – proposed by Eir in response to ComReg's Information Notice.

⁴⁵ ComReg 19/124, paragraphs 6.80 – 6.82

⁴⁶ ComReg 19/124a, paragraphs 174 – 175

We discuss each of these options (as well as those already assessed in our initial award format recommendations) in turn below, noting that a key driver of the discussions is Three's particular concern over the interaction of the CCA and the competition caps proposed (specifically the sub-1 GHz cap).

Eir's view that all combinations should be included in a RIA

In its response to ComReg's RIA Information Notice, Eir set out its view that ComReg's award format RIA needs to consider "*all possible choices of auction format(s) not only in combination with its preferred time-slicing approach, but also with alternative options for the packaging of the available spectrum, including with the 2.1GHz spectrum being time-sliced but with no time-slicing of the 2.3GHz and 2.6GHz spectrum, and with the 2.1GHz spectrum being packaged into two categories differing by start date and duration, also with no time-slicing of the 2.3GHz and 2.6GHz spectrum.*"⁴⁷ Eir also believes that the options considered need to include the possibility of awarding the 700 MHz spectrum separately in a different process.

We disagree with Eir's view that the RIA needs to include all possible combinations of auction format and spectrum packaging as described. Since there are a number of factors that are set independently of the award format and cannot realistically be changed, it is only relevant to assess the options that can be accommodated based on those.

Where factors outside the choice of auction format are already set or deemed necessary, including the alternatives in the RIA options would be inefficient and unnecessary. Based on the reasoning that these are independent of the specific award format, there would be no need to subsequently assess every combination in a RIA. For example, where the need for various award design features has already been established as part of a long and careful consultation process and there are important reasons for doing so, there should not be any need to perform a RIA on every auction format with and without such design features. For example:

- the inclusion of certain bands (e.g. the 700 MHz spectrum in the award alongside the higher frequency bands);
- the need for time slices across the 2.1 GHz, 2.3 GHz and 2.6 GHz bands in favour of alternatives that could distort competition during the award process;
- the use of a 70 MHz sub 1 GHz competition cap and a 375 MHz overall cap are to prevent distortions to downstream competition and there should not be any need

⁴⁷ ComReg document 20/78

to assess the same auction format with different competition caps.

6.2 Proposed format - CCA with exposure pricing

As discussed extensively in previous documents and summarised above, we believe that a CCA with exposure pricing, as proposed by ComReg in the Draft Decision and Draft IM, is the appropriate format for the award. The key features of the format are:

- an open, clock stage (or 'primary bid rounds'), with package bidding, to remove aggregation risk, and relaxed activity rules, so that a bidder can always bid for its preferred package if its previous bids were 'truthful' (i.e. in accordance with its valuations);
- a supplementary bids round, where bidders can express valuations for a range of packages, which reduces the chance of inefficiently unsold lots;
- winner determination by maximising the value of winning bids, selecting at most one bid per bidder from all bids submitted, thereby reducing the incentives for gaming, as any bid could become a winning bid;
- minimum revenue core (MRC) pricing, which maximises incentives to bid truthfully subject to having satisfied winners and losers; and
- while MRC pricing creates some uncertainty over prices, this can be mitigated this by including information on exposure prices during the clock rounds.

Views of respondents

Interaction of a CCA and the caps

Three claims that the specific combination of the proposed competition caps and the use of a CCA discriminates against it. As a result of a larger initial sub-1 GHz spectrum holdings, Three is only allowed to bid for two 700 MHz lots, while the other MNOs can each bid for three. In a CCA, Three interprets this as ComReg guaranteeing the other MNOs a 700 MHz lot at reserve price (assuming no bidders other than the MNOs compete for 700 MHz spectrum), while not extending the same offer to Three, which it views as discriminatory.

In principle, Three accepts that price differences may arise as a result of bidders having different valuations for the same spectrum, but it suggests in its response to the Draft Decision that bidders should generally pay similar prices for similar things, and it does not accept that the existence of synergies is sufficient grounds for a departure from uniform pricing, or that any efficiency grounds have been presented for the use of a CCA with the proposed competition caps. It suggests that prices will not reflect true opportunity cost if it cannot bid for three 700 MHz lots. Moreover, it believes that price differences will be a greater burden than suggested by ComReg and DotEcon, and it presents examples to support its claim that price differences will be substantial, which we address in turn in Annex A. It therefore believes that ComReg's response is disproportionate, and against its statutory objectives.

Neither of the other MNOs accept Three's claim that the format proposed by ComReg discriminates against. In their responses to the Information Notice, Eir states that Three's complaints about price asymmetry are not a material concern, while Vodafone submits that caps applying to all bidders but affecting operators with larger holdings asymmetrically have been a feature of previous auctions in Ireland and elsewhere, and that redesigning the auction to allow Three to maintain a spectrum advantage at a low cost would be discriminatory.

In response, Three claims that allowing Vodafone, but not Three, to express a value for a third lot confers a direct advantage on Vodafone, and therefore it is unsurprising that Vodafone would opt to retain this advantage. Three also contends that Vodafone's reference to Three winning a lot at reserve price in the 2012 MBSA (discussed in Section 5) suggests it accepts that ComReg's current proposals confer an advantage on it.

*Aggregation risk
and smaller
operators*

Vodafone suggests that a CCA is the only format that can adequately deal with aggregation risk in this award, and it reiterated in its response to ComReg document 20/56 that a CCA is the appropriate format given the complex lots on offer. Three claimed in its response to ComReg document 20/56 that a CCA is unpopular with respondents and only supported by Vodafone because of aggregation risk arising unnecessarily as a result of time slicing. However, in its response to ComReg 20/78 Three also asserts that Vodafone had an interest in maintaining the discrimination against Three.

Three further suggests that too much weight has been put on aggregation risk because, although an entrant would be at

greater risk of winning a subset of the lots it demanded in an SMRA, an SMRA would still be better for smaller bidders than a CCA. The reason given in Three's response to the Draft Decision is that, because MNOs would have less incentive to drop demand in a CCA, there would be less opportunity for smaller bidders to pick up residual lots. Three also observes that smaller bidders faced higher unit prices in the 3.6 GHz award and would likely do so again in this award.

In its latest response, Imagine referred back to its comment in response to the consultation on included spectrum (ComReg 18/60), that a CCA as implemented in the 3.6 GHz award favours larger bidders, which ComReg had omitted in a reference to Imagine's support for the use of a CCA. In its earlier response, Imagine explained that the difficulty for smaller bidders arises because of the need to access sufficient funds upfront to cover the auction fee, rather than being able to spread this cost over the duration of the licence (i.e., increases above the minimum price affect only the spectrum access fees (SAFs), as opposed to maintaining the 60/40 split with the spectrum usage fees (SUFs)). We note that this comment is not specific to CCAs, and that Imagine agrees that a CCA is an appropriate format, provided there are no further changes to the rules that disadvantage smaller bidders.

Gaming behaviour

Three claims in response to the Draft Decision that bidders in a CCA have a greater incentive to bid for packages they do not expect to win than they would have in an SMRA, but they know that doing so may induce other bidders to bid more aggressively. Therefore, it asserts that demand reduction incentives persist in a CCA, but demand reduction is more likely to lead to an inefficient outcome than in an SMRA (where any bias would be towards a 'consensus' view on the likely outcome, and lower prices may be good for subsequent investment). The incentives in a CCA introduce the risk that bidders may adopt:

- different approaches to demand reduction and are caught in a 'prisoners dilemma' that could result in inefficient outcomes; and
- conquering strategies in which they attempt to block rivals' access to spectrum, because they can overstate their own values without directly affecting their own price.

Three asserts that ComReg's view of spectrum licence fees as sunk costs is overly simplistic, and that MNOs have limited access to capital, meaning that greater spectrum prices may constrain investment elsewhere and reduce willingness to compete on price. It submits this makes more financially

constrained bidders more willing to gamble on strategic demand reduction in a CCA.

In the same response, Three also submits that CCAs are open to price driving behaviour, and it points to DotEcon's discussion in a report on auction design in the Netherlands that suggested inefficient outcomes could arise if bidders are concerned more about the price they pay relative to their rivals than maximising surplus. In particular, it highlights that DotEcon expressed a concern that, in a scenario where there was a second price rule and asymmetric caps, bidders who were concerned about not paying more than their rivals might attempt to exploit the asymmetry, and even if synergies were sufficient to justify a combinatorial format, the extent to which prices reflected opportunity cost would still be restricted by bidders' ability to compete for additional spectrum.

Throughout its responses, Three asserts that price driving is likely to be a significant factor in the award if ComReg proceeds with a CCA, but its most detailed comments on the matter were offered in response to the Draft IM (in particular, to the exposure pricing report in Annex 12, that includes a discussion on price driving), in which Three claimed that bidders have an incentive to drive prices because they:

- do not want to pay higher prices than rivals as a result of being the only one not to adopt a price driving strategy; and
- could induce rivals to drop target lots by exerting price pressure on them.

It also asserted that DotEcon has overstated the risks to bidders of engaging in price driving, as Three claims bidders do have a good idea of each other's demand structure, and because the competition caps may reduce the risks of price driving, rather than reducing the incentives to attempt this strategy.

Additionally, Three submits that incentives would be weaker under other formats, because bidders would affect their own price, and that DotEcon has underplayed the risk of missing bids.

On the other hand, Vodafone suggests in its response to the Draft IM that there is little gain from price driving behaviour in this auction, because the competition caps and significant existing spectrum holdings mean that bidders would be unlikely to be able to affect downstream competition by overbidding. In general, Vodafone believes that the risk of gaming is low in this

award, because of the there are many lot categories and the auction is too complex for gaming to be an issue.

Eir is concerned about the need for budget constrained bidders to submit knockout bids significantly in excess of the price that they will have to pay, in the even that there are unsold lots at the end of the clock rounds. Eir submits that its concern is based on its observations from past auctions, in which there were no unsold lots following the supplementary bids round, and that ComReg is wrong to dismiss the potential effects of gaming in this regard.

Price transparency

In general, Eir's main objection to the use of a CCA is that, in its view, the lack of price transparency creates a serious governance issue for a budget constrained bidder. Such a bidder may face a situation in which the price of its preferred package is above its budget, but below its valuation, and it may therefore not submit a bid for that package, even though the price it would ultimately have to pay could be within its budget. Although the addition of exposure pricing information is welcome, it is insufficient to resolve Eir's concern, as it remains possible that a budget constrained bidder could be unable either to bid for the package it prefers at prevailing round prices, or subsequently to submit the knockout bid for its final clock package. Eir submits that this creates a risk of an inefficient outcome unless there are further rule changes. To that end, in its response to ComReg document 20/56 (the Information Notice), it proposes two changes to the CCA that it considers would ameliorate (although not eliminate) its concerns. In particular Eir suggests:

- setting bid amounts equal to exposure prices; and/or
- replacing the supplementary bids round with one or more 'additional rounds' in the event that there are provisionally unsold lots at the end of the primary bid rounds, where the additional rounds are very similar to rounds in a CMRA (except that a second-price rule would be used rather than pay-as-bid).

Given the extent of the proposed changes, these two options are considered separately in Sections 6.3.8 and 6.4.7 respectively.

In its response to the document 20/32 (the draft IM), Eir also made the suggestion that, in addition to exposure pricing, it may be useful in improving bidders' understanding of the risk associated with submitting a supplementary bid at less than the knockout bid amount (although unlikely to resolve Eir's

concerns) to provide bidders with the following information at the end of the primary bid rounds and before the start of the supplementary bids round:

- *"The minimum bid that the bidder could make for its final primary package in the supplementary bids round for that bid to win. We anticipate that this could be calculated by assuming that all other bidders that made a non-zero bid in the final primary round made the knock-out bid for their final primary package in the supplementary bids round, and no other supplementary bids were made by any bidder.*
- *The minimum bid that the bidder would need to make for its final primary package in the supplementary bids round for that bid to win if no other supplementary bids were made by any other bidder."*

Vodafone shares Eir's expressed view that a lack of price transparency was one of the main problems with previous CCAs. While Vodafone states that it is difficult for it to assess how effective exposure pricing information will be, it expects that it will make a positive contribution to resolving the issues with price transparency and has no apparent downside.

Assessment and recommendations

The combination of the caps and a CCA is not discriminatory

Three's main complaint is not about the design of the competition caps, or the use of a CCA (although it asserts the need to facilitate switching, the complementarities across bands, and the need for time slicing have been overstated), but the interaction of the two. Specifically, Three suggests that use of the MRC pricing rule in the context of the competition caps, means that Vodafone and Eir will pay too little as Three would not be able to express a value for a third lot of 700 MHz spectrum in its bids which would therefore not be reflected in the opportunity cost that determines the prices paid by Eir and/or Vodafone. In our view it is not reasonable to describe this as Three overpaying for spectrum, as its price will be set by the same method and will reflect the opportunity cost of its own winning bid.

As established in the discussion of competition caps, allowing an outcome in which Three wins three 700 MHz lots would give the possibility of an outcome with an extreme level of asymmetry in post-award sub-1 GHz spectrum holdings that could damage downstream competition. Absent this cap, Three's bids might reflect expected anticompetitive gains in

addition to its genuine value for the spectrum, so ComReg would not be able to ensure Three was expressing only legitimate opportunity cost. On the other hand, Eir and Vodafone may wish to level up with Three by winning a third 700 MHz lot, and an outcome in which they do so may well be consistent with an efficient outcome.

Both the same competition caps and the same pricing rule apply to all bidders. Any asymmetric effects of this cap are a result of Three's larger existing holdings, and it would be inappropriate to intervene to protect Three from competition and thereby reinforce its existing advantage.

Opportunity cost and non-uniform pricing

All of the suggested rule changes to a CCA, as well as proposals to move towards a uniform price format, represent a departure from opportunity cost pricing that would reduce Eir and Vodafone's incentives to compete for third lots. As a result, Three would be more likely to win 700 MHz spectrum, regardless of whether this is the efficient outcome, and the intervention would appear to be a direct attempt to protect Three's current advantage.

The reasoning for these changes is in part based on Three's assertion that non-uniform pricing is rarely required to support efficient outcomes, and on the assumption that the efficient outcome involves each MNO winning two 700 MHz lots. However, we do not know in advance what structure demand is likely to have, cannot presume this is the efficient outcome, and we cannot ignore the effect of a deviation from opportunity cost based pricing on bidding incentives.

Reasonable bid incentives, and content winners and losers, requires bidders to pay in line with opportunity costs. However, with a small number of bidders, there is no guarantee that opportunity costs will be the same for each winner, and Three is incorrect to rely on any intuitions related to 'laws of one price', that might be used to claim there is an issue with it potentially paying a different price to its rivals.

Aggregation risk would be an issue for strong entrants

The different expiry dates of existing 2.1 GHz rights of use require a lot structure that facilitates competition in the auction, and we have established above that time slicing is the appropriate way of dealing with this. Clearly time slicing any band creates significant aggregation risk (as highlighted by a number of respondents) and substitution risk due to the likely strong complementarities between lots across time slices, and this necessitates use of a combinatorial auction format that supports package bidding (such as the CCA, CMRA or SBICA).

However, as we have set out previously in ComReg document 19/124a, our recommendation to use a CCA is not contingent on time slicing. We believe that time slicing in the higher frequency bands is not the only potential source of aggregation risk or substitution in this award, and in particular:

- bidders may require a minimum amount of spectrum in excess of the lot size within any given band, so there are likely complementarities across lots within bands;
- bidders may desire a combination of lots across multiple bands (e.g. a mix of sub-1 GHz band higher frequency spectrum, as would typically be the case for a mobile operator), in which case there would be complementarities across spectrum bands; and
- the various higher frequency bands are likely to be substitutable at least in the long run, so bidders are likely to have valuations for a range of alternative packages with different combinations of spectrum and want to switch multiple blocks across those bands in response to price changes.

These points may not be so relevant to some or all of the existing MNOs with an established network and substantial existing holdings, but could be relevant to smaller operators and/or potential new entrants where ensuring minimum spectrum holdings or a particular mix of frequencies may be essential, and we do not believe this is a factor that can be ignored in the context of the Irish market and ComReg's statutory obligations.

Moreover, the CCA is generally an entrant friendly format, especially when there is a large number of lots, as it allows bidders to bid for a wide range of packages of interest and maximise the chances that one of those bids will fit in with the demand of the larger bidders.

Three's suggestion that a CCA is not the appropriate way to provide an opportunity for entry appears to be based on the assumption that an entrant would have very low valuations (indeed, this is the case in NERA's examples discussed in Annex A and because MNOs might have a greater incentive to drop lots in an SMRA to secure a better price, that smaller bidder would prefer an SMRA, as it would have the opportunity to pick up the lots dropped by an MNO. It is not clear that this offers entrants any way of mitigating aggregation risk, but more importantly, it does not appear to be consistent with an efficient award. ComReg's interest should be in ensuring an entrant with

a sufficiently high valuation for its preferred package is able to compete.

Although Imagine also comments that the CCA implemented for the 3.6 GHz award favoured larger bidders, our understanding is that this comment was not intended as an argument for not using a CCA, which Imagine believes is an acceptable format for this award. It referred back to a previous consultation response in which it was concerned that, while the minimum fee was split between SAFs and SUFs, all of the price increase above this minimum level had to be paid up front. However, although there may be a small variation in prices arising under different formats, with an efficient and competitive outcome we would not expect the final prices paid by winners to differ drastically across formats. In all cases, in order to win spectrum a bidder will generally need to bid (and pay) enough to beat the highest bid from amongst its competitors (i.e. the opportunity cost of winning being awarded the spectrum, as under the CCA pricing rule). We do not believe, therefore, that the upfront fee is likely to be significantly higher under the CCA than under any other auction format. Whilst we agree that smaller bidders are more likely to face difficulties with financing large upfront payments, the split between the SAF and the SUFs is independent of the auction format and, since we believe the SAF will be largely the same under most reasonable formats with a competitive outcome, we disagree that this is a problem of the CCA favouring larger bidders.

Three has overstated the risk of gaming

Three suggests that demand reduction incentives persist in both a CCA and an SMRA, but are only likely to result in inefficient outcomes in a CCA. In a CCA, Three claims there is a risk of aggressive bidding, and the effect will be higher prices, rather than increased likelihood of achieving an efficient outcome. However, if 'aggressive' behaviour simply entails bidding a higher proportion of valuation for larger packages of lots, this is entirely consistent with efficiency.

Three has claimed that there are incentives for demand reduction and conquering strategies in a CCA that will prevent an efficient outcome, but we do not believe either of these incentives would be present in ComReg's proposed CCA. Firstly, it frames the CCA as a one-shot prisoner's dilemma, in which the optimal outcome from the bidder's perspective is tacit collusion (i.e., because there is reciprocated strategic demand reduction), but in the equilibrium of the game we achieve the competitive outcome, where bidders do not collude, and there is no strategic demand reduction. Modelling the auction in this

way is helpful in highlighting an important argument for the CCA, that bidders have an incentive to bid truthfully, as there is no direct benefit to unilaterally reducing demand in a way that is not based on the bidder's valuations. A rational bidder, even if budget constrained, will not expect its demand reduction to be reciprocated, therefore it is unclear why Three claims that this analysis demonstrates incentives for strategic demand reduction in a CCA. To be clear, the efficient outcome is the competitive one, even if this is not preferred by bidders, and Three's own framing of the issues suggests that rational bidding in a CCA will deliver that efficient outcome.

Conquering strategies also seem unlikely, given that the competition caps are set to avoid bidders being able to express a value based on blocking a competitor from competing effectively downstream.

Three's other concern over strategic behaviour in a CCA is that price driving will be prominent. In particular, it quotes a DotEcon design report for an auction in the Netherlands, in which we note that price driving could be a greater issue under a second price rule in some circumstances, and consider what our recommendation would be if:

- bidders are concerned about the price they pay relative to rivals rather than surplus maximisation (i.e., the context in which price driving is more likely);
- caps affect bidders asymmetrically; and
- synergies are sufficient to justify a combinatorial auction.

Three omits the answer offered in that report, that these might be conditions under which a CMRA is appropriate.⁴⁸ No respondent supports the use of a CMRA, and in any case, we do not believe that price driving is likely to be one of the main concerns in this auction.

There remains little incentive for, and significant risks of price driving

Firstly, we are unconvinced that there are strong reasons for bidders to be concerned about their rivals' prices. In the exposure pricing report⁴⁹, we noted that bidders may have an incentive to engage in price driving under the following circumstances, none of which appeared particularly likely:

- there is a principle/agent problem in which the shareholders/management of a bidder cannot easily assess

⁴⁸ DotEcon, 'Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum', Prepared for the Dutch Ministry of Economic Affairs, July 2019, p. 25.

⁴⁹ ComReg document 20/32, Annex 12, Section 4.2.3

performance in the auction, and therefore attempt to use price comparisons to do so;

- bidders may find themselves cash strapped and unable to invest in infrastructure; or
- predatory bids aimed at inducing other bidders to drop demand (which seems more credible, and more specific to a CCA, than the other cases).

Three's reasoning is related to the latter two points. In its response to the Draft Decision, it suggests that bidders have limited access to capital, and therefore high prices will affect subsequent investment and competition. However, we are still of the view that large telecoms operators are very unlikely to face sufficiently strong capital constraints to affect downstream competition, even if they face a marginally higher cost of capital as a result of using parent companies or external capital markets instead of internal funds. If there are capital market imperfections, it is not possible to fix these using a spectrum auction, and if anything, we would expect the additional costs to be factored into valuations (leading to slightly more cautious bidding), and not to be sufficient to incentivise price driving (especially given the risks a price driving bidder would be exposing itself to).

Three also contends that incentives for price driving could be based on the belief that higher auction prices will decrease bidders willingness compete on price in the downstream market. However, we have no reason to believe that a bidder would not compete to the best of its ability in the downstream market, irrespective of the auction price (e.g., consider a scenario in which a bidder was handed rights of use for free – we do not expect that this would lead MNOs to drastically drop the prices offered to consumers). We are aware of the NERA/GSMA report referenced by Three⁵⁰ that presents a positive correlation between auction and downstream prices, however, the causation is far more likely to run in the opposite direction, that is, higher auction prices are in anticipation of higher prices and profits downstream (i.e., MNOs factor this into their valuations, because of e.g. the characteristics of consumers in that country), rather than somehow demonstrating that operators will avoid competition because of higher auction prices. Therefore, we would expect the incentives for price driving, if based on the hope of causing a rival to become

⁵⁰ <https://www.gsma.com/spectrum/wp-content/uploads/2018/12/Effective-Spectrum-Pricing-Full-Web.pdf>

capital constrained or removing its willingness to compete downstream, would be very limited.

Three's most detailed comments on the incentives for price driving are in response to the Draft IM. Firstly, it alleges that bidders will not want to face a higher price than their rivals as a result of being the only bidder that does not engage in price driving. However, this is not an incentive to engage in price driving in itself, and therefore it is unconvincing unless we have some other reason to believe bidders are strongly concerned about relative price outcomes. Secondly, it suggests that bidders might overstate their values in to apply price pressure that forces bidders to drop lots. We discussed this point in the exposure pricing report and remain of the view that there are limited circumstances in which this behaviour would be effective, and that it is difficult to distinguish from genuine competition for additional lots. In general, Three's characterisation of the CCA as a one-shot prisoner's dilemma in which tacit collusion is the correct outcome and any strong competition is an attempt at price driving rather than competition for additional spectrum is unreasonable. We have no reason to expect bidders are not interested in winning additional lots (e.g., a third 700 MHz lot), and absent any credible incentives for price driving, we assume this is legitimate competition.

Even if the incentives are small, Three's concerns might be justified if, as it contends, the risks associated with price driving had been greatly overstated. However, we agree with Vodafone that such behaviour would be complicated in a multi-band award, and do not find it plausible that bidders would have such a clear view of rivals' valuations as to be able to price drive at little risk. Three contends that the competition caps introduce "lower or zero risk opportunities for price driving".⁵¹ On the contrary, we believe the greater effect of the cap comes from it being sufficiently tight to rule out bids for packages that bidders would not have inherent value for, or that might not be consistent with an efficient outcome, meaning that it reduces the incentives and scope for submitting price driving bids (irrespective of the risks of such bids being accepted if they could be submitted), and increases the probability that any bids for large packages are a result of 'legitimate' competition rather than predatory bidding.

⁵¹ ComReg 20/68, p.38

*Price transparency
and budget
constraints*

The lack of price transparency was identified by other respondents as a more serious issue than price driving. Regarding observed behaviour in previous CCAs, we first highlight that lots being unsold at the end of the clock rounds, but not after the supplementary bids round, is not indicative of gaming. In circumstances where a CCA is appropriate, bidders are likely to have increasing marginal valuation, and so may drop demand by multiple lots in one step, and the purpose of the supplementary bids round is to prevent these lots going inefficiently unsold. Furthermore, if bidders were genuinely dropping demand in the final primary bid round (with the intention of buying it back in the supplementary bids round) just to increase the knockout bid for others, that should not be of particular concern. In particular, if there is an expectation that unsold lots dropped in the final primary bid round will just be included back into other bidders' final primary packages, then these can be discounted from the knockout bid calculation.

That said, although exposure pricing is a significant improvement to price transparency, particularly if there are few provisionally unsold lots, we do recognise Eir's problem that budget constrained bidders might at some point be unable to bid for their preferred package at given round prices. However, we also highlight that this specific issue for budget constrained bidders is Eir's primary reason for preferring a uniform price format, and as such it is not in agreement with Three, even though both prefer other formats to a CCA.

In relation to Eir's suggestion to provide additional information at the end of the primary bid rounds, we agree that a bidder would likely find it useful to know the minimum bid that it could submit for its final primary package to ensure that bid would win. However, we disagree that this could be calculated "*by assuming that all other bidders that made a non-zero bid in the final primary round made the knock-out bid for their final primary package in the supplementary bids round, and no other supplementary bids were made by any bidder*". Bidding at this amount would not provide any guarantees to the bidder that it would win its final primary package, and we are unclear as to why calculating this amount would be helpful. Similarly, Eir's other suggestion of reporting the "*minimum bid that the bidder would need to make for its final primary package in the supplementary bids round for that bid to win if no other supplementary bids were made by any other bidder*" seems to be somewhat meaningless as it is based on a very specific assumption of what other bidders will do and does not appear

to provide any information that would help the bidder to maximise its chance of winning the final primary package.

Our assumption is that the motivation behind Eir's suggestion is to improve the information policy to assist bidders with establishing the maximum amount they would actually have to bid for their final primary package in order to guarantee winning it. The standard calculation of the knockout bid assumes that there are no restrictions on what bidders can bid for beyond the relative caps and supply of lots. However, where other constraints apply (e.g. competition caps), the minimum amount the bidder needs to bid in order to secure the final primary package may in fact be below the standard knockout bid, as other bidders may, for example, be constrained in their ability to submit bids for the unsold lots because doing so would breach the cap. In that regard, there may be a potential improvement to the information policy to report a knockout bid amount that only takes into account the (hypothetical) supplementary bids of others that are actually feasible, and therefore better reflects what a bidder would need to bid to secure its final primary package. A significant concern with this approach, however, is that it could reveal quite a lot of information to bidders about what their competitors are bidding for. For example, a bidder could calculate the potential knock-out bid amounts it would face under different assumptions about competitors' demand, and telling the bidder what it's (refined) knockout bid actually is would allow it to at least narrow down the range of competitor scenarios it is facing at the start of the supplementary bids round. Overall, any further additional information of this kind would likely be of very little use, or would reveal excessive information about rivals' bids, whereas exposure pricing information is both informative and without risk, therefore we would recommend ComReg continues with its proposed information policy.

6.3 Alternative options for the CCA

6.3.1 Joint 700 MHz cap of 2 x 25 MHz

As a means of mitigating the alleged discrimination arising from the combination of the proposed competition caps and the CCA, Three proposed a joint cap of 2 x 25 MHz on any two bidders for 700 MHz lots. ComReg then included this option in the information notice.

This cap would be applied alongside the proposed sub-1 GHz cap and would exclude outcomes where two bidders jointly won all of the available 700 MHz lots from the winner and price determination processes. It would require additional rule changes, namely:

- a change to the closing rule, such that the auction continued if there were two bidders each competing for three 700 MHz lots each; and
- measures to prevent issues relating to missing bids, such as requiring bidders for three 700 MHz lots to also submit a bid for an otherwise equivalent package with two 700 MHz lots.

ComReg raised the following preliminary observations about this joint cap, it:

- appears to restrict bidders other than Three in order to address Three's concerns about the price it might pay, not to prevent distortions to competition;
- would preclude outcomes that are permitted under ComReg's proposed cap (i.e., where both Eir and Vodafone have 70 MHz of sub-1 GHz spectrum, but Three only has 50 MHz);
- might amount to an effective reservation of spectrum for Three in the event that only the MNOs bid for 700 MHz spectrum; and
- the closing rule and measures to prevent missing bids may add undue complexity.

Views of respondents

Three initially proposed the joint cap, but prefers other formats

Three's complaint about the combination of the proposed caps and the use of a CCA is that it effectively reserves one 700 MHz lot for the other MNOs at reserve price (if there are no bidders other than MNOs), which it alleges is discriminatory. Three has suggested the joint cap as a means of applying the same reservation to all three of the MNOs. Although it would prefer an alternative format to the CCA, it describes this as a viable option if a CCA is to be used. Three highlights that while the joint cap would secure a better price outcome for Three (in a 3-bidder contest) relative to ComReg's proposed cap, it would not change the prices to be paid by Vodafone or Eir. NERA also notes that a joint cap was applied in the Swiss 700 MHz auction.

Other respondents oppose the CCA rule changes

Vodafone submits that all of the Options 5a – 5c in the Information Notice (i.e. this joint cap, the joint cap for price determination only, and the third lot value cap) serve no purpose other than to reduce the price that Three will pay, or to prevent an outcome where Three has less spectrum than the other MNOs. As such, adopting any of these three options would not align with ComReg’s objectives and would be discriminatory against other bidders.

Eir highlights that Three’s concern is over asymmetric pricing, not that any two bidders should win all of the available 700 MHz spectrum. Subject to the sub-1 GHz competition cap, there is no justification for prohibiting two bidders from winning all six 700 MHz lots, and this additional cap could clearly lead to an inefficient outcome. It is at the very least disproportionate and should not be adopted.

Imagine expressed a general concern with the amendments to the CCA proposed under Option 5 in ComReg’s Information Notice, stating that departures from the well understood rules risk undermining the benefits of the original design, and bringing about unforeseen outcomes.

ComReg invited comments on some potential effects of the joint cap

Vodafone agrees with ComReg’s preliminary observations on the joint cap, whereas Three provided mostly disagrees with ComReg and provided detailed comments. In particular, Three acknowledges that the cap effectively reserves a block of 700 MHz spectrum for it, but suggests that this is exactly the opportunity offered to Vodafone and Eir, and so extending this to Three removes discrimination. Three claims it is seeking to level the playing field, and that otherwise the discount offered to its rivals for a first 700 MHz lot could make them more competitive for a second.

Regarding the effects of the cap on potential outcomes, Three suggests that ComReg’s proposals already go beyond what is necessary to safeguard competition, and it does not see why precluding an outcome in which it has 50 MHz while the other MNOs have 70 MHz each should be a material concern. This outcome is dependent on Three not bidding (enough) for 700 MHz lots, would leave it with no sub-1GHz spectrum after 2030, and does not rule out Three having the joint lowest amount of sub-1 GHz spectrum. The effect of the cap is to rule out one rather asymmetric outcome, and in doing so the auction may become strategically simpler, as opportunities for price driving are reduced. Three also highlights that ComReg has argued that a cap above 70 MHz risks only two winners of 700 MHz spectrum, which is the outcome the joint cap prevents.

Three disagrees with the other MNOs' characterisation of its arguments

In response to ComReg document 20/78, Three has also commented directly on the points made by Vodafone and Eir against its cap. Three notes that Eir has suggested the cap will lead Three's price to be set by one other bidder plus the reserve price, but explains this is intended, as it the alleged discrimination arises from offering this opportunity to others but not Three. Regarding Vodafone's comments, Three feels Vodafone has misunderstood, and it is unfair to suggest it is seeking to distort the rules to its advantage, as it claims it is only seeking equal treatment.

Assessment and recommendations

We have provided a detailed assessment of this option in Section 5.3.4 above where we conclude that it would lead to unequal treatment of the three MNOs with a lack of rationale as an equitable and consistent measure to protect downstream competition.

We therefore do not see this as an appropriate option for this award.

6.3.2 CCA with joint cap for price determination

If ComReg was disinclined to exclude particular outcomes using the joint cap, Three suggested that the cap could apply only for the purpose of price determination. In its response to the Information Notice, it further proposed a 'minimal intervention' and 'broader intervention' version of the joint cap for price determination.

Changes to price determination could be restricted to situations in which Three alleges there is discrimination

Under the minimal intervention version of the rule, the 2 x 25 MHz cap on two bidders in the price determination algorithm would only apply in circumstances in which Three alleges there would be discrimination against it. That is, unless there are exactly three winners of 700 MHz spectrum and one of those is Three, normal price determination rules apply. If there are exactly three 700 MHz winners including Three, any bid sets including bids from both of the other 700 MHz winners and no reserve price 700 MHz bids are excluded for the purpose of price determination.

Three posits that the cap could apply to a broader range of scenarios, but does not provide a detailed explanation of the rule in that case, because the missing bids problem (i.e., where

bidders do not submit bids for otherwise equivalent packages containing two 700 MHz lots rather than three) could result in prices being too low.

ComReg has observed that this rule could lead to prices that do not cover opportunity costs, and reduced incentives to bid truthfully.

Views of respondents

All three MNOs agree with ComReg's comments that additional cap for the purpose of price determination could lead to prices that do not reflect opportunity costs and create an incentive for bidders to bid above their valuation. Eir and Vodafone submit that this could distort the auction process and lead to an inefficient outcome.

However, Three asserts that the current sub-1 GHz cap already creates an incentive for Eir and Vodafone to overbid for packages containing two or three 700 MHz lots, and similarly that, under the proposed rules, Three's rivals would not have to pay the true opportunity cost associated with its intrinsic value for a third lots. Therefore, it contends that the minimal version of the joint cap would simply extend the same opportunity and incentive to Three, and would thereby remove the alleged discrimination without distorting the award.

Assessment and recommendations

We have provided a detailed assessment of this option in Section 5.3.4 above where we conclude that applying Three's proposed joint cap within the price determination process only would undermine the integrity of the proposed auction process, treat the three MNOs in an unfair manner and risk spectrum being inefficiently assigned.

We therefore do not see this as an appropriate option for this award.

6.3.3 Value cap on third 700 MHz lot

Three has also suggested that the value expressed by for a third 700 MHz lot could be capped at the final 700 MHz clock price, and that this could potentially be applied alongside either of

the joint caps described above. It has subsequently clarified that this would be implemented by requiring a bidder who had bid for packages including three 700 MHz lots to submit supplementary bids for otherwise equivalent packages containing two 700 MHz lots, with the price difference between these bids being capped at the 700 MHz final clock price.

ComReg has made several of observations on this proposal, and has invited comments on whether:

- the proposed rule can be justified on competition grounds or would restrict potentially efficient outcomes;
- bidders have a value in being able to guarantee winning their final primary package, as they would lose this option under the rule;
- the rule would restrict Vodafone and Eir's ability to compete for third lots;
- marginal valuations for a third 700 MHz lot can be assumed to be decreasing without compromising an efficient assignment; and whether the rule
- creates excessive complexity that would prevent the exposure pricing functionality from providing useful information to bidders.

Views of respondents

At the time of providing its comments, Eir suggested that the exact proposal was unclear, but anticipated that it would only be relevant to bidders whose final primary package contained three 700 MHz lots, and that such a bidder would have to submit the supplementary bid described above. This could inefficiently lead to a bidder not winning a third lot.

Vodafone agrees with ComReg's expressed concerns over the rule change, commenting that it:

- restricts competition and auction outcomes without justification;
- removes the opportunity for a bidder to guarantee winning its final primary package (in Vodafone's view an important feature of a CCA), which would distort the process;
- limits Eir's and Vodafone's ability to compete for a third 700 MHz lot; and
- adds excessive complexity.

On the other hand, Three submits that there are a number of benefits associated with this additional proposed rule, such as

preventing bidders expressing inflated values for third lots for gaming purposes and reducing the missing bids problem. Three suggests that this rule should be adopted alongside one of the joint caps (for winner and price determination, or price determination only) discussed in the preceding section. However, and while it suggests the rule would improve the CCA regardless, Three would not be satisfied by the additional of the third lot value cap on its own, as it alleges the discrimination would remain in that case.

It also disagrees with the concerns raised by ComReg, because, for instance, it believes that it only prevents predatory or price setting bids, not legitimate competition between Eir and Vodafone. Three recognises that bidders could no longer guarantee winning their final primary package, but notes that they could still submit a knockout bid guaranteeing the final primary package, or the package subject to the supplementary bid required by this rule, a situation which it compares to submitting a relaxed bid in the final clock round. Three asserts that this should be a satisfactory outcome for all involved.

Further, Three submits that decreasing marginal valuations are consistent with experience elsewhere, and it will only concede that the rule disadvantages other bidders if ComReg receives credible evidence about bidders valuations. Finally, Three rejects that the rule adds complexity, arguing that it reduces uncertainty for bidders by ruling out extreme outcomes arising from exaggerated or deliberately omitted bids.

Assessment and recommendations

We have provided a detailed assessment of this option in Section 5.3.4 above, where we conclude that there would be serious adverse effects from applying a cap on the value that can be expressed for a third 700 MHz block, as proposed by Three, by unduly restricting bidders from expressing true (and legitimate) valuations for a third 700 MHz block.

We therefore do not see this as an appropriate option for this award.

6.3.4 Increased 700 MHz reserve prices

ComReg has noted that increasing 700 MHz reserve prices could reduce the extent of the price asymmetry, because

reserve price lots would be included in hypothetical allocations used for price determination, if only the MNOs bid for 700 MHz spectrum. However, ComReg has highlighted that there may not be much scope for increasing reserve prices that are intentionally set at a conservative level to avoid choking off efficient demand.

ComReg has invited views on the extent of any increase but has noted that our earlier benchmarking report estimated a minimum price range, and ComReg could set fees at the upper end instead of the lower end of that range.

Views of respondents

Eir summarises all of Options 5d – 5f as measures to increase the price paid by Three's competitors in the event of weak competition. It submits that there are no grounds for this arbitrary price increase and no way in which this could lead to a more efficient use of the spectrum, but on the contrary, it could reduce investment in networks if higher prices mean bidders subsequently have less capital available.

On the option to increase 700 MHz reserve prices in particular, Eir contends that the proposed reserve prices are already close to market value, and as such any price asymmetry would be low. As a result, increasing reserve prices is more likely to choke off demand than it is to significantly reduce price asymmetry. In turn, this increases the risk that 700 MHz lots go inefficiently unsold, and therefore Eir strongly opposes increasing 700 MHz reserve prices.

Three suggests that this measure would reduce the extent of the price asymmetry, but it alleges that there would still be some discrimination against it. It also agrees that this runs the risk of spectrum going inefficiently unsold, and comments that it is inconsistent with international best practice in setting reserve prices. Three also describes this and the remainder of the variants of Option 5 (i.e. those that Three itself did not come up with) as non-viable CCA options.

Vodafone strongly opposes increasing 700 MHz reserve prices. It notes that ComReg generally sets reserve prices at a conservative, lower bound estimate of market value, which is likely below final prices. Further, it highlights that the aim of setting reserve prices in this way is to encourage competition, discourage frivolous bidding, and allow prices to be set by the auction (as opposed to by ComReg). On the other hand,

Vodafone submits that increasing reserve prices has no justification under ComReg's mandate to assign spectrum in a transparent and non-discriminatory manner.

In addition, it notes that reserve prices are already close to market value, and that this value could fall in the recession resulting from the ongoing pandemic. Therefore, Vodafone suggests that there is no scope to increase reserve prices without a serious risk of choking off demand.

More generally, Vodafone comments that each of Options 5d – 5f adds complexity and uncertainty, could prevent bidders from expressing their valuations for packages, and therefore are liable to distort the auction process.

Assessment and recommendations

We agree with ComReg and all of the respondents, that this proposal risks choking off demand, and therefore leaving spectrum inefficiently unsold. The conservative minimum prices set using the benchmarking methodology aim to balance this risk of choking off demand against the risk of encouraging tacit collusion or speculative participation that comes with setting prices too low. Any proposal to increase minimum prices relative to those that would otherwise be set implies moving away from the level that ComReg deems optimal based on this trade-off. Therefore, it should not increase 700 MHz prices unless there is a good reason to believe this will lead to a more efficient award. No such reason has been identified.

Measures to reduce price asymmetry are unnecessary

Vodafone and Eir have submitted general comments that the measures proposed by ComReg under Option 5 are intended only to reduce price asymmetry and are not conducive to an efficient award. We agree that increased reserve prices (via any of these methods) are unlikely to increase the probability of an efficient outcome, and as we do not agree with Three either that there is likely to be a price differential that creates an unfair burden on it, or that the price differences are in any way discriminatory, therefore we can see no reason to adopt any of these alternative reserve prices.

We also highlight that while both groups of sub-options under Option 5 could reduce price asymmetry, those proposed by Three create significant issues for competition in the award, unequal treatment of the MNOs, and inefficiency of the potential outcome. We do not see an objective basis for adopting any of these changes, and all of them deviate from the

principles underlying the auction design. Notwithstanding, the proposals based on increasing reserve prices would be less problematic if they remained below bidders' valuations (though ComReg cannot be sure this would be the case), whereas reducing Three's price would always distort its incentives.

6.3.5 Increased value of unsold 700 MHz lots in price determination

Under this proposal, the reserve prices would remain unchanged, but the value of unsold lots in price determination would either be based on:

- a higher benchmarking estimate (in a similar way to how ComReg could increase reserve prices under the previous proposal); or
- alternative valuations expressed by other bidders for a third lot.

ComReg suggests that this proposal creates a lower risk of choking of demand, but it also observed that it might;

- not be consistent with MRC pricing, and moving away from the MRC approach might create incentives to deviate from truthful bidding;
- lead to a contradiction in how ComReg assigns lots; and
- the method for estimating the value of 700 MHz lots may not be sufficiently robust.

Views of respondents

Vodafone's comments apply to the remainder of the rule changes suggested under Option 5 of the information notice, and it suggests that any of these would constitute ComReg stepping away from the core principles underlying its auction design. In particular, they would all involve collecting more revenue than necessary to ensure an efficient outcome, and therefore ComReg would create incentives to deviate from truthful bidding. Moreover, the price of 700 MHz lots would no longer be objective or transparent, the additional complexity and reduced transparency would deter bidders, and the proposals would reduce competition by restricting Eir and Vodafone's incentives to compete for additional lots.

Respondents are unclear on how the proposal would work

Eir submits that there is insufficient detail in both the benchmarking and inference from bids versions of the proposal. In the benchmarking case, Eir raises the example of a winning bidder whose bid was below the higher benchmark and asks whether this bidder would be awarded the spectrum, and if so, whether the price would be based on its bid or the higher value. Eir suggests that MRC pricing already sets a value based on bids in the auction, and that the alternative proposal would presumably base the price on the average across all bids, and therefore would likely be based to some extent on the bidders own bids.

Notwithstanding the lack of detail, Eir contends that this proposal would require bidders to pay something above opportunity cost, and is likely to create incentives for bid shading. Therefore, it increases the chances of an inefficient outcome.

Regarding the use of a higher benchmark, Three suggests that this is inherently arbitrary, and that it would either be too low, and fail to address the alleged discrimination, or too high, and unnecessarily increase the price bidders pay for spectrum.

Three suggests that the second option proposed (i.e., that the value of unsold 700 MHz lots for price determination is based on alternative valuations expressed by other bidders for a third lot) could be used to set prices to reflect the opportunity cost that would have been expressed by its bid absent the cap, but it is not straightforward to infer valuations in this award.

Therefore, it suggests a simpler approach, where the value of 700 MHz lots is set to the lower of the final clock price, and the maximum value that would not change the outcome of the winner determination.

Three suggests this would remove the alleged discrimination against it, but it is nevertheless not the appropriate rule change, because it could overstate the opportunity cost that Three would impose, and it is a substantial deviation from opportunity cost pricing.

Assessment and recommendations

This is a substantial deviation from opportunity cost pricing that is not supported by any of the respondents. It only serves to increase price uniformity (which in any case is not relevant to ComReg's objectives), and is likely to reduce incentives to bid straightforwardly, and therefore risks an inefficient outcome.

6.3.6 Non-linear 700 MHz reserve prices

ComReg also included non-linear 700 MHz reserve prices in the information notice (i.e. reserve prices per lot that are increasing in the number of lots). It also invited views on whether:

- marginal valuations are increasing or decreasing;
- non-linear reserve prices would be less likely to choke off demand from smaller bidders than increasing prices;
- this measure would reduce price asymmetry; and whether
- it would be inconsistent to apply non-linear reserve prices for the 700 MHz band only.

Views of respondents

Three submits that non-linear reserve prices would not directly address the alleged discrimination, and are, in its view, inconsistent with international best practice. It creates some risk of spectrum going unsold, albeit not to the same extent as simply increasing reserve prices, but more importantly it is arbitrary and inconsistent with bidders valuation structures, as Three contends that bidders could have increasing or decreasing valuations for a second lot.

Again, Eir is unclear on the details of the proposal, for example on whether round prices would be non-linear, or if this is only for price determination. It suggests that the change would only be relevant in cases where the overall opportunity cost of a winning package was below its non-linear reserve price, and therefore it is unlikely to address the alleged discrimination.

Eir claims that this would change the purpose of reserve prices from something that promotes efficiency, to a means of setting prices at a higher proportion of valuation. Moreover, the degree of confidence that ComReg could have in the reserve prices would be even lower than under the current proposals. Eir also comments that it expects marginal valuations to be decreasing from the third lot onwards.

Assessment and recommendations

As with the previous suggestion, non-linear reserve prices might reduce price asymmetry in some circumstances, but they would also risk choking off demand, and restrict competition for third lots, as the surplus associated with the third lot would be

reduced. This is a departure from ComReg's well founded reasoning for setting reserve prices to balance risks and is not conducive to an efficient outcome.

6.3.7 Weighted Vickrey nearest pricing

Under the proposed approach to price determination, ComReg would find the prices that collect the minimum revenue subject to ensuring that all subsets of bidders collectively pay enough to outbid competing bids. From the set of prices in that minimum revenue core, the 'Vickrey nearest' prices are selected, that is, the prices that minimise the sum of square distance between the price and the Vickrey prices (i.e. bidders' individual opportunity cost).

If ComReg was to adopt weighted Vickrey nearest pricing, it would instead minimise the weighted sum of squares, where the weight corresponds to the bidder's winning, for example the:

- value of the winning lots at reserve prices; or
- number of 700 MHz lots assigned to the bidder.

ComReg invited views on whether this would reduce price asymmetry, and whether it would restrict competition between Vodafone and Eir.

Views of respondents

Eir does not see how this addresses Three's concern and would expect clarification and a further consultation if ComReg was to take the proposal further.

Three agrees that this does not address the alleged discrimination. It submits that it would only alter the relative prices between two or more bidders where a joint opportunity cost is material in the price determination. In principle, some form of weighted Vickrey nearest rule could create a small disincentive to win larger packages, but Three contends that this effect would be negligible, and it would not deter price driving behaviour from a bidder who believed there was a strategic benefit from doing so.

Notwithstanding the rule's irrelevance to the alleged discrimination, Three submits that there could be a case on fairness grounds for bidders winning more 700 MHz spectrum to cover a greater share of the opportunity cost. However, given

the number of bands in the award, it is not obvious that this change would have any effect.

Vodafone, in its general response to Options 5(e), 5(f) and 5(g) set in ComReg's Information Notice, outlined its view that using Weighted Vickrey nearest prices would be a step away from ComReg's core principles, on the basis that:

- more revenue could be raised than necessary for an efficient outcome;
- it could create incentives to deviate from truthfull bidding;
- the pricing of 700 MHz lots would cease to be objective and transparent;
- bidders may be deterred by the additional complexity and lack of transparency; and
- competition in the award would be lessened due to reduced incentives for Vodafone and Eir to compete for additional lots.

Assessment and recommendations

In the event that a bidder won more 700 MHz lots than its rivals, it could be liable to cover a greater share of the opportunity cost, and we agree that this creates some small disincentive to compete for third lots. More generally, it is not guaranteed to reduce price asymmetry (e.g. if MNOs win two 700 MHz lots each), there does not seem to be any particular rationale for introducing the more complex rule to support a efficiency in the award, and it is not supported by any of the respondents. We do not see any justification for introducing weighted Vickrey nearest pricing and do not recommend adopting it.

6.3.8 Exposure prices as bid amounts

Eir submits that exposure pricing information is helpful but does not go far enough in reducing price uncertainty for budget constrained bidders. As a potential improvement to the CCA, it suggests that bid amounts should be set equal to the exposure price of the package subject to that bid, for that bidder, in the round in which it submitted the bid (i.e. the price of the package at round prices, minus the bidder's discount for that round, as notified to the bidder at the start of the round in which it submits that bid), subject to that amount being no less than the reserve price.

This would have some implications for the relative and final price caps:

- if a bidder submits a relaxed primary bid, the necessary bid amount for any required chain bids would also be reduced by the discount in the round in which the relaxed bid was submitted;
- "the condition for a bidder being able to submit a relaxed primary bid would continue to be that the amount of any and all required chain bids be no greater than the price of those bids in the current round, but that price would now be the post-discount price"; and
- for bidders who submit a zero bid in the final primary round (or earlier round), the final price cap would be reduced by the amount of the discount in that round.

This is a separate proposal to Eir's 'iterative CCA' (which we discuss below), but Eir suggests the two could be adopted together.

Views of respondents

Eir suggests that this proposed rule change would remove uncertainty for budget constrained bidders. It would allow such a bidder to bid on a package whose round price, but not exposure price, exceeded the bidder's budget (or valuation for the package), without the risk of the discount falling and the bidder being liable to pay more than the discounted amount that it saw at the point of submitting the bid.

As a bidder's discount in a given round is the same for all packages, Eir submits that setting bid amounts equal to exposure prices would not change a bidder's choice of package, as the relative prices have not changed. It interprets this as bidders still bidding the full round price for lots they are competing for, but only the current maximum 'second price' for lots that are no longer subject to competition from others.

Eir submits that this has an added benefit of removing the possibility that a bidder's effective knockout bid is below final round prices, which is potentially a material problem for budget constrained bidders and could result in inefficient outcomes.

Eir has considered whether the rule change has wider implications

Eir has considered several potential implications of this proposed rule and submitted reasoning as to why it should not create other problems. In particular, Eir suggests:

- it is not problematic that the bid discount could decrease in future rounds (the previous discounted bid would stand, but the bidder would be able to bid a higher amount for the same package);
- different bid amounts for the same package in the same round (submitted by different bidders) are not problematic as this is a result of bidders having different discounts *"reflecting a difference in the current maximum 'second price' that those bidders would have to pay for the lots within their package that were no longer being (actively) competed for by other bidders"*, and the bid amount for the lots actively being competed for would be the same;
- the activity rules would be largely unaffected, because the difference between the price of packages remains the same whether it is calculated pre- or post-discount; however
- the adjustments to chain bid amounts and the final price cap are required to ensure consistency.

Three asserts that the provision of exposure pricing information is a sufficient measure to address Eir's concerns, and it does not support this rule change (or Eir's iterative CCA) because it does not remove the alleged discrimination.

Assessment and recommendations

Eir's concern is fundamentally about the difference between the price that a bidder would ultimately have to pay and its bid amount. As setting bids under this rule would still be subject to the same winner and price determination process, setting bid amounts to exposure prices would not remove this issue. This is one of the reasons that Eir would prefer a SCA, as it is only in pay as bid formats that this uncertainty is not present. However, uniform price formats lack the favourable bidding incentives of a CCA, and for this (and other reasons set out in the following section), we do not recommend a SCA in this case.

Eir is correct that this measure would remove some very specific cases that it is concerned about, namely where the effective knockout bid is below the final clock price, which itself is above the budget constraint. However, one of the key circumstances that concerns Eir is when a knockout bid is well above final clock prices as a result of unsold lots, as is very possible in the presence of increasing marginal valuations. Setting bid amounts equal to exposure prices does nothing to resolve this, although we recognise that Eir also wishes to replace the supplementary bids rounds with additional rounds for this reason.

The assumptions under which this might be a risk free change are very strong. The calculation of exposure prices assumes that this is the final clock round, and that it ends with no unsold lots. However, this is unlikely, as in any context where a CCA is appropriate, there is a reasonable probability of undersell at final clock prices, else there would be little reason for a supplementary bids round, and therefore, while exposure pricing is an improvement to the information available to bidders, it is not appropriate to offer it as a guarantee of what they might pay. Moreover, while Eir is correct that *if a bidder bids straightforwardly*, this proposed rule change would have no effect on its preferred package in each round, it nevertheless complicates bidding decisions and is a departure from the favourable pricing rules of a CCA, which makes us less confident that bidders would bid truthfully.

In addition to being ineffective in addressing Eir's concern and overly reliant on quite specific assumptions, this proposed rule change would create additional risks. In particular, it would likely obscure price discovery, because bidders aggregate demand would represent different bidder specific prices, rather than a common price. As the rule change would be ineffective and is not without risk, we do not recommend it is adopted.

6.4 Alternative auction format options

In this section we discuss the various alternative auction formats (other than variants of the CCA) that have either been assessed by ComReg and DotEcon as part of their analysis or proposed by stakeholders in their responses to the consultation documents.

6.4.1 Sealed-bid combinatorial auction (SBCA)

As discussed above, the sealed-bid combinatorial auction was an option considered in DotEcon's original auction design report. The winning outcome is determined on the basis of bids received in a single round; each bidder can submit multiple, mutually exclusive, bids for alternative packages of lots, with bid amounts solely at the discretion of the bidder. The winning bids are selected so that the total value of bids accepted is the greatest possible given the supply of lots, and subject to each bidder winning at most one of its bids, the same process as used for the CCA. Prices are determined using the same

opportunity-cost based approach as in the CCA, or bidders can be required to pay the full amount of their winning bid.

The SBCA has a number of favourable characteristics in that:

- it removes aggregation risk and substitution risk by allowing for package bidding;
- it is mechanically simpler than complex multi-round formats, making it easier and (with only one round) faster to run, and potentially reduces the amount of work required by bidders to prepare; and
- there is very limited scope for collusion or gaming (due to the lack of opportunity for signalling and/or reacting to other bidders' behaviour).

However, we eliminated the format as a suitable option for this award on the basis that an auction with an open stage is likely to be highly beneficial, in particular given the large number of lots across multiple substitutable bands. With the proposed lot structure there would be a very large number of alternative packages, and with a SBCA it would be very likely that a restriction on the number of bids each bidder could submit would be necessary to make bid submission and calculation of winning bids and prices feasible. Bidders would therefore need to decide on the relevant subset of their packages of interest to bid for but without any information about likely prices or demand from other bidders. This increases the risk of an inefficient outcome due to bidders omitting key packages that could fit in around the demand of competitors. An open stage mitigates this risk by providing bidders with information about the demand of competitors and allowing them to focus their bids on lots/packages they might realistically expect to win.

Views of respondents

We did not receive any responses from stakeholders in relation to the SBCA and assume that all parties are in agreement that this is not an appropriate format for this award.

Assessment and recommendations

We remain of the view that the SBCA is not appropriate for this award, for the reasons discussed above, and given the lack of comments from stakeholders do not consider this option any further.

6.4.2 Simple Clock Auction

The simple clock auction (SCA) is another format initially considered in our award format report.

In a clock auction, multiple items are grouped in categories of identical lots. The mechanics are simple: the auctioneer specifies a price per lot for each lot category, and bidders state the number of lots in each category they want at the prevailing prices. If there is excess demand, the auctioneer will increase the price for categories with excess demand and invite bidders to submit further bids. Activity rules prevent a bidder from increasing its demand as the auction progresses; each lot is assigned a number of eligibility points, and any given round the sum of the eligibility points associated with the lots a bidder bids for in the round (the bidder's 'activity level') cannot exceed the sum of the eligibility points associated with the lots the bidder bid for in the previous round (the bidder's 'activity level'). The auction ends when there is no excess demand for any lot category. All bidders that submitted a bid in the final round are awarded the lots they bid for in that round and pay the final clock round price for each lot that they win.

The format is relatively simple in terms of bidding mechanics and the process for determining winners and prices. It helps to mitigate aggregation risk in that bidders will never win a subset of the lots they are bidding for at given round prices, while the pay-as-bid rule is easy to understand for bidders and means that there is no uncertainty over what bidders would pay if a particular bid were to win.

However, the SCA was removed from our shortlist of candidate formats in the auction design report, largely because of the substitution risk that bidders could be exposed to. In particular, an important limitation of the SCA when there are multiple lot categories is that switching could be highly restricted by the eligibility points used for each lot category. A bidder that reduces its eligibility will be unable to submit any further bids that would involve an activity level greater than its new eligibility level. This can lead to substitution risk when lots have different eligibility levels, and/or the number of lots required differs across lot categories.

A further limitation of the SCA is that it allows bidders to submit just a single bid in each round at given prices, and only the bids submitted in a particular round are assessed to determine whether the auction can end and the winning outcome. This significantly restricts the number of potential allocations across

bidders that can be considered and limits the extent to which bidders' preferences over alternative packages can be accounted for when determining the auction outcome. This is particularly problematic in scenarios where there is a large number of lots available over a variety of substitutable categories. Conversely both the CCA and CMRA allow bidders to submit a range of bids expressing preferences over different packages, which provides greater possibilities for 'packing' the demands of different bidders to establish an efficient outcome

With the SCA, there is also a substantial risk of inefficiently unsold lots i.e. if demand drops too abruptly from one round to another in response to price increases applied by the auctioneer (e.g. if several bidders reduce demand in the same round, or if bidders reduce demand by several units in one step) and the auction ends with excess supply. This can be the result of price increments being too large, but if there are complementarities across lots even small price increments could lead to one or more bidders dropping demand a large number of lots in one go. There are extensions to the basic clock auction format that can be implemented to help mitigate this risk, such as the use of exit bids and/or a combinatorial closing rule, but these are likely to have limited impact when there is a large number of lots available:

- Exit bids can be made when a bidder drops demand; they specify a price (required to be between the round price in the preceding round and the current round price) at which the bidder would be prepared to buy the lots it no longer demands at the current round price. If there are unsold lots at final round prices, these exit bids can be taken into account and may help to achieve a more efficient outcome. However, the extent to which bidders can fully express demand for packages of interest is limited, in particular if there is a large number of alternative packages to bid for and/or bidders have increasing marginal values for additional lots.
- A combinatorial closing rule allows all bids (including exit bids) made in earlier rounds to be taken into account when determining winners to find the value maximising combination of bids, taking at most one from each bidder, subject to the number of allocated lots not exceeding supply. This can help to rectify inefficiencies that could otherwise result from one or more bidders having increasing marginal valuations (as it allows for bidders to win larger packages at a price below final clock prices if it fits with the demand from other bidders). However, the

impact is likely to be small where there is a large number of alternative packages and bidders are limited in the extent to which they can express demand for the different options, and the CCA provides much better scope for establishing the efficient distribution of lots amongst bidders.

In addition to these limitations, the clock auction is susceptible to gaming. It creates strong incentives for strategic demand reduction (where bidders reduce demand early in order to keep prices low, in particular if they anticipate having to reduce demand later in the auction anyway), and also offers price driving opportunities when bidders can switch between lot categories as only the final round bid is binding and it allows bidders to bid for lot categories they do not want simply to increase the price for competitors.

Views of respondents

In its response to document 19/59R, Eir appears to have supported the decision to exclude the SCA on the grounds that it constrained bidders' ability to switch across lot categories. However, Eir suggested that this issue could be mitigated by introducing a relaxed activity rule (discussed further below).

In its later response to document 20/56, Eir seems to have adopted a different view in stating that a SCA, with or without a relaxed activity rule, would be a preferable option to the CCA. The primary reason for this seems to be in relation to Eir's concerns over the risks faced by budget constrained bidders in the CCA and the potential for a situation where *"budget-constrained bidders may find themselves (through no fault of their own) unable to bid in a manner that is consistent with them winning the spectrum package of most value to them"*.⁵² Eir is of the view that pay-as-bid formats (such as the SCA) are better able to support budget constrained bidders and would be a better option than the CCA. Bidders should be able to submit bids that allow them to win their most valued package in the final outcome without having to pre-judge what that outcome might be.

Further, Eir contends that since the CCA could lead to an inefficient outcome as a result of budget constrained bidders not being able to fully represent their valuation structure in their bids, and therefore the fact that the SCA (with or without a

⁵² ComReg document 20/78

relaxed activity rule) could lead to inefficiencies is not sufficient reason to reject the format, and that the specifics of the award (not the theory) need to be taken into account when assessing auction formats.

Assessment and recommendations

For the reasons discussed above, we remain of the view that the SCA is not an appropriate format for this award, in particular:

- the SCA exposes bidders to substitution risk when there are multiple substitutable lot categories;
- bidders are significantly limited in the number of packages they can express demand for, which restricts the number of potential allocations across bidders that can be considered;
- there is a significant risk of inefficiently unsold lots, especially when there are synergies across lots; and
- the SCA is susceptible to strategic demand reduction and gaming.

In response to Eir's view that the SCA is preferable to the CCA in terms of supporting budget-constrained bidders, we reiterate the fact set out in document 19/124a that budget constraints are problematic in all auction formats. Regardless of the format, there will typically be some need for bidders to assess what they can realistically win within their budget, and possibly to update such an assessment in the course of the auction. This applies to the SCA (with or without a relaxed activity rule) where a budget constrained bidder has a complex decision about competing for a larger number of lots, because it may need to contract to a smaller number of lots later due to reaching its budget constraint, but could by then have already raised prices to the extent that it is no longer willing to take fewer lots at the prevailing round prices. As a simple example, suppose a bidder values one lot at €50, two lots at €150, and three lots at €300 but has a budget of €250. At a price of €80 per lot, the bidder would want to bid for three lots as that maximises its surplus as the given price. If the price were to increase to €85, the bidder would still want to bid for three lots but would not be able to because the total bid amount (€255) would be above its budget. The bidder is also no longer willing to bid for either one or two lots as the price is above its valuations, and it would need to drop out of the auction and win nothing. During the auction, the bidder would need to make decisions about whether to contract its demand and try to win a smaller number of lots while prices were still low enough (if the expectation is that it

would not be able to win all three lots) or to continue bidding for three lots and risk winning nothing.

Where budget constraints bite, bidders will not be able to fully represent their valuation structures (or bid for their most valued package in the final outcome) under any format, including the SCA, and we do not see this as a problem purely related to the CCA. Moreover, combinatorial auctions, such as the CCA, allow bidders to compete for a range of packages in a way that might not be feasible under the SCA. Consider the example above; with the SCA, if the bidder continued to bid for three lots until the price exceeded its budget, it would have no opportunity to express a value for one and/or two lots and would win nothing. Under a CCA, the bidder could submit bids for one, two and three lots. We acknowledge that the bidder would face a decision over whether to maintain value differentials in its bids or bid up to valuation for the smaller packages, but there would still be greater flexibility for expressing its valuation structure than under the SCA and it would give the bidder a chance of winning a smaller package if it could not win the full three lots.

Although we recognise the difficulties for budget constrained bidders, on balance we expect a greater likelihood of achieving an efficient outcome in a CCA than a SCA. This is because issues relating to budget constraints can be mitigated to some extent by providing exposure pricing information, and while a pay as bid format may provide certainty over prices, it would not be without issues for budget constrained bidders. On the other hand, there are a number of different reasons that a SCA might fail to deliver an efficient outcome, such as due to strategic demand reduction, gaming due to inefficiently committing bids, or the limited scope for expressing valuations for many different packages, all of which are relevant to this particular award.

6.4.3 Simple clock auction with relaxed activity rules

In its response to document 19/59R, Eir set out proposals for an adjusted SCA with a relaxed activity rule whereby a bidder could submit bids exceeding its eligibility provided they were consistent with the preferences it had already expressed. Eir argued that this would allow bidders to express their preferences throughout the auction (mitigating the substitution risk faced by bidders under the standard SCA rules), but would not have the same risks as the CCA or CMRA due to its relative simplicity and transparency. The SCA with relaxed activity rules

was also suggested by ComReg as a RIA option in document 20/56.

In document 19/124a we set out our assessment of Eir's proposals and our view that the SCA with a relaxed activity rule would not be suitable for this award. The arguments are essentially the same as for the standard SCA. Although the introduction of a relaxed activity rule would help to mitigate substitution risk, there are still fundamental issues with the format that mean it would not be appropriate:

- The SCA allows bidder to submit just a single bid in each round at given prices, and only the bids submitted in a particular round are assessed to determine whether the auction can end and the winning outcome. This significantly restricts the number of potential allocations across bidders that can be considered and limits the extent to which bidders' preferences over alternative packages can be accounted for when determining the auction outcome. This is particularly problematic in scenarios where there is a large number of lots available over a variety of substitutable categories. Conversely both the CCA and CMRA allow bidders to submit a range of bids expressing preferences over different packages. This provides greater possibilities for 'packing' the demands of different bidders to establish an efficient outcome.
- The SCA is also particularly susceptible to unsold lots, especially where there are complementarities across lots and aggregate demand can suddenly drop from being greater than supply to being below supply, even with small price increments. As discussed in our award design report, there are additional features that can be bolted on the SCA to mitigate this risk (such as exit bids and combinatorial closing rules). However, these do not fully resolve the issues that arise when there are complementarities between lots, and thus in our view these are not sufficient to mitigate the risks or support an efficient outcome in such an important award. Conversely, combinatorial formats such as the CCA and CMRA deal with the risks of unsold lots far more effectively and are more likely to result in an efficient allocation.

Furthermore, it is not possible to adopt a relaxed activity rule in the SCA without introducing potential for gaming. In the SCA, only the clock bids in the most recent round are relevant for the determination of the winning outcome. However, the relaxed activity rule hinges on establishing constraints on bidders to

ensure that bidders who reduce demand must uphold their offer to reduce demand and accept a possibility of winning smaller packages, which requires considering a wider range of bids (including clock bids and bids for smaller packages) when determining the winning outcome. Simply allowing bidders to increase their demand if some conditions on relative prices are met would create a wide range of gaming possibilities, allowing bidders to hide their demand and/or distort prices.

Views of respondents

In its response to ComReg's RIA Information Notice (document 20/56), Eir reiterated its preference for a SCA with relaxed activity rule, asserting that it would be the most appropriate format taking account of the Irish circumstances. The arguments put forward are the same as those discussed above regarding the standard SCA, namely that the CCA proposed by ComReg could end with an inefficient outcome (due to issues faced by budget constrained bidders) and a pay-as-bid approach would remove that risk. Bidders should be able to submit bids that allow them to win their most valued package in the final outcome without having to pre-judge what that outcome might be.

In response to Eir's suggestion to use a SCA with relaxed activity rule, Vodafone notes that Eir's proposal to use a SCA appears to be focused on improving price transparency but believes this is better addressed by including exposure pricing information in the CCA. Vodafone is reluctant to support an untested auction format such as this.

Imagine agrees with ComReg's assessment of the SCA with relaxed activity rule set out in document 20/56 and does not believe it would be more favourable than a CCA or SMRA for this award.

Three asserts that if time slicing is retained then Eir's proposal to use a form of SCA that combines package bidding with a pay-as-bid rule would be appropriate. However, it agrees with DotEcon and ComReg's assessment that adding a relaxed activity rule is not the best way to fix the problems with the SCA, in particular due to ComReg's concern that it might increase "*potential for gaming that would allow bidders to hide their demand or distort prices*". In general, Three agrees that with the SCA there is a risk of lots going inefficiently unsold as bidders drop demand, and that bids not being committing until

the final round creates a risk of gaming behaviour. Three is less concerned about the SCA limiting bidders' options for submitting bids for a wide range of packages as it believes that *"a well-designed clock auction would provide sufficient flexibility and price discovery to allow bidders to identify efficient outcomes"*⁵³. Three sets out an alternative proposal for a SCA with adjustments, which it refers to as the Enhanced SCA (eSCA) – this is discussed further below.

Assessment and recommendations

In general, we stand by our previous assessment and views regarding the SCA and the SCA with relaxed activity rules, as set out above and in ComReg documents 19/59a and 19/124a. The proposals by Eir go some way to removing substitution risk, but they do not address the other significant and fundamental issues that would be created by using a SCA for this award. Furthermore, Eir has not provided any evidence in its responses to explain why our concerns are not valid, and we highlight the views of other respondents that the proposed approach would not be suitable.

We reiterate our assessment set out above that budget constrained bidders face difficulties and risks under any auction format, not just the CCA, and the SCA (with or without relaxed activity rules) does not remove these risks. In that regard, we agree with Vodafone that the introduction of exposure pricing to the CCA is a better approach to mitigating the issues that arise from the uncertainty over what bidders would pay relative to their bid amounts, rather than adopting a format that is significantly inferior to the CCA for this award in other ways.

We therefore remain of the view that the SCA with relaxed activity rules is not a suitable option for this auction.

6.4.4 Enhanced Simple Clock Auction (eSCA)

In its response to ComReg document 20/56, Three has set out proposals for an alternative clock auction format with additional measures to address the risk of unsold lots and scope for gaming that is associated with the SCA. As highlighted above, Three asserts that these are the two key issues with the SCA,

⁵³ ComReg document 20/78

and is less concerned about the lack of opportunity to submit a wide range of bids.

Three has provided detailed rules for how it proposes the eSCA to work. These can be found in ComReg document 20/78, but we summarise our understanding here.

As part of the rules, Three has proposed a lot structure that is the same as set out in the draft Information Memorandum but with the exception that there is no time slicing in the 2.3 GHz and 2.6 GHz bands (as Three claims that this is unnecessary).

The initial stage of the auction would progress largely in the same way as the SCA:

- Bidders bid for quantities of lots in each category at specified clock prices.
- Prices are increased in successive rounds for categories that have excess demand.
- The clock rounds close when there is no longer excess demand in any category, and bidders win their final round demand.

However, Three proposes a number of additional rules relative to the SCA:

- **Demand retention:** for a given frequency band, if the price remains unchanged from the previous round for all lot categories that include lots in that band then a bidder cannot reduce its demand in any of those lot categories (although the bidder may choose to increase its demand in one or more of those categories). Those bids are 'retained' and carried over into the next round.⁵⁴ Three notes that this rule "*would de facto mean that bidders can make package bids within bands but not across bands*" and "*would mean that aggregation risk related to time slicing is addressed*".
- **Optional exit bids:** whenever a bidder drops demand in a lot category it will be able to submit 'optional exit bids' for that category. Optional exit bids are for individual lots, and the maximum number of exit bids a bidder can make for a lot category in a given round is equal to the number of lots by which it reduced its demand in the round. The exit bid amount must be less than the current clock price and

⁵⁴ Note that this is on a per band rather than a per lot category basis, so a bidder may reduce its demand in a category where there was no price change provided the price has been increased for at least one other lot category including lots in the same band.

greater than or equal to the previous clock price and must be the same for all exit bids related to that lot category.

- **Compulsory exit bids:** for the 700 MHz and 2.1 GHz lot categories, if a bidder drops demand in a single round by more than one lot it will be *required* to place a 'compulsory exit bid' for each additional lot that they drop (i.e. if a bidder drops demand by two lots it must submit one compulsory exit bid, if it drops demand by three lots it must submit two compulsory exits bids). Compulsory exit bids are for individual lots. The bid is automatically set to be the previous round price, although the bidder may increase the amount provided it is less than the current clock price and greater than or equal to the previous clock price, and the same as the bid amount for any optional exits bids submitted in the same category. This rule is design to *"prevent bidders from trying to hide demand or price driving in categories where incumbents may have more predictable demand"*.

The activity rules are very similar to those in the SCA, except that:

- for the 2.3 GHz and 2.6 GHz lot categories, a bidder can use some or all of the eligibility points associated with a reduction in demand to submit optional exit bids or switch demand to a different lot category; and
- for the 700 MHz and 2.1 GHz bands, a bidder may use the eligibility points associated with the first lot of reduced demand to submit an optional exit bid or switch demand to a different lot category – for any additional lots dropped, the associated eligibility points cannot be used to switch demand to a different category.

Overall, a bidder's activity level in a round (the sum of eligibility points associated with their demand across all categories at the applicable clock prices) cannot exceed:

- the bidder's activity level in the previous round; less
- the sum of eligibility points associated with lots subject to exit bids (optional and/or compulsory) submitted by the bidder in the current round.

This essentially means that a bidder cannot submit an exit bid for a lot and at the same time use the eligibility associated with that lot to bid for additional lots in another category.

The clock rounds end following a round in which there was no excess demand for any lot category at prevailing prices.

Winning bids are determined as follows:

- *"All bids submitted in the final round at the clock price become winning bids.*
- *Any bids from prior rounds that were retained at the final clock price become winning bids.*
- *If, after completion of steps I and II, there are unallocated lots, all Optional Exit Bids and Compulsory Exit Bids are ranked together in price order from highest to lowest. Subject to available supply, the highest ranked exit bids with bid amounts that equal or exceed the previous clock price (i.e. bids that have a value no less than one bid increment below the final clock price) become winning bids."*⁵⁵

For each lot category, winning bidders pay a uniform price for the lots they win in that category equal to the amount of the lowest winning bid.

If there are unsold lots following this initial phase of the auction, a supplementary phase will be run, comprising up to five sequential sealed-bid supplementary rounds (one for each band with unsold lots).

In a supplementary round for a given band, bidders may submit:

- Exit bids not previously identified as winning bids, where a bidder has discretion to carry one or more of its relevant optional exit bids into the supplementary round, but all compulsory exit bids are automatically entered; and/or
- Package bids, where the bidder can submit a limited number of mutually exclusive package bids at a bid amount that is at least equal to the sum of the uniform prices determined for the relevant lots in each lot category.

The winning bids for a given lot category are determined based on the *"highest value combination of bids*

- I. that can be accommodated from the supply of lots unallocated in the clock rounds;*
- II. does not cause any winning bidder to breach the spectrum cap; and*
- III. includes at most one package bid and any number of individual bids from any one bidder."*

Each bidder pays the amount of their winning bids.

⁵⁵ As per Three's proposed rules set out in ComReg document 20/78

Views of respondents

Three claims that its eSCA is the appropriate format for the award if time slices are used, as it is a uniform price format. Three suggests that, as it is a uniform price format, it removes the alleged discrimination against it, even under the proposed sub-1 GHz cap. It submits that the risks of unsold lots and of price driving would be the main problems with a SCA as supported by Eir, but that the exit bids and demand retention rules in its eSCA resolve these issues.

Three comments that exit bids must not reintroduce aggregation risk, which they could do if inappropriately designed, because a bidder might submit exit bids in one band, but subsequently switch its demand to another. Its winner determination rules, whereby exit bids below the penultimate clock price in a category do not become winning bids before the supplementary bids rounds, aim to remove aggregation risk.

Three also submits that a SCA is susceptible to price driving because bids are insufficiently committing, and this is the justification for its demand retention rule, and for compulsory exit bids, which apply in lot categories where Three claims bidder's demand is predictable.

Eir prefers an eSCA to a hybrid SMRA, but suggests rule changes to reduce within band aggregation risk

At the time of its most recent comments, Eir had not had the opportunity to thoroughly review the eSCA rules proposed by Three, but suggested that there could be merit in the format. In particular, in Eir's view it is preferable to the hybrid SMRA, because it exposes bidders to less substitution and aggregation risk

In its initial view, Eir commented that it has no objection to time slicing the 2.1 GHz band in a SCA, and that by using time slicing instead of long and short licences, the format would avoid the problems with long/short licences identified by Vodafone, without requiring the complexity of a CCA. However, Eir submits that, because the eSCA is not a true package bidding format, additional measures would be needed to prevent bidders winning an inefficiently small amount of spectrum. Eir suggests this could be achieved by increasing the lot sizes on offer, or alternatively to allow bidders to specify a minimum requirement of two lots.

Assessment and recommendations

As a first point, it is worth highlighting that one of the main reasons for initially ruling out the SCA for this award was the substitution risk that bidders can face. This alternative format suggested by Three does not appear to do anything to address this, and in fact seems to make the issue worse.

In particular, we refer to the restrictions on bidders when reducing their demand in the 700 MHz or 2.1 GHz bands, and the fact that they cannot switch demand for more than one lot into another band in any given round. This means that, if a bidder is bidding for more than one lot in either of these bands, it cannot switch its full demand cleanly into an alternative, substitutable band. This may not be such an issue with regards to 700 MHz, as we expect that to be more of a complement than a substitute for the other (higher frequency) bands included in the award. However, we are of the view that the 2.1 GHz, 2.6 GHz and 2.3 GHz bands are, (at least in the long run) likely to be substitutable and that bidders should be able to switch between these bands. Under the rules proposed by Three, a bidder wanting to switch all of its demand out of 2.1 GHz and into 2.3 GHz or 2.6 GHz would need to do this one lot at a time in successive rounds, which creates the risk that the auction ends with the bidder only part way through its switch, and could also lead to inaccurately reporting demand at given prices. Under these rules we would also be concerned that bidders with genuine demand for spectrum in the 2.1 GHz and or 700 MHz bands but who consider themselves weaker bidders would refrain from bidding in those bands simply in anticipation of difficulties switching to alternative bands in later rounds. This could detrimentally affect the level of competition within the award and could lead to an inefficient outcome.

Another fundamental issue with this proposed format is that it does not account for aggregation risk associated with complementarities across bands or within bands. In fact, the rules proposed by Three seem to introduce aggregation risk into a format where one of the key benefits is that it removes such risk. Three asserts, in its response to ComReg document 20/56, that in this award aggregation risk is likely to be modest, suggesting that:

- within bands, bidders may have minimum requirements but these are likely to be low; and

- across bands there are only aggregation risks when time slicing is used (and Three's proposed rules and lot structure address aggregation risk from time slicing).

This may well be the case for Three (and potentially for other established operators with large amounts of existing holdings, although we cannot make such assumptions), but as we have argued before we cannot preclude the possibility of non-MNO bidders who may have different requirements, and this needs to be taken into account when determining the most appropriate award format. For example:

- a bidder looking to enter the mobile market might require a combination of sub-1 GHz and higher frequencies; or
- bidders with no (or low) existing spectrum holdings may have minimum requirements for their business case to be viable.

We therefore do not believe that we can ignore the potential aggregation risks arising from cross-band or intra-band synergies (irrelevant of time slicing) simply because these do not affect Three.

The demand retention rule proposed by Three, whereby bidders are unable to reduce their demand in a band where the price remains the same relative to the previous round, means that a bidder cannot reduce its demand in one band in response to price changes in a complementary band and could get 'stuck' on lots it does not want to acquire at the given prices. For example, suppose a new entrant needs a mix of 700 MHz and 2.6 GHz spectrum, but winning either band on its own is not viable for its business case. If the prices for the 2.6 GHz lots at some point stop increasing, the bidder's demand for those lots would be retained for future rounds. If the 700 MHz price then increases beyond the point at which the total price across all of the lots the bidder needs is above its valuation, the bidder could drop out of the 700 MHz band (potentially with exit bids) but its demand for 2.6 GHz would remain active and end up winning (when the bidder would no longer want those lots) if there were no further changes in that band. This situation is analogous to the potential problem faced by bidders in a SMRA getting 'stuck' as the standing high bidder on lots they no longer want.

Where there are complementarities within bands, specifically the 700 MHz and 2.1 GHz bands, the compulsory exit bids rule means that a bidder may be forced to submit a bid for one or more lots above valuation. Taking a simple example, suppose a bidder interest in the 700 MHz band needs at least two lots, and

otherwise does not want anything (i.e. the value of a single lot to the bidder is €0). If the bidder were to bid for two 700 MHz lots in the auction up to the point at which the total price of the two lots exceeds its valuation and then dropped out (a completely rational approach), under the rules proposed by Three it would then be forced to submit a compulsory exit bid for a single 700 MHz lot at a price at least equal to the previous round price. If that exit bid were to then end up winning, the bidder would have to pay for a single lot at an amount significantly above its valuation of €0.

Similarly, the compulsory exit bids rule means that the format does not fully address aggregation risk resulting from time slicing in the 2.1 GHz band, as Three contends. In particular, if a bidder is forced to submit exit bids for individual 2.1 GHz lots (which would be for individual lots in one time slice or the other), it faces the risk of winning lots in one time slice but not getting the equivalent number in the other and paying over its valuation. Although the risk of this might be fairly small, it is still there.

Eir has suggested that the possibility of winning some, but not all, exit bids could provide an argument for increasing the size of the lots (specifically those proposed to be in 5 MHz blocks), to *“reduce the risk that a bidder wins an inefficiently small amount of spectrum in a band”*⁵⁶. Essentially, Eir seems to be concerned about the potential aggregation risk arising from the fact that exit bids are for individual lots, and if there are synergies across lots included in a bidder’s exit bids (and the bid amounts reflect these synergies) there is a risk that a bidder will win some, but not all, of its exit bids at a price that is above its valuation. We agree that this is an issue with the eSCA, but we do not believe that increasing the size of lots is an appropriate way to fix the problem. In general, it is desirable to award lots in the smallest usable unit, which gives flexibility for bidders to acquire bandwidths in line with their specific usage requirements and supports efficient assignment of the frequencies across bidders. Rather than increasing the lot sizes and reducing the flexibility that comes with smaller lots, a better solution would be to use an auction format that supports full package bidding and is generally better able to deal with complementarities across lots and not face bidders with aggregation risk.

⁵⁶ ComReg document 20/94

Eir's alternative suggestion to allow bidders to specify whether or not they would prefer to win no lots rather than just one lot might have some merit as a general approach to helping bidders to avoid winning an unusably small amount of spectrum, and the approach of allowing bidders to specify minimum requirements (spectrum floors) has been used in previous auctions. In this case, however, this would seem to create provisions for circumventing the compulsory exit bids (i.e. a bidder that dropped demand by two lots in a single round in the 700 MHz auction would be required to submit at least one exit bid for a 700 MHz lot, but this could then be essentially voided by the bidder stating it does not want to win a single lot). This would then seem to render one of the key features of the new format meaningless. Perhaps more importantly (given that we have identified problems with compulsory exit bids in this case), we note that Eir's suggestion does nothing to address complementarities between lot categories.

Overall, we do not believe that the eSCA proposed by Three is an attractive auction format for this award. It is susceptible to aggregation risk and does not remove the substitution risk that was one of the main reasons for not using the SCA in the first place. This conclusion stands whether or not the 2.3 GHz and 2.6 GHz bands are time sliced; Three's detailed rules use a lot structure that only time slices the 2.1 GHz band, but the assessment above does not change if time slicing is extended to cover all of the bands above 1 GHz.

6.4.5 Simultaneous multi-round ascending auction (SMRA), including hybrids

Two variants of the SMRA have been discussed so far in the consultation process, in particular the:

- standard SMRA with frequency generic lots⁵⁷; and the
- hybrid SMRA (proposed by Three).

We note that ComReg included two sub-options in the information notice (i.e., with time slices or with long/short licences), and that a number of respondents have suggested that an SMRA could be suitable absent time slicing. However, we take time slicing as given for the purpose of this section, and therefore we focus on SMRAs with time slicing. In any case,

⁵⁷ Discussed in detail by DotEcon in Annex A of ComReg 19/59a, and included by ComReg as Option 2 of the information notice (ComReg 20/56)

many of the issues with an SMRA persist regardless of lot structure.

In the first round of a standard SMRA, bidders submit bids for each of the lots they demand at round prices, and the auctioneer determines standing high bids for each lot independently. At the end of a round, the round price increases for over-subscribed lots (i.e., those subject to multiple bids). In subsequent rounds, bidders can:

- either maintain their standing high bids, or raise the bid on those lots to current round prices; and/or
- submit new bids for lots on which they are not the standing high bidder.

Activity rules typically apply such that the sum of the eligibility points associated with lots for which the bidder has submitted bids in the round, or for which the bidder has maintained its standing high bid, must not exceed the bidders eligibility for the round.

The auction ends when there is no bidding activity in a round, and bidders pay the total amount of their winning bids.

Where there are complementarities across lots, bidders are exposed to a considerable amount of aggregation risk in SMRAs, because it is possible to win only a subset of their demand expressed in any given round. This can be mitigated to some extent by the inclusion of:

- withdrawals, whereby a bidder removes its existing standing high bids; and
- waivers, which allow a bidder to maintain its eligibility without submitting (enough) bids.

We expressed our view that an SMRA was not a suitable format for this award, because:

- there are significant aggregation risks for bidders who want to win multiple lots (whether within a band, across multiple bands, or across time slices);
- bidders face substitution risk in the event that they want to switch to a different combination of lots in response to price changes, but are stuck as a standing high bidder for some of the lots that they wish to switch away from;
- further substitution risk arises if differences in eligibility points meant bidders were unable to switch back to relatively cheaper options;
- aggregation risk and substitution risk, as well as potentially causing an inefficient outcome, can face bidders with

strategic complexity if there are complementarities across lots;

- the SMRA can create incentives/opportunities for strategic demand reduction; and
- the auction may proceed very slowly if there are many lots on offer, because it can take many rounds for prices to increase across all substitutable lots.

Three has suggested using a hybrid SMRA, which it claims is the most appropriate format if its preferred lot structure (with long and short 2.1 GHz licences) was used. However, it would also be possible to run a hybrid SMRA using the lot structure proposed by ComReg. The key difference in the hybrid SMRA are that bidders submit bids for the quantity of lots they demand in each category of generic lots, with standing high bids for a given lot category then determined by the following ranking mechanism:

- bidders who submitted new bids in that lot category are placed in a queue in a random order;
- all previous standing high bids that have not been replaced by new bids are entered into the queue below this round's bids, in the same order they were in for the previous round's queue; then
- the top ranked bids in the queue become standing high bids.

Three highlights that, as bidders are ranked, at most one bidder can become a standing high bidder on only a subset of its demand in a given lot category.

Three also proposes that there should be waivers, but no withdrawals. Furthermore, it notes that there can be at two prices for winning bids in a category, and it suggests that all bidders should pay the lowest winning bid.

View of respondents

Time slicing and aggregation risk

Vodafone comments that ComReg has not proposed any form of SMRA that would be viable under the current lot structure. However, it suggests that it would be possible to run an SMRA if time slicing was removed completely, although it has recognised in previous responses that this is only possible if Eir surrenders its existing 2.1 GHz licence early.

Three suggests that ComReg has overstated aggregation risk in this award. It points to the use of hybrid SMRAs in other

European awards, and claims that the only material difference between those awards and the Irish case is that 2.1 GHz spectrum becomes available at different times in Ireland, and that it is appropriate to use a hybrid SMRA and with long and short licences instead of time slicing.

Substitution risk

Eir expressed a general concern about substitution risk in SMRAs. It submits that this is particularly relevant in this award, because there are a number of substitutable bands on offer, but bidders are likely to have a strong preference for a large block of spectrum in one of these bands, over having the same amount of spectrum fragmented across two bands. If an SMRA were to be used, it would need some measure to facilitate switching (e.g. an unlimited number of withdrawals with limited penalties attached).

Three claims that an SMRA is unlikely to result in an inefficient outcome

Three submits that demand reduction is a normal feature of spectrum auctions and should only concern ComReg if it leads to potential winning bids exiting the auction and therefore risks an inefficient outcome. It asserts that, in the context of a 5G-era auction where the main bidders are established MNOs and some entrants, the scope for inefficiency in an SMRA is limited because:

- bidders enter the auction with realistic views about plausible outcomes, and are unlikely to give up spectrum they expect to win easily;
- there may be focal points for sharing demand in a band that all parties independently perceive as reasonably efficient, which could lead to efficient outcomes without much competitive bidding;
- in auctions such as this with a large amount of spectrum available, incentives to moderate demand may be greater, but the lots dropped will be marginal to the bidder's business case, and the economic effect of any inefficiency is likely to be small; and
- SMRAs encourage bidding to intrinsic values rather than blocking strategies, because a failed blocking strategy would greatly inflate the bidders own price, hence SMRAs provide protection from highly asymmetric outcomes that are likely inefficient.

In response to the information notice, Three was clear that its preference was for a hybrid-SMRA, rather than a standard SMRA. It asserted that each of the risks identified by ComReg were limited in a hybrid SMRA, stating that:

- **substitution risk** is low because switching is easy while there is significant excess demand, and bidders are well placed to anticipate that it will become more difficult as demand converges to supply;
- **aggregation risk** is only significant because of time slicing, as it expects minimum requirements within bands to be low, and no very strong complementarities across bands; and
- **gaming** strategies could be present in any multiband auction, but (as it stated before) demand reduction is less likely to lead to inefficient outcomes in an SMRA. Three also disagrees with ComReg that smaller bidders have greater incentives to drop demand, because the financial incentive is stronger for bidders pursuing larger quantities.

As aggregation risk relating to time slicing is the only risk that Three accepts is material, it proposes to use a hybrid SMRA with long and short licences instead.

*Eir comments on
Three's specific
proposal*

However, Eir has submitted that there are also a number of issues with the detailed rules for a hybrid SMRA proposed by Three. In particular, Eir contends that there would still be aggregation risk in the 2.3 GHz band (where there would be multiple lot categories with standing high bids determined independently), and substitution risk which could result in inefficiently fragmented demand.

Assessment and recommendations

Regarding the standard SMRA, we stand by our previous arguments⁵⁸, that it is not the appropriate format for this award because of, for example, the significant:

- aggregation risk for bidders aiming to win multiple lots (whether across bands, across time slices, or within the same lot category);
- substitution risk, particularly as there are multiple substitutable bands in this award;
- incentives for strategic demand reduction.

No respondents in their latest submissions have suggested this is the appropriate format in the context of this award (although Vodafone suggests that some form of SMRA, not necessarily the standard version, could be suitable if time slicing was not required, albeit it acknowledges that it is, at least in the case of

⁵⁸ As set out initially in ComReg 19/59a

the 2.1 GHz band). Therefore, we concentrate in this section on hybrid SMRAs.

Aggregation risk remains significant under Three's hybrid SMRA

Firstly, we note that Three's proposed hybrid SMRA is suggested alongside a revised lot structure (with long and short 2.1 GHz licences), however we believe that time slicing is more appropriate. Three submits that "*if implemented with Time Slicing, this format may increase aggregation risk for bidders*", and in that case it suggests its eSCA, discussed above, is a more appropriate format.

However, even if time slicing was not necessary, we would still have significant concerns about aggregation risk in a hybrid SMRA. We do not agree with Three that the only significant complementarities are across bands, as aggregation risk also arises because of:

- minimum requirements within a band, although the determination of standing high bids means this is slightly less problematic in a hybrid SMRA than the standard version, but we expect most bidders in all of the bands in the award will want more than one lot in a band, and so the risk remains significant;
- complementarities between bands, which even if small for established MNOs, could be significant either for entrants needing high and low frequency spectrum, or for smaller bidders wanting spectrum in multiple high frequency bands for redundancy; and
- as highlighted by Eir, between frequency generic and frequency specific lot categories within the same band (we recognise that Three has proposed a revised lot structure for its hybrid SMRA that mitigates this to some extent, although this is at the cost of reducing the flexibility bidders have to demand different quantities of spectrum).

Substitution risk does not disappear as the auction progresses

Although it may be possible for bidders to manage substitution risk while there is significant excess demand, we disagree with Three's assertion that it is not a substantial issue with the format. Even if bidders are aware of the problem, it remains possible that a bidder could prefer lots in one band at round prices, and then be left as a standing high bidder on only a subset of its demand, leaving it unable to switch fully into another band which it prefers at the next rounds prices. Given that bidders will not know their rivals' valuations, it is unclear how they could be expected to precisely predict whether they would end up in this situation, and therefore this creates strategic complexity for bidders attempting to anticipate this, and avoid being standing high bidder on lots it no longer wants.

Strategic demand reduction does risk an inefficient outcome

Three accepts that there are incentives for strategic demand reduction in SMRAs, but contends the risk of this leading to an inefficient outcome is small. This appears to be based on the assumption that all bidders will have a clear idea of each other's valuations, and therefore it will be relatively straightforward for them to reach a tacit collusive outcome. Firstly, there is no reason to expect that this is the case, as it is for the auction to extract information on bidders valuations and attempt to find an efficient outcome, but also we do not accept that if the degree of inefficiency introduced by using an SMRA were small, this would be grounds to accept an inefficient outcome unnecessarily, unless there are other significant factors that outweigh the risk of a slightly inefficient outcome.

In its contention that the economic effect of inefficiency is small, Three has focused on the case for MNOs. For entrants or smaller bidders in the award, the spectrum they could potentially win could represent a large fraction of their total holdings. Three's argument simply does not apply to smaller bidders, and the award design cannot consider only the effects on MNOs.

We assume that any blocking strategy would only be effective if it led to a very asymmetric outcome, which afforded the bidder pursuing the blocking strategy a degree of market power that it could then exploit. However, the competition caps exclude such asymmetric outcomes, and so there is no prospect of a blocking strategy being successful, and therefore incentives to pursue one would be very limited, regardless of whether the bidder would inflate its own price in the process. As discussed above, the second price rule in the CCA provides far greater incentives for bidders to bid to valuations, which in turn increases the chances of achieving an efficient outcome.

6.4.6 Combinatorial multi-round ascending auction (CMRA)

The CMRA is another format initially considered in the original auction format design report.

The process follows the multi-round structure of a clock auction, in that:

- identical lots are grouped together into lot categories;
- the auctioneer announces the price for each lot category in a round, and bidders specify the number of lots in each

category they wish to acquire at the prices announced by the auctioneer – this constitutes the headline bid of the bidder in that round.

Bidders can also make additional bids (i.e. in addition to the headline bid, for other packages) in each round, submitted alongside their headline bid for the round, subject to the constraints that:

- none of these bids can exceed the round price; and
- that relative caps that arise from previous headline bids are satisfied (the relative caps arise when a bidder reduces its eligibility by bidding on a headline bid with less eligibility than its preceding one, following the same approach as in a CCA).

The CMRA adopts the relaxed activity rules developed for the CCA, which allow bidders to increase their demand (in terms of eligibility points) relative to the preceding round if doing so is consistent with the relative caps. This allows bidders to make bids that they would have been able to do in the supplementary bids round of a CCA.

The auction does not end when there is no excess demand at round prices in any category, but rather when the optimal outcome given the bids received so far (using a combinatorial evaluation of bids analogous to that used after the supplementary bids round in a CCA) involves accepting a bid from each bidder – these become the winning bids and bidders pay the amount of their bid.

Determining whether any lots require a price increase (and hence whether or not a further round is required) does not simply rely on assessing excess demand at current clock prices. Instead, the CMRA determines which lots need a price increment by checking which bidders would be at risk of losing, and then determining the lots for which demand at clock prices from these bidders clashes with the bids from other bidders.

The closing rule means that the auction may end with excess demand in bidders' headline bids or could continue even if there is excess supply at current round prices.

The CMRA has a number of advantages that are relevant to this award:

- It is a combinatorial format that supports package bidding, and thus eliminates aggregation risk and substitution risk.
- It is an open format that allows bidders to submit bids for a range of packages, allowing bidders to assess demand and

form views over packages they are likely to win, which can help them to focus their bids on particular targets in scenarios where it is not possible/feasible to express demand for the full range of packages the bidder might be interested in.

- Bidders can simply pursue a small number of preferred target packages, and only consider other packages if their preferred targets become too expensive, or when they run out of budget for these.
- An efficient outcome is possible even if there are synergistic valuations, as prices are not bound to linear prices.
- The pay-as-bid rule is simple to understand and does not lead to the same uncertainty over final prices that is a feature of the CCA.
- Bidders can always bid back following a round if they do not win one of the bids they have submitted.

For these reasons, we considered the CMRA a relatively strong candidate for this award, along with the CCA. However, as discussed above, in the end we judged that a CCA would be better as there are potential downsides to the CMRA:

- Given the number of lots available, we anticipate that at least some bidders may want to keep a large number of alternative packages in play throughout the auction to maximise their chances of winning. If bidders wish to make bids for many alternative packages in each round, then the CMRA might be challenging in terms of determining and entering all relevant bids amounts in each and every round and submitting them within the round time.
- The CMRA, as with all pay-as-bid auction format, can create incentives for strategic demand reduction and/or bid shading by bidders in order to keep prices low and maximise their returns. This could be particularly relevant in this award due to the fact that the large supply of lots might allow bidders to share the spectrum available in a tacitly collusive outcome with a view to settling at low prices.

Views of respondents

In the information notice, ComReg was of the view that a CMRA was unlikely to be suitable, because the format is relatively novel, and because the lots available in this award means that bidders might have to consider bids for a large number of packages in each round, which could add unnecessary

complexity. None of the respondents support the use of a CCA, because they agree with ComReg about these issues, and they have further concerns that the format lacks transparency.

Vodafone observes that this award is likely to occur at the end of a series of European awards and could be the last auction in Ireland for some time. Therefore, it is reluctant to support an unfamiliar format, and prefers a tested process in which reasonable expertise should be available to all parties.

Three agrees with previous comments from Eir, that the format is complex and lacks transparency. It also alleges that, even though the CMRA is a pay as bid format, there would still be discrimination against Three in this award, because under the proposed caps, there could be opportunities to exploit the lack of competitive bids for incremental 700 MHz lots.

Eir stands by its previous comments that the CMRA is not an appropriate format (because it is complex, likely to favour stronger bidders, and lacks the transparency of a SCA), but it now suggests that some of the benefits associated with a CMRA could be achieved through its iterative CMRA.

Assessment and recommendations

We have discussed the CMRA in detail in previous documents⁵⁹, noting in particular that the combinatorial nature of the format means it would effectively manage aggregation risk (across bands and across time slices), and would allow bidders to switch demand freely. However, we identified some key limitations relative to the CCA, namely that a CMRA is vulnerable to strategic demand reduction, susceptible to bid shading that would lead to inefficient outcomes if bidders made mistakes, and in particular it added unnecessary complexity by requiring bidders to maintain bids for a large number of packages in each round.

Subsequently, respondents have added their own concerns with the format, such as a lack of transparency, and all stakeholders agree that a CMRA is not the appropriate format for this award. Therefore, we do not believe it needs further consideration, and continue to recommend that a CMRA is not used in this case.

⁵⁹ ComReg 19/59a, Section 7.2.3

6.4.7 Iterative CCA

In its response to ComReg document 20/56 (the RIA Information Notice), Eir has suggested a new form of open, combinatorial auction, which it calls an 'iterative CCA'.

In summary, this new format appears to be the same as ComReg's proposed CCA if there are no provisionally unsold lots at the end of the primary bid rounds, but would replace the supplementary bids round with one or more 'additional rounds' in the event that there were unsold lots.

At the start of each additional round, ComReg would announce a round price for each lot category. Each bidder would then submit a single 'headline bid' in exactly the same way as they submitted primary bids (i.e. the number of lots demanded at round prices, with the same relaxed bidding rules), with the exception that in the first additional round a bidder's headline bid would be its final primary bid. Optionally, bidders would also be allowed to submit a number of 'additional bids', which would be subject to similar constraints to supplementary bids, in particular:

- the minimum bid amount would be the greater of the reserve price and the bidder's highest previously submitted bid amount for the package;
- the maximum bid amount would be the current round price of the package; and
- bids for packages exceeding the bidder's eligibility for the round would be subject to the relevant relative price cap.

At the end of each additional round, ComReg would calculate the highest total value across all feasible bid combinations (with all primary bids, chain bids, headline bids, and additional bids included in the calculation).

- If at least one feasible combination of bids achieving that maximum revenue includes exactly one bid from every bidder, the auction ends. Winner and price determination then proceed in exactly the same way as proposed in the current CCA, based on all bids submitted to that point.
- Otherwise, there is a further round, with round prices determined in a similar way to the recent Danish CMRA.

If a further round is required in a CMRA, the auctioneer first identifies the bidders who submitted a non-zero headline bid in the most recent round, and for which there exists a value maximising feasible combination of bids that does not include a bid from this bidder. Each of these 'omitted bidders' must face a

price increase for the package subject to its headline bid (because its current bid is not sufficient to guarantee that it wins any lots). For each omitted bidder, the auctioneer determines which lot categories require price increases, by constructing hypothetical bids containing only the lots in a particular category included in the headline bid, and checking whether the bidder would still have been an omitted bidder had it submitted this hypothetical bid. If no lot categories are identified for price increases, the auctioneer may repeat the process for that bidder using hypothetical bids based on bands, instead of lot categories.⁶⁰ Then, the extent of the price increase in lot categories where one is required is set by the auctioneer.

Eir suggests that it could be helpful to provide further information, alongside round prices, but this additional information is not an essential part of the format. For example, ComReg could provide information on:

- the highest total value of a feasible combination of bids to date;
- the highest total value of a feasible combination of bids including the bidders latest primary/headline bid; but
- probably not aggregate or excess demand, as those quantities are not particularly useful in additional bids rounds.

This is a separate proposal to its idea of setting bid amounts equal to exposure prices, but it recommends that the two could be applied together. If ComReg adopted both an iterative CCA, and the proposal to set bid amounts equal to exposure prices, Eir suggests that the discount from the final primary bids round should be applied to all headline bids.

Views of respondents

Eir claims that this format would be a considerable improvement on the proposed CCA, although it still suggests that some form of SCA is the appropriate format for the award.

It submits that the key advantage of the format would be that no bidder could win nothing unless it had explicitly submitted a zero bid. Moreover, Eir suggests that this format would provide bidders with a far more refined understanding of how much

⁶⁰ This summary is based on the Norwegian CMRA that took place in May 2020. The Danish CMRA referenced by Eir did not include a second type of hypothetical bid.

they would need to pay for their preferred packages, and that this would be very useful to budget constrained bidders, who could make a better informed decision on whether to continue bidding for that package, or to concentrate on a smaller one, with no risk of winning nothing by making the wrong decision.

Finally, Eir submits that it would reduce the incentive for bidders to deliberately bid in a way that increases uncertainty in the final primary round. This is because bidders would learn more about likely final prices, rather than having to guess at where this price lies within the potentially large range between a package's final round price and the associated knockout bid.

Three was the only respondent to comment on Eir's proposal. It commented that the modifications do not address its own concern about alleged discrimination, and that Eir's issues regarding price transparency and budget constrained bidders had already been adequately addressed by the inclusion of exposure price information. Therefore, Three sees no merit in the alternative rules, and suggests ComReg should not adopt new and untested rules that are without merit.

Assessment and recommendations

The format proposed in the event of unsold lots at the end of the primary bids rounds appears to be essentially a clock auction (with relaxed activity rules) followed by a CMRA with a Vickrey-nearest pricing rule. There may be some merit in the proposal, as we expect there would be a set of rules that would provide additional information to bidders, compared to what they would receive in a CCA. However, our base assumption is that the clock rounds provide a reasonable resolution, and that the supplementary bids round is for minor adjustments to the allocation, and to prevent lots going inefficiently unsold. If this was not the case, we would have recommended a different combinatorial format (e.g. a CMRA or combinatorial sealed bid auction). Under this base assumption, we do not believe that much would be achieved by having additional rounds in place of the supplementary bids round.

As the additional information provided to bidders is limited, and the effect on the outcome is likely to be small, we suggest that any benefits of this format are insufficient to justify the added complexity and the use of an untested format. In particular, we note that respondents have opposed the use of a CMRA on the basis that it is untested, and this format would be even less

familiar to bidders (i.e. the CMRA has never been used in Ireland, but has been elsewhere, while this format is completely novel).

The case in which the additional bids rounds would make the most difference is when there are unsold lots at the end of the clock rounds, and knockout bid amounts are relatively high as a result. In this instance, there would be relatively many additional rounds, and high additional round prices, which would require bidders to submit a complex set of bids on many occasions, therefore we would be most concerned about the complexity precisely when there appears to be a case for the format. More fundamentally, we do not believe it is likely that Eir would be knocked out entirely in this case, unless there was a fourth bidder with a similar demand profile (in which case, Eir's budget constraint cannot be prevented from affecting the outcome).

Finally, we note that this format would still use a second price rule, so it would again be ineffective in addressing Eir's fundamental concern about a difference between final prices and bid amounts. Overall, we suggest that the benefits of both of Eir's proposals (applied independently or together) are insufficient to justify the added complexity or move to an untested format (which respondents are generally opposed to), and we do not recommend either are adopted.

6.5 Summary of conclusions

There are a number of features of this award that initially lead us to recommend a CCA, and which continue to imply that it is an appropriate format. Among other things, package bidding is necessary for bidders to manage the otherwise significant aggregation risk in the award (which arises as a result of complementarities between bands, between time slices, and because of minimum requirements in a band). Other combinatorial formats are untested and would add excessive complexity in this case.

Opportunity cost pricing incentivises bidding based on valuations, by minimising revenue, subject to ensuring content winners and losers, which we believe is important in maximising the chance of an efficient award. Likewise, competition caps must include existing holdings if they are to ensure there is effective competition in the market following the award. Both of these features were proposed for good reason, and we see no reason to be concerned about their interaction.

Eir has a reasonable concern about the effect of uncertainty over final prices on budget constrained bidders but, in many circumstances, this will be addressed effectively by exposure pricing information. While we see some merit to further changes to information policy, this is outweighed by the risks associated with its proposed changes, such as revealing excessive information about individual bidders, or moving to an untested format.

None of the suggested adjustments to the CCA set out in the Information Notice are appropriate, in particular:

- Three's additional caps (Options 5a – 5c) fail to treat bidders equally, because they take distributions of spectrum that are acceptable under the caps, and tilt the award towards outcomes in which Three's relative position is stronger; and
- ComReg's pricing rule changes (Options 5d – 5g) are an unnecessarily attempt to achieve more uniform prices and are not supported by any stakeholders.

Even with the amendments proposed by various stakeholders, all other auction formats are unsuited to the specific circumstances (e.g. aggregation risk persists in hybrid SMRAs and the eSCA, while there is a risk of inefficiently unsold lots in SCA with relaxed activity rules).

7 Minimum prices

7.1 Views of respondents

In its response to the Draft Decision, Three asserted that ComReg intends to set minimum prices that balance the risk of choking off demand against the risk of encouraging frivolous participation, and that these two issues create an upper and lower bound for minimum prices (with a significant margin between the two). It submits that:

- choking off demand by setting the minimum prices too high would have significant negative consequences since spectrum could go unsold; whereas
- the consequences of setting minimum prices too low are not significant as low value bidders are unlikely to affect the outcome of the auction.

In addition, Three contends that the setting minimum prices at the benchmark values means they are not a conservative estimate of market value, and for these reasons it suggests a margin between the benchmark and the minimum price should be introduced.

In its response to ComReg 20/32, Three also raised the point that the same minimum prices are proposed for the 2.6 GHz TDD guard bands as for the rest of the band, but asserts that this is an exceptionally high reserve price for restricted spectrum that cannot be fully deployed for high-power mobile. Three highlighted that in some other European countries these lots have been awarded automatically to the winner of the adjacent TDD lot with no additional charge.

Vodafone, in its response to the Draft Decision, claims that uncertain transition arrangements and coordination restrictions in the 2.3 GHz band (which would reduce the value of the band) have not been considered. It also agrees with NERA's point from a previous response that prices will be lower in this award because of increased spectrum availability and limited ability to monetise 5G spectrum.

Eir, in its response to the draft IM, observed that the reserve prices specified in the draft IM had changed significantly without explanation, but the SUFs remain unchanged. It asserts that this can only be down to a change in methodology, because both are determined by the minimum price calculation.

Three also requested an explanation for the changes to the reserve prices.

In response to ComReg 20/56, respondents' further comments relating to minimum prices were mostly in the context of the potential rule changes for the CCA, and generally agreed with ComReg's principles for setting minimum prices.

7.2 Assessment and recommendations

As Three suggests, there are consequences from setting minimum prices too high and also from setting them too low. We (and ComReg) are well aware of these and the relevant risks, which have been taken into account when forming a view on the appropriate level of minimum prices for the award. Of course, it is practically very difficult (or even impossible) to know precisely at what minimum price levels frivolous bidding would be an issue or demand would be inefficiently choked off, but minimum prices are set at a level that is expected to provide a suitable balance of these risks based on information gathered from similar awards in other countries via a benchmarking exercise. We agree with Three that there would be significant consequences from valuable spectrum going unsold due to inappropriately high reserve prices, but we are also of the view that inefficient outcomes from frivolous or speculative bidding are a relevant concern, even if relatively unlikely.

We also note that, as Three has neglected to recognise, an additional consideration is the potential for minimum prices that are too low to create opportunities and incentives for gaming behaviour, as the incentives for strategic behaviour aimed at reducing competition in the award to keep prices low, such as tacit collusion, are greater when there is a larger difference between the reserve price and the expected competitive price. Even if speculative participation is not a significant concern, that is not in itself a sufficient reason to reduce reserve prices.

The benchmarking report (an updated version of which will be published alongside the final IM) gives (for each band) an estimated range for the expected market price of the spectrum (based on observed prices from the award of similar spectrum in other countries), which then is used to inform the minimum price to be used. We have discussed in detail, in ComReg 19/59b and ComReg 19/124a, our reasoning behind the recommended level of minimum prices and why we consider

these to be sufficiently conservative so as to avoid choking off demand. In particular we highlight that:

- using the geometric mean of prices achieved in other awards, rather than the arithmetic mean as we have done in previous benchmarking exercises for ComReg, is an improvement on the benchmarking methodology that provides a better central estimate of licence prices which is closer to (and in our sample, below) the median;
- the proposed minimum prices are in line with those used in the 2012 award (MBSA) of similar spectrum in Ireland⁶¹; and
- the prices *achieved* (i.e. the market price of the spectrum) in the 2012 multiband award were significantly higher than the minimum prices, while the prices paid previously for 2.1 GHz licences are significantly higher than the value suggested by the benchmarking (and the proposed minimum price for the band).

We would also question whether Three's views on the minimum prices expressed in its response to the Draft Decision are consistent with its view (expressed in the same response) that it will be unfairly exposed to paying substantially more than its rivals due to its inability to express a value for a third 700 MHz block. In particular, if the minimum price for 700 MHz lots cannot be described as conservative, but is instead close to market value, then Three would expect to pay a similar amount to the other MNOs for these lots, regardless of any interaction between the format and the caps.

Regarding Vodafone's (and NERA's) comment that the value of spectrum has likely fallen, we remain of the view set out previously⁶² that, although the business case may have changed, and there may have been a decline in prices in some bands, this remains valuable spectrum, and we can be reasonably confident that the minimum prices will be below market value in this award.

For these reasons, and although we recognise that there will always be uncertainty in relation to benchmarking, we are confident that the proposed minimum prices are set sufficiently

⁶¹ In particular, the proposed minimum prices for the 700 MHz band is in line with the minimum prices for the 800 MHz and 900 MHz bands in the 2012 MBSA, and the proposed minimum price for the 2.1 GHz band is in line with the minimum price for the 1800 MHz band in the 2012 multiband award in Ireland, with the minimum prices proposed for the 2.3 GHz and 2.1 GHz bands significantly lower still.

⁶² ComReg 19/124a, paragraphs 130 - 139

conservatively so as to avoid the risk of inefficiently choking off demand (even if the value of spectrum has fallen). We therefore disagree with Three that a greater margin between the benchmarks and the minimum prices is necessary.

Nevertheless, there may be some merit to Three's arguments that the minimum prices for the 2.6 GHz TDD guard band blocks might be too high. Although, as discussed above, we believe that the proposed minimum prices have been set sufficiently conservatively, we agree that the TDD guard band blocks are likely to be less valuable than the rest of the band. On that basis there may be an argument for setting lower minimum prices for these blocks to reduce the risk of them going unsold. We understand that, on this basis, ComReg is proposing to reduce the reserve price of the 2.6 GHz TDD guard band blocks to €25,000 for the first time slice and €35,000 for the second time slice, and to reduce the SUFs to €5,000. We do not see any issues with this proposed change.

Similarly, we understand that ComReg is proposing to reduce the reserve price of the upper 2.3 GHz frequency-specific lot (2390 – 2400 MHz) to €197,000 for the first time slice and €285,000 for the second time slice. The SUFs would be reduced to €52,575. This is to reflect the expected lower value of those lots relative to the rest of the band as a result of the lower EIRP limit imposed on the associated frequencies. Again, we see no reason not to make these proposed adjustments to the minimum fees.

As noted above in Section 6.1, and in relation to Vodafone's comment on the 2.3 GHz minimum fees, developments to the RurTel network mean that the 2300 – 2330 MHz frequencies will be included in the award as generic lots along with the frequency range 2330 – 2390 MHz, and the issues relating to coordination and transition are much less pronounced than in the early stages of the MBSA2 consultation process. Given this, the 2300 – 2330 MHz frequencies would have the same minimum prices as the other 2.3 GHz frequency-generic lots.

Finally, we note that the change in minimum prices identified by Eir and Three is simply a result of the increased licence duration, rather than a change in methodology. Although the annual SUFs (before CPI adjustment) are unchanged, they are being paid over a longer period so the *total* SUFs have increased (such that the discounted sum still makes up 60% of the new minimum price).

In the table below, we set out revised minimum prices that take into account:

- the reduction in minimum prices for the 2.6 GHz TDD guard bands and the 2.3 GHz fixed-frequency lot; and
- the new mobile WACC of 5.85% recently introduced in Ireland.⁶³

Table 5: Minimum fees updated using new WACC

Band	Time slice	Lot size	Reserve price per lot (€)	Annual SUF per lot (€)
700 MHz	NA	2x5 MHz	9,158,000	998,931
2.1 GHz	1	2x5 MHz	1,327,000	525,753
2.1 GHz	2	2x5 MHz	2,849,000	525,753
2.3 GHz (2300 - 2390 MHz)	1	5 MHz	197,000	52,575
2.3 GHz (2300 - 2390 MHz)	2	5 MHz	285,000	52,575
2.3 GHz (2390 - 2400 MHz)	1	10 MHz	197,000	52,575
2.3 GHz (2390 - 2400 MHz)	2	10 MHz	285,000	52,575
2.6 GHz FDD	1	2x5 MHz	394,000	105,151
2.6 GHz FDD	2	2x5 MHz	570,000	105,151
2.6 GHz TDD	1	5 MHz	197,000	52,575
2.6 GHz TDD	2	5 MHz	285,000	52,575
2.6 GHz TDD Guard Bands	1	5 MHz	25,000	5,000
2.6 GHz TDD Guard Bands	2	5 MHz	35,000	5,000

⁶³ <https://www.comreg.ie/publication/the-cost-of-capital-for-the-irish-communications-sector-final-report>

These minimum prices are indicative to demonstrate the impact of the new WACC and may be revised for the final Information Memorandum, following an update to the benchmarking exercise to take account of recently completed awards and any adjustments to our recommendations in light of the new data.

Annex A NERA report

A.1 Three's proposals for modifying the award

Three's various proposed modifications of the CCA

In Section 5, we discussed a number of proposals made by Three aimed at addressing what Three claims is discrimination against it in terms of the price it might pay for 700 MHz lots compared with other winners. Three considers that this discrimination arises because of interaction between the CCA format and the sub-1 GHz cap. This cap prevents Three from acquiring a third block of 700 MHz due to its larger existing holdings of sub-1 GHz spectrum.

Section 5 reviewed three proposals advanced by Three in its non-confidential submissions:

- A joint cap of five lots of 700 MHz spectrum across any two winners, which we considered unjustified on competition grounds and to advantage Three unfairly by eliminating the possibility of Three ending two blocks behind the other MNOs;
- A similar joint cap, but applying only to counterfactual situations used to calculate opportunity costs for the purposes of pricing, which potentially leads to losers being prepared to pay more than winners actually pay and an incentive for Three to overstate its value for two 700 MHz lots leading to inefficient outcomes and possible windfall gains for Three (amongst other problems);
- A cap on the incremental value that bidders can express for third blocks of 700 MHz through their bids set by the final clock price, which potentially greatly handicaps any bidder finishing the clock rounds with three 700 MHz lots from expressing their true value of retaining these lots (amongst other problems).

These proposals have the common feature that they inhibit Vodafone's and Eir's ability to compete for a third lot. More broadly, we consider that there is no justification for such approaches as one or both of Vodafone and Eir winning three lots of 700 MHz spectrum does not lead to any significant concerns about lessening of downstream competition, as discussed in Section 5.

Role of NERA's examples

We do not repeat the discussion of Section 5 in this annex, but rather focus on a report from NERA that provided a set of worked examples with the aim of supporting Three's arguments. Three has asserted confidentiality over the specific examples in the NERA report.

We do not consider that the contents of this annex are necessary in considering Three's proposals. The arguments of principle given in Section 5 are sufficient to support our recommendation to ComReg that Three's proposals be rejected. Therefore, the intention of this annex is primarily to respond to the examples offered by NERA and put them into context. Overall, we consider that NERA makes claims that are unjustified by the examples.

A.2 Opportunity cost and non-uniform pricing

Three's proposed alternative formats

In addition to its proposals to tweak the proposed CCA listed above to limit the claimed discrimination in terms of relative winning prices, Three also states that a CCA is not its preferred auction format. Instead, it has advocated a hybrid SMRA with short and long licences (rather than time slicing) or, if time slicing remains, an "enhanced" simple clock auction (in essence a simple clock auction, but with exit bids, switching restrictions and follow-up rounds to allocate unsold lots).

Both of these options would involve essentially uniform pricing for lot categories. In a clock auction or in a hybrid SMRA where lot categories are created, the auctioneer sets a common price per lot at which bids are made and winners eventually pay the amount of their winning bids. This contrasts with the minimum revenue core pricing approach used in the CCA, where each winner (and group of winners) pays according to the opportunity cost caused by being awarded its particular package of lots. Winning prices are determined for each winning package bid, rather than for each lot category and may not be expressible as a uniform price per lot for each lot category.

Efficiency impact of uniform pricing

Three makes the general claim that non-uniform pricing is rarely required to support efficient outcomes. However, we disagree and consider that Three is overly focussed on the outcome in which the three existing MNOs each win two 700 MHz lots. We do not know in advance what structure of demand bidders may

have and we cannot be presumptive that the efficient allocation is two blocks of each for the three MNOs. There is a range of possibilities:

- The cap allows for possibilities in which Vodafone and Eir can win up to three blocks and other bidders without existing sub-1 GHz spectrum could win even more. Successful competition from an entrant, which – even if unlikely – cannot be ruled out, might lead to a wide range of possible outcomes in terms of how remaining 700 MHz blocks might be allocated across existing MNOs;
- As discussed in Section 5.3.4, it is quite plausible that some bidders could have synergies between first and second lots that lead to discrete reductions in demand from two, or even three, blocks of 700 MHz to zero as per lot prices are increased. Non-uniform pricing would be required to achieve efficient allocation in such a case if the clock stage ended with unallocated 700 MHz lots;
- Potential entrants may have business cases with various forms of synergies, possibly needing minimum amounts of spectrum and also combinations of spectrum across different bands. Under these circumstances, winning prices may not be compatible with uniform pricing due to the value of lots depending on which other lots are assigned with them.

Effect of uniform prices on bidding incentives

We also need to take into account the effect of the pricing rule on bidding incentives, which in turn has an efficiency consequence if bidders are given incentives to distort their bids.

If we impose a requirement for price uniformity, then this is incompatible with reasonable bidding incentives. In particular, there is a clear incentive created for bidders to take into account the impact of their own demand in increasing price that is typically absent when minimum revenue core pricing is used. In practice, this means that with price uniformity there is an incentive not to compete for a larger number of 700 MHz lots unless there is a strong likelihood of winning those lots. In particular:

- Even if there is no competition for 700 MHz lots other than from the three MNOs, price uniformity incentivises Vodafone and Three not to compete for third lots. In turn, this reduces competition faced by Three. It also makes an even split of the six available 700 MHz more likely.
- If there is competition for 700 MHz lots from one or more entrants, under uniform pricing, there is an incentive for entrants to compete for a smaller amount of spectrum than

straightforward bidding in line with their business cases would indicate. Unsuccessfully competing for a larger number of blocks than necessary may be unattractive given the difficulty of outbidding the existing MNOs.

In contrast, the minimum revenue core pricing approach used in the CCA provides incentives to bid reasonably in line with valuation in most contexts. This is because in this approach the amount that bidders pay subject to each winner (and group of winners) paying opportunity costs. If bidder competes unsuccessfully for a larger number of lots, this does not increase the price that bidder will itself pay if only wins a smaller number of lots.

A.3 NERA examples

NERA's report presents a sequence of worked examples. These focus on the situation in which [REDACTED]

[REDACTED]

These examples use valuations set for the three MNOs that are chosen by NERA. As far as we are aware, they are not set by reference to any realistic model of valuations. Indeed, we note that NERA itself says that "[w]e assume all three MNOs have equivalent valuations for 2x10 MHz. We set this at a robust [REDACTED]

[REDACTED]

[REDACTED] [REDACTED] Canada has typically demonstrated especially high spectrum prices by international standards, [REDACTED] [REDACTED].

To provide some context for these valuation assumptions, the proposed reserve price for a 700 MHz lot of 2x5 MHz is a little less than €9.2m, with an annual SUF of a little under €1m. The reserve price and SUFs together have an NPV cost of approximately €23m for a 2x5 MHz 700 MHz lot over its 20-year licence duration, corresponding to €0.46/MHz/pop. This is in line with our benchmarking to the geometric mean of prices in

⁶⁴ Page 36 of NERA report, which forms part of Three's response to ComReg 19/124.

competitive European auctions of 700, 800 and 900 MHz bands in the last 10 years.⁶⁵

Clearly it is reasonable for NERA to set valuations in their examples [~~] [~~] Therefore, we take the NERA examples as being illustrative in nature, rather than there being any particular significance in the specific numerical outputs. As we discuss below in regard to Example 4, we believe that Three has overstated the significance of these numbers within its own submission given that NERA's examples appear primarily intended to illustrate qualitative points.~~~~

Example 1

In this example, [~~] [~~] NERA then concludes this outcome is unfair and "*also seems inconsistent with ComReg's general objective of fostering competition, as its rules impose higher costs on the smaller operator*".~~~~

[~~] [~~]~~~~

Bidders are not in symmetric positions as, with a small number of competitors with different valuations for third blocks, winners face differing degrees of competition. It makes little sense to

⁶⁵ See Table 2 of ComReg 19/56b. These figures are for 15-year licences and have since been recomputed for a 20-year licence and also a revised WACC.

characterise bidders as “weak” or “strong” within this example, as [\times [REDACTED] \times] and the only difference is their appetite for an additional third lot [\times [REDACTED] [REDACTED] \times].

This approach to pricing is consistent with ComReg’s objective of efficient allocation, as [\times [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] \times]

We strongly disagree with NERA’s comment that this outcome is inconsistent with fostering competition, as in practice caps would apply to eliminate outcomes where downstream competition is at risk of being damaged. The question of downstream competition is simply absent from NERA’s example. Within the example, [\times [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] \times]

Finally, we note that if a simple clock auction or an SMRA had been used, it would be necessary for prices to rise sufficiently to [\times [REDACTED] \times] This would result in all winners paying a price of [\times [REDACTED] \times] [REDACTED] \times] Therefore, *all* winners pay significantly less in the CCA [\times [REDACTED] \times] as a result of the minimum revenue core price setting winning prices at the minimum possible level, subject to each winner (and group of winners) paying at least its opportunity cost.

The much higher prices in a SMRA or simple clock auction outcome under simple straightforward bidding would translate into an incentive for [\times [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] \times] This incentive for bidders to understate their valuations for third lots risks inefficient outcomes. It also tends to favour a 2/2/2 split of the six available lots, favouring the status quo in terms of the relative positions of the three MNOs’ sub-1 GHz spectrum holdings.

Example 2

In its next example, NERA [§ [REDACTED]] but supposes that Three is not able to bid for a third block. NERA observes that [§ [REDACTED]] NERA asserts that this example demonstrates that "[t]he impact of ComReg's sub-1 GHz cap is to accentuate Three's disadvantage relative to Vodafone and also disadvantage it relative to Eir."

Clearly if we compare a case in which Three cannot bid for a third block against one in which it can, then the competition faced by Vodafone and Eir from Three will be reduced and their winning prices will fall as result. However, NERA is putting the cart before the horse, as the imposition of the cap on Three is not an auction design choice, but rather a requirement to protect downstream competition that needs to be taken as a prior when considering the auction design.

If we replaced the 7-block cap on sub-1 GHz holdings with a 3-block acquisition limit, then the worst-case possibility is that Three finishes four blocks ahead of the smallest MNO, holding twice the amount of sub-1 GHz spectrum. This would weaken competition and Three's bid could contain an anticipation of rents from downstream market power. Therefore, if we used a 3-block acquisition limit the auction prices for Vodafone and/or Eir would be artificially inflated in the event that Three ultimately won fewer than three blocks.

NERA's comparison of an auction with and without the ability of Three to bid for a third block is not meaningful. Whether or not Three should be allowed to bid for third block is not an auction design question, but a rather a question about what potential outcomes are compatible with effective downstream competition. Either it is acceptable to allow Three to bid for a third block, or it is not; either way we then need to consider the auction design taking any competition constraints as given.

Example 3

NERA next modify their example by adding an additional bidder other than the three MNOs. This entrant [§ [REDACTED]] NERA interprets this example

as showing that "a fourth bidder is most unlikely to mitigate Three's disadvantage".

NERA interpret this example as showing that Three's price disadvantage remains even if there is competition from bidders other than the MNOs. However, what the example actually shows is that [REDACTED] [REDACTED]] As the number of competitors increases, then the differences in the intensity of competition facing different bidders become smaller. However, within the example, the effect is small because the fourth bidder has weak valuations relative to the MNOs and is only bidding slightly above reserve. The pricing impact is limited because bidders need to compete against reserve prices anyway. Therefore, the pricing impact of the fourth bidder is related to the gap between its marginal valuations and reserve prices, not the absolute level of its bids. If the fourth bidder had strong valuations, or if we reduced the reserve prices, the impact would be greater.

In any case, we do not accept NERA's premise that Three has some disadvantage that needs to be mitigated. All that is happening in this example is [REDACTED] [REDACTED]] due to the cap preventing Three from acquiring a third lot; in this case, adding the entrant does increase competition for Vodafone and Eir.

Example 4

Examples 4 and 5 form the centrepiece of NERA's claim that they "have identified a material risk that gaming behaviour could exaggerate price asymmetry and/or undermine the efficiency of the auction outcome".

Example 4 has a complicated set up, involving assumptions about [REDACTED] [REDACTED]] However, the point being made by the example is ultimately simple. The essence is that if, say, [REDACTED] [REDACTED]]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] ✂]

NERA's narrative suggests that [✂ [REDACTED] ✂]
[REDACTED] ✂]
having "...an anti-competitive upside from blocking..." one of [✂
[REDACTED] ✂] from winning two blocks, but also that it
has a budget constraint that is [✂ [REDACTED]
[REDACTED]. ✂] The mechanism by which the
anticompetitive value is then expressed is [✂ [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] ✂]

The narrative offered by NERA around [✂ [REDACTED] ✂]
is that, in the clock rounds, [✂ [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] ✂] NERA highlights that this is [
✂ [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] ✂]

During the [✂ [REDACTED]
[REDACTED] ✂]

[✂ [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

could result in a large asymmetry in sub-1 GHz spectrum holdings.

We have already explained at length in Section 5 that conditions of downstream competition depend on the portfolios of spectrum held by operators, of which the total amount of sub-1 GHz spectrum is a particularly important aspect. The proposed sub-1 GHz cap allows a modest increase in asymmetry amongst the three MNOs in their sub-1 GHz holdings. It also allows for symmetric outcomes, in the precise sense that the allowed outcomes for the split of sub-1 GHz spectrum amongst the three MNOs does not distinguish their identities; if some split is possible with each getting various numbers of sub-1 GHz blocks, then so is the split where we permute the identities of the MNOs. Therefore, there is no basis for preventing Vodafone (or Eir) from bidding from a third block; indeed, to do so would arguably be strongly discriminatory against Vodafone (or Eir).

NERA's explanation around its [\times] by NERA, but in our view this greatly overinterprets the example.

We cannot even consider the question of whether any particular behaviour is "gaming" without more clarity about the underlying valuations of bidders and how these relate to bids. Let us consider the various possibilities:

- [\times]
- [\times]

[REDACTED]

- [REDACTED]
- [REDACTED]

[REDACTED]

[REDACTED]

Example 4 appears to have gained particular significance, as the specifics of this example are quoted directly by Three in the executive summary of its response to ComReg 19/124, namely that *"we present plausible scenarios for the auction in which Three is at risk of being 'knocked out' of the contest for 700 MHz spectrum inefficiently, or to paying a premium of as much as [REDACTED] for winning the same as its competitors"*. In fairness to NERA, they did not themselves claim any particular significance to the [REDACTED] in their examples and have not claimed that these figures are intended to be realistic. We noted above that NERA makes an initial health warning that the assumed valuations are large relative to reasonable benchmarks. It is clearly reasonable to illustrate qualitative issues by means of numerical examples; however, this should not confer unwarranted status on those numbers.

In Example 4 [REDACTED]

Example 5

Example 5 considers [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]]

It is not clear what this example adds to Example 4, but we note that [REDACTED]
[REDACTED]]

NERA notes that [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]]

NERA complains that we have been dismissive of the potential for price driving in ComReg 19/124a on the basis that bidders have little information about competitors' demand and valuations, so face risks from overstating valuations for larger packages of lots. In our view, NERA's example demonstrates our point vividly. In Example 5 [REDACTED]
[REDACTED]
[REDACTED]]

As a general matter, NERA appears to [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]] NERA has not set out its implicit

Example 7

This example considers an alternative valuation setup in which [
 ✂ [REDACTED]
 ✂] This does not raise any
 fundamental new points, but rather shows again that [✂
 [REDACTED]
 ✂]

Annex B Contingent release of spectrum

B.1 Three's proposal

Three's new proposal

Three wrote to ComReg on 3 December 2020 setting out a new proposal that it be allowed to bid for up to three blocks of 700 MHz in return for a legally binding offer to release one block of its existing sub-1 GHz spectrum in the event that it won three blocks of 700 MHz spectrum. The specifics of the proposal were (quoting from Three's letter) as follows:

- *"Three will identify and agree with ComReg 1 lot (2x5MHz) of its existing sub-1GHz spectrum that Three is willing to divest itself of, subject to the conditions below. The lot to be divested will be specifically identified and agreed with ComReg and will be in the 900MHz band ("the Divestment Lot");*
- *The divestiture of the Divestment Lot would be triggered if Three wins more than 2 lots of 700MHz in the upcoming spectrum auction;*
- *The two 900MHz FDD lots left will need to remain contiguous in the band;*
- *Three will divest the Divestment Lot within a reasonable time following the spectrum award (the Transition Time), such period to be agreed with ComReg but which could be 3 months;*
- *The Transition Time would allow Three to migrate its use out of the Divestment Lot (to ensure continued service to consumers), and would also include a specified period for Three to offer to transfer the spectrum through a sale of rights, such period to be agreed with ComReg, following which if no agreement for sale can be reached, then the Divestment Lot would be surrendered to ComReg and available for re-licensing in a new award lot where Three would not be entitled to participate;*
- *The Divestment Lot would not count against Three's bidding cap in the upcoming spectrum award such that Three would be permitted to bid for up to 3 lots of 700MHz spectrum in the upcoming spectrum auction."*

Concerns about this proposal

We have grave concerns about this proposal, for the reasons set out in subsections below. In summary:

- Three's proposal allows it to win a third block of 700 MHz spectrum, but to deny the released 900 MHz block to the MNO with the smallest overall holdings of sub-1 GHz spectrum. This risks worse outcomes for downstream competition than the current proposals.
- Contingent availability of a 900 MHz lot for a subsequent award creates severe problems for bidders other than Three in valuing 700 MHz lots and may result in inefficient outcomes. Trying to integrate the release and re-award into a single unified process along with award of the current MBSA2 spectrum is extremely complex and highly impractical.
- Fair treatment of the three MNOs would seem to require also giving Vodafone and Eir the opportunity to give up 800 MHz or 900 MHz contingently on being awarded additional 700 MHz blocks and potentially then also allowing Three to give up more than one block. This would lead to concerns over the complexity of the award process and significant uncertainty for bidders about what spectrum may be available.

Although these are cumulating reasons, in our view the issue of creating uncertainty in the valuation of 700 MHz lots for bidders other than Three is severe enough *by itself* to rule out Three's proposal. This problem is quite fundamental and arises due to the contingent availability of a 900 MHz lot that is a substitute for 700 MHz spectrum; it is not dependent on any particular details of Three's proposal.

B.2 Impact on downstream competition

70 MHz cap

We note that Three specifically says that it would be restricted from re-acquiring any released sub-1 GHz block in the event that it acquired three 700 MHz blocks. Therefore, this proposal is compatible with the proposed 70 MHz cap on sub-1 GHz holdings following the award (and any divestment of spectrum by Three if required).

If any released block were ultimately obtained by Vodafone or Eir within a 70 MHz cap, then the permitted outcomes in terms of total sub-1 GHz holdings would be the same as under ComReg's proposals in the Draft Decision. The composition of holdings as a result of Three effectively swapping a block of 900 MHz for a block of 700 MHz would be different, but this has no particular consequence. As a result, no new issues are raised

regarding the analysis of downstream competition by these proposals under the assumption that Vodafone and Eir can compete neutrally for any released 900 MHz block.

Private sale of released block

However, Three's proposed method for divestment would allow it to withhold the 900 MHz block from Vodafone and Eir and sell it to another party, even if that meant lower revenues from sale of the block. It is not unrealistic for Three to be able to sell the spectrum to a non-MNO (e.g. ESB, Imagine or Airspan) if cheap enough. At the very least, Three may have the opportunity to sell the block to whichever of Vodafone and Eir would suit it better, rather than to the operator with the greatest need and highest value.

Selling the released block to a non-MNO could lead to an asymmetry of three blocks in post-award sub-1 GHz holdings across the MNOs. If Three and another MNO win three 700 MHz blocks each and Three sells the released 900 MHz block to a non-MNO, there would be a 7/7/4 outcome across the three MNOs. This is not possible under ComReg's current proposals, where, assuming all 700 MHz blocks are won by existing MNOs, the greatest asymmetry that can result is two blocks.

Therefore, a concern with these proposals is that Three's control over the divestment process could lead to worse outcomes for downstream competition than if the released 900 MHz block is unavailable to the MNO with the least overall sub-1 GHz spectrum. This concern would not arise if Three were to release a sub-1 GHz block unconditionally and return to ComReg, as then ComReg could re-award this in a neutral manner where all MNOs could compete for it subject only to the 70 MHz cap.

B.3 Impact on the award process

Three's new proposal is formulated on the basis that a block of 900 MHz spectrum might be released if Three won three blocks of 700 MHz and then subsequently re-awarded either after the MBSA2 or in some follow-up stage within the same formal process. This raises very considerable problems for the MBSA2 award process.

General problems with sequential auctioning of substitutes

In the event of Three winning a third 700 MHz block and then releasing a 900 MHz block, this would create a situation in which substitutable spectrum at 700 MHz and 900 MHz would be awarded sequentially, rather than simultaneously in a single integrated auction process.

Sequential auctions of substitutes are generally understood to risk inefficient outcomes. This is because bidders need to form expectations about the prices likely in the second auction in order to value lots in the first auction and these expectations may prove to be incorrect. For example, if a bidder expects a low price in the second auction, this reduces what it is prepared to bid in the first auction; the bidder may miss out in the first auction, but then competition in the second auction may be stronger than it anticipated and it loses out in the second auction as well. Sequential auctions create an unavoidable need for bidders to forecast how prices of substitutes might change from one auction to the next.

*Different position
of Three and other
bidders*

In the context of this award, there is a further specific problem, as Vodafone, Eir and other bidders would be bidding for 700 MHz lots in the MBSA2 process without knowing whether they will have any opportunity to acquire a 900 MHz lot subsequently. This faces those bidders with a high level of uncertainty about how to value 700 MHz.

What is most concerning is that, because the release of a block by Three is contingent on it winning a third 700 MHz block, Three knows whether or not a block will be released when it formulates its bidding strategy, but other bidders will not know this. In particular:

- When Three bids for packages including at most two blocks of 700 MHz spectrum, it knows it will retain all of its existing sub-1 GHz spectrum;
- When Three bids for a package including a third 700 MHz lot, it knows that it will need to release a 900 MHz block and can reflect the lost value of this block in its valuation of 700 MHz spectrum. The only uncertainty for Three is around who might subsequently win the released 900 MHz block. However, this is of fairly little consequence, as Three knows, because of the 70 MHz cap, that even after re-award of the released block by ComReg no other bidder can end up with more sub-1GHz spectrum that Three has.

In contrast, uncertainty about the future availability of a released 900 MHz lot is a very considerable problem for bidders other than Three as the following example shows. For definiteness, consider Vodafone's choices (the same is true for Eir):

- If Vodafone bids for any 700 MHz lots, then it knows that between three and five lots are likely to be split

between Three and Eir, as entry into this band is unlikely. Vodafone does not know the split between Eir and Three as the auction format has limited transparency, only providing information about total demand for each lot category, not a breakdown into individual bids;

- Therefore, irrespective of how many lots it bids for, Vodafone does not know whether or not Three is likely to win three lots and so release a 900 MHz lot.

One response to this problem might be to make the MBSA2 auction fully transparent, revealing full information about bids made. However, this runs risks of then facilitating tacit collusion and gaming. For some time, best practice in spectrum auctions has been to provide only limited transparency. It would be an adverse step to make the MBSA2 fully transparent for the reasons already set out in the consultation documents and Draft Decision.

In any case, increasing auction transparency would not really help. Under Three's proposals, Three can make a private sale of the released 900 MHz block, so there is the potential that it may not be made available to either Eir or Vodafone. Therefore, other bidders face uncertainty about whether they will get the chance to compete for the released block even if the auction were made fully transparent. Therefore, we conclude that are very considerable problems with Three's proposals.

Further, we note that even if we were to attempt to integrate the re-award of a released 900 MHz block into a unified process with award of the MBSA2 spectrum, this would create severe difficulties. The 900 MHz block is only contingently available, and this depends on the outcome of bidding for 700 MHz lots. Therefore, we do not have a fixed supply of 900 MHz lots.

It is technically possible to accommodate this issue in a sealed bid combinatorial auction, by taking bids for packages of lots that may or may not include the 900 MHz lot. We then solve for the winning bids contingently, looking at the scenarios where 900 MHz is released and not released separately. However, in the CCA (and indeed other open formats) there is the problem of whether bidders should or should not include a 900 MHz lot in their *single package* chosen each clock round given they do not know whether it will ultimately be available. Any bids including the 900 MHz lot cannot become winning bids unless Three wins three 700 MHz lots. There is little information available from reported aggregate demand for each lot category relevant to assessing how likely a 900 MHz block is to be released, as this depends on how the 700 MHz lots will be

split (aggregate demand information alone does not tell the bidder anything about this). Therefore, we would seem to have little option but to allow bidders to submit *two* bids in each clock round, one with and one without a 900 MHz lot. Whilst the details would need some further consideration, this would be somewhat like running two auctions in parallel. For example, we would need differentiated clock prices for 700 MHz lots depending on whether or not a bidder included a 900 MHz lot, as demand for 700 MHz would clearly depend on the availability of substitute 900 MHz spectrum. This would create an unprecedented level of complexity for bidders that is significantly beyond that under the rules proposed by ComReg. Developing an appropriate set of auction rules would involve a significant delay, as further work on the details and re-consultation with stakeholders would be needed.

B.4 Equitable treatment of other MNOs

We note that if ComReg were to adopt this – or any similar – proposal from Three, then it would seem to require offering the other MNOs a similar facility to release existing sub-1 GHz spectrum contingently on being awarded 700 MHz lots. It is not clear to us how such a facility could reasonably be restricted to only Three.

Three's requirement that its remaining 900 MHz spectrum after divestment be contiguous would seem to indicate that Three has in mind to release the 900 MHz block it currently holds at the top of 900 MHz band. This block is not contiguous with Three's other 900 MHz blocks, but is adjacent to Vodafone's existing spectrum. Therefore, there are particular reasons why Three may wish to release spectrum in the 900 MHz band, and this block in particular.

However, if such swapping facilities were offered to the other MNOs, they would need to be offered in regard to both 800 MHz and 900 MHz holdings, given that both these bands count towards the sub-1 GHz cap. There would be no particular reason to allow swapping in regard to one band, but not the other.

Clearly providing a general facility for existing spectrum to be released conditional on acquiring other spectrum would raise further concerns about complexity of the process and uncertainty for bidders about what spectrum may be available due to such contingent release being triggered.