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# **DotEcon Report:**

## **ComReg allocation of unassigned Time Slice 1 1800 MHz spectrum: Advice on award process and rules**

**Consultants Report**

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**An Coimisiún um Rialáil Cumarsáide**  
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# ComReg allocation of unassigned TS1 1800MHz spectrum: Advice on award process and rules

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## 1 Introduction

1. Following the completion of the Multi-Band Spectrum Award of 800MHz, 900MHz and 1800MHz spectrum ('MBSA') in December 2012, 2x15MHz of 1800MHz spectrum remained unassigned in Time Slice 1 (1 February 2013 – 12 July 2015). The unassigned spectrum is in three contiguous blocks labelled blocks I, J and K for the purposes of the MBSA. The frequencies of the blocks are as follows:
  - Block I: 1750-1755MHz paired with 1845-1850MHz;
  - Block J: 1755-1760MHz paired with 1850-1855MHz;  
and
  - Block K: 1760-1765MHz paired with 1855-1860MHz.
2. We have been requested by ComReg to consider the options available to ComReg for awarding spectrum rights of use for these blocks up to 12 July 2015 (the end of Time Slice 1). Overall, we consider it beneficial to follow an approach that is consistent with that used in the MBSA; however, we propose a simplification of the award process, as the availability of spectrum, potential demand and uncertainties faced by bidders in this award are substantially lower than in the MBSA. Consequently, we propose:
  - offering the spectrum available in three frequency-specific, 2x5MHz blocks (which bidders will be able to package into combinatorial bids);
  - setting reserve prices on the basis of those used in the MBSA, with the appropriate adjustments to account for the difference in licence start dates and duration;  
and
  - using a sealed-bid combinatorial auction to determine the optimal allocation of rights amongst qualified applicants.

3. This note is structured as follows:
  - we first consider the background and pertinent circumstances of this award, in Section 2;
  - in Section 3, we consider the packaging options for the spectrum available;
  - in Section 4, we consider the auction features relevant to this award; and
  - Section 5 sets out our recommendations regarding reserve prices that may be suitable for the licences offered in the award.

## 2 Background and circumstances for the award

### **A competition for the spectrum in question is necessary, but the design is open to specification**

4. ComReg made clear in its consultations and final decision on the MBSA process that liberalised spectrum would only be awarded to interested parties through open competition. While this approach was taken in the context of another award process, it is nonetheless relevant here as, pursuant to the Authorisation Regulations,<sup>1</sup> ComReg is obliged to put in place open, objective, transparent, non-discriminatory and proportionate procedures for the granting of rights of use of spectrum. Offering the spectrum in an open competition is also consistent with ComReg's Strategy Statement for managing the radio frequency spectrum. Therefore, we consider that spectrum should be allocated on the basis of selecting the highest offers from qualified applicants.

### **Time and proportionality are two key considerations in designing the process**

5. ComReg's stated position on the treatment of any unsold lots from the MBSA is "to retain its discretion regarding how it might treat any unsold spectrum lots depending on the factual circumstances arising from the award process, save for the decision that unsold lots will not be allocated for a reasonable period after the process, and, in any event, will not be allocated for a period of at least 1 year",<sup>2</sup> a period that will expire on 5 December 2013. The maximum duration of any licences for the use of unallocated spectrum would be relatively short (6 December 2013 – 12 July 2015),

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<sup>1</sup> Regulation 9(4)(a) of S.I. 335 of 2011.

<sup>2</sup> ComReg document 12/25

and their underlying value (if there is an interest in this spectrum by one or more parties) will erode as their duration gets shorter. Therefore, decisions on the award process should be made bearing in mind that the aim is to have the award process completed to meet ComReg's currently proposed commencement date for lots of 1 February 2014.

6. A related issue is that, in addition to time, the cost of participation in an award process must be reasonable in the context of the eventual licence or licences involved. This point relates not only to direct costs (such as auction advisors), but also to indirect costs (such as management time). In particular, both direct and indirect costs of participation in an award process increase if an award design is complex. This is generally not considered to be a constraint in auctions of high value, as the cost of participation is small relative to the value to a bidder of acquiring its target lots, and hence bidders are prepared to commit relatively more resources to figure out the best strategy to win the lots they want. However, the level of complexity of an award process (and thus the potential participation cost) needs to be proportionate given the likely overall value of the spectrum available for award. In particular, while the MBSA process was appropriate given the value of the spectrum offered and the wide range of possible outcomes, participants in this award process may be relatively more sensitive to the cost of participation.
7. In this context, there is scope for using a simpler approach for this spectrum assignment than those approaches that are appropriate for the award of larger amounts of spectrum or including multiple frequency bands, as was the case with the MBSA process. Such formats include sealed-bid auctions, with or without combinatorial aspects, using either first price (pay-what-you-bid) or second price (opportunity-cost pricing) methodologies.

**Facilitating the maximum level of competition will be important in this award**

8. Given the relatively short duration of the licence or licences available and the limited bandwidth available, it is likely that the number of interested parties and potential alternative allocations will be limited. Therefore, steps should be taken to encourage participation in the award process, which should in turn encourage the efficient use of this spectrum. This will involve:
  - packaging the spectrum in a way that allows different users to express their requirements, and which allows for an efficient distribution of the spectrum between interested parties;

- lowering participation costs by using a simple, straightforward and reasonably quick process; and
  - removing any unnecessary risks faced by bidders in the bidding process in order to simplify their valuation work and other considerations that may affect their bidding decisions.
9. The potential demand for spectrum will also depend on the reserve price of the lots. Nevertheless, special care should be taken when setting reserve prices, as deviating from the approach followed in the MBSA process without good reason could among other things distort bidding incentives in future awards.

### 3 Spectrum packaging

10. Spectrum packaging may affect the value of the spectrum for the parties interested in bidding, as well as the likely level of competition for the lots available. In addition, the optimal choice of format will greatly depend on the lots available.
11. The spectrum available for award forms a contiguous block of 2x15MHz in the 1800MHz band for Time Slice 1. Given that only a relatively limited number of lots are available, the potential complexity of the award is limited.
12. There are two parties with adjacent spectrum, Meteor and Vodafone, neither of whose frequencies for the following licensing period (Time Slice 2 ('TS2'), running from 13 July 2015 to 12 July 2030) are the same as those to be included in this award. H3G already has a licence for the spectrum blocks offered in this award in TS2, and thus may also have a particular interest in acquiring the available spectrum. These factors may have an important impact on the extent of competition for the spectrum. However, demand for the blocks available may not be limited to those operators who hold adjacent spectrum or the same frequencies in TS2 – for example, any operator may wish to acquire the available spectrum in order to have greater flexibility for their transition plans when migrating customers to new technologies.
13. Nevertheless, the specific location of the lots offered is likely to affect the value that existing operators may place on this spectrum. Therefore removing uncertainty about the specific frequencies may help interested parties determine their value and influence their willingness to pay for different lots.
14. We start this section by discussing the size of the lots available and then whether these should be offered as frequency-specific blocks or on a frequency-generic basis.

### 3.1 Size of lots

15. There is only a relatively small amount of spectrum to be made available in the current award. Given the existing licensing of spectrum in the 1800MHz band, we consider that it is only practical to consider spectrum packaging options that are in line with the band plan. This means potentially allocating the available spectrum in one of three ways:
  - one lot of 2x15MHz;
  - a 2x5MHz and a 2x10MHz lot; or
  - three 2x5MHz lots.
16. In the MBSA, all spectrum made available, including 1800MHz spectrum in TS1 and TS2, was packaged in 2x5MHz lots and awarded with a combinatorial bidding facility:
  - lots of 2x5MHz were considered to be the correct size 'building blocks' from which bidders could build spectrum packages; and
  - combinatorial bidding allowed the aggregation of lots by bidders into packages of spectrum that would constitute useable chunks in line with their respective business plans, without risk of winning only a subset of this demand.
17. In the MBSA, there were a number of pertinent issues that, in our view, motivated this approach:
  - There was a large amount of spectrum being made available, which included frequencies that bidders might consider substitutable to some degree and other frequencies which bidders might have considered complementary. This made demand for some lots highly contingent on winning others.
  - Acquiring at least some of the spectrum being made available was essential to mobile operators going forward. No other sub-1GHz spectrum was forecast to be made available in the medium term and two of the most popular bands for the deployment of LTE (or '4G') services, 800MHz and 1800MHz, were both being made available in the auction. The use of small lots in this case provided scope for outcomes where more users to use the spectrum available.
  - Given the amount of spectrum available in each band, there was no obvious way to *a priori* apportion the spectrum into a number of defined spectrum packages. The process of competition operated to allow bidders to identify their preferred packages

given the different prices and different relative prices between the lots, and bid on these packages. The winning packages were determined based on the total pool of bids.

18. Packaging the spectrum in three 2x5MHz blocks offers more options for awarding the spectrum. In particular, the smaller blocks provide greater flexibility for any interested parties to tailor the size of a licence to their needs, while at the same time making it possible to accommodate more users within the available spectrum, than under the other two packaging options. Therefore, it seems beneficial to follow the same approach as in the MBSA and package the spectrum in this way. Any aggregation risks should then be addressed through the auction format.

### 3.2 Frequency-specific versus frequency-generic lots

19. The available lots could be awarded on a frequency-specific or frequency-generic basis. If the lots are awarded on a frequency-generic basis, the award process would need to feature an assignment stage for determining the specific frequencies assigned to each winner of the frequency-generic lots.
20. The main reason for using frequency-generic lots is that this can greatly simplify the number of alternative combinations bidders need to consider when determining whether they wish to acquire any spectrum. However, this is not a significant issue with the current award due to the small number of lots available, as even with frequency-specific lots the number of possible combinations is very small.
21. Whether lots are offered on a frequency-generic or frequency-specific basis may also affect the substitutability of different lots. In particular, using a frequency-generic approach may remove some restrictions on the substitutability of different lots that result from the specific frequencies of the block. However, this may not be desirable if the value of blocks differs greatly, which would be the case if bidders place substantially greater value on blocks that are contiguous to their existing spectrum holdings.
22. Conversely, offering the available spectrum as frequency-specific lots allows bidders to take the value of specific frequencies into account in their demand (and thus take account of whether lots are contiguous to their existing licences). This minimises the value uncertainty relative to the case where a bidder acquires generic spectrum first and

then expresses preferences over alternative frequencies in an assignment stage.

23. Using frequency-specific lots is not necessarily essential for resolving issues relating to the difference in value due to contiguity of frequencies to existing holdings. For example, such issues could be resolved through a requirement that, if Vodafone or Meteor wins any lots, then they are directly assigned frequencies contiguous to their current holdings.
24. Nevertheless, the benefits from using a frequency-generic approach appear to be limited in this award due to the small number of lots available. On the other hand, offering the spectrum as frequency-specific lots may substantially simplify both the bidding process (removing the need for an assignment stage) and any valuation and bid strategy work required by bidders relative to the case where frequency-generic lots were used, contributing to lower participation costs. Therefore, we consider that using a frequency-specific approach might be appropriate for the present award.

## 4 Auction format choices

25. In this section we provide a general overview of the key auction features that may be relevant for the choice of auction format for a particular award. We then discuss the relevance of a number of features for the award, taking account of the likely participation and demand in the auction.

### 4.1 Combinatorial bidding

26. The lots available for auction can be offered on a standalone basis:
  - bidders can make bids for each one of the lots;
  - at the end of the auction, each lot is assigned to the bidder that submitted the highest bid for that lot.

Under this approach, bidders bid on the basis that they may win each lot separately.

27. Lots in this award could be offered on a standalone basis, especially if the spectrum available is offered as frequency-specific lots. This would simplify the winner determination process, as winners could be determined by simply ranking the bids received on each lot. However, this could introduce a number of risks for bidders:



- For example, bidders bidding for more than one block could be exposed to aggregation risks if they have synergy values across lots.
- In addition, bidders seeking more than one block could be exposed to fragmentation risks if they fail to win a block that is contiguous to their existing holdings but end up winning the block next to it.
- Where a sealed-bid format is used, this could lead to substitution or exposure risks for bidders who might be interested in a few but not all blocks (e.g. a bidder wishing to win a single block and no preference between two blocks, but not wishing to acquire both of them). This is because the bidder would not be able to submit mutually exclusive bids for alternative blocks.

As a result of these risks, bidders may be unwilling to reflect their full valuation for combinations of the lots available in their bids, instead opting for lower amounts that reflect the uncertainty that they may win a different, less valuable combination of lots.

28. The MBSA used combinatorial bidding, which eliminates these risks by allowing bidders to specify bids for combinations or 'packages' of lots, with the understanding that each bid may only be accepted in its entirety. Bidders are thus protected against outcomes where they win a combination of lots for which they have not made an explicit bid. The determination of winners in a combinatorial auction needs to take into account the total value that can be raised from accepting compatible package bids from different bidders; it is therefore slightly more complex than when offering lots on a standalone basis (which simply requires accepting the highest bid for each lot). However, the great advantage of combinatorial bid processes is that they allow bidders to express their full valuation for a package of lots, promoting efficiency when there are complementarities between lots.
29. Given these considerations, and the fact that the possible number of packages bidders could bid for (and thus the complexity of a combinatorial bid process) is relatively limited, using a combinatorial approach as in the MBSA would be preferable and simple. Note that a combinatorial approach could be used regardless of whether the spectrum is offered as frequency-generic or frequency-specific lots (where the main difference would be that a slightly larger number of combinations would be available when using frequency-specific lots, as not only the number of lots but also which specific lots are selected would be relevant when determining a package).

## 4.2 Open stage versus sealed-bid processes

30. Some spectrum auctions feature an open stage, where bidding is conducted over a number of rounds. The open stage requires bidding to be progressive, so that bidders can gain information about the demand from competitors and update their expectations on the value of lots, likely prices and the likely outcome of the process. There are two main benefits from an open stage:
- the information disclosed during the open stage can mitigate common value uncertainty;<sup>3</sup> and
  - where bidders may have a limited budget, the open stage may allow them to gauge the likely demand from competitors, so that they can better tailor their bids according to their expectations of the lots they may be able to win.
31. However, common value uncertainty is likely to be limited in this case, in particular due to the relatively limited bandwidth available and the short duration of the licences. Due to this, our view is that demand from new entrants or for completely novel uses of the spectrum is unlikely for the following reasons:
- any new business case covering only this period (given that all spectrum has already been allocated in Time Slice 2) is likely to be unviable, as the short duration of the licence makes it unlikely that all costs associated with purchase of equipment would be recovered; and
  - a test and trial licensing system for short-term experimentation already exists in Ireland.

Therefore, as demand is likely to come mainly, if not entirely, from existing operators, any common value uncertainty is likely to have already been addressed within the MBSA, as all existing mobile operators participated in the MBSA. Operators may also have had an opportunity to better gauge the value of 1800MHz spectrum on the basis of their current holdings.

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<sup>3</sup> *Common value uncertainty* refers to situations where there are common drivers of the value of lots in an auction that are unknown to bidders. When there is common value uncertainty, the open stage of an auction process provides bidders with an opportunity to improve their estimates and valuations during the bidding process, which effectively reduces the risk of inefficiencies arising from uncertainty over the value of lots.

32. In addition there are multiple benchmarking reports commissioned and published by ComReg on the value of this and other spectrum included in the MBSA in the public domain. Therefore, relevant information is publicly available generally.
33. The other potential benefit from an open stage is that it assists bidders in improving their expectations on the likely outcome of the process. This is especially relevant in the context of combinatorial auctions, where an important challenge is to determine how to best reflect the bidder's preferences in a consistent set of alternative bids. This task can be complex if the bidder is subject to budget limitations.<sup>4</sup>
34. However, the present award process presents very limited challenges, as:
  - bidders can only bid for a very limited number of alternative packages, thus limiting the difficulty in expressing a comprehensive set of relative valuations;
  - due to the short licence duration, and therefore the lower *absolute* value of the spectrum available, any overall limit on the maximum budget available to a bidder is likely to be relatively less important, and may well be above the bidder's actual valuation for the lots offered; and
  - likely bidders may have already participated in the MBSA, in which case they have already had an opportunity to bid for this spectrum and gather information about the demand for these lots.
35. Conversely, open stage processes require additional procedures and involve greater costs than closed, sealed-bid processes (both in terms of implementation and participation by bidders, and in terms of the uncertain but longer duration of the process). Given the limited spectrum available and the short licence duration, the tolerable level of associated costs with an award process for such licences

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<sup>4</sup> Bidders subject to a budget constraint will need to consider the trade-off between reflecting their value differentials in their bids for different packages (not to undermine their chances of obtaining more valuable packages) and ensuring that the bids they submit for small packages are sufficiently high (so that they do not risk not winning any spectrum at all). However, the information revealed during an open stage (for example in a CCA) allows bidders to form reasonable expectations on the relative competition for different lots and their likely prices, thus reducing the uncertainty faced by budget-constrained bidders when determining their final set of bids.

is correspondingly low. Therefore, the potential benefits from an open stage process would not appear to offset the additional costs and time that it would require.

36. An additional advantage of using a sealed-bid process is that it withholds information about demand, which could otherwise be used by some bidders in order to steer the outcome to restrict competition in the downstream market (for example, by deterring entry or denying spectrum to specific competitors). In multi-round auctions, some bidders may be able to target specific lots and raise prices until (any or specific) competitors drop out. However, in a sealed-bid setting, such bidders would find it more difficult to predict the bids from its competitors.
37. As discussed above, we do not consider that the case of the temporary entrant is a significant consideration for this award. The pool of potentially interested parties for the spectrum to be included in this award is very likely limited to those with similar spectrum usage rights in the same band in Time Slice 1 or the following time period; that is, the four existing mobile operators. However, there are potential issues due to the asymmetries that result from the specific location of the blocks available. In particular, some bidders could target particular blocks that are not contiguous to their existing holdings simply to raise the cost for competitors.<sup>5</sup> Any strategies aimed at this would be more risky in a sealed-bid process rather than when information about competitors' value is revealed in an open stage.
38. If a single round process were used to award the spectrum available, no information would be made available to bidders about the bidder demand from the point at which they submit their own bid (or bids) to the announcement of the auction outcome. In general, withholding information about applicants or their demands at application (before the outcome of the award process has been determined) would contribute to reducing the likelihood of strategic bidding aimed at raising competitors' costs.

### 4.3 Pricing rule

39. Naturally, bidders want to maximise their surplus – that is, the difference between the value of the lots acquired and

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<sup>5</sup> For example, there may be a strategic value for one or more parties in bidding for this spectrum if H3GI were to bid for the lots, simply to slow down H3GI in moving to its long-term position in the band, or to increase the cost to H3GI of doing so.

the price actually paid for these lots. Therefore, their interest lies in winning the lots they bid for at the lowest price possible, provided that the price is no greater than their valuation of the lots. Depending on the price mechanism used, bidders may have incentives to shade their bids (bid below their full valuation) to ensure that they enjoy surplus from purchasing the item at a price below their valuation:

- *First-price* mechanisms require that bidders pay what they bid. In the context of a multi-round auction, bidders will only raise their bids if they need to (in order to outbid their rivals), and therefore will only need to bid an amount that is just above the valuation of their rivals. However, bidders will find it difficult to establish an optimal bid amount in the context of a sealed bid, where the valuations of rivals are not disclosed as part of the bidding process. In this context, bidders need to establish their bid amounts based on their expectations on the bids that other bidders will submit. If the expectations of bidders are wrong, then the auction process could result in an inefficient allocation of the lots.
  - *Second-price* mechanisms aim to remove this problem by establishing that a bidder will only be required to pay the minimum amount that would be required to outbid its rivals. Therefore, losers set the price to be paid by winners. Effectively, a second-price mechanism in a sealed-bid process will lead to the same outcome as a first-price multi-round auction in the scenario where bidders do not update their valuations in response to information revealed during the process. The advantage of second-price mechanisms is that they provide good incentives for bidders to bid their true valuations because this only affects their chances of winning, not the price they may have to pay. This removes incentives to bid below valuations and improves the likelihood of an efficient outcome.
40. The MBSA used a second-price rule to achieve the objective of an efficient allocation of spectrum. The properties of the

second-price mechanism also seem adequate for the current award, as the same objective applies.<sup>6</sup>

#### 4.4 Proposed auction format

41. In light of the considerations above, we consider that:
  - combinatorial bidding is desirable;
  - the auction process does not require an open stage; and
  - a second-price rule would be best suited for promoting efficiency.
42. Therefore, a sealed-bid, second-price, combinatorial auction of the three frequency-specific lots available seems appropriate for this award. Provided that frequency-specific lots are used, an assignment stage would not be required.

### 5 Reserve prices and spectrum fees

43. In this section, we provide a discussion on the minimum prices for the spectrum available.
44. Clearly, the design of the award process for the release of new spectrum rights of use for frequencies unassigned in the MBSA should not risk destabilising the outcome of the MBSA process, or introduce any advantages or disadvantages for those bidders that bid in the MBSA, as this could also undermine bidding incentives for any upcoming award processes. Therefore, it would seem appropriate that unassigned 1800MHz spectrum should be awarded under conditions that are consistent with those under which Liberalised Use Licences were awarded in the MBSA.

#### 5.1 Approach followed in the MBSA

45. The spectrum available in this award was already offered within the MBSA, with minimum prices that:

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<sup>6</sup> First-price sealed-bid processes may be appropriate in the scenario where there is a risk that bidders may restrict competition in the downstream market by excluding competitors. However, the structure of the downstream market cannot be expected to materially depend on the allocation of the spectrum available for this award. Therefore, there are no good arguments for deviating from the approach used for the MBSA.

- reflected a lower bound estimate of market value, to be charged to winners in the absence of competition; and
  - were in line with ComReg's objectives for the award.
46. In Annex 10 of ComReg's published Response to Consultation and Decision on Multi-band Spectrum Release (12/25a)<sup>7</sup>, ComReg noted that minimum prices in the MBSA would be appropriate:
- a) *To deter frivolous bidders without genuine business cases whose participation may prolong the auction process and waste resources;*
  - b) *To disincentivise and guard against uncompetitive auction outcomes, including those which could arise from anti-competitive collusive behaviour of potential bidders;*
  - c) *Encouraging efficient use and ensuring effective management of spectrum; and*
  - d) *To ensure that the administrative cost of the auction process is recovered.*<sup>8</sup>
47. In addition, ComReg also noted the factors that should inform the setting of the minimum price:
- a) *The minimum price should not give rise to or increase incentives for collusive behaviour;*
  - b) *The minimum price should not be set so high as to choke off demand;*
  - c) *The minimum price should not be set so low that there is participation by frivolous bidders;*
  - d) *The minimum price should not reflect any social option value; and*
  - e) *The administrative costs of running the award process should be recovered from the minimum price set.*<sup>9</sup>
48. In the MBSA, ComReg considered that it was in line with its statutory functions, objectives and duties to set a minimum price that reflected a lower bound estimate of the market value of the spectrum concerned and that it would be

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<sup>7</sup> ComReg, 16/03/2012, Multi-band Spectrum Release, Release of 800MHz, 900MHz and 1800MHz Radio Spectrum Bands, Annexes to ComReg Document 12/25.

<sup>8</sup> Paragraph A10.4 of 12/25a.

<sup>9</sup> Paragraph A10.5 of 12/25a.

appropriate to use international benchmarks to calculate these estimates.

## 5.2 Approach for setting minimum prices in the upcoming award

49. ComReg's objectives and constraints in awarding spectrum in the upcoming award are the same as in the MBSA. Therefore, it is appropriate to follow the same approach when setting minimum prices.
50. Arguments could be made that the minimum price for the upcoming award should be based upon the actual prices paid or outcome of the MBSA process. For the reasons outlined below, we are of the view that this would not be appropriate.
51. First, the approach used in the MBSA was not to set minimum prices that reflected an expectation of auction prices, but simply to safeguard against potential low competition scenarios. Setting a minimum price that reflected the actual outcome of the MBSA would be a clear departure from the approach used in the MBSA process.
52. Second, even if the actual price paid for spectrum won within the MBSA process was considered to be an appropriate mechanism for setting the minimum price in this award process, it should be noted that the MBSA used a combinatorial format, with prices that applied to *packages* rather than *individual lots*. Therefore, it is not possible to calculate a specific price for 1800MHz TS1 lots, as prices in the MBSA were for significantly larger spectrum packages.
53. Furthermore, concluding that the reserve price used in the MBSA was too high from the fact that the spectrum now available was previously offered in the MBSA and left unsold would be incorrect. All of the winning bids in the MBSA were above the reserve price for the package they related to, and therefore it would appear that the reserve prices of individual lots would not have been a constraining factor for



bidders in expressing their demand for additional lots.<sup>10</sup> Therefore, the fact that some lots went unsold might have been a consequence of the options available when selecting compatible winning bids from different bidders, rather than a result of reserve prices being set too high and choking off demand. Lowering reserve prices for unallocated spectrum where there is no clear evidence that reserve prices were set too high in the first instance could also set bad incentives for bidders in future competitive processes.<sup>11</sup> Furthermore, reducing minimum prices relative to those used in the MBSA could be discriminatory against Winning Bidders in the MBSA, which ComReg may wish to consider in relation to its regulatory obligations, but outside the scope of our report.

### 5.3 Adjustments to the minimum prices in the MBSA

54. Despite the fact that the MBSA was concluded relatively recently, one could argue that the minimum prices may need to be adjusted to reflect any additional international benchmarks from awards concluded since the MBSA, in order to ensure consistency with the international benchmarking methodology used in the MBSA. In particular, the 1800MHz band has become even more

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<sup>10</sup> Reserve prices were implemented to set the minimum price for each package, not as a minimum increment on the overall price of a package when adding additional lots. This meant that, provided that any bid amount was at least the reserve price for the package it related to, bidders were able to express incremental willingness to pay for individual lots below their reserve price and could still expect to win them if their demand fitted with the remaining winning bids. For example, suppose we have three lots available, with a reserve price per lot of €10; a bidder would have been able to bid €20 for a single lot and €22 for two lots, which reflects a value of €2 for the second lot (which is below the reserve price for the lot). As the objective of the winner determination in the MBSA was to maximise the value of winning bids to ensure efficiency, then an outcome where the bidder is allocated two lots would be preferable to that where the bidder receives a single lot.

<sup>11</sup> For example, bidders may have greater incentives to strategically reduce demand in the first process with an expectation that spectrum will go unsold and will be made available at a lower price, as the bidder might not only might win the smaller package at a lower price than if it competed for it, but may have the option to buy additional spectrum later at a relatively low price.

prevalent as a band for rolling out LTE in the past year.<sup>12</sup> Therefore, it may be the case that the value of having more liberalised 1800MHz spectrum at hand for launching and maintaining 4G services using this band has increased over the year.

55. However, the market value estimates underpinning the reserve prices in the MBSA have not changed significantly over the course of the year. Any adjustments to the reserve prices based on international benchmarking would be minor, as there are only very few new benchmarks that could be added to the analysis, and these generally lie within the estimates calculated for setting minimum prices in the MBSA.
56. Since the MBSA, India, the Netherlands Singapore, and Fiji have all auctioned 1800MHz spectrum. However:
- As in the MBSA in Ireland, the Netherlands used a CCA format to auction 1800MHz spectrum as part of its multi-band auction. No bidder won a package comprising only of 1800MHz spectrum; hence, it is not possible to derive 1800MHz benchmarks from the Dutch auction.
  - The average price of 1800MHz spectrum from the auctions in India, Singapore and Fiji is presented in Table 1.<sup>13</sup> However, these auctions were not particularly competitive, and are therefore unlikely to provide good information on market value. In India and Singapore, spectrum was awarded at or very near reserve prices (in India, over half of the spectrum offered in the auction went unsold, although it is not

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<sup>12</sup> According to the Global Mobile Suppliers Association (“GSA”), 1800MHz has emerged as the main band for LTE network deployments. 1800MHz spectrum is now used in over 43% of commercially launched LTE networks, with 84 commercially launched LTE1800 networks in 45 countries with at least another 23 network deployments planned, or in progress (see slide 5 and 10 of GSA’s “Global LTE Market Update”, 1 August 2013 available at: [http://www.gsacom.com/downloads/pdf/GSA\\_Global\\_LTE\\_Market\\_Update\\_010813.php4](http://www.gsacom.com/downloads/pdf/GSA_Global_LTE_Market_Update_010813.php4)). For the latest LTE1800 developments see <http://www.gsacom.com/lte1800>.

The emergence of LTE-Advanced Carrier Aggregation technology may also increase the importance of 1800MHz spectrum insofar as network operators will be able to combine different bands to supply even faster services. For example, see: <http://lteworld.org/news/telstra-and-ericsson-make-lte-advanced-call-1800mhz-and-900mhz-commercial-network>.

<sup>13</sup> For ease of comparability against the minimum price in the MBSA, we present the average price of a 2x5MHz lot from these auctions, adjusted to a duration of 15 years (as per the MBSA) and Irish population of 4.59 million.

clear whether this was due to high minimum prices or a lack of confidence in the Indian regulatory environment following various high profile disputes).<sup>14</sup> In Fiji, the low minimum prices were combined with a tight spectrum cap that meant it was not possible to allocate all of the spectrum available given the number of participating bidders.<sup>15</sup>

Table 1: New 1800MHz benchmarks<sup>16</sup>

Country	Average price of a 15-year licence for a 2x5MHz lot adjusted to Irish population (€ millions)
India	10.87
Singapore	9.19
Fiji	0.53

57. Overall, the few new 1800MHz benchmarks available do not suggest that the value of a long-term licence of 1800MHz spectrum has changed significantly from the value estimate of €10m for a 15-year licence of 2x5MHz of 1800MHz spectrum that was used for the MBSA. On the other hand, the reserve prices used in other international auctions

<sup>14</sup> 1800MHz licences controversially awarded in 2008 were annulled by a Supreme Court decision in 2012, leaving operators in a position where they would have to 'buy back' frequencies they had already acquired in the first process; Batelco and Etisalat exited the Indian market following the Supreme Court Order and did not take part in the auction. In addition, the TRAI imposed a substantial tax on operators with spectrum holdings exceeding 2x4.4MHz, which could have further discouraged bidding for 1800MHz in the auction (see [http://articles.timesofindia.indiatimes.com/2012-10-09/india/34342375\\_1\\_excess-spectrum-mhz-of-airwaves-frequencies-spectrum-allocation](http://articles.timesofindia.indiatimes.com/2012-10-09/india/34342375_1_excess-spectrum-mhz-of-airwaves-frequencies-spectrum-allocation)).

<sup>15</sup> Vodafone won six 1800MHz lots just above reserve while Digicel and new entrant Telecom Fiji Limited competed for the remaining 1800MHz spectrum, eventually winning three lots each. Final prices, however, were kept low relative to reserve, with competition being resolved in only a small number of rounds.

<sup>16</sup> As per the benchmarking analysis for minimum prices in the MBSA, prices have been converted from local currencies to Euros using 2012 Price Purchasing Parity (PPP) exchange rates from the World Bank's World Development Indicators database. 2013 PPP exchange rates are not yet available from the World Bank. Licence duration adjustments are also consistent with the benchmarking analysis for minimum prices in the MBSA. For more details, see Section 10.5.1 of DotEcon Report for ComReg, Dec 2009, *Liberalisation of spectrum in the 900MHz and 1800MHz bands*, Document Number 09/99c.

selling 1800MHz spectrum are consistent with the minimum prices set for the MBSA.

58. Given that nothing has materially changed in market circumstances since the MBSA, there is no reason to deviate from the reserve prices used in the MBSA, except for any necessary adjustments to take account of inflation and of the different start date and duration of any new spectrum rights of use issued.

## 5.4 Proposed Minimum Fees

59. Table 2 below presents the reserve prices and SUFs for the spectrum made available in the MBSA. These were set by reference to a market value reflecting a minimum price of €20m for a 15-year licence of sub-1GHz spectrum and €10m for a similar 1800MHz licence. The minimum price was halved between the upfront reserve price and annual Spectrum Usage Fees (SUF) components.

*Table 2:  
Breakdown of  
reserve prices and  
SUF*

Spectrum	TS1 upfront payment	TS2 upfront payment	Annual SUF
800MHz	€2.55m	€8.26	€1.08m
900MHz	€2.55m	€8.26	€1.08m
1800MHz	€1.27m	€4.13m	€0.54m

60. The split of upfront reserve prices and SUFs used in the MBSA is aimed at ensuring the optimal use of spectrum over the term of the licence. This objective is still applicable to the relevant spectrum licences, though admittedly of less importance overall given that the resulting licences will have a relatively short duration. Applying the same reserve/SUF split ensures consistency between the upcoming award and the MBSA.
61. Annual SUFs for the MBSA were calculated on the basis of a "Net Present Value" (NPV) adjustment. In Annex 10 of ComReg's published Response to Consultation and Decision on Multi-band Spectrum Release (12/25a) ComReg decided

to use a real discount rate of 8% for this calculation.<sup>17</sup> This calculation is illustrated in Box 2 below.

*Box 1: Reserve price and SUF calculations*

**Notation**

$MP_{15year}$ : Minimum Price of a 15-year licence

$MP_{TS1}$ : Minimum Price of a Time Slice 1 licence

$MP_{TS2}$ : Minimum Price of a Time Slice 2 licence

$DF_{TS1}$ : NPV Discount Factor for Time Slice 1 licence

$DF_{TS2}$ : NPV Discount Factor for Time Slice 2 licence

$DF_{15years}$  : NPV Discount Factor for a 15-year period

**Calculations**

Time Slice 1 has a duration of 2.5 years (Feb 2013-Jul 2015) and Time Slice 2 has a duration of 15 years (Jul 2015 – Jul 2030) and the discount factors are calculated as follows:

$$DF_{TS1} = 1 + \frac{1}{(1+8\%)} + \frac{0.5}{(1+8\%)^2}$$

$$DF_{TS2} = \frac{0.5}{(1+8\%)^2} + \sum_{n=3}^{16} \frac{1}{(1+8\%)^n} + \frac{0.5}{(1+8\%)^{17}}$$

$$DF_{15years} = \sum_{n=0}^{14} \frac{1}{(1+8\%)^n}$$

$$MP_{TS1} = MP_{15year} \times \frac{DF_{TS1}}{DF_{15years}}$$

$$MP_{TS2} = MP_{15year} \times \frac{DF_{TS2}}{DF_{15years}}$$

$$\text{Reserve price of time slice 1} = 0.5 \times MP_{TS1}$$

$$\text{Reserve price of time slice 2} = 0.5 \times MP_{TS2}$$

*Annual SUF*

$$= \left\langle \frac{0.5 \times MP_{15years}}{DF_{15years}} \mid \frac{0.5 \times MP_{TS1}}{DF_{TS1}} \mid \frac{0.5 \times MP_{TS2}}{DF_{TS2}} \right\rangle$$

<sup>17</sup> ComReg, 16/03/2012, Multi-band Spectrum Release, Release of 800MHz, 900MHz and 1800MHz Radio Spectrum Bands, Annexes to ComReg Document 12/25, paragraph 10.125.

*Box 2: Reserve price and SUF calculations*

62. The unassigned 1800MHz rights to be offered would run at most from February 2014 to July 2015. Therefore, the duration of any licences would be no longer than 1 year and 6 months (or approximately 1.5 years). This is obviously a shorter duration than Time Slice 1 in the MBSA.
63. The annual SUFs are unaffected by the overall duration of the licence, and therefore need no adjustment save applicable pro rata adjustments to reflect a SUF period of less than one year. However, reserve prices should be adjusted to take into account the different start date and shorter licence duration. The calculation for this adjustment is illustrated in Box 2 below.

Box 3: Reserve price and SUF for unassigned 1800MHz rights

**Notation**

$MP_{Unassigned1800}$ : Minimum Price of a licence running from Feb 2014 till Jul 2015 (1.5 years)

$DF_{Unassigned1800}$ : Discount Factor for a period of 1.5 years

**Calculations**

$$DF_{Unassigned1800} = 1 + \frac{0.5}{(1 + 8\%)}$$

$$MP_{Unassigned1800} = MP_{15year} \times \frac{DF_{Unassigned1800}}{DF_{15years}}$$

$$\begin{aligned} \text{Reserve price of Unassigned 1800MHz} \\ = 0.5 \times MP_{Unassigned1800} \end{aligned}$$

$$\text{Annual SUF} = \left( \frac{0.5 \times MP_{Unassigned1800}}{DF_{Unassigned1800}} \right)$$

64. Applying this adjustment yields an upfront reserve price of **€0.791m** for a licence of 1.5 years. The applicable annual SUF is **€0.54m/year** as per the Time Slice 1 and 2 licences. Both the reserve price and SUF are expressed in 2012 prices, and need to be adjusted for inflation accordingly.

Table 3: CSO CPI between June 2012 and 2013<sup>18</sup>

June 2012 CPI	101.2
June 2013 CPI	101.9
Inflation between June 2012 and 2013	0.7%

65. According to the CSO, prices rose by 0.7% between June 2012 and June 2013. The reserve price of €0.791m in June 2012 prices is therefore equivalent to **€0.797m in June 2013 prices**. We propose that the reserve price be readjusted to September 2013 prices once CSO data becomes available. The proposed fees for the spectrum being made available as part of the current award are summarised in Table 4.

Table 4: Proposed minimum licence fees

Reserve Price	€0.797m + CPI Adjustment*
Annual SUF	€0.54m + CPI Adjustment**

\* This Reserve Price is in June 2013 prices and will be readjusted to September 2013 prices once CSO data becomes available.

\*\* In line with the MBSA process, the CPI adjustment to the first SUF payable should use 1 February 2013 (i.e. the commencement date of the Liberalised Use Licences) as the starting date for the calculation of the CPI.

<sup>18</sup> See:  
[http://www.cso.ie/en/media/csoie/releasespublications/documents/latestheadlinefigures/cpi\\_jun2013.pdf](http://www.cso.ie/en/media/csoie/releasespublications/documents/latestheadlinefigures/cpi_jun2013.pdf)