



An Coimisiún um  
**Rialáil Cumarsáide**  
Commission for  
**Communications Regulation**

# **Response to Consultation and Draft Decision on the Release of the 400 MHz Sub-band**

## DotEcon Assessment of Responses to Document 18/92

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Assessment of  
responses to ComReg  
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18/92

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# 1 Introduction

On 31 July 2017 ComReg published Document 17/67, a consultation document on its proposal to release spectrum in the 410 – 415.5 MHz sub-band. This set out ComReg’s high level views of potential uses for the spectrum as well as its initial proposals for the award.

Subsequently, on 24 October 2018, ComReg published a further consultation document, ComReg Document 18/92, which took into account the comments received on Document 17/67 and provided more detailed proposals for the award process. Alongside this consultation document, ComReg published supporting reports prepared by DotEcon (document 18/92a), offering recommendations on a suitable award process, and by Plum (document 18/92b), considering the technical characteristics of the 400 MHz band and the potential uses.

Stakeholders were invited to submit comments on these documents. ComReg received responses from:

- Nokia;
- the 450 MHz Alliance;
- Northern Ireland Electricity Networks (NIEN);
- Huawei;
- The Joint Radio Company (JRC);
- ESB Networks (ESBN);
- EirGrid; and
- WPD.

In general, the responses have been broadly positive in relation to proposals for the award process, although some concerns and suggested amendments have been raised. In this document, DotEcon (as ComReg’s expert economic adviser) sets out its assessment of the comments in these responses concerning matters raised in relation to the proposed award format. In particular, this report considers the comments submitted on:

- the mode of operation;
- licence duration;
- opportunity cost pricing;
- the WACC used for calculating SUFs; and
- the lot structure.

## 2 Licence duration

### 2.1 Comments received

Six of the eight respondents believe that the proposed 15-year licence term is too short.

The main argument appears to be based on the premise that a 15-year licence term does not suitably reflect the long investment cycles in the utility sector. Deployment and investing in a utility network is expensive, and the returns are much lower than those achieved by commercial services. This means that:

- full network deployment may take a long time, due to the need to raise capital for investment to continue (ESBN claims that it could take a number of years to deploy a smart grid network, since spectrum users other than MNOs do not have access to the same levels of capital, which means that full rollout requires benefits to be accrued in order for continued deployment); and
- since revenue streams are smaller than for commercial mobile operators, a greater length of time (compared with more standard mobile licence terms) is required to make a reasonable return that would justify the investments.

On the basis of the points above, the respondents therefore argue for a longer licence duration. Suggestions are mostly in the 20-25 year range, although EirGrid suggests 25-30 years and ESBN argues for indefinite licences (or at least 25 years) to support long term decisions over smart grid development. ESBN further claims that since ComReg has identified smart grid as the best use of the spectrum, and reasonable access to other utilities will be a part of the licence conditions, there is less need to keep licences short in order to reassess the most efficient allocation so often.

A number of respondents also highlight the need for clarity around the process for licence renewal, arguing that uncertainty might impact on incentives to invest in the network (especially towards the end of the licence). In particular:

- the 450 Alliance considers that a method for extending the licences at the end of the licence term should be clearly set out in advance of the award to avoid the uncertainty becoming a disincentive to invest in the network after a particular point (e.g. 10 years into the licence); and
- Huawei highlights its belief that users of the spectrum would wish to continue operations beyond the initial licence expiry date, and that to remove uncertainty for the operator ComReg should provide clarity in advance over the approach to licence renewal.

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## 2.2 DotEcon Assessment

We fully agree with comments to the effect that asset lifetime in the utility sector are likely to be significantly longer than the proposed 15-year duration of the licence. Indeed, some assets may have much longer economic lives (for example, electricity distribution transformers might last 35 years). However, asset lifetimes will vary across different types of assets.

There is no necessity that the lifetime of spectrum licences used in the support of utility networks have similar duration to the (varied) economic lives of the assets used in those networks. Indeed, over a 30-year horizon, we might expect to see significant changes in the ways in which data connectivity needed to support utility networks is supplied and used. Bandwidth requirements are likely to grow, but also there may be increased capabilities for use of remote computing to summarise sensor data. The reliability of public mobile networks is likely to improve significantly with 5G, providing additional options.

Spectrum, especially below 1 GHz, is a physically-limited scarce resource. Therefore, it is appropriate for ComReg to consider the potential future opportunity costs that might arise if reconfiguration of spectrum usage is inhibited.

Therefore, for a utility provider choosing to invest in its own spectrum licence, we do not consider that the lifetime of long-lived utility network assets is the relevant factor. Rather, such a decision should take into account both changing requirements and other potential means of delivering connectivity that might become available. The assets used to deliver connectivity over spectrum (i.e. the radio access network and supporting infrastructure) are likely to have a much shorter lifetime due to technical changes than would longer-lived utility assets.

Regarding ESNB's suggestion for indefinite licences, we do not agree that this would be the best approach. Whilst there may be valid arguments for a longer licence duration, we do not consider it appropriate for the licensee(s) to hold an indefinite claim on the licences for a valuable public resource. Technology advancements and changing spectrum requirements mean that it may be appropriate for ComReg to periodically reassess frequency assignments in order to ensure long term efficiency, especially as changing patterns of spectrum use may require coordination of many parties. If licences were to be awarded without an expiry date, there would need to at least be some mechanism by which ComReg could reclaim the frequencies in the event that an alternative assignment could be reasonably considered better. In this case, indefinite licences would seem to offer little advantage (in terms of security for operators) compared with finite licences, noting that a limited licence duration does not preclude the possibility for licence

renewals/extensions in the future if considered appropriate by ComReg. Provided long-run expectations are appropriately managed (to support investment decisions and long-term planning by operators), we do not see any particular reason to assign licences on an indefinite basis.

This said, concerns about licence renewal process and the uncertainty this might create have been raised by some respondents. However, ComReg has established a clear approach through its spectrum awards to date. Incumbent holders of expiring licenses can expect licences to be re-awarded in a timely manner (usually significantly before expiry of any existing licence), subject to there being any need to reconfigure bands or modify licence conditions to reflect updated technical requirements or new public policy objectives. Existing licensees would have fair opportunity to compete for new licences, but cannot expect to receive protection from competition for that spectrum, as retaining expiring licences would only be efficient providing that there are no other users with greater value for that spectrum. Therefore, licensees retaining spectrum beyond their initial term can expect to pay a market-determined price for access to that spectrum; indeed, if this were not the case, other potential future users of that spectrum might have legitimate cause for complaint.

Therefore, whilst licensees necessarily face some risk about licence renewal, they can assume that (i) extensions will be made available where possible in a timely manner and (ii) that they would not face any financial risk of being “locked in” to that spectrum and paying an excessive price for renewal, as if they were successful in retaining that licence, any subsequent spectrum fees paid by the incumbent would be determined by the value of that spectrum to *other* users, not the value to the current user.

Whilst there are some adverse incentives created to investment from excessively short licences, there is a trade-off to be struck with ComReg’s broader concerns about maintaining options for future spectrum management. We do not see that this trade-off is significant different for this band to other bands awarded by ComReg. For these reasons set out above, we do not consider that arguments about alignment with network utility asset lifetimes are compelling. Therefore, we recommend that ComReg maintain its typical approach to setting licence duration.

## 3 Opportunity cost pricing

### 3.1 Comments received

The reaction to the proposed auction format has been largely positive, with the majority of respondents explicitly highlighting their support for the proposals or not making any comment.

However, one comment was submitted by ESNB in relation to the pricing rule, which we address in this section. ESNB suggests that the upfront fees (established during the auction process) should be determined using an opportunity cost based pricing rule. It claims that this would be in line with other recent auctions run by ComReg, and would be in line with meeting ComReg's objectives for the award whilst ensuring that winning bidders do not overpay.

### 3.2 DotEcon assessment

We highlight first that the proposed minimum prices for this award are set at a very low level in order to reflect the uncertainty over the value of the spectrum and to avoid leaving it inefficiently unsold. No respondents objected to the overall level of the minimum prices and those that commented were in support of the amounts proposed (notwithstanding ESNB's comments on the annual fees, discussed below). We do not believe that there should be any cause for concern over the level of the prices to be paid under the proposed rules, and we do not see any strong need for additional rules aimed at minimising prices further.

We also consider that there are other specific arguments for not introducing an opportunity-cost pricing rule. The proposed auction format is a clock auction with exit bids and a combinatorial closing rule, which as standard would require winning bidders to pay the amount they bid for the lots they win. These winning bid amounts are established through incrementing prices round by round in order to find a market clearing level (with exit bids and combinatorial closing helping to improve efficiency). Winners are therefore not necessarily (and will be unlikely) required to pay their full valuation for the lots they win, but will pay only up to the level required to beat competing demand (subject to the auction rules).

This format is different to the those used by ComReg for other recent awards i.e. the combinatorial clock auction (CCA) for the MBSA and 3.6 GHz award, and a sealed bid combinatorial auction (SBCA) for the recent 26 GHz award. With both the CCA and the SBCA there is a sealed-bid component where bidders express the *maximum* they are willing to pay for each package of lots they might



be interested in; efficiently determining the optimal allocation relies on these bids accurately representing the bidders' true valuations, and an opportunity cost pricing rule helps to incentivise this. Therefore, bidders tend to bid at value, but the opportunity cost pricing rules means that they only pay what is necessary to win.

Use of a pay-as-you-bid pricing rule within an open auction for the 400 MHz award is not in itself a deviation from ComReg's typical approach. It is the result of using a different auction format that is more suited for this particular award (as discussed in our auction design report). The pay-as-you-bid rule combined with multiple rounds should still result in paying in line with opportunity cost, as bidders only need to out-bid competitors.

We emphasise that the combination of a simple clock auction with an opportunity cost pricing rule (as suggested by some respondents) is incoherent from an auction design perspective. In a simple clock auction that does not use exit bids or a combinatorial closing rule, opportunity cost-based pricing would not be feasible as only current round bids are used for determining winners and there would be insufficient information in previously submitted bids to reasonably establish opportunity cost. An opportunity cost pricing rule is used in CCAs and SBCAs specifically to incentivise many bids for different packages to allow efficient allocation in situations where there are complex structures of lots; this issue is absent here.

It is important to note that in the single item case (i.e. as the first auction with the single Part A lot), there is little difference between the price that would be achieved with the proposed rules and an alternative format applying an opportunity cost rule. Bidders would continue to bid for the item in each round until the round price exceeds their valuation, at which point they would reduce demand to zero, possibly submitting an exit bid at the same time. The auction will end when the round price exceeds the second highest bidder's valuation, and the winner will pay the prevailing round price (or its exit bid if it also dropped demand). In a single item auction, the opportunity cost of assigning the item to the winner is equal to valuation of the second highest bidder; the closer the winning bid is to the second highest bidder's valuation, the closer the price to be paid by the winning bidder will be to opportunity cost, and the difference between the two will be *at most* one price increment above the second highest valuation. Therefore, paying at opportunity cost is an emergent feature of the simple clock auction.

The issue is therefore largely only relevant for the Part B auction. With multiple items, the situation is not quite as straightforward as the single item case, and opportunity cost pricing might make a difference in some cases where bidders have strong complementarities across lots. However, it still applies that under the proposed rules, prices are increased incrementally and winners will only need to keep bidding until excess demand is resolved (in accordance with the combinatorial closing rule) rather than at their

full valuation. We therefore do not believe that opportunity cost pricing will make a particularly large difference to the prices to be paid by winners. Moreover, relative to a simple pay-your-bid rule, implementing an opportunity cost rule introduces significant complexity to the award, both in terms of implementation and for bidders to fully understand. As discussed in our previous report, we consider it important for this specific setting to keep the auction format as simple as possible. On that basis, and since we do not envisage opportunity-cost pricing to make a material differences to the prices paid, we are not convinced that the additional complexity would be justified by the potential benefits.

For these reasons we do not propose to change the pricing rule proposed.

## 4 Minimum prices

### 4.1 Comments received

The majority of respondents appear to be in favour of the proposals for the minimum prices and the 40:60 split between the upfront spectrum access fee (SAF) and the annual spectrum usage fees (SUFs), either offering their support or not commenting. The only suggested amendment to the minimum prices came from ESNB.

ESNB agrees with the proposals to charge an upfront SAF and annual SAFs, and supports the proposed 40:60 split, but believes that the weighted average cost of capital (WACC) used as the discount rate for calculating the SUFs is not set at the relevant level. It argues that 8.63% is suitable for spectrum releases for MNOs as it reflects the “*equity returns required from private operators in the telecommunications market*”, but not for this award where the circumstances are different. Instead, it believes that a more appropriate WACC would be 4.95%, as calculated by CRU for investments in Network Infrastructure. Given this, the annual SUFs should be lowered from €39,000 to €32,000.

### 4.2 DotEcon Assessment

By way of context, we re-emphasise that minimum prices are not intended to represent estimates of the market price of spectrum, but rather be set such that there is a low probability that minimum prices exceed market prices. Therefore, to the extent that there is uncertainty about estimates of market value, or there is the potential to make alternative assumptions, this is already reflected in the generally conservative approach we have adopted in recommending minimum prices.

The WACC used to calculate the discounted SUFs is based on ComReg’s current estimate of a typical (nominal and pre-tax) mobile WACCs i.e. 8.63%. We accept ESNB’s argument that this might not be a suitable rate for applying to a utility network, in particular as commercial mobile revenues are likely to be less stable and more correlated with the state of the economy, leading to a higher beta and a higher cost of capital than a utility network.

In determining SUFs, there are a number of potential users/uses for the Part B spectrum who could have very different costs of capital. The SUFs clearly cannot be differentiated for different types of user, as they must be set prior to the auction and known to bidders to be considered as part of their valuation of a spectrum licence. For a given minimum price, which is the discounted value of the auction

reserve price (i.e. the minimum SAF) and annual SUFs, using a lower discount rate gives lower SUFs.

However, a key function of the SUFs is to provide an incentive for licensees to vacate spectrum where they have little value for it, and setting the SUFs too low would compromise this benefit. Therefore, the main trade off in setting SUFs is between encouraging spectrum that is not being efficiently used to be vacated, and the risk of setting SUFs too high and causing a licensee to inefficiently vacate spectrum.

Because of uncertainty, in our view minimum prices are already conservatively set, with the consequence that using a lower cost of capital for calculating the split of a minimum prices between a reserve price and annual fees could lead to SUFs that would not provide an effective incentive for vacating spectrum that the licensee had little value for.

Moreover, there is a reasonable case for using a cost of capital similar to that of a commercial mobile operator for the purpose of determining the SUFs, as although this would not be how the spectrum would be likely be used, it would represent a potential alternative use for that spectrum. The intention of the various spectrum charges – both SAFs and SUFs – is merely to ensure efficient use of that spectrum, which typically requires charges to be determined not by the value of spectrum to the user, but by the value to potential alternative users.

Bidders can take into account their own individual WACC in the bids they submit during the auction(s) to ensure that the overall price they would pay (SAF plus SUFs) is reflective of their valuation for the spectrum, and small differences between individual WACCs and the WACC used for determining the SUFs should not have any material impact on the ability of different users to compete in the award, particularly when minimum prices have already been set conservatively. Moreover, deferring payments by putting more of the total fee into the SUFs, as would be the case with a higher WACC, would support rather than hinder bidders with limited funds or uncertainty over valuations.

On this basis we do not see any particular need to adjust the proposed SUFs based on a lower WACC and propose to apply the minimum fees as set out in our previous report.

## 5 Lot structure

### 5.1 Comments received

The proposals set out in the consultation document were to allocate 2x3 MHz of spectrum as a single frequency specific lot dedicated to smart grid, and the remaining 2x2.5 MHz as 2x100 kHz frequency generic lots (with specific frequency assignments automatically generated after the award). In general, the responses to consultation appear to support these proposals, although two alternative approaches were suggested:

- Nokia agrees that 2x3 MHz is ideal for smart grid services but highlights that the standards would allow for a different partitioning that would “*create a more narrow LTE subsystem that could serve adjacent Utility needs (Electricity AMI, Water, Gas)*”. In particular, Nokia suggests that the spectrum could be partitioned as follows:
  1. 2x3 MHz (LTE) for Utility designation;
  2. 2x1.4 MHz (LTE); and
  3. 2x1.1 MHz for Narrow Band Designation.
- Huawei believes that the lot size for Part B (the frequencies not reserved for smart grid) should be 200 kHz or larger, although no reason for this is provided.

### 5.2 DotEcon Assessment

Before addressing the suggestions from Nokia and Huawei, we note our understanding that ComReg has decided to reduce the amount of Part B spectrum available for the award by 1.5 MHz. In this case there will be a total of 2x4 MHz available for the award, split into:

- a single 2x3 MHz lot reserved for smart grid (Part A, as previously proposed); and
- ten 2x100 kHz lots (Part B) to be awarded on a service and technology neutral basis.

Given the reduced amount of Part B spectrum, the split proposed by Nokia is no longer feasible. However, even if the full 2x5.5 MHz were still available we would not recommend splitting the spectrum as suggested. It is unclear to us whether Nokia is proposing to reserve the 2x1.4 GHz block for a particular use/user. If that is the suggestion then we reiterate our opinion expressed in our previous report that the 2x3 MHz reservation should be sufficient for a smart grid network (that could be used by all utilities), and there should be no need for a larger reservation (either as part of the same lot or as a second reserved lot). In any case, the proposed lot structure would

not have precluded another bidder from acquiring a 2x1.4 MHz assignment, since bidders are able to bid for any number of the available Part B lots in accordance with their bandwidth requirements. Therefore, if a particular bidder (such as a potential second utility network operator) wished to acquire 2x1.4 MHz, it would have been able to do so provided it was able to compete with other sources of demand.

In relation to Huawei's suggestion that the Part B lots should be made available as 2x200 kHz lots, we highlight that:

- bidders are able to bid for any number of the 2x100 kHz Part B lots available; and
- the proposed auction format supports package bidding, so a bidder will never win a subset of the lots it bid for at a particular price.

Therefore, if a bidder is only interested in bandwidths that are a multiple of 2x200 kHz, it can choose to bid only for even numbers of lots without risk of ever winning an odd number.

The only reasons to increase the size of the lots above the proposed 2x100 kHz bandwidth as suggested would be that either:

- there is no potential demand for lots that are smaller than 2x200 kHz, in which case using smaller lots is pointless; or
- the number of lots resulting from use of a particular bandwidth is very large and creates unmanageable complexity for the auction.

Neither of these arguments are applicable, given that:

- there is potential for demand from PMR users with a minimum bandwidth requirement of 2x100 kHz, as indicated in the previous report by Plum Consulting<sup>1</sup>; and
- with 2x1 MHz of Part B spectrum available, using 2x100 kHz lots would likely result in 10 lots for the second auction (or 40 lots in the unlikely scenario that the smart grid spectrum went unsold) which is certainly manageable from both the auctioneer and bidder perspective.<sup>2</sup>

Given these points, we recommend keeping to the proposed 2x100 kHz lot size for Part B in order to maximise flexibility for bidders to bid according to their specific bandwidth requirements.

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<sup>1</sup> ComReg document 18/92b

<sup>2</sup> As discussed in our previous report, even if the full 2x5.5 MHz were still available there would be 25 Part B lots if the Part A lot was sold, and 55 lots if not; neither of these cases would have been particularly problematic.