An Coimisiún um
Rialáil Cumarsáide
Commission for
Communications Regulation

Proposed Multi Band Spectrum Award

Including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands
Non-Confidential Submissions to Consultation 19/59R and other relevant material

Response to consultation and further consultation

Reference: ComReg 19/124g

An Coimisiún um Rialáil Cumarsáide
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1 Non-Confidential Submissions to Consultation 19/59R

1.1 Dense Air

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Commission for Communications Regulations
One Dockland Central
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Ireland

30 July 2019

Dear Sirs,

Dense Air Submission to ComReg 19/59
Proposed Multi Band Spectrum Award consultation

On behalf of Dense Air Ireland Limited, we thank you for the opportunity to comment on the above consultation.

Dense Air Ireland Limited

As explained in the 18/60 consultation, Dense Air Ireland Limited (DAI), part of the Dense Air Group has been established by Airspan Networks to acquire dedicated spectrum assets to offer a neutral-host "whole-sale" operator small cell network service to support 5G evolution.

At time of writing, Ireland is one of 5 country regions where Dense Air has acquired spectrum, others include Australia, Belgium, Portugal and New Zealand with further planned.

Our group mission is based on the premise that true 5G service concepts depend on massive "densification" of evolving mobile networks.

Since August 2017, Dense Air has been developing plans to build and operate a wholesale neutral-host shared network using small cell architecture to provide network densification as a service to mobile network operators (MNOs) in Ireland.

Our Dense Air business approach includes small cell products of the type being mass deployed by Sprint in the USA and Reliance Jio in India where there are dramatic efficiency improvements, faster deployment times, lower capital and operating cost and better end customer experience.

Small cell architecture and deployment based on the Dense Air managed service approach in dedicated spectrum is proven to address the need for "massive densification" of mobile networks to help accelerate 5G evolution in Ireland.

The evolution towards 5G service concepts is not possible without "massive densification" of mobile networks and small cell architecture provides the planned mechanism to provide this densification.

Specifc comments on spectrum bands potentially suitable for WBB

As stated in our earlier submission for "macro" bands like 700 MHz and 1.4 GHz, Dense Air believe that these spectrum assets are best utiilised by Ireland's existing Mobile Network Operators.

We continue to believe that TDD spectrum in 2.3 GHz and 2.6 GHz bands will promote the rapid deployment of pervasive 4G LTE and support mass deployment of both Standalone and Non-Standalone 5G networks.

In this regard, Dense Air continue to implement and execute plans to offer innovative Neutral Host managed services to Irish operators based on the mid-band spectrum frequenices currently available and to be made available in future declared auctions, in order to deliver cost effective ways to extend and densify existing mobile and fixed wireless networks.

Specific comments on Band Specific Developments

We believe the 2.3 GHz and 2.6 GHz TDD eco-system can be used to enhance and extend service in Ireland on a very cost effective basis.

2.3 GHz is currently one of most deployed mid-bands spectrums for 4G services, with massive deployment across the global including Europe and Asia, with a wide and extensive eco-system that enables low cost services in both Mobile and Fixed Wireless solutions. The release of additional spectrum in this band (2300 MHz to 2390 MHz) will enables operators to economically add capacity and extended coverage to their networks.

For 2.6 GHz (Band 38), is also happening at scale in other countries, especially in Japan and North Amercia. Over 250,000 indoor small cells have been deployed in the USA and over 20,000 outdoor small cells, on poles and/or cable strands.

We believe the 2.3 GHz and 2.6 GHz TDD eco-system can be used to enhance and extend service in Ireland on a very cost effective basis and we support ComReg's decision to make additional spectrum available in the proposed future auction.

We also believe it would be best to award **national** licenses for the 2.3GHz and 2.6GHz bands to align with the need for 5G evolutions in rural and urban areas of Ireland.

Conclusion

> **Dense Air fully supports a spectrum award process and is encouraged that ComReg plans to facilitates the release of additional spectrum in the 2.3 GHz and 2.6 GHz. This will allow innovative operators, which complements the allocations at 3.6 GHz for 5G NR, to deliver Neutral Host managed services to deliver, cost effective ways to extend and densify existing mobile and fixed wireless networks.**

Yours sincerely,

Paul

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1.2 Eir

eir

Response to ComReg Consultation:

Proposed Multi Band Spectrum Award

ComReg Document 19/59R

7 August 2019

DOCUMENT CONTROL

Document name	eir response to ComReg 19/59R
Document Owner	eir
Status	Non-Confidential

The comments submitted in response to this consultation document are those of Eircom Limited and Meteor Mobile Communications Limited (trading as ‘eir’ and ‘open eir’), collectively referred to as ‘eir Group’ or ‘eir’.

Introduction

eir welcomes the opportunity to respond to ComReg's Consultation in relation to the proposed Multi Band Spectrum Award (MBSA2).

eir notes that the present consultation addresses the issue of auction format, but not the detail of the auction rules that would apply if any particular auction format were selected. There is for example no discussion or analysis of potential alternative auction rules (noting that for all the analysed auction formats, a range of alternative auction rules have been used or proposed by regulators in other countries). Moreover the current consultation does not provide a complete description of any specific set of rules for any of the auction formats considered (for example there is no detailed proposal for how the activity rules would work in a Combinatorial Clock Auction (CCA) given the potential existence of both two time slices and 700MHz lots that would not be time-sliced, as proposed by ComReg).

Nor does the current consultation provide draft text to support the proposed licence conditions. eir reserves its position to comment further and / or alter its position on matters considered in this response when precise specifications of proposed obligations are made available for consultation.

For the avoidance of doubt, eir believes that ComReg will have to consult again on the details of the auction rules that it intends to use for the auction before the publication of its draft IM and the draft licences. eir reserves the right to comment on or object to those proposed rules and conditions, whether they remain the same as those outlined in the current consultation or differ from them, and would expect ComReg to take any such comments or objections fully into account before ComReg publishes its draft IM.

Spectrum bands proposed for the award

eir notes ComReg's proposal to include the 700 MHz Duplex, the 2.1 GHz Band, the 2.3 GHz Band and the 2.6 GHz Band in the Proposed Award. eir does not agree that the 2.1GHz band should be included in the Proposed Award as its circumstances are materially different to the other bands. The 2.1 GHz spectrum is in use and integral to the operation of the mobile networks in Ireland. Its proposed inclusion is unfair and due to the need for time-slicing in the 2.1GHz band, introduces unnecessary complication into the award process. This is particularly the case when ComReg proposes to extend time-slicing to all the above 1GHz spectrum bands.

The 2.1 GHz band is important because over the years operators have acquired sites in locations to optimise network performance at 2.1 GHz. If an existing operator fails to acquire 2.1 GHz spectrum

in the proposed award it may be forced to migrate to the 2.6 GHz band resulting in a need for alternative and / or additional base station sites to provide an equivalent level of geographic coverage. This would not be an efficient outcome but is a possibility with the highly complex auction and liberal overall spectrum caps currently proposed by ComReg. The auction design must be simplified significantly and/or continuity of service for all existing licensees in the 2.1 GHz band addressed though alternative mechanisms as discussed below.

eir is disappointed that neither ComReg nor DotEcon has properly assessed the concerns regarding fairness previously raised by eir. Instead ComReg (see ¶ 3.94) seeks to sweep the concerns away on the basis that eir and Three have diametrically opposing concerns and these in some unexplained way cancel each other out. It remains the case that eir is at a different point in the investment cycle of its current licence relative to Three and Vodafone who have fully paid off their spectrum access fees and are able to maximise their return on investment on the 3G licences. We believe that ComReg (see ¶ 3.91) has erred by being overly reliant on DotEcon's superficial assessment that all bidders are equal in what is essentially a 2.1 GHz licence renewal auction.

As ComReg acknowledges the existing operators will continue to use the 2.1 GHz for some time to come and will likely re-purpose use of the band over time. A more proportionate approach would be to directly assign 2x15MHz to each of eir, Three and Vodafone for the period covered by the proposed award (assuming ComReg continues to see value in making the 2.1 GHz spectrum co-terminus with the greenfield spectrum in the proposed award). The remaining 2x15MHz, available on expiry of Three's A or B licence (whichever it decides) could be included in the proposed award without the need for time-slicing. The outcome of the award in respect of these 3 lots would provide a reference point for the fees to be applied to the directly assigned spectrum.

ComReg appears to argue (see ¶ 4.106) that all of the 2.1 GHz band must be included in the proposed award because there is insufficient time to do something different. This is not an acceptable justification. eir's proposal above, which ComReg has not previously considered, addresses concerns raised in its assessment as the 3 lots included in the proposed award could also be of interest to new entrants (see ¶ 4.171) and provide a reference for pricing of the assigned rights (see ¶ 4.172-4.176).

Spectrum for Broadband Public Protection and Disaster Relief (BB-PPDR)

eir agrees with ComReg's summary view (see ¶ 2.36 to 2.37) to include the full 2x30MHz of the 700MHz Duplex in the proposed award as spectrum requirements for BB-PPDR can be addressed separately, including use of commercial services as is the case in a number of Member States.

Cybersecurity

eir notes the references (see ¶ 2.52) to the 'Union toolbox' for cybersecurity and expects that there will be due consultation at the appropriate time should ComReg feel it necessary to include any related measures in the proposed award process, for example in the terms of the rights of use.

2.1 GHz licences in the proposed award

The following comments are without prejudice to eir's view that some of the 2.1GHz spectrum should be administratively re-assigned to the existing licensees. The inclusion of all of the 2.1 GHz spectrum in the proposed award will have distortionary effect unless changes are made.

eir is supportive of the proposal whereby Three may request to have its licences extended to 15 October 2022, subject to the terms and conditions, including payment of appropriate fees, as set out in Annex 5 of the consultation. This is necessary to reduce the distortionary effect of introducing time-slices. Ideally steps should be taken to eliminate the need for time-slices. This could be achieved through eir's proposal above where only part of the 2.1 GHz band is made available in the award.

However if all future rights for 2.1 GHz are to be determined by auction then it will be necessary that two time-slices are applied. The first time-slice running from 16 October 2022 to 11 March 2027. The second running for the remainder of the licensing period for the spectrum in this award. We note ComReg's observation (see ¶ 5.17) that "*DotEcon advises that the proposed inclusion of 2.1 GHz Band necessitates the use of "time slices" to enable the assignment of the full 2×60 MHz and to also allow Eir the opportunity to obtain new 2.1 GHz rights beyond the expiry of its existing rights*." eir notes it is also the case that eir may acquire additional 2.1 GHz rights of use in time slice 1 and queries why DotEcon has not acknowledged this.

However eir does not agree that it is appropriate or necessary to apply time-slicing for the 2.3 GHz and 2.6 GHz bands. This introduces unnecessary complexity which can be avoided to make for a simpler and more manageable auction design. It is also questionable whether time-slicing the 2.3 GHz and 2.6 GHz bands is compatible with the provisions of the the European Electronic Communications Code (EECC) on licence duration.

As we note later in this response, if all of the 2.1 GHz band is to be included in the award there also needs to be a sub-cap of 2x50MHz applied specifically to the 2.1 GHz band.

Early liberalisation of 3G licences

eir agrees there should be an early liberalisation option but does not agree with ComReg's preferred option 2A (see ¶ 5.38). Option 2A "*Provide*[s] *the option for all existing licensees to liberalise some or all existing 2.1 GHz rights of use from the time of the substantive decisions concerning the present Proposed Award*". In reality existing licensees may have insufficient information to decide on liberalisation in advance of the outcome of the MBSA2. Vodafone and Three will have uncertainty regarding access to future rights and eir will have uncertainty as to what, if any, liberalisation fee would apply for the remainder of its current licence. In eir's view the timing of the exercise of the liberalisation rights could be better aligned to option 2B "*Provide the option for all existing licensees to liberalise some or all existing 2.1 GHz rights of use following the assignment of new rights of use in the proposed frequency bands in the Proposed Award*." However, provided the operators have flexibility as to the timing of when they exercise the option they can make that decision as they see fit. It should be the case that the licensee can decide when to exercise the liberalisation option. We note that the proposed approach to calculating what if any fees may be applicable to liberalisation (see ¶ 5.43) refers to using values "*over the years for which the early liberalisation is applicable*". We request ComReg to confirm that the liberalisation option may be exercised at the licensee's discretion at any point in the period before a current licence expires.

Option 2A arguably creates a situation of too much uncertainty if the liberalisation option has to be exercised in advance of the decision maker being cognisant of all the relevant terms and conditions, including price. However it seems that ComReg does not perceive there to be much uncertainty in Annex 6. For example ComReg feels (see ¶ A6.39) "*there remains the possibility (albeit slim) that additional liberalisation fees may apply.*" (see ¶A 6.65) "*However, under Option 2A, Eir may, because of any financial exposure that may result from the potential spectrum liberalisation fee mechanism in respect of the liberalisation of its existing 2.1 GHz rights in Time Slice 1, choose to wait until after the Proposed Award to liberalise its existing rights, ComReg observes:*

- *based on the available information, it is unlikely that any liberalisation fees would apply.*
- *furthermore, other substitutable bands are proposed to be awarded alongside the 2.1 GHz Band; and*
- *in light of the above factors and recalling that Time Slice 1 is circa 5.5 years, it is unlikely that Eir would choose not to liberalise its existing rights in Time Slice 1 at market-determined rates and may therefore avail of any liberalisation option at the time of the ComReg's substantive decision.*"

If ComReg is to set a definite decision date for the liberalisation of existing licences (e.g. as proposed under Option 2A) then on the basis that ComReg considers it highly unlikely that

additional fees would apply in the case of eir, ComReg should make a decision now that fees will not apply.

eir does not agree with ComReg's proposal to levy an additional fee for the liberalisation of eir's existing 2100MHz licence, for the reasons it has previously put forward. eir also objects most strongly to the following specific aspects of the proposals put forward by ComReg in this regard.

DotEcon has proposed that the relevant benchmark for any liberalisation fee should be the difference between the auction price for new 2.1 GHz spectrum rights in Time Slice 1 and the current fees being paid by eir (including both SAFs and SUFs). The problem with this is that this difference will reflect not only the value of liberalisation (if any) but also any change in the value of (unliberalised) 2.1 GHz spectrum rights between when eir acquired its licence, and the date of the auction. The prices paid by Three and Vodafone for 2.1 GHz rights in time-slice 1 (assuming they are successful) will also reflect the value to Three and Vodafone of continuity of service / mitigating the cost of being forced to a higher frequency band. eir submits (again) that it would be wholly inappropriate for ComReg to levy an additional fee on eir in respect of any increase in the value of the 2.1GHz spectrum held by eir that does not relate to liberalisation.

DotEcon proposes that the liberalisation fee should be calculated (see ¶ 5.43) including consideration of new 2.1GHz spectrum rights in Time Slice 2. There is no explanation offered as to why this approach is appropriate or equitable particularly as the liberalisation option is only applicable to time-slice 1. We note (see ¶ 5.59) "*Having considered DotEcon's analysis and recommended approach, ComReg is of the preliminary view that the suggested methodology would be appropriate in present circumstances*". Again, ComReg appears to be blindly accepting the advice of DotEcon. ComReg must clearly explain why it considers the methodology to include time-slice 2 to be appropriate. ComReg "*also observes that this process is similar to the approach taken by ComReg for calculating refunds and adjustments to licence fees for the 3.6 GHz licences awarded in 2017 in the event of delayed access to the spectrum*." For the ongoing unacceptable delays to access the 3.6 GHz licences ComReg calculates pro rata refunds based on the fees determined by the auction. This is entirely unrelated to liberalisation of existing licences and as such is an irrelevant observation.

Moreover, to the extent that ComReg is of the view that it would be unfair or would distort competition to liberalise eir's existing licence at no additional fee to eir, it should be equally concerned about the unfairness and/or distortion of competition that would arise if eir's competitors were to acquire liberalised 2.1 GHz spectrum at a price lower than that paid by eir. It would be totally unacceptable for eir to face the risk of having to pay an additional fee for liberalisation if the

auction price is above the price of eir's existing licence without having the counter-balancing opportunity of receiving a rebate on the price of its existing licence if the auction price is below that.

eir therefore submits that ComReg should either liberalise eir's existing licence for the rest of its term without any additional fee (as eir has previously proposed), or if ComReg insists on charging eir an additional fee if the auction price of 2.1GHz spectrum in time-slice 1 is above the level of fees currently being paid by eir, then it should also give eir a commensurate rebate on its current fees if the auction price is below that level.

To the extent that it is relevant for the purpose of comparing current and future pricing, we request ComReg to clarify how eir's current price of 0.559 €/MHz/pop for its 2.1 GHz has been calculated in footnote 268. In that same footnote the current price for the other B licences is quoted as 0.722 €/MHz/pop. The payment terms for all B licences are the same and as such the only difference is the date of issue. A 5 year difference in the date of issuance does not explain the material delta between the prices assigned to the B licences. If a mechanism is established to compare eir's 3G licence cost with the outcome of the MBSA2 then the appropriate comparator for the 3G licence should be closely aligned to a value in the region of 0.772 €/MHz/pop.

National licences

eir agrees that licences should be for a limited number of rights on a national basis (see section 6.1) There is no rationale for regional licensing in respect of the proposed bands.

Licence durations (section 6.3)

(¶ 6.116) "*Based on the preceding material, ComReg's preliminary view is that a duration of between 15 to 20 years appears reasonable, with the weight of European practice and recent Irish practice for similar bands (i.e. 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands) supporting a duration of 15 years.*" eir does not agree that licence durations should be considered in terms of 15 years. ComReg's proposal is based on a backward looking assessment of European practice and a somewhat circular reference to recent Irish practice.

ComReg states (see ¶ 2.42 / 6.96) that it is mindful of the relevant provisions of the EECC which is to be transposed into national law by 21 December 2020. It is therefore disappointing that the licence durations proposed by ComReg are incompatible with the EECC – they are too short. Article 49(2) of the EECC requires individual rights of use for these radio frequencies to be valid for a duration of <u>at least</u> 15 years, and where the licence duration is not valid for at least 20 years the right of use must include a right of extension so as to ensure regulatory predictability for a period of at least 20 years. Notwithstanding the fact that the EECC has not as yet been transcribed into Irish

law, eir finds it surprising that ComReg has not proposed licence durations that comply with the provisions of the EECC. The EECC is intended to encourage greater consistency between Member States on matters such as licence duration and ComReg should not be making Decisions now based on past practice that is not compatible with the EECC.

eir also considers the currently proposed end date for these licences (c.2035) to be too close to the end date for the previously awarded 800MHz and 900MHz spectrum (i.e. 2030). Uncertainty over the future of this spectrum at the same time as uncertainty over the future of the 800MHz and 900MHz spectrum will likely compound to put operators (and their investors) in a very challenging position, with potentially significant negative impact on, for example, investment in networks and services in the period leading up to the end date of these licences. A licence duration in the proposed award of 20 years would put sufficient space between the licence expiry dates.

Finally, eir also notes that the proposed term of the time-slice 2 licences is only approx. 8 years. Whilst this may not be too problematic if the same licensee also holds the same spectrum in time-slice 1 (but see our more general comments above about the overall duration and end date of licences), if this is not the case then the proposed term is close to the very minimum period required by an operator to be able to invest in relevant technology and earn a positive return on that investment. eir believes this further reinforces the need for the duration of the licences to be materially extended.

eir would therefore urge ComReg to be compliant with the EECC and to extend the period for which spectrum is awarded through this auction to at least 20 years from the date that the new 700MHz, 2.3GHz and 2.6GHz rights of use come into force e.g. to 30 November 2040 if the commencement dates for those rights is 1 December 2020.

Auction format (Chapter 7)

eir has serious concerns about the proposal by ComReg to use a CCA format for this auction (see ¶ 7.124). In eir's view the CCA format lacks transparency in ways which can make it extremely hard for some bidders, in particular those with a more limited budget, to bid effectively, and at the same time creates the opportunity for some bidders to engage in strategic bidding games. eir is not averse to taking risks when bidding for spectrum, but needs to be able to quantify and manage those risks. In eir's view the CCA format does not allow it to do this:

- Uncertainty over the difference between the amount bid and final price creates a real governance challenge for some bidders, in particular those with a more limited budget.
- The potential need to submit bids for an amount that is significantly in excess of the price that the bidder is likely to have to pay if the bid wins (e.g. knockout bids) is a particular

challenge – significant risk that some bidders will be unable or unwilling to submit such bids, with consequent risk that they will not win the spectrum they should (i.e. an inefficient outcome).

- Budget constrained bidders may be put in the invidious position of having to decide whether they are going to take the 'safe' option of bidding full value for smaller packages and less than full value for larger packages, and thereby risk winning less spectrum than they should, or take the 'risky' option of bidding as much as they can for larger packages and less than full value for smaller packages, and thereby increase their chances of winning a larger package but risk winning nothing at all; in either case, if they make the wrong choice, the outcome of the auction will be inefficient.
- Possibility that a bidder will unexpectedly come out of the auction with nothing, with no opportunity to bid again; again favours stronger bidders who can afford to make the knock-out bid necessary to guarantee a winning package.
- Opportunity cost pricing can lead to price asymmetries that favour stronger bidders (even if there is no strategic price-driving behaviour, but even more so if there is).

In eir's view, DotEcon and ComReg misjudge the significance of these issues to some potential bidders in the upcoming auction and consequently underestimate the risk that a CCA will fail to achieve ComReg's objectives, in particular an efficient assignment of the available spectrum and promotion of long-term competition in downstream markets.

eir notes that other potential auction formats, in particular those using a pay-as-bid formula (such as the Simple Clock Auction (SCA) or more complex Combinatorial Multiple Round Ascending (CMRA) formats), mitigate a number of these risks:

- There is no uncertainty over the amount that will need to be paid if a bid wins and hence bidders can easily decide whether or not they can afford to submit a particular bid.
- There is no need (or opportunity) to submit bids for amounts that are significantly in excess of the price that will need to be paid if the bid wins, hence no issue for bidders that would be unable or unwilling to do so.
- Budget constrained bidders are in a far stronger position to submit bids consistent with their full valuations up to the overall limit of their budget.
- Bidders that submit 'gaming' bids risk having to pay the full amount of their bids if they win.
- No risk that a bidder will come out of the auction with nothing, unless they have submitted a bid for nothing.

eir therefore strongly believes that ComReg should prefer one of these formats over the proposed CCA format, given the very real risk that a CCA format auction will not deliver an efficient outcome and may asymmetrically favour bidders with deeper pockets.

As regards the characteristics of alternative auction formats, eir notes that whilst the CMRA format has the benefits of being a pay-as-bid auction, eir is concerned that there may still be a risk of significant price asymmetry favouring stronger bidders (potentially even greater than in a CCA). The problem in this case being the risk that more financially constrained bidders will end up winning their final round headline bids at final round prices (which could be significantly higher than the opportunity cost of the spectrum), whereas a stronger bidder may be able to act to end the auction and win one of their additional bids at a (significantly) lower price. The complexity and limited previous history of CMRA auctions is also of concern to eir.

eir also does not favour formats that constrain the ability of bidders to switch between substitute packages of spectrum in an attempt to limit the risk of spectrum remaining unsold at the end of the auction – such as the Simultaneous Multiple Round Ascending (SMRA) or SCA with retained demand. Off-loading the risk of unsold spectrum onto bidders, by constraining their ability to switch between substitute spectrum packages, decreases rather than increases the likelihood of an efficient assignment of the available spectrum in eir's view.

As regards the SCA format, eir notes that one of DotEcon's principal reasons for rejecting this format appears to be the substitution risk that bidders might be exposed to if a simple eligibility points based activity rule is used. In eir's view it would be relatively easy to develop a SCA format that used a relaxed activity rule similar to that typically used in CCAs and CMRAs, i.e. one that allowed bids for spectrum packages having an associated eligibility in excess of the bidder's eligibility limit for the round if that bid would nevertheless be consistent with the preferences between packages revealed by that bidder in earlier eligibility reducing rounds. This would allow bidders to submit bids consistent with their preferences throughout the auction, provided that they took care to not submit bids inconsistent with their true preferences in eligibility reducing rounds. Given the transparency and relative simplicity of such a format (relative to a CCA or CMRA), and hence its mitigation of some of the significant risks of a CCA or CMRA, we would urge ComReg and DotEcon to give serious consideration to the development and use of such a format.

Irrespective of the auction format selected, eir notes that ComReg's proposal to use two time-slices for the 2.3GHz and 2.6GHz spectrum, as well as for the 2.1GHz spectrum, significantly increases the number of different packages that a bidder could bid on. eir does not believe this additional flexibility is either necessary or desirable. eir is concerned in particular that this additional flexibility

has the potential to create strategic gaming opportunities for certain bidders. eir believes therefore that it would be more appropriate for only the 2.1 GHz spectrum to be time-sliced (if all of the 2.1 GHz band is to be included in the award), with all other spectrum being awarded for the full period of spectrum availability in one go. eir further notes that this would remove all of the aggregation risk for bidders arising from the proposed splitting of the usage rights between two time slices for the non-2.1 GHz frequency bands, which would further reduce the need to use a fully combinatorial auction format – a simpler format, such as a SCA with relaxed activity rule should be sufficient (and would be a better choice in other regards).

eir notes that ComReg's auction advisors, DotEcon, are also advising the Dutch Ministry of Economic Affairs on auction design issues in connection with an intended upcoming multi-band spectrum auction of 700 MHz, 1400 MHz and 2100 MHz spectrum. eir notes that in that case DotEcon rejects the need for a combinatorial auction format (such as the CCA or CMRA), noting the mechanical complexity of such formats, and prefers instead simpler pay-as-bid formats (such as the SMRA, SMRA clock hybrid or the clock-plus format), highlighting their simplicity and the certainty they give to bidders. DotEcon further notes that in its view any potential risk of strategic demand reduction can be addressed without having to forego the benefits of a simple pay-as-bid format by simply avoiding excessively low reserve prices (setting reserve prices closer to the prices that could be expected in a competitive auction).

eir further notes that Prof. Peter Cramton and Pacharasut Sujarittanonta, who have undertaken an independent peer review of DotEcon's advice on behalf of the Dutch Ministry, concur with DotEcon's views on these matters .

eir strongly believes that similar considerations apply in the context of the upcoming multi-band spectrum auction in Ireland as in the Netherlands, in particular the need for an auction format that is simple and provides bidders with the greatest possible certainty. eir therefore strongly urges DotEcon and ComReg to reconsider their current preference for a complex combinatorial auction format, and to prefer instead a far simpler multi-round pay-as-bid auction format, whether that be a simple SMRA, a simple clock, an SMRA clock hybrid or a clock-plus auction.

Lot size for 700 MHz band

eir believes that the lot size in the 700 MHz band should be set at 2x10MHz. This is consistent with ComReg's coverage proposals to achieve at least 30Mb/s at the cell edge. In contrast a smaller quantum of spectrum, 2x5 MHz will not be capable of supporting such a service level as acknowledged in ComReg's proposal that an operator with only 2x5 MHz in the 700MHz band can only have a looser obligation of 20 Mb/s at the cell edge. Given the EECC's objective to encourage

Very High Capacity Networks we strongly question whether a 700MHz lot size of 2x5 MHz is compatible with the EECC.

Lot size in 2.3GHz band

eir agrees with ComReg's proposals for a 30MHz lot (2300-2330 MHz), a 10MHz lot (2390-2400 MHz), with the remainder of the band being made available in lots of 5 MHz.

Lot size in 2.6 GHz band

eir agrees with ComReg's proposals for generic 2x5 MHz lots (FDD) and 5 MHz lots (TDD) with two frequency specific lots where FDD and TDD touch.

Assignment phase (section 7.5.2)

eir has no objection to the principles proposed by ComReg which are consistent with the approach successfully applied in the MBSA. As noted at the start of this response we reserve the right to revisit this and other issues as more specific details emerge.

Competition caps (section 7.7)

eir agrees with ComReg's proposal to apply both a sub-1GHz cap and an overall spectrum cap during the proposed MBSA2, and for those caps to take into account the existing spectrum holdings of bidders. Such spectrum market caps are an important method of ensuring that auctions do not lead to highly asymmetric spectrum holdings amongst mobile operators that could be detrimental to downstream competition.

In eir's view, with the sole exception of the 2100MHz spectrum (which we discuss further below), none of the spectrum that is proposed for inclusion in this award is sufficiently different from the other mobile spectrum already held by operators to justify applying spectrum caps that relate solely to the spectrum to be awarded in this auction.

Given the importance of 2.1 GHz spectrum to the mobile operators' existing operations however, eir believes that it would be appropriate to apply 2.1 GHz specific caps if all of the band is to be included in the proposed award. Such a requirement is necessary and appropriate. ComReg must apply an additional 2.1 GHz specific spectrum cap of 50MHz (5 blocks) in both time-slices. This is in addition to the sub-1GHz and overall spectrum caps already proposed. The purpose of this additional cap would be to prevent any subset of the three existing mobile network operators from acquiring all of the available 2.1 GHz spectrum, thereby denying it to one or more of their competitors. This remains a real risk even at the lower end (375MHz) of the range proposed by ComReg for the overall cap. Absent any new entrant bidders, this would guarantee each of the

existing MNOs a minimum of 20MHz (i.e. 2×10MHz) of 2.1 GHz spectrum to enable them to maintain their existing service offering without major disruption to end users.

As regards the level of the proposed caps, eir agrees with ComReg's proposal that the sub-1GHz spectrum cap should be set at 70MHz. ComReg has proposed a range for the overall spectrum cap ranging from 375MHz to 420MHz. eir strongly believes that the appropriate level of this cap should not exceed 375MHz for reasons that we discuss below and indeed should arguably be lower absent additional protections.

eir notes that the upper end of ComReg's proposed range for the overall spectrum cap (420MHz) is based on a proposal from DotEcon that is intended to maintain the existing level of asymmetry between the three existing mobile network operators in percentage terms, measured in a particular way. Spectrum is a competitive differentiator. Why else do operators compete in award processes? It is therefore important to ensure that larger players are not able to monopolise their market position through the accumulation of large spectrum holdings to the disadvantage of competitors. DotEcon applies an odd form of logic to justify the proposed range for the overall spectrum. DotEcon (see ¶ 7.222) considers, based on a superficial analysis, "*that a post-award spectrum asymmetry at least at the same level as after the Merger is unlikely to be problematic and there does not seem to be any particular need or justification to seek to actively reduce the current differences in MNO spectrum holdings on competition grounds.*" So in effect DotEcon is saying, with only superficial analytical justification, that the competitive level has not noticeably deteriorated as a result of the post merger spectrum asymmetry.

eir notes that ComReg has not conducted a proper assessment of competition in the mobile market and questions the logic behind a position that proposes to support maintaining the same degree of asymmetry in the market. It is disappointing that ComReg (see ¶ 7.261 & 7.262) blindly agrees "*with DotEcon noting that there is no evidence to suggest that developments since the merger have altered competition in any significant way such that a restriction greater than existed at the time of the merger would be required.*" There is no evidence because there has been no proper assessment of the market. Consequently ComReg's preliminary view that "*there would seem to be little justification to actively seek to reduce the asymmetry in MNO holdings at this time*" has no basis. Furthermore the proposed approach, which compares the position of eir and Three ignores the position of Vodafone. The overall spectrum caps proposed by ComReg would allow Vodafone to increase their asymmetry relative to eir. Such a situation cannot be believed to benefit competition in the mobile market.

Even if one accepted DotEcon's and by extension ComReg's logic, which eir does not accept, eir strongly believes that the way in which DotEcon has measured percentage asymmetry (as the difference between the largest and smallest holdings as a percentage of total available spectrum) fails to reflect what really matters in the market, which is the extent to which the player with the least spectrum can replicate the capacity and capability of the player with the most spectrum. In eir's view therefore a more appropriate metric of percentage asymmetry would be the difference between the largest and smallest holdings as a percentage of the largest holding.

Based on that metric, the current percentage asymmetry is 34% overall (i.e. the operator with the smallest amount of spectrum has just less than two thirds of the amount of spectrum of the largest operator). An overall spectrum cap of 420MHz (the upper end of ComReg's proposed range) could lead to a percentage asymmetry of more than 50% i.e. the operator with the smallest amount of spectrum could hold less than half that of the largest (indeed of both the other two operators), even if none of the spectrum were acquired by a fourth party. eir contends that it is clear that this would put the operator with the smallest amount of spectrum in a position where they would not be able to compete on anywhere near equal terms with the other two operators, to the detriment of consumers and competition.

An overall spectrum cap of 375MHz would limit this asymmetry to a maximum of 23% (assuming only the existing mobile operators win spectrum in the auction) however it still creates a risk that an existing operator could be pushed out of the 2.1 GHz band if all of that band is to be included in the auction. Therefore an overall spectrum cap of 375 MHz is only acceptable provided that a 2.1 GHz specific cap is also applied, as proposed above.

Fees - Minimum prices (section 7.8)

eir notes that a significant proportion of the observations from other awards (including competitive awards), collected by DotEcon in the context of their benchmarking of spectrum prices, are below the minimum prices that they and ComReg propose for this auction. That is to say that in a significant proportion of previous awards (including awards that DotEcon consider to be competitive) the out-turn auction price is below the price that ComReg is proposing should be the starting price for spectrum in this auction.

For example the proposed minimum price of EUR 0.38 /MHz/pop for 700MHz spectrum lies between the first quartile (EUR 0.204 /MHz/pop) and median (EUR 0.557 /MHz/pop) of the observed prices for 700MHz, 800MHz and 900MHz spectrum achieved in competitive awards in Europe in the last 10 years. Hence somewhere between 25% and 50% of those observed out-turn prices must be below the minimum price proposed.

Similarly the proposed minimum price for 2.1GHz spectrum lies between the first quartile and median of the observed prices for 2.1GHz spectrum in competitive awards in Europe over the last 10 years (and closer to the median than the first quartile), and the same for the combined 2.3GHz and 2.6GHz minimum price.

Given that such a high proportion of observations from recent competitive European auctions lie below the proposed level of minimum (starting) prices, we find it hard to agree with ComReg's assertion that the proposed minimum prices are "conservative". In our view a more appropriate basis for minimum prices would be no higher than the lower quartile of these distributions in each case.

That said, if ComReg were minded to agree with our recommendation that it would be more appropriate to use a pay-as-bid auction format (see above), but ComReg remains concerned about the potential for bidders to engage in strategic demand reduction if minimum prices were 'too low', eir would be content for minimum prices to be set at the currently proposed levels (but not any higher) in the case that a pay-as-bid auction format were used, to reduce the potential benefits of strategic demand reduction and hence reduce the likelihood of it occurring.

This should not however be a consideration if a CCA format is selected – in that case eir is strongly of the view that minimum prices should be reduced as proposed above.

eir has no objection to the proposal (see ¶ 7.296) that the minimum price be apportioned on a 40/60 basis (SAF/SUF).

Licence Conditions (section 8)

eir agrees that the licences should be service and technology neutral (¶ 8.7) and we note that the licences in all bands will be made available on a non-exclusive basis in line with current practices.

Coverage

ComReg considers that indoor coverage is better addressed through Native Wifi (see ¶ 8.77) and mobile repeaters (see ¶8.78). Consequently ComReg proposes that any coverage obligation should be focussed on outdoor coverage. We agree that any coverage obligation should be based on outdoor coverage. It is not possible to effectively monitor compliance with an indoor coverage obligation and modern building materials, as assessed by ComReg, make it impossible to predict indoor coverage levels.

However, we object to ComReg's proposals to impose an obligation to provide Native WiFi and obligations to roll-out VoLTE. eir considers both of these services to be competitive differentiators and we do not see it as ComReg's role to eliminate competitive differentiation. Further, Part B. of the Schedule to the Authorisation Regulations 2011 sets out Conditions which may be attached to spectrum rights of use. None of the permitted conditions apply in respect of the proposed Native Wi-Fi obligation and it is not clear on what basis ComReg is seeking to impose this obligation. It would seem that ComReg may be acting ultra vires. eir notes that that the first condition in Part B[1] may give ComReg authority to impose a VoLTE obligation but only in respect of the frequencies for which the right of use applies. We reserve our position on these proposals.

For the purpose of the proposed competitive award process eir agrees that coverage obligations should be approached from a precautionary and symmetric basis. ComReg (based on previous Oxera work) considers (see ¶ 8.90) that a population coverage obligation should "*primarily focus on a minimum data rate of 30Mbit/s for a single user at cell edge*". eir agrees but as noted earlier this will necessitate a 2x10MHz lot size in the 700 MHz band. eir also agrees with the proposed scenario 2 specification of the coverage obligation as set out in Table 17.

For the higher frequency bands, ComReg proposes that the coverage obligation be expressed by reference to the number of base stations deployed with the number of sites varying depending on whether a 'Mobile' service is being provided or an 'Other' service such as FWA. eir has no objection to the targets proposed in Table 20. However, eir requests ComReg to clarify what targets would apply if an operator is using the spectrum for mixed use. e.g. Mobile in some parts of the country and Other elsewhere.

Quality of Service obligations (section 8.5)

ComReg proposes (see ¶ 8.243) to attach "*similar*" quality of service standards for voice calls including VoLTE as apply in the 3.6 GHz licences. In principle this does not seem unreasonable however until we see the precise specification we cannot agree to a "similar" arrangement. Further consultation will be required. eir also notes that it has not had the opportunity in the time afforded to validate that the network monitoring tools available for VoLTE will be able to measure performance against the proposed targets.

[1] Obligation to provide a service or to use a type of technology for which the rights of use for the frequency has been granted including, where appropriate, coverage and quality requirements.

Termination of technology

ComReg proposes (see ¶ 8.252) "*to attach a licence condition (in respect of notification of the termination of a technology) to spectrum rights in the Proposed Bands on substantively the same terms as that imposed previously for licences in the 800 MHz, 900 MHz, 1800 MHz and 3.6 GHz bands*". This proposal does not appear unreasonable however until we see the precise specification we cannot agree to a "substantively the same" arrangement.

Potential wholesale access (MVNO) conditions (section 8.7)

ComReg seeks views on whether it would be appropriate to attach an MVNO access condition to some or all of the 700 MHz rights of use. eir does not believe such a condition is necessary or justified. It is eir's firm view that ComReg can only impose access obligations where it has clearly identified a market failure following a proper market review in accordance with Regulation 27 of the Framework Regulations (SI 333 of 2011).

Spectrum leasing

eir notes (see ¶ 8.277) that legislation to implement spectrum leasing has been prepared but not yet enacted. ComReg indicated it would implement a spectrum leasing regime in advance of the 3.6 GHz licensing in 2017. This is now 2 years late. eir requests ComReg to confirm when it expects the legislation to be enacted.

Transition arrangements (section 9)

eir notes that ComReg proposes to approach potential transition arrangements for the 2.1 GHz band from the same perspective as the 2012 award. eir agrees that the 2012 transition worked well. This is because all existing MNOs in the 900 MHz and 1800 MHz bands acquired spectrum rights in part facilitated by appropriate spectrum caps. This mitigated the risk that the customers of one or more MNOs would face disruption. As noted earlier in this response a band specific spectrum cap for the 2.1 GHz band is required if all of the band is to be auctioned.

1.3 Ericsson

Ericsson Response to ComReg consultation: “Proposed Multi Band Spectrum Award including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands”

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Ericsson welcomes the ComReg proposal for a multi-band spectrum awarding 470 MHz of harmonised spectrum rights in the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands.

The proposed Multi Band Award will help realise the full potential of 5G network deployments and meet the growing demands on network performances enabling 5G use cases that will bring social and economic benefits to Ireland.
National licensing of the right spectrum, in sufficient amounts, to mobile broadband providers is fundamental to creating momentum for 5G service deployments.
Ericsson is a strong proponent of harmonised spectrum use across Europe in terms of frequency ranges and technical conditions. This enables countries to benefit from a 5G NR eco-system of scale, which is at least as wide as the EU, as well as from potential interoperability and roaming capabilities. Ericsson welcomes ComReg’s approach in this regard.
To realise the full benefits of 5G it is critical that through this Spectrum award ComReg prioritises and incentivises network deployment and coverage over the potential income generated by the auction.
As more services become dependent on mobile networks Ericsson believes that spectrum alongside telecommunications networks should be considered by nations as critical national infrastructure.

Ericsson considers it essential that spectrum awards ensure:

- Harmonised spectrum arrangements are applied across the EU and internationally.
- Harmonised frequency ranges, technical conditions, tuning ranges are applied across the EU.
- The security of interoperability/roaming across boarders
- Bandwidth availability to meet 5G and network performance demands
- Spectrum availability for high-throughput backhaul systems is assigned
- View Spectrum as part of the country’s critical national infrastructure

Ericsson Response to ComReg consultation: “Proposed Multi Band Spectrum Award including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands”

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- Incentivise network deployments to meet 5G use case availability and coverage needs

Ericsson’s response to the ComReg consultation:

As a general comment on the technical conditions as set out in Annex 12 for the 2.1 GHz and 2.6 GHz bands; they do not seem to address AAS (Active Antenna Systems) as they only refer to the EC Decisions that were last updated in 2008 and 2012.

Noting that these technical conditions have been updated to include technical conditions for AAS, which resulted in the newly approved ECC DEC (06)01 and ECC DEC (05)05 respectively for the bands 2.1 GHz and 2.6 GHz, and noting that the related CEPT Report 72, which constitutes the basis for the planned update of EC DEC 2012/688/EU and 2008/477/EC, Ericsson encourages ComReg to include the technical conditions for AAS as set by ECC DEC (06)01 and ECC DEC (05)05 into Annex 12.

Reference to the relevant documents:

- [1] CEPT Report 72, Report from CEPT to the European Commission in response to the Mandate “to review the harmonised technical conditions for certain EU-harmonised frequency bands and to develop least restrictive harmonised technical conditions suitable for next-generation (5G) terrestrial wireless systems”, https://www.ecodocdb.dk/document/12367
    - With ANNEX 2: UPDATES TO EC DECISION 2012/688/EU (2 GHZ)
    - With ANNEX 3: UPDATES TO EC DECISION 2008/477/EC (2.6 GHZ)

Ericsson Response to ComReg consultation: “Proposed Multi Band Spectrum Award including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands”

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- [2] ECC Decision (06)01, “The harmonised utilisation of the bands 1920-1980 MHz and 2110-2170 MHz for mobile/fixed communications networks (MFCN) including terrestrial IMT systems”, Amended 8 March 2019, https://www.ecodocdb.dk/document/394

- [3] ECC Decision (05)05 “Harmonised utilization of spectrum for Mobile/Fixed Communications Networks (MFCN) operating within the band 2500-2690 MHz”, Latest amended 5 July 2019, https://www.ecodocdb.dk/document/388

Ericsson also proposes some minor amendments in Annex 12 to make the requirements clear when it comes to measurement BW and similar parameters, all based on the ECC/EC DEC. The amendments are in red text:

A 12.10

The 700 MHz EC Decision provides some discretion in relation to setting of a measurement bandwidth for EIRP out-of-block emissions. ComReg intends to award the 700 MHz band in 5 MHz blocks, as such, the 700 MHz EC Decision identifies a measurement bandwidth of 5 MHz. ComReg proposes to apply this measurement bandwidth to out-of-block emissions in both the uplink blocks in the range of 703-733 MHz and the downlink blocks in the range of 758-788 MHz. The base station baseline power limit applies as follows:

- for uplink frequencies in range 698-736 MHz, a maximum mean EIRP limit of -50 dBm per cell across 5 MHz bandwidth shall apply;

- for uplink frequencies as defined in Decision 2010/267/EU (i.e. 832-862 MHz), a maximum mean EIRP limit of -49 dBm per cell across 5 MHz bandwidth shall apply;

- for downlink frequencies in the range 738-791 MHz, a maximum mean EIRP of 16 dBm per antenna across 5 MHz bandwidth shall apply;
- for downlink frequencies as defined in Decision 2010/267/EU (i.e. 791-821 MHz), a maximum mean EIRP limit of 16 dBm per across 5 MHz bandwidth antenna shall apply; and
- for frequencies below 694 MHz where DTT broadcasting is protected, a maximum mean EIRP limit of -23 dBm per cell977 across 8 MHz bandwidth is required.

A 12.11

The 700 MHz EC Decision defines transitional power limits for downlink only blocks in the frequency range 733 – 788 MHz, as follows:

- for -10 to -5 MHz offset from lower block edge or 5 to 10 MHz offset from the upper block edge, a limit of 18 dBm maximum mean EIRP per antenna shall apply across a 5 MHz measurement bandwidth; and
- for -5 to 0 MHz offset from lower block edge or 0 to 5 MHz offset from the upper block edge, a limit of 22 dBm maximum mean EIRP per antenna shall apply across a 5 MHz measurement bandwidth.

A 12.12

For a block in frequency range 788-791 MHz, with an upper edge at:

- 788 MHz, a 21 dBm maximum mean EIRP limit per antenna shall apply across a 3 MHz measurement bandwidth;
- 783 MHz, a 16 dBm maximum mean EIRP limit per antenna shall apply across a 3 MHz measurement bandwidth;
- 788 MHz for protection of systems with bandwidth < 3 MHz, a 11 dBm maximum mean EIRP per antenna limit shall apply across a 200 kHz measurement bandwidth; and

- 783 MHz for protection of systems with bandwidth < 3 MHz, a 4 dBm maximum mean EIRP per antenna limit shall apply, across a 200 kHz bandwidth.

A 12.13

For a block in the frequency range 791-796, with upper edge at:

- 788 MHz, a 19 dBm maximum mean EIRP per antenna limit shall apply across a 5 MHz measurement bandwidth; and
- 791-796 MHz for a block with upper edge at 783 MHz, a 17 dBm maximum mean EIRP per antenna limit shall apply across a 5 MHz measurement bandwidth.

A 12.14

For a block in the frequency range 796-801 MHz, with upper edge at 788 MHz, a 17 dBm maximum mean EIRP per antenna limit shall apply across a 5 MHz measurement bandwidth.

A 12.15

The 700 MHz EC Decision provides for base station limits for part of the guard bands not used for PPDR or M2M radio communications, i.e. 694-703 MHz and 788-791 MHz. These limits are implemented as follows:

- A power limit of -32 dBm maximum mean EIRP per cell across 1 MHz shall apply to spectrum between the lower band edge of the 700 MHz frequency band and FDD uplink lower band edge (i.e. 694-703 MHz); and
- A maximum mean EIRP limit of 14 dBm per antenna across 3 MHz shall apply to spectrum between FDD downlink upper band edge and the FDD downlink lower band edge as defined in Decision 2010/267/EU (i.e. 788-791 MHz).

A 12.16

Ericsson Response to ComReg consultation: “Proposed Multi Band Spectrum Award including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands”

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A base station power limit is defined in the 700 MHz EC Decision for part of the duplex gap not used for PPDR or M2M. Although provision for these services in the paired frequency range 733-736 / 788-791 MHz has not been made as part of this process, ComReg intends to implement the following power limits of the duplex gap (733-738 MHz), in line with the 700 MHz EC Decision. These limits are implemented as follows:

- for – 10 to 0 MHz offset from FDD downlink lower band edge or lower edge of the lowest downlink-only block, but above FDD uplink upper band edge, a 16 dBm maximum mean EIRP per antenna limit shall apply across 5 MHz; and
- for more than 10 MHz offset from FDD downlink lower band edge or lower edge of the lowest downlink-only block, but above FDD uplink upper band edge, a – 4 dBm maximum mean EIRP per antenna limit shall apply across 5 MHz.

Ericsson Response to ComReg consultation: “Proposed Multi Band Spectrum Award including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands”

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About Ericsson:

Ericsson is one of the leading providers of Information and Communication Technology (ICT) to service providers, with about 40% of the world’s mobile traffic carried through our networks. We enable the full value of connectivity by creating game-changing technology and services that are easy to use, adopt and scale, making our customers successful in a fully connected world. For more than 140 years, our ideas, technology and people have changed the world: real turning points that have transformed lives, industries and society.

About Ericsson Ireland:

Ericsson Ireland operates in two locations, Dublin and Athlone, and has responsibility for three distinct business segments:

- Sales and Support for our Local Customers
- Research and Development (R&D)
- Professional Services delivered globally.

Our local customer base is the focus of our business. Since 1957 we have been a supplier and partner to the Posts and Telegraphs (P&T), subsequently eir, with whom we continue to work today. Over the years, our list of customers has grown substantially and now includes Vodafone, Three, Telefonica/giffgaff, Virgin Media, ESB, Irish Rail and many more. We continue to work in a progressive way with our customers; where once we sold telephony switches, we now deliver software to leverage digital services that will eventually lead us to 5G and beyond.

Our R&D center based in Athlone was established in 1979 and continues today to be one of the leading R&D sites for Ericsson globally. It is recognized across Ericsson for its world-class development systems that are optimized for high speed deliveries and superior quality products. It houses a full spectrum of network and IT competences needed to systemize, build and support next generation network management systems for Ericsson.

Ericsson Response to ComReg consultation: "Proposed Multi Band Spectrum Award including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands"

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Ericsson Ireland also hosts the global hub for the delivery of high value professional services including Network Transformation, Network Design & Optimization, System Integration, Managed Services, Business Consulting, Operational Consulting, Technology Consulting and Learning Services.

Through collaboration and support of local schools and universities, educational and technology organisations and support of several charities, Ericsson Ireland has a strong connection with the local community.

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1.4 Imagine

Imagine

Imagine's response to the Proposed Multi Band Spectrum Award –

(ComReg 19/59)

Contents

1 Introduction

Imagine welcomes the opportunity to respond to the recent consultation ComReg 19/59 "Proposed Multi Band Spectrum Award".

2 Imagine Response

As a general comment that applies throughout the document (19/59) it is unhelpful that ComReg repeatedly refers to "MNO" as an apparent proxy term for a licenced spectrum operator. This is particularly unhelpful in the context of discussing liberalised spectrum options. We recognise that the use of this acronym may be appropriate in certain specific contexts but it is used throughout the document in a variety of situations and contexts where it is clear from the context that it should more rightly refer to a holder of spectrum rights which may include, but may not necessarily be, an MNO.

Ref 4.148

The 700 MHz band is an important band for rural connectivity. Given Ireland's challenging demographic characteristics the availability of sub-1GHz spectrum bands, including the 700 MHz band, is particularly important to providing rural connectivity. Should this spectrum be allocated by way of Administrative assignment then it is appropriate that it should be allocated to an operator (either an MNO or any spectrum rights holder) with spectrum licenses. If this spectrum (700MHz) were to be assigned administratively it should be assigned only on the basis that the operator in question has clearly demonstrated the commitment and capability to deliver the specific interventionist coverage obligations that must accompany such an assignment. Only in such cases should scarce national spectrum be administratively assigned.

Overall we agree with ComReg's preferred option that it *"..should be assigned by way of an open, appropriate competitive auction format"*

Ref 4.164

It is correct to say that FWA operators would elect for Assignment Option 1 (Auction) in preference to the other assignment options listed. Should ComReg be minded to proceed with any other assignment option with an 'administrative' component this would only be acceptable if ComReg were to ensure that FWA Operators in addition to MNOs would be considered as relevant parties for receipt of such assigned 700MHz spectrum. To administratively assign such spectrum to MNOs exclusively would exacerbate the

already significant distortion that exists in the market with a very substantial quantum of national spectrum already in the hands of mobile phone service operators that are primarily focused on preserving their market position rather than introducing new services into the market thereby making it more efficient for all stakeholders.

Ref 5.23

We question the appropriateness of ComReg's conclusion in this section. ComReg's view appears to be driven from a conviction regarding the substitutability of these frequencies but advances no real basis for its conclusion. In our view it is highly questionable to assume or infer substitutability between these bands, since

a) 2.1GHz is FDD and is an existing mobile band for 3G
b) 2.3GHz is a TDD band and well suited to 5G FWA services
c) part of 2.6GHz is also TDD (Band 41) and also well suited to 5G FWA services.

There appears to be no valid justification therefore for creating time slices for 2.3GHz and the TDD Portion of the 2.6GHz band as this is only needed for the 2.1GHz FDD bands, will make the use and management of the TDD bands unnecessarily complex and may therefore make investment in, and development of, FWA services in these bands less attractive. We therefore urge ComReg to reconsider the appropriateness of its position in this regard and to amend its proposals accordingly.

Ref 6.6

We disagree that the correct approach in this award process should be to award spectrum rights for the entire country and we do not agree that the reasons outlined by ComReg justify such a conclusion. In particular, in relation to

Bullet 1

It is largely irrelevant what other countries did as the primary concern for ComReg should be which option will give rise to more competitive services being provided in underserved areas of Ireland which are the areas most in need of service development. The fact that such an approach has in the past *"...resulted in large numbers of mobile devices being available for use in these bands, making them particularly suitable for the deployment of mobile broadband networks, which are typically deployed across the whole State"* is not a justification for taking such an approach now. This is an historic backward-looking assessment and does not take any cognisance of the current and future needs of the Irish market – particularly those parts of the market outside of the major urban conurbations. In fact, such an award options specifically favours mobile networks and is not in keeping with the needs of the market or an efficient spectrum award process which encourages competition and service development. Awarding spectrum on such a basis will consolidate these spectrum resources in existing MNOs and will continue to stifle service expansion, innovation and competition in the market.

Bullet 2

It is largely irrelevant what other countries did.

Bullet 3

We do not agree that the particular factors which informed ComReg's approach in its 3.6 GHz Award do not arise for this award process. While it is not appropriate here, as it was not in the 3.6GHz award, that spectrum should continue to be allocated in 'FWALA' lots of 20km radius this in no way justifies going from one extreme to the other. Leaping from the inappropriateness of 20km local licences to conclude that a national licence is therefore correct is unjustified and is a position for which ComReg advances no particular arguments. There are many levels between local 'FWALA' type licences and a single national licence that would be appropriate to consider and which would ensure real competition for spectrum and ensuring the correct level of focus by spectrum holders on very different needs and levels of service available across the market. At the very least ComReg must consider awarding spectrum in urban 'CSO' areas separately from 'Regional' areas similar to the approach taken in the 3.6GHz auction. It may not be necessary to further split the regions into four areas as was the case in the 3.6GHz auction but separating spectrum in urban and regional areas is essential to the integrity of the process overall and to properly take on board the needs of the market.

In fact, throughout the consultation it is clear that ComReg considers the spectrum under consideration to be of interest to a variety of operators and for a variety of uses including mobile and FWA. However, having used such a justification elsewhere in the consultation ComReg completely ignore it here and instead use the benefits for mobile networks as a mechanism to justify a single national licence which is a very significant step in the overall process and one which will have far reaching consequences for those seeking to obtain spectrum. Indeed, proceeding with such a licencing regime will significantly favour existing national operators as any new spectrum holder will have to construct a network in already well served urban areas whether they want to or not as the costs of the spectrum will likely be driven by population coverage as much as other factors.

In drawing a conclusion ComReg refer to *"...benefits in terms of both spectrum efficiency and competition to proceed with a dynamic and scalable national and regional award"* but do not mention what these alleged benefits might be and so it is difficult to weigh these as a reason for abandoning the rationale that was adopted in the 3.6GHz award.

Ref 6.8 and 6.9

We do not agree that *"..fixed wireless and mobile deployments are likely to be across the whole State and not limited to specific urban/rural areas."* ComReg are aware that there are networks constructed (and under construction) that are focused exclusively on regional parts of the country where exists a well-documented deficit of service. In fact. The 3.6GHz award was constructed by ComReg on precisely the premise that permitted such developments. At this point in time, with three existing mobile networks and other fixed networks in urban areas there is little incentive for further competing network construction in

urban areas. Densification is certainly an issue in certain urban areas but of more significant concern is service extension into parts of the country that are currently not well served with either mobile or fixed services. By insisting on a single national licence rather than even an 'Urban' and 'Rural' split is significantly disadvantaging operators willing to invest in regional Ireland rather than urban Ireland and is consigning those living outside of the more profitable urban areas to remaining with their current poor service portfolio longer than otherwise would be the case. It is our strong view that ComReg have not justified their assertion that a national licence is appropriate for this award and we encourage you to reconsider your position and conduct the award process on a basis similar to that of the recent 3.6GHz process with Urban and Regional licences awarded separately. Such an approach would not inject material complexity into the process but would greatly increase the strategic focus of operators to acquire spectrum in areas where they had clear business plans rather than merely acquiring spectrum as an adjunct to more limited objectives – particularly where such objectives were focused on high population density urban deployments at the expense of regional service development.

Ref 6.52

While technically it may be appropriate to consider interference issues the approach taken here is significantly disproportionate to the underlying service. To consider effectively sterilising significant portions of the national geography and 20MHz of valuable spectrum to provide basic telephony to c. 87 customers is excessive in the extreme. Almost any other approach would be more acceptable than this given the time, effort and cost that will be needed to engineer, implement, monitor and police such an arrangement. We strongly suggest a revised approach to this issue including the provision of a hard deadline to provide alternative service to these 87 customers.

Ref 6.58

We believe the best approach here is to give Eir a hard deadline to execute a shutdown of the network.

Ref 6.73

We disagree with ComReg's approach in this paragraph and we believe it is more efficient for this spectrum to be used in full for TDD – i.e. entire 194MHz band from 2496 – 2690 (Band 41) as opposed to the ComReg proposal for it to be licenced as 2x70MHz Band 7 FDD and 50MHz in Band 38 TDD. In the context of likely use cases and modern deployment scenarios it is more likely to be deployed efficiently as TDD services and as such forcing symmetric FDD spectrum is inefficient and unnecessary.

Ref 7.264

The issue of spectrum caps is central to the overall effective operation of the market and there are a number of factors to be considered in this context including existing MNO services, FWA requirements, service innovation, geographic service disparity and overall competition issues.

Where significant spectrum holdings can be consolidated into MNO positions this creates significant barriers to entry for new service providers and provides incentives for MNOs in particular to acquire spectrum as a barrier to entry and then concentrating service availability into the urban conurbations which provides the best economic return to the MNO. This has led to the significant service disparity across the country with regional areas being particularly poorly served by existing MNOs. This is of course exacerbated by the skewed nature of Irish demographics and population density but these are factors that are unlikely to change in the future. Consequently, ComReg must be mindful in all spectrum auctions of the desire and ability to encourage service availability in Regional Ireland and therefore spectrum licencing and overall spectrum caps must take these factors into account. However, it appears that only two factors were considered by ComReg in regard to spectrum caps and these are the issue of asymmetry in spectrum holdings of existing MNOs and the potential for there to be unsold lots if the MNOs don't have large enough caps.

With regard to unsold lots, the 3.6GHz auction demonstrated the desirability of acquiring spectrum by existing and new operators and that auction had c. 55 Rounds of bidding and final pricing well in excess of the original reserves and many multiples of the initial bid prices. In fact, the evidence supports that there is considerable demand for spectrum resources from both existing and new operators and that any concerns regarding potential unsold lots is unfounded and high caps could allow existing MNOs to inefficiently consolidate spectrum resources to the detriment of service development especially in Regional areas where exiting competition is weakest.

We fully agree on the desirability of effective spectrum caps however we believe ComReg's concern should be less about asymmetry between the three incumbent mobile operators and more around ensuring that there is sufficient spectrum available for other operators to be able to compete and acquire it. Setting spectrum caps relative to existing inequalities seems a poor approach since it does nothing to consider the uneven nature of the manner in which these MNOs have served the market and there is no evidence that they are about to change that approach.

With a prospective Cap of 375MHz to 420MHz and nearly 350MHz of new spectrum available, given current MNO allocations of between 185MHz and 280MHz it is possible for the incumbent mobile operators to acquire a very significant portion and in the case of two mobile operators (Vodafone and Eir) the majority of this new spectrum without exceeding the overall Cap. This defeats the purpose of having a Cap at all.

Given ComReg's approach to Caps, which is focused largely on MNO asymmetry, it appears the cap is more about attempting to ensure that existing MNOs can get roughly equal amounts of national spectrum as opposed to an approach which considers what is in the best interests of the market as a whole and the needs of all of the citizens of the state. ComReg's approach may be more understandable if there was an adequate quantum of competition across the country and market and also comparable service quality and availability. It is well known that this unfortunately is not the case and there is significant service disparity across the country and limited or no effective competition in many parts of Regional Ireland. In circumstances where no further incentive was required then it is acceptable that regulatory intervention may not be needed and limited or no caps may be appropriate. This is not the case in Ireland and spectrum caps must perform a more useful function than merely allowing historic incumbent mobile phone operators continue to harvest existing markets and divide new scarce spectrum resources between them where the market has significant ongoing and unmet service needs.

If ComReg were to consider asymmetry in service availability as a factor in determining caps it would doubtless indicate a lower level of cap than that proposed. It is of critical importance that ComReg recognise the need to focus scarce spectrum resource to those operators and geographic areas that are most in need of it and continuing to view the market as a homogenous whole is a grave error in approaching long-term commitments to scarce natural resources. Such an approach in he past has not resulted in well-developed service offerings to customers across the country and continuing with a similar approach now will not result in new behaviour from the same MNOs who will continue to focus investment into the more profitable urban areas to the detriment of those in Regional Ireland.

In such a market, there is an obligation on the regulator to learn from past MNO behaviour and ensure spectrum resources result in improved outcomes for customers most in need. Consequently, to encourage competition spectrum caps should be based on no one operator acquiring more than 25% of the total available spectrum. This would indicate an appropriate cap to be c. 290MHz and while we recognise that this may not offer much opportunity for Three to acquire additional spectrum it would provide opportunity for other operators to develop and deploy services. To the extent that ComReg increase the cap above this level it will increasingly make it more difficult for further new entrants to the market and it will therefore increasingly make it unlikely that new services will be made available particularly in Regional Ireland.

In the unlikely event that spectrum remained unallocated then a mechanism could be put in place to allow the cap to be breached by any operator who had indicated a willingness to acquire such spectrum at the final price determined by the auction. However, we consider such an outcome to be highly unlikely.

We disagree that a cap in the 400-420MHz range would be at all reasonable given the certainty that such a cap would ensure further asymmetry in spectrum holdings and inevitably lead to dysfunctional market incentives in the form of spectrum hoarding with a continuation of service asymmetry in underserved areas of the country.

A cap in the 385-395MHz range permits a situation where all available spectrum resources can and will be consumed by existing mobile operators, further increases asymmetry in spectrum holdings and does nothing to stimulate service development and competition in the market.

In terms of setting the appropriate level of overall spectrum cap in the auction process it is clearly imperative that the current level of asymmetry is not maintained as concentrating such a large proportion of liberalised spectrum in the hands of any on operator is undesirable. Therefore, setting a cap at the lowest reasonable level is the least-worst outcome for the market as a whole. In this context, setting an overall cap at 375MHz is the preferred option. This will ensure that there is adequate flexibility in bidding for all interested operators without promoting a situation where unwelcome concentration of spectrum can arise.

Ref 7.262

We disagree with ComReg that *"....there would seem to be little justification to actively seek to reduce the asymmetry in MNO holdings at this time."* We believe that for the reasons outlined in response to 7.264 above and the level of service disparity in the market is sufficient justification alone to encourage new entrants into the market. Further, we believe such a view can only be justified if ComReg are viewing the market solely from the point of view of existing MNOs as opposed to holding a view that sees MNOs only as a part of the market.

1.5 Mr Liam Young

Submission in Response to Comreg's Consultation on the Proposed Multi Band Spectrum Award Including the 700MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands

Comreg Document Reference 19/59R

Submitted by

Liam Young

7th August, 2019

This document contains a Non-Confidential Submission for Unrestricted Publication

The views expressed in this document are the views of the author alone, and do not represent the views of any other individual or organisations with which the author may be associated. The author's contact details have been submitted separately to Comreg.

This report was submitted to Comreg on 07/08/19 from the author's home in West Donegal, located within the NBP intervention area, using a Vodafone 4G LTE signal, and using a mobile signal repeater to deliver an indoor 24Mbit/s download speed and a 6Mbit/s upload speed. The fixed network alternative available from eir at this location delivers a maximum download speed of 2.1Mbit/s, with a maximum 0.3Mbit/s upload speed. No other network operators, including, mobile, fixed or fixed wireless currently offer broadband services to this address (except those retailing eir's same network infrastructure).

Table of Contents

1. Executive Summary

Thank you for the opportunity to submit a response to the Spectrum Award proposals as set out in Comreg's Consultation Document Reference Number 19/59R. This submission sets out the case that Irish mobile users, consumers and Irish citizens generally, are best served by the adoption by Comreg of an interventionist approach in setting licence conditions in the forthcoming spectrum awards process. Further, this submission urges the Commission to apply higher quality of service conditions to licences than the levels of service indicated as being preferred by it in its preliminary view. In particular, this submission argues that both the network coverage licence conditions and the download speed licence conditions require intervention by Comreg, particularly since there is strong evidence that the current user experience of Irish mobile users lags well behind those of other EU countries, and behind many countries internationally.

The radio spectrum bands being considered for licence in this consultation represent a very significant scarce resource managed and regulated by Comreg on behalf of the Irish State. The forthcoming awards process represents a once-off opportunity for Comreg to ensure that the benefits of this resource are maximised for the benefit of Ireland's citizens. This awards process, once completed, will be key to determining the extent to which Irish users, consumers and businesses, urban and rural, will have access to crucial connectivity services that compare favourably (or unfavourably) with those available in other countries for at least the next 15 years. From a personal and business perspective, the quality of this connectivity has a crucial bearing on the relative competitiveness of Irish businesses, and their consequent ability to grow and create employment in Ireland.

According to most recent research data, the quality of service data relating to coverage levels and data connectivity speeds compare Ireland very poorly in international comparisons, with Ireland achieving only just around average coverage levels for 4G LTE, and according to the most recent DESI Report[1] published by the European Commission. According to the Speedtest Global Index[2], Irish users suffer the worst MBB average data download speeds of any on of the 28 EU member countries, with an average download speed of only 24.07 Mbit/s, ranking only 71st in the world, behind countries such as Armenia, Sri Lanka and Iran. More depressingly, Ireland's ranking has actually fallen three places since the last survey. For further evidence, a report published in May 2019 by OpenSignal[3] paints a similar picture regarding average download speeds, also placing Ireland slowest among all EU member states. The OpenSignal Report also places Ireland towards the bottom of the rankings in terms of 4G availability.

References:

1. Digital Economy and Society Index Report 2019 on Connectivity, published by the European Commission
2. Speedtest Global Index, published by Ookla LLC, June 2019
3. The State of Mobile Network Experience, OpenSignal, May 2019

The evidence is clear that competition among Irish MNO's, which has been a feature of the market in Ireland since 1998, is not sufficient to ensure that Irish mobile users receive best in class quality of service and coverage levels, and most of the data suggests that the opposite is true. For this reason, Comreg must consider the use of strong levels of intervention in setting quality of service levels that meet international standards of comparison.

Although there is currently no research data to confirm the preference of non-industry stakeholders, this submission argues strongly that given a choice between better quality of service or higher spectrum licence fees, the vast majority of Irish users and taxpayers would prefer that Comreg makes decisions that seek to ensure better quality of service in terms of network coverage and download speeds from MNO's, rather than securing higher licence fees.

1.1 Key Points of this Submission

(a) Comreg should adopt ***an interventionist approach*** to setting licence obligations to ensure minimum coverage and download speeds, rather than the precautionary approach favoured by Comreg in its consultation document.

(b) Comreg should set much more ***challenging network coverage and minimum download speed conditions*** than those set out in the consultation document.

(c) Comreg should include in its licence awards a coverage condition on incumbent MNOs of ***98% of all Irish Eircode addresses within 3 years, and 100% within 5 years.***

(d) Comreg should set a minimum download speed of ***50Mbit/s within 3 years***, increased to a minimum download speed of ***100Mbit/s within 5 years***.

(e) Comreg should include a minimum network latency target for data downloads of ***10ms within 3 years***.

(f) Comreg should ***permit licencees the freedom to use any resources and technologies available*** and within their control to allow them to meet their licence obligations, including, but not limited to, the licenced spectrum awarded, other spectrum already licenced by the MNO, and should explicitly permit fixed wireless connections, and also consider permitting non-radio based fixed connections including copper and fiber to satisfy the licencees coverage obligation.

(g) Comreg should ensure that the decisions it makes are made having taken proper account of the ***significant potential for industry bias*** in the responses it receives to this consultation.

(h) Comreg should ensure that its approach to the licence award process is not constrained or influenced by considerations relating to the Government's National Broadband Plan. ***Comreg's statutory obligations regarding maximizing the use of Ireland's radio spectrum resources for Irish consumers is unqualified,*** and should not be constrained or restricted by overlapping plans for fixed network solutions.

(i) Comreg should study closely the outcome of the recent licence award process overseen by the Bundesetzagentur in Germany, which concluded in June 2019, ***where similar interventionist coverage and download speed conditions to those recommended in this submission have been successfully imposed and accepted by licencees***.

(j) Comreg should study closely the spectrum awards process adopted and subsequent network rollout in Sweden, where ***4G LTE coverage has now exceeded 99.9% population coverage***, driven by a regulatory intervention, and despite having a much lower population density than Ireland.

(k) This submission strongly recommends that Comreg, in setting its licence conditions, considers that the business case for an incumbent MNO to invest in new spectrum ***does not just involve the economics of an investment relative to its associated return,*** as assessed by the various reports commissioned by Comreg. An MNO's bid considerations also involve other priorities, ***aimed at protecting and continuing to extract returns from all previous investments***, often expressed as goodwill, stretching back in time to the rollout of its first network and the acquisition of its first customer.

1.2 Background to this Submission

The author's motivation in submitting a response to Comreg's consultation is based on a concern, having reviewed the Comreg consultation document and associated industry consultant reports, that Comreg and it's consultants may not be sufficiently exposed to the views of Irish consumers and citizens on this issue, views which may contrast significantly from the views of industry players with significant commercial and financial interest in the outcome of Comreg's deliberations and decision-making.

The author has no particular mandate to represent the views of any group of stakeholders, and offers only the views of a single individual citizen and business owner operating internationally and with operations located in remote parts of rural Ireland.

My perspective is one which is very supportive of initiatives that are designed to maximise and optimise the use of our national resources, such as, in this case, radio frequency spectrum. I hope that this submission will help to contribute towards providing helpful and balanced feedback to the Commission in its task of making important decisions regarding the optimal plan to award frequency spectrum licences that benefits all stakeholders.

1.3 Scope and Structure of Response

The second part of this submission *(Section 2)* addresses an important issue relating to this consultation process which I believe warrants serious attention by Comreg's Commissioners, and which is intended to be a constructive input to Comreg's consideration of its approach to this and future consultations.

The third part of this submission *(Section 3)* directly addresses and provides summary responses to the "Overview of Key Proposals" as set out in Comreg's Consultation Document No 19/59R.

The fourth and final part of this submission *(Section 4)* purposely focusses on the issues raised in "*Chapter 8 – Licence Conditions"* of the Comreg consultation document, as the issues raised in this section, and the proposals being suggested, are those which the author considers have the most significant consequences for all stakeholders. In particular, the issues and options being considered by Comreg relating to *Coverage and Roll-Out Conditions* are issues which are considered to be the most critical, and which are very likely to have diverging views between industry and non-industry stakeholders. This submission endeavours to provide a clear and coherent rationale where the views expressed differ significantly from those being favoured by Comreg or those being recommended by Comreg's economic or technical consultants.

1.4 About the Author

Liam Young, (BBS, MBA, C.Dir) commenced his business career as a member of Telecom Eireann's commercial team that planned and executed the launch of Eircell, Ireland's first mobile network, in 1985. Liam was employed in various roles in Telecom Eireann and subsequently joined BT, where he led to the establishment of BT's operations In Ireland. Liam was the founder and CEO of Conduit plc, a successful international directory information services provider that has worked closely with many of Europe's mobile operators including Vodafone and O2 in Ireland, Orange, O2 and Vodafone in the UK, One and Mobilkom in Austria, Orange in Switzerland, and Sonera of Finland. Liam has served as a non-executive director of Fleetmatics plc, a SaaS fleet management company using mobile network technology, until its acquisition in 2016 by Verizon. Liam is currently Chairman and CEO of Errigal Bay Ltd, an export-driven seafood producer with 150 employees, with operations in Donegal and Wexford.

2. Comreg Consultation – User Representation of Views

As outlined in the Executive Summary of this submission, the author's primary motivation in submitting a response to Comreg's consultation is a concern that Comreg may, in this instance, be under-exposed to the views of Irish consumers and taxpayers, and Irish citizens generally, views which may contrast significantly from the views of industry players with significant commercial and financial interest in the outcome of Comreg's deliberations and decision-making.

As I am sure the Commission is aware, Comreg is required to seek the views of all stakeholders, and to ensure that a broad spectrum of interests is considered before making decisions that, in this case, will have wide-ranging implications for Irish society for decades to come. In the case of this particular consultation, it appears that the consultation process is aimed primarily at seeking responses from industry players, with little evidence of efforts by Comreg to stimulate public awareness that this process is underway or even exists.

For example, the Comreg Consultation document inviting responses only appears within the "Industry" section of Comreg's own website, and seems to have been excluded from all sections of the "Consumer" section, including the "Consumer News" section, "Consumer Information" section, the "Consumer Engagement" section, and is even excluded from the "Open Consultations" tab within Comreg's Consumer microsite. While this may be an inadvertent omission on Comreg's part, the general sense conveyed is that Comreg is primarily interested in the views of industry players, and is not especially interested in the views of other stakeholders.

In addition, and reinforcing this impression, the very detailed technical content of Comreg's consultation document, coupled with multiple references to previous consultations, and consultant reports, while very important and useful in teasing out issues with industry players and especially from intending spectrum award applicants, has less relevance and renders less accessible the process to other stakeholders who may wish to have an input to some of the more important general policy-making aspects of Comreg's decisions relating to the forthcoming frequency awards.

While this may not be Comreg's intention, the fact remains that it is very likely that a significant proportion of the respondent submissions to this consultation will be industry players, and that those responses will be prepared using deep access to information and resources. While these industry players may be more knowledgeable and undoubtedly possess a high degree of technical, human and financial resources to research and respond to Comreg's consultation in an articulate and insightful way, the problem for Comreg is that the analysis and views received will be naturally designed towards influencing a decision outcome that maximises their own commercial interests. While this is of course each respondent's right, the net effect of this set of circumstances is the possibility that the views received by Comreg in response to this consultation are skewed in favour of the interests of industry players, views which are unlikely to reflect the views of other stakeholders.

Comreg must already be aware that this "motivated to respond" bias from industry stakeholders brings with it the danger that the views of other less vocal or even silent stakeholders are not given the same level of attention or consideration in a detailed and complex process such as pertains in decisions relating to frequency spectrum awards.

To put this simply, the detailed technical and economic issues, and the complex nature of the considerations and technical jargon that are inherent in this process, and as set out by Comreg

and its consultant reports, are not likely to be easily understood by the average citizen or mobile user, and will very likely discourage many from responding to Comreg's consultation invitation.

However, the decision outcomes of this process have significant implications for Irish users and even non-users of mobile and broadband services in Ireland for at least the next 15 years, and therefore requires that that the views of all stakeholders are sought, fully understood and carefully considered before action is taken.

Without wishing to second-guess Comreg's means of addressing the problem described above, if it recognises that a problem exists at all, the submitter respectfully suggests that Comreg should actively review the proportion of industry and non-industry representation of the responses it receives to this consultation, and consider the consequent weight with which it attaches to those responses. It should also consider consulting further, in an effort to address the imbalance which I believe may occur.

Given the importance of the issue being considered, I would suggest and recommend that the Commission consider the possibility of adopting more accessible mechanisms to consult more widely with non-professional and non-industry stakeholders on this topic, possibly using an emailed multi-choice survey method regularly adopted by business and non-business organisations to research consumer views, or possibly using focus groups to elicit the views of a broader section of stakeholders.

I do appreciate that Comreg does have mechanisms in place to ensure it receives input from non-industry sources, such as the Consumer Advisory Panel, and also receives reports also from specific groups such as the Mobile Phone and Broadband Taskforce. However, the existence of these mechanisms should not reduce or negate the need to ensure that the particular issues being canvassed and addressed in this consultation are made as accessible as possible, and that the resulting views of non-industry stakeholders are given sufficient regard in coming to decisions.

In any case, the issues raised in this response are intended to be constructive, and not intended to diminish the important work of Comreg, nor its efforts to consult with stakeholders. I hope that this submission will help to provide balance to the Commission in coming to conclusions and making important decisions regarding the optimal plan to award frequency spectrum licences in Ireland to the benefit of all stakeholders.

3. Direct Response to Comreg's Overview of Key Proposals

The responses contained in this section directly address the numbered paragraphs set out in Comreg's Consultation document, contained in the "Overview of Key Proposals" section, and are in summary form. A more detailed response to Comreg's proposals that relate to *"Licence Conditions"* is provided in *Section 4* of this response.

Point 1: *Noted*

Point 2: *Noted*

Point 3: *Noted and fully agree with and support this proposal*

Point 4: *Noted and fully agree with and support this proposal*

Point 5: *Noted*

Point 6: *Noted and fully agree with Comreg's comments*

Point 7: *Noted and fully agree with and support this proposal*

Point 8: *Noted*

Point 9: *Noted and I do not agree with or support this proposal.*

I believe that the interests of Irish consumers, taxpayers and in particular, rural MBB users are best served by the adoption of an interventionist approach to coverage obligations, rather than the precautionary approach favoured by Comreg in its consultation document.

Point 10: *Noted and I do not agree with or support this proposal.*

I would strongly urge Comreg to set substantially higher minimum download speed targets than those set out in its consultation document. In order to demonstrate the practical workability of this approach, I would refer Comreg to the recent coverage and download speed obligations set by the Bundesnetzagetur in the recent awards process which successfully concluded recently in Germany. Among the licence conditions imposed on German bidders, the regulator required that licence holders must provide

".....coverage with a transmission rate of at least 100Mbit/s for at least 98% of households in each federal state by the end of 2022".

Further, I would recommend that Comreg's licence obligations include, as is the case in Germany, a minimum network latency target, measured in milliseconds, as an important measure of data download service quality, and would include challenging milestones by which licence holder should achieve each target.

This submission questions the use of population coverage percentage as the best method of setting and measuring minimum coverage obligations. Comreg's definition of population coverage leaves scope for various interpretations as to how the measure is actually calculated, and, in particular, the precise method of

determining actual population location. For this reason, and without full clarity of how population coverage is calculated, this submission recommends that either Eircode coverage or a combination of geographic coverage and Eircode coverage should be considered by Comreg as better alternatives to drive network coverage obligations.

Point 11: *Noted. I agree with and support this proposal with some reservations.*

Please also refer to Response to Point 9 above. An interventionist approach to download speeds and coverage obligations is considered by many telco regulators across the globe to be a critical component in ensuring that licence holders roll out services quickly, and that radio frequency spectrum is used efficiently and to the maximum benefit of users. The interests of users and MNOs are unlikely to coincide on this issue, and it is to be expected that MNO's would prefer to be free to rollout services and network coverage plans in a manner that suits their own operational and financial needs, rather than have these measures imposed on them externally.

A precautionary approach risks reinforcing a widely-held perception among Ireland's rural population that urban-dwellers are unfairly favoured and prioritised over rural communities whenever infrastructural services are being considered. A rapid roll-out of advanced mobile services to rural communities ahead of, or at least at the same time as roll-out to urban centres will be a significant contribution towards countering this perception. Aside from the social benefits, a challenging network and services roll-out timetable is also crucial from a national competitiveness viewpoint, helping to ensure that businesses and consumers enjoy the benefits of connectivity and new services within the earliest possible timeframe, ahead of, or at least as quickly as, those enjoyed in other countries.

While a balanced approach to this issue is of course required, a precautionary approach also risks allowing network equipment vendors and MNOs to push Ireland's roll-out of 5G services down their priority list. At a practical operational level, MNO's and equipment manufacturers that operate across many international markets are unable to deliver network equipment and services to all markets served simultaneously. In assessing the international priority with which each market will have new services rolled out, a key consideration will be the regulatory roll-out obligations which must be met in each market. Adopting a precautionary approach will almost certainly serve to encourage equipment manufacturers and MNOs to push Irish 5G networks down their order of priority list.

The evidence from international studies referred to in the Executive Summary of this submission demonstrates that Ireland lags far behind most developed nations in average mobile data download speeds, and is at or below the rural population coverage average of most nations in terms of our current 4G LTE coverage. This performance demonstrates that the dynamics of competition among licencees in Ireland is unlikely to address the quality of service deficit without significant intervention measures by Comreg.

Point 12: *Noted and I do not agree with or support this proposal*

Please also refer to Response to Point 11 above.

Comreg's consultation document offers no rational reasoning behind the view put forward that *"interventionalist obligations are ideally achieved via a sequential step in a spectrum award or through a separate process."* In my view, neither the regulator, the licence holders, or indeed any other stakeholders would benefit from the prospect of sequential changes to the licencees obligations following the award process, as this would only serve to create a degree of uncertainty for all stakeholders as to the precise benefits and obligations of the licence at the time of bidding for the frequency licence. This uncertainty could cause intending bidders to assign less value to the licence in light of the prospect of shifting or increasing licence obligations that may or may not arise over time. From an Irish taxpayers' and users' viewpoint, the likelihood that MNOs will accept new "sequential" obligations voluntarily once the licence agreement is in place is very low, and the imposition of new licence obligations post the award process is likely in any case to be too late to address a market failure once it occurs. From a contractual point of view, it seems unlikely that Comreg could unilaterally impose new conditions on a licence that has already been granted, and which would at best, be open to legal challenge.

It is also worth pointing out that Comreg has, to my knowledge, no record of engaging in post-award obligation changes to address deficits in quality of service performance, despite the evidence of significant deficits in the international comparisons cited above.

Point 13: *Noted*

Point 14: *Noted*

Point 15: *Noted and I support with this proposal subject to the coverage obligation relating to the deployment of a specific number of base stations being sufficiently challenging to ensure the efficient use of spectrum to deliver maximum coverage.*

Point 16: *Noted*

Point 17: *Noted and I support with this proposal subject to the coverage obligation relating to the deployment of a specific number of base stations being sufficiently challenging to ensure the efficient use of spectrum to deliver maximum coverage.*

Point 18: *Noted*

Point 19: *Noted and I support this proposal subject to the coverage obligation relating to the deployment of a specific number of base stations being sufficiently challenging to ensure the efficient use of spectrum to deliver maximum coverage.*

Point 20: Bullet Point 1: *I agree with and support this Proposal*

Bullet Point 2: *I agree with and support this Proposal*

Bullet Point 3: *I agree with and support this Proposal*

Bullet Point 4: *I agree with and support this Proposal*

4. Response to Proposals relating to Proposed Licence Conditions

I have set out below a summary of the reasons why Comreg should consider setting a challenging intervention level of coverage and download licence obligations on successful bidders in the forthcoming 700MHz award process.

4.1 The National Broadband Plan (NBP) and associated rollout schedule ***should not be used as a reason to deprioritise***, or to choose not to drive MBB coverage or pace of rollout, because:

(a) The NBP process is already well behind schedule and, given the delays that have already been encountered since it's inception in 2012, could well be delayed further from it's intended rollout schedule. The suggestion that Comreg might adopt a strategy that involves favoring a rural fixed fibre-based broadband solution to address rural broadband connectivity rather than simultaneously driving rapid MBB rollout, ***exposes rural communities to the risk that neither solution will deliver a satisfactory solution*** within a reasonable timeframe.

(b) Comreg has a statutory responsibility to ensure that Ireland's radio spectrum is used in an optimal manner, to deliver services to users in the most efficient manner possible. It could be argued that an approach that involved sub-optimising this responsibility in favor of a strategy that involves dovetailing the award and rollout of 5G networks with the Irish Government's NBP rollout is not compatible with Comreg's obligations in this regard.

(c) Furthermore, Comreg may need to ensure that its approach is compatible with EU State Aid and EU Competition Rules, since the adoption of a strategy that is perceived to be taking a less than optimal approach to the spectrum licence award, in an effort to avoid or discourage licencees from encroaching on the objectives of the NBP may be problematic. Irrespective of your views on this issue, ***a rapid rollout and coverage of both fixed and mobile high-speed broadband infrastructure is in the Irish rural consumers' best interests.***

While it is appreciated that this is a complicated issue, the question arises as to why it is that fixed high-speed rural broadband services require Government intervention in Ireland, while mobile high-speed rural broadband services do not, according to Comreg's preliminary view as set out in its consultation document? From a rural users' perspective, ***both*** technologies should be enabled and incentivized, partly because their use cases and applications are often different, and also because EU Competition Law is based on the premise that ***the consumer is best served by promoting fair competition between vendors offering different but competing solutions to the fullest extent possible.***

This implies that Comreg needs to consider not just the extent of competition between mobile operators, but between all operators offering high speed connectivity solutions, both fixed and mobile, and including those offering fixed wireless solutions. It seems logical that an interventionist approach by Comreg to the issue of network coverage and download speeds in the forthcoming awards

process best serves this objective, ***since this matches the approach taken in respect of fixed broadband services, and provides the best means of ensuring rapid delivery of high speed MBB services to all parts of the country,*** and not just those in urban and semi-urban areas.

(d) It is accepted by most experts that fibre broadband is currently the best solution for many user applications delivering high speed connectivity, low latency and good network reliability. However, there are also many rural high-speed broadband applications that are best delivered using a mobile network solution rather than fixed, such as applications in the farming, fishing, mining and forestry industries.

For example, the NBP solution, involving the predominant use of fiber to a fixed customer point, does not address the likely requirement among the estimated 56,000 farms within the NBP "intervention area" that require connectivity not just within the main farm building, but also across external farm buildings including milking parlours, grain and fodder stores, and, depending on the application, across the entire acreage of the farm. ***A public mobile network solution is likely to be far more effective in meeting a farm-wide solution than a fixed broadband solution***, which would likely require the user to invest in further private radio network infrastructure to propagate connectivity across all the farm building and land acreage. Similarly, many non-farm businesses located in rural areas (44,000 in the NBP intervention area) can uniquely benefit from a wide-area mobile network solution rather than a fixed network solution, including those engaged in transport and logistics, manufacturing and local utilities that require remote connectivity including, water, power and environmental services management.

(e) Many Irish rural businesses compete internationally, and require services not simply comparable with those available in Irish urban locations, but which match or compare favourably with MBB services available to its supply chain partners and competitors in other countries. Ireland is already behind a number of other European countries in rolling out 5G networks, with live 5G networks now launched in 26 countries so far this year (as of the submission date), and the priority in applying intervention coverage obligations should be less about ensuring coverage is eventually achieved, ***but in ensuring coverage and high download speeds are achieved within a short period of time***. The urgency with which rural high-speed broadband services are required is far more acute than the Comreg consultation document would appear to suggest, and more urgent than existing Irish MNOs are likely to acknowledge.

(f) In Section 8.86 of the consultation document, Comreg seeks to assess whether 30Mbit/s or 50Mbit/s is an appropriate download speed obligation, and concludes that 30Mbit/s is sufficient. This conclusion is at least partly reached based on DotEcon's assertion that

> *"mobile coverage obligations should not be seeking to replicate the speeds and consumer experience deliverable over fixed broadband..."*

Why not? DotEcon's assertion needs to be rigorously tested and analysed by Comreg, as this issue goes to the core of the formulation of its policies regarding

MBB in Ireland, ***and its acceptance or rejection will directly influence the consideration of issues addressed in this consultation.*** Since the mid-1980's, mobile network technologies have challenged and become a direct replacement for services that were traditionally delivered over fixed networks, progressively replacing fixed voice telephony services, messaging services, email download services, and more recently, data download and internet access services. Live video streaming and other data-intensive services are already gaining popularity over mobile networks using 4G LTE, and, while perhaps not quite matching the quality of fixed alternatives***, will very likely meet and even exceed the fixed network experience with the launch and maturing of 5G services***.

The debate as to whether MBB will become a direct replacement to fixed broadband will likely not reach a clear conclusion for some years, but Comreg would be remiss in not seeking to ensure that the rollout of both technologies is developed and encouraged to their full potential. It is instructive to note that many voice users have abandoned fixed line telephone services in favor of the mobile alternative, not for quality of service reasons, but for reasons to do with convenience and the logic of purchasing bundled services including voice, voicemail, messaging and data as a package delivered by one provider to one device rather than two or more.

Despite the arguably higher quality and reliability of fixed line voice services compared to mobile, ***users have predominantly chosen mobile because it delivers an acceptable solution in both home and mobile scenarios***, and it makes more sense to use and pay for one service rather than two. According to the *Digital Economy and Society Index Report 2019 on Connectivity*[1] prepared for the European Commission, households using MBB alone to deliver their home broadband needs has grown rapidly over the past few years, and this trend is expected to continue. This trend is partly driven by the relatively high fixed rental element of both fixed and mobile services, which drives users to avoid paying multiple service providers for similar services. Fixed broadband providers may find they are swimming against the tide, with users deciding to choose to use one service for both mobile and home broadband requirements, ***even if the standalone fixed broadband solution is superior in terms of download speeds and reliability***.

(g) The consultant reports provide useful analysis in weighing up the costs and implications of an interventionist approach to drive coverage and download speeds, yet ultimately reach overly pessimistic conclusions in their estimates of the ability and incremental cost to operators of delivering higher coverage rates and download speeds. I believe some of the reports suffer from an analysis approach that is somewhat retrospective rather than forward looking, and often fail to recognise all of the of potential for improved coverage and download speeds that are possible using available new technologies which are both 5G and non - 5G related.

(h) The report prepared by Oxera, entitled *"Future Mobile Connectivity in Ireland"* while thought-provoking and interesting in exploring current trends, should, in my view, be treated with some caution as a reliable predictor of future usage of mobile services in Ireland by Comreg. The primary research methodology of the study, as set out in Section 3.2 of Oxera's report, appears to be confined to interviews with Irish MNOs and equipment vendors, and does not include any surveys of likely end-user demand. The industry players interviewed, while undoubtedly very knowledgeable about the markets in which they serve, are not the users of services that will ultimately determine how the market develops.

(i) Of even greater concern, the Oxera Report methodology describes its use of *".....comparisons with demand patterns in other countries (provided similar services have been launched)."* But the services that are being considered and planned for in Comreg's consultation document are services that will almost certainly use 5G technologies and standards, none of which had been launched commercially in any country prior to the publication date of the Oxera Report. For this reason, it's difficult to see how demand patterns from other countries could usefully be applied by Comreg in coming to conclusions regarding the forthcoming spectrum awards, ***since the services that would generate these demand patterns does not yet exist.***

(j) Although the Oxera modelling exercise takes account of the use of Carrier Aggregation in coming to its conclusions, it does not detail the extent to which it assumes Carrier Aggregation is deployed in its model by the MNOs. ***This is a critical issue in coming to conclusions about the future download speed capability of Irish MNOs.*** While Carrier Aggregation might not always be a practical solution in more densely populated areas, Ireland's rural population characteristics actually provide a relative advantage to MNOs operating in Ireland in deploying both two-band and three-band Carrier Aggregation, since the relatively low population density and therefore consequent number of users contending for channels in each cell area in rural areas of Ireland is less, and therefore the number of channels available to deploy three-band Carrier Aggregation is greater than would otherwise be the case.

(k) The network cost conclusions reached using the synthetic mobile network model adopted by Oxera appear to depend significantly on assumptions about the Macrosite Height per Geotype Area. The report authors acknowledge that these assumptions are based on estimates, and not based on height information from real deployments in the Irish licensed data. These height assumptions require close scrutiny by Comreg in assessing the reliability of the study findings, as they may not match existing actual macrosite heights used in the transmission networks of Irish MNOs, nor bear any relationship to actual Irish topographical data. For example, the assumption built into the Oxera model that the average height of rural macrosites in Ireland is lower than those sited in urban locations, although possible, seems unlikely given Irish planning restrictions on urban building height, and the topographical features of rural Ireland, where hilltop macrosites are commonly located.

(l) The Oxera study also appears not to consider the impending availability to MNOs of technologies that are closely related, if not fully part to the 5G standard, such as improved antenna and beam-forming technologies that are particularly designed to improve coverage in rural scenarios. Nor does it consider other technical developments that form part of 5G, such as the emergence of new small cell antenna solutions that are designed to assist operators in overcoming local authority planning compliance. In addition, the recent emergence of fixed wireless broadband solutions as a complimentary solution to deliver high speed rural broadband should be considered by Comreg as a further complimentary tool towards allowing MNOs to deliver on their coverage obligations. Incumbent MNOs have already commenced using fixed wireless solutions as an integral part of their network offering in other countries, and this trend is likely to help MNOs to achieve coverage and high-speed connectivity in otherwise difficult to reach rural locations.

(m) Although referred to in passing, but not apparently factored into Oxera's model, is the fact that the use of the 700MHz band brings with it a further benefit – its propagation characteristics are inherently an improvement over those of the 800MHz and 900MHz bands, and dramatically better than those currently in use in the 1800MHz and 2100MHz bands. Although difficult to quantify, this improvement should, on its own, lead Comreg to the conclusion that operators will have an enhanced capability to improve rural network coverage using the 700MHz band.

(n) The fact that all three incumbent MNOs already use the 800MHz and 900MHz bands, as well as the mid-band frequencies to achieve high coverage levels, leads to the obvious conclusion that the addition of a further even lower band provides incumbent MNOs with a combination of frequencies that allows for an even higher degree of coverage by re-engineering and repurposing their existing frequency use. From a coverage capability viewpoint, the benefit for MNOs in adding the 700MHz band to an existing "stock" of current-use frequencies is not simply incremental, ***but can have a compounding effect if engineered correctly***.

(o) None of the reports commissioned by Comreg appear to adequately consider the strategic and competitive issues facing MNOs in formulating their approach to the forthcoming spectrum awards process, other than the basic financial and economic considerations. ***Mobile operators and their shareholders, like most businesses, have a range of issues to consider in deciding on their business strategy, some of which are not captured by a straight economic analysis.***

This is best exemplified by studying the outcome of the recent German 5G spectrum award process, where higher than expected bids were made by the incumbent MNOs, despite the inclusion of very demanding licence obligations, which included 98% household coverage nationally within three years, and a commitment to deliver a 100M/bits download speed capability. Despite the very high bids, totalling €6.5Bn, all of the successful bidders subsequently complained about both the licence obligations and the cost of the licences. The bidding process was entered into by each bidder voluntary, and the minimum coverage and download licence obligations were known by each in advance. Although each bidder could have chosen not to bid, or to bid less than they did, the bidders chose to bid the amounts they did.

While it remains to be seen whether the bidders have overpaid for the spectrum licences, there are clearly a number of underlying factors at work in driving experienced MNOs to not only accept the challenging licence obligations and yet bid higher than predicted amounts to secure the licences. Mobile network operators, liken most organizations, are certainly driven by financial and economic considerations, but also need to ensure that their business model for growth and competitiveness remains intact and sustainable, and a mobile operator that has already invested heavily in previous generations of infrastructure, intellectual property and customer acquisition cannot easily decide to change or abandon its course.

These previous investments, while still very valuable, are largely sunk investments, meaning that they cannot be easily realized if the business decides not to continue to grow into the future. ***A mobile network operator without radio spectrum availability into the future risks its sunk investments becoming stranded investments.*** Consequently, this submission strongly recommends that Comreg takes into account the fact that the business case for an incumbent MNO to invest in new spectrum does not just involve the economics of an investment relative to its associated return, as analysed by the various reports commissioned by Comreg, but also involves other important MNO considerations aimed at protecting and continuing to extract returns from all previous investments, often expressed as goodwill, stretching back in time to the acquisition of its first customer.

Comreg, in representing the interests of both Irish consumers and the Irish State, both of whom have a keen interest in ensuring Ireland is at the forefront of international connectivity, now has a once off opportunity to ensure that the forthcoming spectrum licence award process is designed in a way that delivers tangible MBB quality of service results for Irish business and consumers over the next 15 years. I hope and trust that the Commission will deliver on this task.

Liam Young

7th August, 2019

ENDS

1.6 Motorola Solutions

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August 7, 2019

Ref: Submissions to ComReg 19/59R:

Motorola Solutions, hereinafter referenced MSI, thanks ComReg for the opportunity to submit our comments to this comprehensive consultation and study contributions. This response is made available to ComReg without any publication restrictions. We are always available for any questions you may have to our response.

Yours sincerely,

For Motorola Solutions

Bharat Bhatia
Director and Head of International Spectrum and Regulatory Team
Motorola Solutions

No of Pages: 6 including cover letter

Motorola Solutions' comments to the 19/59R,
Proposed Multi Band Spectrum Award, Including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands

Introduction

MSI notes, that this consultation/spectrum study primarily deals with Mobile Service under the EU/CEPT terminology of MFCN for the provision of ECS (Electronic Communication Services). This market segment deals with the provision of ECS on commercial basis and is commonly based on the acquisition of spectrum awards through a competitive process including auctions.

As a systems and services vendor, MSI shall stay neutral in the ComReg considerations on detailed methods and principles of the award processes for MFCN spectrum.

The 19/59R however also deals with BB-PPDR, which regulators often treat as a Sectoral Service, with many associated special and stringent characteristics and requirements, making generally no commercial incentives to implement in a commercial grade MFCN environment.

Under the EU framework, the *National Law and Order* provisions (TFEU) belong *inter alia* under the principle of subsidiarity and, is therefore treated by the EU Commission with extreme care in order not to overstep the national sovereignty of Member States with undue spectrum regulatory initiatives; - Softening approaches such as the concept of "flexible harmonization" has therefore been developed (Commission Implementing Decision (EU) 2016/687) to overcome this but as BB-PPDR already is a high priced niche market, the lack of harmonization of BB-PPDR spectrum makes the mobile network elements even more expensive for Member States.

MSI intends in the following to make some comments on BB-PPDR implementation, which propose a way forward to lower cost and higher quality network elements, reaping some of the benefits of the mass market.

MSI further notice, that even though the consultation specifically outlines the spectrum by "*Including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands*", we observe, that also the 3.4-3.8 GHz band is mentioned (Table 6, p. 194).

MSI shall therefore take the opportunity to attach some comments and recent developments to parts of the 3.4-3.8 GHz band.

Proposals for the 700 MHz band (p. 11)

MSI agree (7) with ComReg, that the total of 2x30 MHz shall be allocated to the Mobile Service after the shut-down of the DTT Services in 2020.

MSI take the view, that, if parts of this 5G pioneer band is foreseen to deliver BB-PPDR services in the future, then a 2x10 MHz slot shall be identified for these vital services ahead of an eventual award, and, if awarded, special provisions in the license agreement

could be considered to prevent a spectrum re-sell, which might bring ownership of the Irish BB-PPDR spectrum in the hands of a potential adversary. In other words, the government shall be in full control of its emergency services spectrum, and as soon as an award is completed, this control may be lost forever.

By the same token, MSI suggests that a coverage obligation "precautionary-plus" shall be assigned to the identified BB-PPDR spectrum slot in accordance with requirements set forth by the national police forces.

Recognizing the 700 MHz band as a 5G "Pioneer" band, it should not be forgotten to mandate the BEM for LTE/5G NR in all segments of the 700 MHz band.

Proposal for the 2.1 GHz band (1920-1980 MHz paired with 2110-2170 MHz), (1900 – 1920 MHz)

As such this band is a traditional 3G band which, and MSI agree that, as licenses expire, this band shall be upgraded to the new 5G NR environment or similar RF compatible interfaces in accordance with the listed harmonization measures of both the CEPT and the EU.

MSI is of the opinion, that a specific coverage obligation is difficult to specify meaningfully until such time, that it has been decided, if licenses shall be country-wide or regional.

Proposal for the 2.3 GHz band (p. 13) (2300 – 2400 MHz)

MSI agree with ComReg to allocate all 100 MHz to the Mobile Service, whether or not awarded or licensed on a first-come-first-served basis or other access principles.

This band offer unique characteristics for localized LTE/NR coverage, including for M2M and IoT automation and control and general voice-and data services for industries, airports, construction sites and similar topologies. See also the MSI comments to the C-band below. The Licensed Shared Access spectrum regulations could be explored to facilitate access to specific users, within specified geographical or technical limits. UK OFCOM has just decided on enabling use of extended C-Band for such systems in addition to smaller blocks in the 1.8 GHz Band and 10 MHz in the 2.3 GHz Band (2390-2400 MHz).

Additional comments regarding the 3.4-3.8 GHz (C) band

MSI understand, that ComReg has awarded this 5G pioneer band already in 2016, and that this is why it is not directly included in this consultation.

However since then, a growing number of countries have identified a 5G NR compatible alternative bands for many current PMR services in lower bands (410 – 430 MHz and 450 – 470 MHz), which in Ireland is considering the 410-430 MHz for BB-PPDR and NB/WB including LTE. The current PMR market in UHF serve a very large number of smaller systems (including TETRA) with localized coverage and control. MSI has the view, that this will be the case for many years to come and that broadband will augment the narrow band

PMR systems with data capabilities.

MSI thinks that parts of this market could very spectrum efficiently be served by the new localized LTE/NR systems in the top-end (3700 – 3800 MHz) of the C-band, such as the German administration is about to decide*: Verwaltungsvorschrift für Frequenzzuteilungen für locale Frequenznutzungen im Frequenzbereich 3.700-3.800 MHz (VV Lokales Breitband)*

Also Sweden has followed this route by a submission of a rulemaking for localized ("municipal") LTE NR in the band 3700 – 3800 MHz. Netherlands has similar rules in place in parts of 3.4-3.8 GHz. France has reserved part of the 2.6 GHz band for enterprise broadband PMR. This is envisioned to cover the growing demand for high reliability and flexibility in the communications demand for *inter alia* "Industry 4.0" and other private enterprise requirements and is partly inspired by the new US regulatory principle of CBRS ("Citizens Broadband Radio Services"), which operates in 3GPP Band 48, slightly lower than the slot 3700 – 3800 MHz. UK OFCOM has just enabled use of extended C-Band for such systems in addition to smaller blocks in the 1.8 GHz Band and the 2.3 GHz Band.

MSI is of the opinion, that ComReg, as part of its new spectrum management plan should consider this opportunity for the future, in fact we take the view, that ComReg should investigate the C-Band for local and private broadband as well as possible expansion of 3800-4200 MHz for this market in Ireland perhaps on a longer-term basis. Our investigation shows, that some infrastructure and chip manufacturers already accommodated this range in their 5G product roadmap.

BB-PPDR spectrum management considerations (p. 26)

As mentioned above, the market for PPDR in general and BB-PPDR in particular is a niche market in the "sea" of Mobile Services and Equipment. It is therefore the driving reason for MSI to take the position that without prejudice to the special requirements set forth by the PPDR community the choice of spectrum and standards should be positioned as close as possible to the commercial mass market in order to drive down CAPEX of the more expensive niche market BB-PPDR networks.

Regarding spectrum, this means the identification of parts of the "MFCN identified spectrum" for BB-PPDR, as only "MFCN identified spectrum" is harmonized in EU.

From this follow, that all BB-PPDR network elements (e-NodeB + UE) might apply all RF chip-sets and higher layer circuits from the low cost mass market.

In studying ITU-R RESOLUTION 646 (Rev.WRC-15), resolves 2:*…to encourage administrations to consider parts of the frequency range 694-894 MHz, as described in the most recent version of Recommendation ITU-R M.2015, when undertaking their national planning for their PPDR applications, in particular broadband, in order to achieve harmonization, taking into account…….*

We notice, that the 700 MHz band is positioned within the specified tuning range in this ITU-R Resolution and relevant recommendation and that therefore the duplex MFCN part (2x30 MHz) can fulfil the requirements for BB-PPDR.

MSI therefore recommends ComReg to focus on BB-PPDR implementations based on

Option 3 or Option 2 and 3 of Table 1.

2.15 bullet number one: *WBB and BB-PPDR services in the 700 MHz Duplex (MFCN)*

Furthermore, MSI take the view that spectrum aggregation in products for a niche market (a piece in UHF, a piece in 700 MHz) in order to achieve a calculated total of spectrum demand (ECC Report 199) is a somewhat counterproductive idea, (2.17) as it makes the market niche even deeper and more difficult to access (product availability) and RF deployment complexity.

2.22 (p. 28) MSI agrees fully with the statement, in particular if it says:

……and the wider European and international context.

2.23 (bullet one) : MSI fully agrees

2.23 (bullet two, p. 29): In general MSI does not adhere to speculation, such as: …

"*i.e. reduced capital and operational costs which otherwise are likely to be substantial*"

2.23 (bullet three): The most significant information is hidden in the statement:

"…noting that there are other non-monetary considerations to also be considered."

However, this is unfortunately not spelled out. MSI thinks that this incorporates the upgrading of a commercial grade network to the PPDR dependability and trust requirements all the way from power back-up of base stations and eNodeB to crypto-transparency etc.. All very expensive upgrades, which hardly can be incorporated in the business plan of a commercial network.

2.23 (bullet six, p. 29): MSI fully agrees with this decision. MSI is of the understanding that Sweden considers that awarding the BB-PPDR spectrum to an emergency communications operator is a "Zero-sum-Game", as the award proceeds later will be charged back to the government for Police and Emergency network subscriptions. As far as we understand: Emergency/PPDR spectrum should remain a state asset.

2.23 (bullet 7): MSI thinks that this will lead to further fragmentation of the BB-PPDR niche market.

2.25 (bullet 1): MSI recognizes, that any data calculation is likely to be overtaken by applications in the near future and that even if the theoretical LEWP model demand calculation resulted in 2x6 MHz of spectrum, it would be more effective to implement in a single band vs. splitting spectrum across bands and aggregating them.

2.25 (bullet 2, p. 30): MSI agrees with the 700 MHz part of it.

2.26 (p. 31): MSI view is that should the government decision be to allocate 2x5 or 2x10MHz (option 3 in Table 1) in 700 MHz for BB-PPDR, the remaining blocks can be awarded on 2x5 MHz blocks basis to operators without restricting anyone from acquiring adequate 2x (2x5 MHz). In addition, a combination based on Option 2 and Option 3 (Table 1 under 2.25) enables an effective 2x5 in the MFCN + 2x3 in the gap (3GPP Band 28B) contiguous block (i.e. 738-736 / 783-791 MHz). While EU Decision 2017/899 considers the

700 MHz a key band for 5G coverage, MSI view is that 5G capacity is likely to be fulfilled in higher bands including 2.5-2.69 GHz and 3.4-3.8 GHz and other mmWave bands for enhanced mobile broadband (eMBB) experience. 700 MHz offers at best what is achievable with LTE in 800 MHz. The historical band 900 MHz is also expected to be re-farmed from 2G/3G to allow for 5G coverage in near future.

Further comments to the observations regarding the LS Telcom Report

2.30 (p. 32): Care should be taken (1st sub-bullet) comparing coverage characteristics of UHF TETRA and possible BB-PPDR in the UHF band based on the most recent AAS and MIMO LTE technology and standards. In regard to the 410-430 MHz band option for BB-PPDR for LTE/BB-PPDR, currently there is no ecosystem supporting this band and that new 3GPP specifications for LTE bands in this range have been just completed. Typically, commercialization of bands and development of ecosystem for bands when driven by niche market such as PPDR is relatively slower than for those in harmonized MFCN arrangements for the provision of ECS (Electronic Communication Services) .

2.31 (p. 33): MSI is of the opinion, that identification of 700 MHz duplex for LTE & 5G NR is an advantage for eventual BB-PPDR implementations, which will benefit from state-of-the-art technology under the MFCN umbrella but notes that such benefit is dependent on timing and finally the decision on which spectrum option for 700 MHz BB-PPDR is adopted as commercialization of LTE or NR in parts of the band is yet to happen.

2.32: Furthermore, having served the DTT sector for many years with excellent rural coverage and indoor penetration is a further advantage for possible new BB-PPDR implementations in 700 MHz Duplex.

Finally, the MSI comments to the Summary Views of ComReg (2.36 – 2.39), has already been tabled in this response.

End of Doc

1.7 MVNO Europe

Response to

ComReg 19/59R

Proposed Multi Band Spectrum Award

Section 8.7: Potential wholesale access (MVNO) conditions

7 August 2019

Contents

I. About MVNO Europe

MVNO Europe represents various types of Mobile Virtual Network Operators (MVNOs), with different business models, addressing retail consumers, business users, the public sector, machine-to-machine and Internet of Things (IoT), etc. http://www.mvnoeurope.eu/members

Our members provide mobile-only offers, fixed-mobile convergent offers and offers incorporating audio-visual media content, financial services, machine-to-machine communications including connected mobility, embedded data SIMs for tablets, laptops and other devices, etc. Our members are also active on wholesale markets as MVNE (Enabler) / MVNA (Aggregator). Some of our members hold rights-of-use over radio spectrum while also being an MVNO. MVNO Europe does not represent branded resellers.

MVNOs currently represent +/- 10% of SIM cards in the European Union.

MVNOs contribute strongly to competition and provide clear Business to Consumer (B2C) and Business to Business (B2B) end-user benefits.

MVNOs also contribute to financing mobile networks through payment of wholesale charges which assure revenues to Mobile Network Operators, whilst avoiding costly duplication of network assets.

II. Introduction

MVNO Europe welcomes the fact that ComReg's consultation 19/59R on the proposed multiband auction (700 MHz / 2.1 GHz / 2.3 GHz / 2.6 GHz bands) contains a Section 8.7 addressing potential wholesale access (MVNO) conditions.

We particularly welcome that ComReg is giving preliminary consideration to whether *'it may be appropriate to attach wholesale access (MVNO) conditions to some or all of the 700 MHz rights of use'*.

We emphasise that other NRAs, notably in the Czech Republic and in France, have proposed to impose detailed wholesale (MVNO) access conditions on ALL 700 MHz licensees (Czech Republic[1])

[1] Annex 2A (pages 5-8) and Annex 2B associated with the 700 MHz licences (2A for existing operators, 2B for potential new entrants) – English versions: https://www.ctu.cz/sites/default/files/obsah/ctu/vyzva-k-uplatneni-pripominek-k-navrhu-textu-vyhlaseni-vyberoveho-rizeni-za-ucelem-udeleni-prav-k/obrazky/20190626-priloha2aen.pdf and https://www.ctu.cz/sites/default/files/obsah/ctu/vyzva-k-uplatneni-pripominek-k-navrhu-textu-vyhlaseni-vyberoveho-rizeni-za-ucelem-udeleni-prav-k/obrazky/20190626-priloha2ben.pdf

and on ALL MNOs (3490-3800 MHz + previously licenced bands) – (France[2]). In both cases, previously granted spectrum licences already contain wholesale access (MVNO) conditions.

We believe that ComReg could readily take inspiration from the Czech and French precedents.

III. Key Comments on Section 8.7 on Potential Wholesale Access (MVNO) Conditions Attached to Some or All of the 700 MHz Rights-of-Use

As stated in the introduction, MVNO Europe particularly welcomes that ComReg is giving preliminary consideration to whether *'it may be appropriate to attach wholesale access (MVNO) conditions to some or all of the 700 MHz rights of use'*.

We appreciate the explicit references made both to Irish legislation[3] and to the EU regulatory framework, notably Art. 5.2(a) of the Radio Spectrum Policy Programme[4], and Art. 52 of the European Electronic Communications Code[5]. These references are important in that they: (i) unequivocally establish ComReg's statutory obligations (among others) to promote competition and, (ii) constitute a firm legal footing for the inclusion of MVNO access obligations in spectrum licences.

We have no comments on Sections 8.7.1 and 8.7.3 (which provide background information and discuss the capacity-based MVNOs Facilitated by the H3G/O2 Merger Commitments).

We welcome Section 8.7.2 (which addresses the impacts of the H3G/O2 Merger), and the expression of ComReg's views on the matter. We are aware of the BEREC Report on Post-Merger Market Developments - Price Effects of Mobile Mergers in Austria, Ireland and Germany[6].

We urge ComReg to examine the Czech and French precedents referenced above, and to reach out to these NRAs to understand the exact scope of the existing and proposed MVNO access conditions (in essence to be applicable to all MNOs and enabling a multi-MVNO constellation). In addition, we recommend that ComReg reach out to its Austrian counterpart, RTR, to gain further up-to-date understanding of the situation in Austria, where a multi-MVNO commitment was made

[2] Pages 26-27 of the main body of the consultation (in French): https://www.arcep fr/uploads/tx_gspublication/consultation-projdec-appel-candidature-5g-juil2019.pdf

[3] http://www.irishstatutebook.ie/eli/2011/si/335/made/en/print

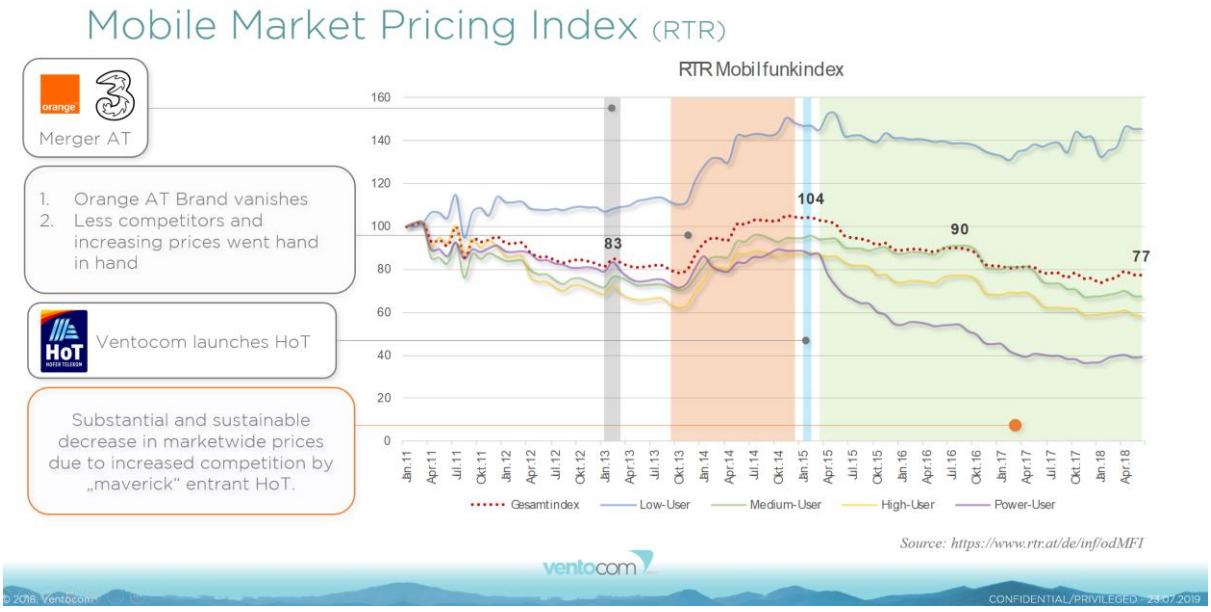
[4] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:081:0007:0017:EN:PDF

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2018:321:FULL&from=EN

[6] https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/8168-berec-report-on-post-merger-market-devel_0.pdf

by H3G when acquiring Orange, including the publication of a Reference Offer for wholesale MVNO access. This reference offer, which is available in English[7], remains important as an EU-wide reference, especially in terms of applicable wholesale charging principles, and even for the level of the wholesale charges themselves, even though the wholesale charges date back to late 2012 (see page 28 and following of the PDF). Full MVNOs have since secured wholesale access from other MNOs in Austria, which suggests that they have been able to secure reduced wholesale pricing compared to the 2012 H3G reference offer.

The multi-MVNO remedy in Austria can be considered a considerable success. In the early period after the H3G-Orange take-over (November 2012) and especially after the Orange brand was phased-out (October 2013), retail prices clearly increased on foot of reduced competition. However, once MVNOs were able to make their mark on the market (January 2015, notably upon launch of the HoT offering of our member Ventocom[8], which is a Mobile Virtual Network Enabler), innovative offers emerged, major brands were successful in the mobile market, and retail prices declined, to the benefit of end-users. The following diagram powerfully underlines market development and pricing in Austria over time. The diagram is derived from open data sets regularly published by the regulatory authority RTR at: https://www.rtr.at/de/inf/odMFI



With regard to Section 8.7.4 (which addresses potential approaches for any wholesale access (MVNO) condition, and in which ComReg outlines wholesale access (MVNO) approaches which

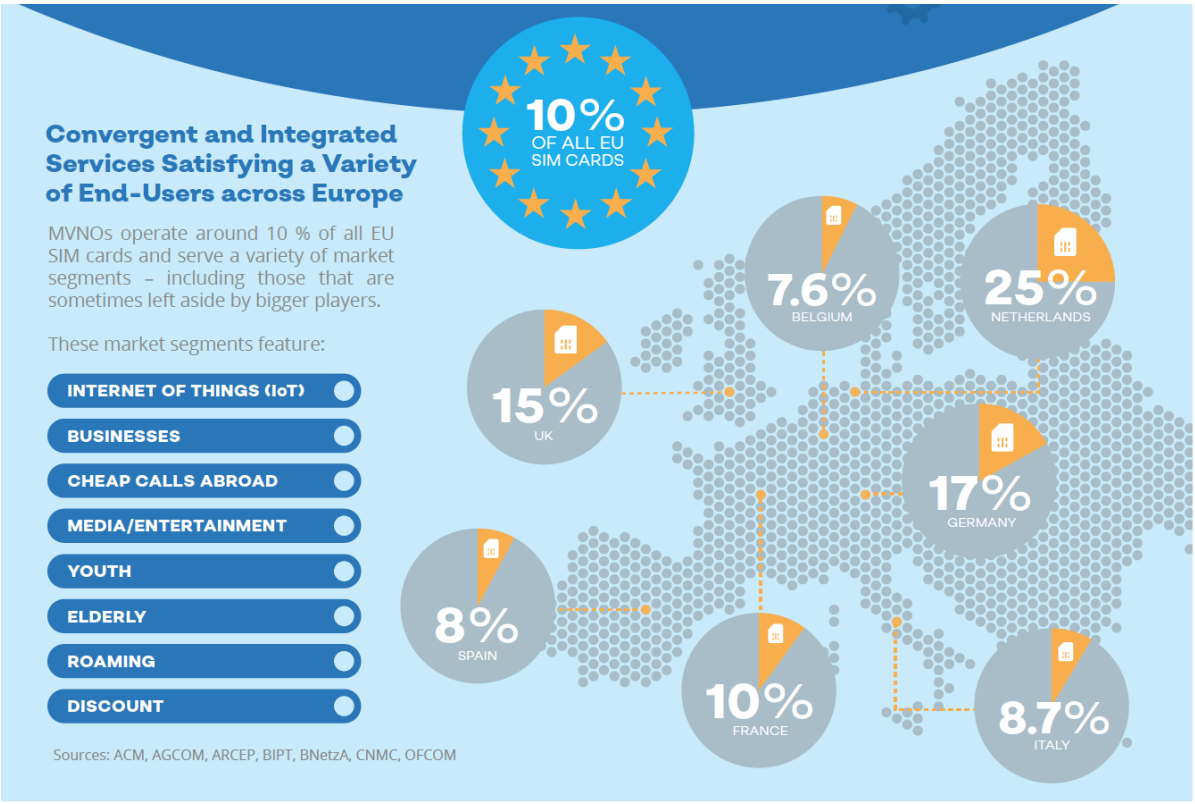
[7] https://www.drei.at/media/common/pdf/info/wholesale/2012h3greferenceoffer.pdf

[8] https://www.ventocom.at/en/

have been employed in Ireland) and Section 8.7.5 (where ComReg seeks views and supporting material from interested parties), we provide the following substantive input:

a) The 2002 3G "A Licence" retail-minus approach did not result in MVNO market entry. This is presumably attributable to a lack of specification of obligations going beyond pure wholesale pricing that would have enabled a Full MVNO/MVNE to secure the necessary technical and commercial independence from the Host MNO for it to be viable to enter the market and become and remain a sustainable competitor. Section IV of our response provides MVNO Europe's long-standing description of what Full MVNO access constitutes as a minimum, distinguishing the technical aspects from the commercial aspects. We are of the opinion that those elements need to be included/reflected in the wholesale (MVNO) access conditions in Irish spectrum licences.

b) The 2014 "capacity agreement" approach resulting from the H3G/O2 Merger Commitments has produced modest results: ID Mobile exited the market, and Virgin Media Ireland's market share is comparatively very small (small in Ireland, and certainly very small compared to the market share achieved by MVNOs/MVNEs in other EU Member States). It is questionable whether Virgin Media Ireland's MVNO constitutes a genuine competitive constraint on Ireland's MNOs. MVNO Europe's collects data on MVNO/MVNE market shares, excluding MNO-controlled entities and branded resellers, showing results as follows:



c) Virgin Media Ireland will presumably renew its "capacity agreement" for a second (and final) 5-year term later this year. It seems highly unlikely, given the very small market share it achieved, that it will exercise the option to avail of the spectrum divestment commitment offered by H3G. In addition, it seems highly unlikely that Virgin Media Ireland will bid – or place winning bids – in the upcoming spectrum auction, since it has a very small customer base to migrate/upsell to an MNO of its own. Therefore, we expect that the spectrum action could result in a status-quo situation, with: (i) the 3 MNOs securing spectrum, (ii) Virgin Media Ireland continuing as the sole beneficiary of the "capacity agreement" for a further 5 years (not changing the existing market situation, and possibly leading to extinguishing MVNO competition in the medium term) and, (iii) little or no incentives for any MNOs to offer voluntary/improved wholesale (MVNO) access that would facilitate a meaningful (new) competitor.

d) The conclusions we draw as MVNO Europe are as follows (answer to Section 8.7.5):

   i) It would be appropriate for ComReg to *'attach wholesale access (MVNO) conditions to some or all of the 700 MHz rights of use that would be granted on foot of the Proposed Award'*, as per ComReg's wording.

   ii) As MVNO Europe, we express a clear preference for the wholesale access (MVNO) conditions to be included in ALL 700 MHz spectrum licences, and indeed ALL spectrum licences made available in the upcoming tender, rather than in one of the 700 MHz licences. Widening the imposition of wholesale (MVNO) access conditions would promote competition between the (likely 3) MNOs to attract MVNOs on their networks, or at least offer diversity of choice for wholesale (MVNO) access seekers, and would help to ensure that MVNOs can be genuine competitors across the full range of mobile and wireless services;

   iii) We believe that ComReg should at least include an opportunity for bidders to make a voluntary commitment to renew and extend wholesale (MVNO) access across ALL their spectrum holdings (those secured in the past and those part of the upcoming tender), and perhaps a reward (e.g. in terms of lower spectrum fees) could be given to those who do make such commitments, including extension of wholesale (MVNO) access to network capacity based on the 2.1 GHz / 2.3 GHz / 2.6 GHz bands.

   iv) The wholesale access (MVNO) conditions should support a multi-MVNO/MVNE market constellation, i.e. not restricting the type or number of access takers. Wholesale access should be granted regardless of the scope of applicants' own infrastructure and (OSS/BSS) systems, and concepts such as Full MVNO and MVNE should explicitly be

recognised, i.e. the access taker needs to have the freedom to only take access to the radio network, whilst it must also be recognised that good faith negotiations on other wholesale access models must be entered into (e.g. lighter MVNO models and branded reseller models);

v) The scope, quality and geographic coverage of wholesale (MVNO) access must not be worse than the scope, quality and geographic coverage provided by spectrum holders to their own customers;

vi) A non-discrimination obligation is necessary, and needs to be explicitly framed as an 'internal-external' non-discrimination obligation, which covers what the spectrum holder provides to itself, and to third parties.

vii) It needs to be explicit that wholesale access takers are entitled to provide both retail services and their own wholesale services to third parties;

viii) The wholesale access obligation needs to be framed in terms of enabling the provision of any service, including Internet Access Service (IAS) and any other services. It is particularly important to enable MVNOs/MVNEs to provide non-Internet 5G network services intended to serve specific industry and public sector segments (often referred to as 'network slices' and 'verticals', e.g. factories and business campuses ('Industry 4.0'), connected mobility, connected devices of all kinds, smart metering, smart cities, healthcare, etc. which require dedicated and tailored services (often referred to as 'specialised services')). Furthermore, wholesale access must be usable by MVNOs/MVNEs to gain customers in the area of Internet of Things (IoT), to support Irish innovative companies, and to support pan-European services and applications. Finally, if an MVNO/MVNE would wish to use its wholesale access to provide more traditional services, including voice and sms, this should also be unrestricted by the wording of the wholesale (MVNO) conditions.

ix) It is essential to provide for a clause preventing margin-squeeze for voice/sms/data, under ComReg supervision (ComReg dispute-resolution powers as a minimum);

x) A clause requiring the publication of a reference offer for Full MVNO/E access is needed, and should be subject to ComReg supervision (ComReg dispute-resolution powers as a minimum). The reference offer provisions need to enable simultaneous launch of services by the Host MNO and MVNOs/MVNEs (such conditions have been imposed in fixed markets, supported by European Commission Recommendations). Time lag and technology lag have been factors holding back MVNOs in the past. Such

time/technology lag has damaged competition, and end-user interests. It should be avoided going forward; ComReg can and should be an active regulatory authority in this area.

xi) A dispute-settlement mechanism, with ComReg acting as the arbiter is essential;

xii) Sanctions in case of MNOs' non-compliance with wholesale access obligations need to be provided for, and they need to be genuinely dissuasive.

IV. Description of Full MVNO Access

MVNO Europe has a long-standing description of what Full MVNO access constitutes. We provide it hereafter, distinguishing the technical aspects from the commercial aspects.

A. Full MVNO access – in technical terms

In technical terms, we believe that the following conditions must be fulfilled in order to achieve Full MVNO access, and thereby achieve the necessary technical independence of the MVNO from the Host Operator(s):

a) Rights-of-use over numbering resources granted by the national regulatory authority directly to the Full MVNO, including: IMSI mobile network code, MSIDSN number range, non-geographic numbers, signalling point codes, operator ID code/number portability code, etc.

b) Own SIM cards, including control over all SIM card functionalities.

c) Control over all network elements, with the exception of the Radio Access Network (RAN), and – at the Full MVNO's discretion – with the exception of backhaul from the RAN. This implies that the Full MVNO has its own HLR (Home Location Register), MSC (Mobile Switching Centre), SMSC/MMSC (SMS and MMS Switching Centre(s)), SGSN/GGSN (Mobile Data network elements).

d) Control over all OSS/BSS (Operations Support and Business Support systems), billing system, customer care system, ability to provision post-paid and pre-paid customers, etc.

e) All calls, SMS/MMS, and data sessions are delivered to the Full MVNO's equipment (i.e. none stay 'on-net' of the Host MNO, none are routed end-to-end by the Host MNO).

f) Full MVNO benefits from the same RAN technologies (e.g. 2G/3G/4G LTE + LTE-M/NB-IoT and 5G) and the same RAN coverage as the Host MNO.

Note: In some cases, the Full MVNO may wish to 'outsource back' the ownership and/or management of certain technical resources or technical processes to the Host MNO, or to outsource them to another provider. This is acceptable as long as it is clear that it is done by the Full MVNO on a fully voluntary basis, without coercion or operational/financial pressure from the Host MNO, and likely under a contract that is separate from the wholesale access contract.

B. Full MVNO access – in commercial terms

In commercial terms, we believe that the following conditions must be fulfilled in order to achieve Full MVNO access, and thereby achieve the necessary commercial independence from the Host Operator:

a) Full MVNO unequivocally owns its customer base, and is able to migrate that customer base to another Host MNO, to its own network, to sell that customer base, etc.

b) No restrictions on type of services provided, and on the type of customers (retail and wholesale) to whom services are provided.

c) No restrictions on the setting of retail prices to customers and wholesale charges to third parties.

d) No restrictions on the receipt of wholesale call / sms termination payments.

e) No restrictions on the Full MVNO to organise its own international roaming.

f) No restrictions on the ability to contract with any third parties (in particular no exclusivity; the Full MVNO must be able to use multiple domestic Host MNOs and international roaming partners if it so wishes).

On the basis of its experience, MVNO Europe considers that where regulatory obligations are imposed on MNOs towards MVNOs, these should include internal-external non-discrimination and transparency principles not only on quality, but also on the wholesale access charges, and specific safeguards against margin-squeeze, in order to ensure that MVNOs are able to replicate ALL retail/channel offers marketed by the Host MNO at all times, without facing a margin-squeeze situation.

In addition, there is a need for specific safeguards for innovation, specifically the prohibition of technical and commercial restrictions as set out above, and a guarantee that MVNOs will be able to benefit from the same RAN technologies (e.g. 2G/3G/4G LTE + LTE-M/NB-IoT and 5G) and the

same RAN coverage as the Host MNO, at the same time as the Host MNO. This is important because we are aware of cases where, for example, 4G was offered to MVNOs several years after the Host MNO started providing it to its own retail customers. Early experience with 5G reveals that MNOs are launching networks, while not enabling MVNOs/MVNEs to launch simultaneously. Expected time lags/technology lags of 12 to 18 months have been mentioned by MNOs questioned publicly on whether and when they would provide 5G wholesale (MVNO) access. Note that the conditions proposed by the French NRA (referred to above) explicitly provide 5G service launches by MVNOs at the same time as the Host MNO launches. The proposed conditions also explicitly cover non-internet 5G services, services for 'verticals', etc.

V. MVNO Europe Contact Details

Should you require any clarifications or further information on the elements and positions set out by MVNO Europe in this document, please contact:

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1.8 Three

Multi-Band Spectrum Award

Response to Document 19/59 from Three

7th August 2019

1. Summary

ComReg has published a proposal to award spectrum by auction in 2020. This will be the largest single award to date of spectrum for wireless communications. It is essential that ComReg gets the process right, as it will directly influence network investment over the next decade and will also be a key factor influencing the pace at which Ireland adopts 5G.

Three does not agree that a Combinatorial Clock Auction (CCA) is the best auction mechanism for this award, and we particularly disagree with the proposal to use a CCA in combination with caps that count existing assignments. This would have a discriminatory effect on Three which is unwarranted and disproportionate, and we believe ComReg should revisit this proposal. We also have concerns regarding the detail of proposals for inclusion of 2.1GHz in the award. A summary of our views is provided below, with more detailed analysis in the following sections.

I. Scope of Bands Included in this Award

Three agrees with ComReg's proposals regarding the inclusion of the following bands:

- in the 700MHz band, 2x30MHz of FDD only;
- in the 2.3GHz band, 100MHz of TDD;
- in the 2.6GHz band, 2x70MHz of FDD, and 50MHz TDD.

Three also agrees that the 1.4GHz band and the 26GHz band should not be included in this award. We see difficulties around ComReg's proposals for inclusion of the 2.1GHz band. We urge ComReg to reconsider its approach to 2.1 GHz so as to provide continuity of existing services while allowing existing licences transition to new liberalised ones.

II. Combinatorial Clock Auction

Three disagrees with the choice of spectrum auction format proposed by ComReg and considers that other mechanisms are more appropriate and should be strongly considered.

In January 2019, Three submitted a document to ComReg which was prepared by NERA. Among other things, that report outlined why many national regulatory authorities (NRAs) and international best practice is moving away from the CCA format, including that the format: (i) may lead to grossly asymmetric price outcomes for bidders, (ii) can encourage spiteful bidding and (iii) is often too complex and lacks transparency. In addition, with the increase in the number of bands available for mobile, it is easier for MNOs to manage aggregation risk without the need for package bidding, thereby diminishing the main advantage of the CCA. We asked NERA to further examine ComReg's proposals as outlined in document 19/59, and information on that analysis is presented below with some examples in Appendix 2. These examples highlight serious concerns with the use of CCA for this award in the manner proposed by ComReg.

Three is of the view that if ComReg was to proceed with this proposal, there would be a real concern as regards the proposal's compatibility with the current (and future) legislative and regulatory regimes, and in particular regarding ComReg's obligations to structure awards in a fair, objective and non-discriminatory manner.

III. Spectrum Caps

Three disagrees with the specific proposal for competition caps, and asks that ComReg revise the proposal for both the sub-1GHz cap and the overall cap. The cap structure proposed is structured in such a way that disadvantages Three disproportionately and without basis *vis a vis* other operators, and this is a particular issue when combined with a CCA auction.

Three is of the view that ComReg has not identified any legal or objective basis for the inclusion of the asymmetric caps. Put differently, ComReg has not identified why the particular caps proposed are needed to prevent extreme spectrum asymmetry. Three also objects to the proposal to set caps that take account of previously awarded spectrum bands, as this approach may distort the auction outcome, and ComReg could alternatively address any concerns it may have about the post-auction distribution of spectrum using symmetric caps based solely on spectrum in the auction.

In particular, Three objects to the proposal to use a CCA auction, together with award spectrum caps that count spectrum which is not included in the award itself. This leads to asymmetrical effects in the auction and to discriminatory treatment of Three as a result, with no objective or fair basis for such treatment.

The combination of asymmetric caps and use of a CCA auction format (with a second price rule) is problematic for the following reasons:

- it discriminates against one the three existing mobile network operators for spectrum (Three) in favour of the two others (Vodafone and Eir) with no objective or reasoned basis for such treatment;
- it would likely prevent an efficient allocation of resources because it precludes Three from bidding for spectrum for which it might have the highest value;
- it discriminates against one operator (Three) regarding the price it has to pay with no objective or reasoned basis for such treatment, i.e. it creates a situation in which some MNOs may predictably pay less than others for spectrum, which is equivalent to a windfall gain;
- it is not proportionate, because there are other measures that ComReg could use to achieve its objectives (e.g. a symmetric cap).

In Three's view, there would be a procedural failure if ComReg was to proceed in implementing this combination of asymmetric caps with the CCA award format, because it has not undertaken the necessary competition analysis to show its proposed measures are "*objective, non-discriminatory and proportionate**".*** There is a substantial risk that implementing ComReg's proposed sub-1 GHz cap would lead to an inefficient outcome, as it creates options for bidders with higher caps to win larger quantities of spectrum at a price below what Three

would have been willing to pay. We note that, in similar circumstances, DotEcon has recently advised against the use of a CCA in the Netherlands[1], citing the same flaws that we highlight here concerning use of asymmetric caps.

Three sees this as a major difficulty with the current proposal, and respectfully requests that ComReg modify its proposals following the consultation to eliminate the problem. This should be addressed early in the development of the award process to avoid delay to the commencement of new licences.

Three proposes an alternative cap structure which we are confident would be more likely to deliver an efficient and non-discriminatory auction process than the current proposals:

- All spectrum caps should be symmetric and limited to bands available in the auction;
- At 700 MHz, the most appropriate cap is 2x10 MHz per operator. If ComReg prefers instead to have 2x15 MHz cap, then it must not use a CCA to allocate this band, as this format is discriminatory given predictable asymmetries between MNOs;
- For bands above 1GHz, there should be a symmetric cap based only on spectrum in the auction. In Three's view, a cap no lower than 150 MHz per operator across 2.1GHz, 2.3GHz and 2.5GHz would provide all bidders with the flexibility they need to pursue realistic targets.

IV. 2.1 GHz Band

ComReg proposed to include the re-licensing of 2.1GHz spectrum as part of this process. This introduces several complications into the award, including the liberalisation of existing licences and time-slices. ComReg proposes to reduce the number of time-slices in the award:

- by providing that Three may apply to extend its existing 3G licences to expire at the same time as the Vodafone 3G licence;
- if extended, the two 3G licences of Three will be unaltered except for the significant matter of fees, which it is proposed will be based on the original fee of the Vodafone and Eir licence (increased by CPI); and
- all existing 3G licences can be liberalised from December 2020.

Three notes that the proposal does not reduce the award to two uniform time-slices:

- 700MHz, 2.3GHz, and 2.6GHz will commence in approximately December 2020;
- 2.1GHz will commence in October 2022.

ComReg is proposing that Three should apply to extend its licences in order to simplify ComReg's proposed award, however the proposed licence fee for extension is inappropriate and without rationale. ComReg is well aware that the 3G licences were awarded under different circumstances, and in fact there are two different types of licence. ComReg's own

[1] "Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum", DotEcon, July 2019. Prepared for the Dutch Ministry of Economic Affairs".

benchmarking indicates that the current value for a liberalised 2.1GHz licence in Ireland is a fraction of the fee proposed[2]. There is no link between the 3G licence awarded to Vodafone in 2002 and a liberalised licence issued to Three in 2020. Further, to apply a CPI adjustment makes no sense in these circumstances.

ComReg's proposal for 3G licence extension fees stands in contrast with the proposal to liberalise Eir's 3G licence up to 2027, which will be for free unless the value for 2.1GHz in the award exceeds the original licence fee. It is questionable why the treatment is so different in both cases. Three urges ComReg to revisit this proposal; we provide alternative suggestions below.

V. Time Slices

ComReg proposes that the 2.1 GHz band be divided into two time slices, one covering the period between the expiry of the Vodafone / Three licences and the later expiry of Eir's licence, and one for the remainder of the full licence term. Three disagrees with this approach, as it involves the creation of artificial lots with durations that do not correspond to bidders' real demands, and also makes the auction unnecessarily complex. We propose that ComReg instead adopts two categories of longer duration lots, one category starting when the Vodafone and Three licences expire, and the other when the Eir licences expire. We set out a number of advantages of making this change, including the important benefit that it will simplify the auction process. We note that the German regulator, BNetzA, adopted this approach instead of time slices for its award of 2.1 GHz in 2019.

If, notwithstanding these arguments, ComReg decides to proceed with time slicing at 2.1GHz, it should not adopt the same time-slices in the 2.3GHz and 2.6GHz bands, as this introduces unnecessary risk and complexity into the auction. These licences should be sold as single blocks with long-term durations.

VI. Licence Duration

ComReg proposes to issue licences with a maximum duration of 15 years for most bands, but 13 years for the 2.1GHz band. Three has previously explained why this is inadequate to promote network investment and is likely to reduce the rate of roll-out of the new services to be delivered with 5G. Three believes this would be contrary to ComReg's objective under the new European Electronic Communications Code (EECC) to promote investment in high capacity networks and contrary to its objective of connectivity. It is also directly at-odds with Article 49 EECC, which requires a minimum duration of 15 years, with licensees given certainty at the outset of what they must do to ensure the licence duration is 20 years. ComReg has set out in Document 19/59 that it has taken account of EECC in relation to its proposals. The EECC will likely be transposed into Irish law or take direct effect before the licences are issued in this award, and in any event, in the meantime, ComReg is legally required to desist from any action that would undermine the Directive. In Three's view ComReg must amend the proposal in order to be compliant with Article 49 of the EECC.

[2] €€0.197 to 0.234 per MHz.Pop for 15 years.

We note that other countries in Europe are moving to longer licence terms. Most recently, in 2019, Germany adopted 20 year and 15 year terms for award of 2.1GHz licences that will run until 2040. ComReg should adopt a similar approach, so as to promote investment in 5G and the competitiveness of the Irish economy within Europe.

VII. Roll-Out / Coverage Obligations

Three supports ComReg's proposals in this regard but cautions that any further obligations would likely act as a deterrent to bidders in the auction. ComReg proposes to include 'precautionary' coverage obligations for any bidder who obtains spectrum in the 700MHz band. This includes:

- a 3 Mbit/s service to 99% of the population and 92% of the geographic area of Ireland; and
- a 30 Mbit/s service to 95% of the population, 90% of motorways, and 80% of primary roads.

Bearing in mind that Ireland has a particularly challenging rural population profile, these obligations are at the upper-end of what network operators could be expected to meet under competitive commercial conditions.

Three is aware that even with the above obligations, there may still be some locations where it is desirable to improve coverage, but not viable to so under normal circumstances. For these areas, the award process gives ComReg a one-off opportunity to develop a mechanism whereby bidders can contract to provide coverage as part of their licence, and we make some suggestions in this regard.

VIII. Minimum Price

ComReg plans to derive the minimum licence fee by benchmarking to find the expected market value, and to split the upfront vs annual fees in a ratio of 4:6. Three agrees with the proposed split, and believes that the overall approach could be acceptable with some minor but important amendments.

It is accepted that setting reserve prices too high can choke off demand and lead to an inefficient auction outcome. Benchmarking always carries a risk of error as it is not possible to entirely recreate the circumstances of the award that is to be run. For this reason, it is necessary to include a margin so that we can be reasonably sure that the auction has the "space" necessary to allow for bids to identify an efficient outcome, ideally with some degree of price discovery over multiple bidding rounds.

Three believes ComReg has included some incorrect references in its benchmark and that these should be removed. ComReg should also include a margin so that it is the auction which determines the outcome, and Three suggests that reducing the minimum price by one standard deviation would achieve this without reducing the effectiveness of the minimum prices. We do not agree that using the geometric mean provides a sufficient margin to allow for efficient price discovery.

IX. Legal Context

Three notes that ComReg is obliged, when structuring awards and awarding 'rights of use' to adhere to both specific spectrum regulatory obligations and its statutory objectives and functions. These obligations require ComReg (when structuring such awards), in particular, to (a) guarantee non-discrimination, fairness, objective treatment as well as legal certainty and consistency and (b) enhance competition, efficient use of spectrum and investment in the market. We set out the legal sources for these in Appendix 1 and cross-refer to these in this submission.

Three is of the view that the current proposal for the award structure raises real concerns about compatibility with these legal requirements (as further outlined below). In particular, Three notes that the EECC will likely be transposed into Irish law or take direct effect before the licences are issued in this award, and in any event, in the meantime, ComReg is required to interpret Irish law in conformity with the EECC and required to desist from any action that would undermine the Directive[3]. ComReg ought to amend its proposal in relation to license duration in order to be compliant with Article 49 of EECC.

[3] Three is advised it is well established in EU caselaw that Member States (the concept of which has been interpreted broadly in EU caselaw and likely applies to State bodies / regulators), must not undermine a Directive in the period following its publication (and pre implementation) per Inter-Environnement Wallonie (Case C-129/96)) and Manglod v Helm (Case C-144/04).

2. Background

In ComReg Document No. 19/59, ComReg sets out its proposals for what will be the largest award to date of radio spectrum that is harmonised for use for electronic communications (470MHz). The spectrum is suitable for use by mobile and fixed access services and includes a "pioneer band" for 5G. The outcome of this process will have a hugely important influence on the shape of competition for wireless services over the next decade, and the speed at which Ireland transitions into the 5G era. As we move from 2G, 3G, 4G, and now add 5G, the diversity of services supported will grow. Depending on the use case, 5G will need to stretch to cover dense machine-to-machine applications, high bandwidth services, and also ultra-reliable communications.

The rate at which new technology is deployed, the extent of coverage, and the investment available to propagate and deliver those services all depend on a process that delivers successful and fair outcomes. It is important that ComReg gets it right.

The investment case for mobile and wireless networks has always had some challenges, and demands for faster, better, and more diverse services have continued to grow since digital services were first introduced using GSM. Overall sector revenues have been in decline as a result of regulation, competition, and substitution by over the top services for the past decade (total mobile revenue has fallen by 23% since Q2 2008, and mobile ARPU has fallen by 38% from €40.87 to €25.08 in the same time). Operators must maintain multi-generational networks (2G, 3G, 4G) while also providing for ever-growing demand for speed and coverage, and rolling out a new generation of equipment (5G). Three expects to see a 5-fold increase in network traffic over the next 5 years, with a 10-fold increase in end user speed.

Still, it is in our national interest that early investment is made in 5G so that Ireland remains competitive relative to its peers in Europe. Even though ComReg has a specific objective to promote efficient investment[4], there are relatively limited tools that ComReg has at its disposal to facilitate investment and innovation. Allocating spectrum in a timely and effective way is one of them. It is worth noting that Irish operators have already invested €932m in acquiring radio spectrum licences since 2012, and this is before any network is built or service delivered.

The effects of this award will influence wireless communications markets in Ireland for the foreseeable future. The 700 MHz band should allow for improvements in rural coverage, while the other bands allow for an increased density of high-speed communications where more capacity is needed. The 700MHz band is particularly important as it is the first pioneer band for 5G that is good for providing rural coverage and building penetration.

ComReg needs to define a process that will award the spectrum in an efficient way, will ensure that competition and investment in the market is not impeded, and is in accordance with the functions and objectives laid out in legislation. Three agrees with many aspects of ComReg's proposals; however, in a few critical areas they fall short. Three respectfully submits that the award should not proceed as described in the current proposal.

[4] Regulation 16 (2)(d) of the Framework Regulations.

The current award is planned to run during Q3 2020, and licences are likely to be issued in Q4 2020. This is the same time that the new EECC is to be transposed into Irish law, and it will, in any event, have direct effect no later than 21st December 2020.

The EECC is relevant to this consultation:

- it sets out objectives for regulators (NRAs) to facilitate the roll-out of high capacity wireless networks and ensure connectivity;
- it details minimum requirements on NRAs for spectrum award processes; and
- it sets minimum durations for spectrum licences in certain bands.

Many of the requirements in the existing framework carry over into the EECC; however, there are also some new requirements. ComReg ought to amend its proposal to be in line with the EECC, in addition to the existing regulatory framework. In particular, ComReg must look again at its approach to licence duration and transparency regarding the process to obtain extensions of licences from 15 to 20 years.

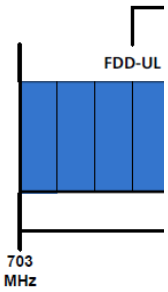
In the following sections, Three provides detailed comments on ComReg's proposals, with alternative suggestions, where appropriate.

3. The Spectrum for Award

The 700MHz band

Though the 700MHz band has the least spectrum (in MHz) of all to be awarded, it is important. Spectrum in the lower UHF bands tend to be better for providing rural coverage and building penetration. The 700 MHz band has also been identified as a 5G "pioneer band" for Europe so it can be expected that there will be a good supply of network and terminal equipment. Any network operator who is planning to build or maintain a mobile broadband service or planning to roll-out any of the 5G services will be likely to carefully consider obtaining some spectrum in this band.

ComReg proposes to award 60 MHz (i.e. 2×30 MHz) of spectrum in the band in its current award. The spectrum is to be divided into lots as shown below.



Three agrees with the proposal to award the 2x30MHz of Frequency Division Duplex (FDD) spectrum. We note that there is also a possibility to use the centre-band as Time Division Duplex (TDD) channels; however, the ecosystem to support this use is not well developed yet, and Three agrees that it should not be included in the award at this time.

The FDD band-plan is being adopted as standard across Europe, and the specification has been developed to protect adjacent services from interference. Three agrees with ComReg that no further measures are required.

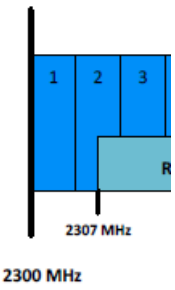
In Document 19/59, ComReg provides some analysis of the requirement to provide spectrum for Public Protection and Disaster Relief (PPDR), and considers whether it is necessary or desirable to reserve some of the 700MHz FDD spectrum for PPDR. LS Telcom has examined and reported on this matter for ComReg. The study is quite comprehensive, and we have no reason to disagree with the conclusions.

The LS Telecom study found that *"2×6 MHz would be sufficient to support PPDR usage in Ireland"*, and that there are several options to provide that. Six options are provided in Table 2 of ComReg's document. Three agrees that any of Options A, B, or C are preferable to options D, E, or F. This is because the latter three all reduce the spectrum that might be available for commercial services. There are other spectrum options available to meet the requirement for PPDR, including the 400 MHz band (2x3MHz); Band 28B (2×3 MHz), and Band 68 (2×5 MHz). There may also be options for PPDR deployment in the 410-430 MHz and the 450-470 MHz bands. In addition to these dedicated spectrum options, the requirement may be met by using hybrids of dedicated and commercial networks.

On this basis, it would not be efficient or justifiable to disadvantage commercial networks by limiting the amount of 700MHz FDD spectrum in the award.

The 2.3GHz Band

There is 100MHz of spectrum available for award in the 2.3GHz band, and ComReg proposes to award it as 20 individual TDD lots of 5MHz each. ComReg's band-plan is shown below:



Three agrees with the proposal to make the full 100MHz available, divided into TDD lots. ComReg has also formed the view that no technical restrictions are required beyond the

introduction of restricted blocks between 2,390 MHz and 2,400 MHz. Three has not identified any reason to disagree with this.

The use of this band by Eir to provide Rurtel services to a very small number of customers presents a number of issues for the award of the band. In the first place, it is noted that the channels do not align with ComReg's band plan, which means that 25MHz of spectrum is impaired. The Rurtel service supports only a very small number of customers (2 in Kerry, 8 in Galway, and 77 in Donegal), leading to the conclusion that it is a very inefficient use of spectrum, given the potential high value alternative use of providing mobile services. The small number of customers in Kerry and Galway is especially noteworthy. In Figure 10 of the consultation document, ComReg presents exclusion/coordination zones that would be required around the Rurtel stations. These are surprisingly large considering the number of customers served, and in fact a substantial part of the geography of Ireland is within the coordination zones.

It seems that Rurtel is an old system running old technology, with limited remaining use. It is not clear when the licences were issued, or for what duration; however, it seems likely that they are annually renewable licences. Given that this is an old system serving a small and diminishing number of customers, and that there is no long term licence expectation, it should be possible to set a termination date for the Rurtel system, if an alternative means is available to serve the relevant customers. In the longer term, these customers will be served by the National Broadband Plan; indeed, it seems likely that most of these customers could already be served by alternative networks. Eir itself claims to already cover 99% of the Geography of Ireland[5] with its mobile service, in which case it is to be expected that the Rurtel system could be replaced by a terminal station that operates to Eir's mobile network. The addition of a fixed user antennae should increase the coverage beyond that available for mobile service. On the basis of the above information, ComReg should set a date for the switch-off of Rurtel, which should be achievable before the end of 2021.

In the meantime, Eir should be required to reduce the bandwidth used by Rurtel to the minimum required. Donegal has the highest number of users at just 77. Even though some repeaters may be required, it seems difficult to justify the use of a full 20 MHz in any of the three locations. Eir should be required to reduce this bandwidth to the minimum necessary, and to justify that bandwidth in each location.

In addition to the above, ComReg should ensure that if Eir is a winning bidder for any 2.3GHz spectrum then in the assignment round, the algorithm gives priority to maximising the extent to which the same spectrum is assigned to Eir as is used for Rurtel. This could easily be achieved within the assignment algorithm. In the alternative, Eir should be required to re-tune Rurtel to operate on the same spectrum that is assigned to Eir in the 2.3GHz band (if any).

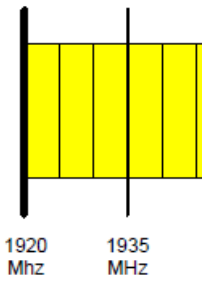
If ComReg does not provide for the above, then Eir would have a natural advantage over all other bidders for 2.3GHz in the assignment round. This arises because the exclusion zones would be likely to have a greater effect to suppress the value of the impaired spectrum for bidders other than Eir. If Eir itself is the new licensee sharing spectrum with Rurtel, then it will have a greater ability and incentive to minimise the coordination areas while avoiding interference between the two networks.

[5] https://www.siliconrepublic.com/comms/eir-mobile-network-investment-ireland-4g-5g

In the event that an operator other than Eir is required to share with Rurtel, then the coordination procedure should be designed so that it does not unduly delay the new licensee from using the spectrum. The procedure that was proposed by ComReg following the recent 3.6GHz award is not suitable, as it favours outgoing licensees over new ones. In the 2.3GHz band, the procedure should be that a new operator provides notice of intention to commence service within the coordination area, and the onus should be on Eir to demonstrate that an issue exists or the roll-out goes ahead by default.

The 2.1GHz Band

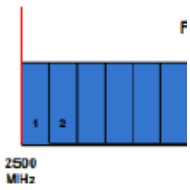
This is the only legacy band that ComReg is considering for inclusion in the award. The fact that it is already in use to provide 3G services causes several complications for its inclusion in the award, which we comment on later. With respect to the band-plan that should be used, Three agrees that it should be the 2x60MHz of FDD spectrum as shown in the plan below. This is a long-established band for mobile services, and the standard specifications have been adequate to ensure coexistence with adjacent services. There is no need for additional guard bands.



The 2.6GHz band

The 2.6GHz band consists of 190MHz and ComReg plans to make the full band available in the award. Three agrees with this.

The 2.6 GHz band has been standardised within Europe for several years, and is in common use. It can be configured in both FDD mode and TDD mode, with the primary band configuration having 50MHz for TDD in between the 2x70MHz for FDD. This is the most common configuration adopted across Europe, although variants with more TDD are possible. ComReg has proposed to adopt the primary configuration as shown below, to provide 2x70MHz FDD, and to use 2x5MHz of restricted lots to provide isolation between the two duplex modes. Three agrees with this.



The 26GHz Band

We note that there is a requirement under Article 54 of the new European Electronic Communications Code (EECC) that spectrum in the 26GHz band should be made available by 31 December 2020 for wireless broadband services:

> *"Article 54: Coordinated timing of assignments for specific 5G bands*
>
> *1. By 31 December 2020, for terrestrial systems capable of providing wireless broadband services, Member States shall, where necessary in order to facilitate the roll-out of 5G, take all appropriate measures to:*
>
> *(b) allow the use of at least 1 GHz of the 24,25-27,5 GHz band, provided that there is clear evidence of market demand and of the absence of significant constraints for migration of existing users or band clearance. . . ."*

We also note that the characteristics of the 26GHz band are significantly different to those that are to be awarded, and that the network and device ecosystem is less advanced.

ComReg has recently completed an award of spectrum for fixed links in this band[6]. There are several issues to be considered in order to optimise this band before an award, and reconfiguration might be necessary. Three is of the view that a separate consultation is required to resolve these matters. Accordingly, we agree that this band should be held back to be awarded in a separate process, so as not to delay the award of the lower frequency spectrum.

The 1.4GHz Band

As previously stated, Three agrees that this band should not be awarded at this time. In particular, the ecosystem for the wider band is not yet developed, and operators would benefit from greater certainty regarding the business case for deployment of supplemental downlink using these frequencies. We look forward to participating in a separate consultation on the terms of award for this spectrum in due course.

[6] https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/26-ghz-spectrum-award/

4. Key Aspects of the Award Process

There are three individual aspects to ComReg's proposed award process that combine to raise serious concerns:

1. Use of a Combinatorial Clock Auction (CCA) mechanism including second price rule for the award;

2. Use of caps based on existing spectrum holdings unsupported by any clear competition rationale; and

3. The use of caps that apply asymmetrically across bidders: one for sub-1GHz spectrum and one for all spectrum in the auction.

ComReg proposes that existing licenced spectrum should count towards the cap. ComReg has not specified exactly which bands and existing licences will be taken into consideration for the purposes of this cap, although it seems from the analysis that the cap will take account of all spectrum awarded in the 2012 multi-band award, and the 2017 3.6GHz award. It is unclear how current 2.1GHz spectrum is to be counted during different periods of Time Slice 1.

The combination of these aspects of the proposed award create a process that is discriminatory, in particular against Three. The approach disadvantages Three without justification and may lead to an inefficient auction outcome. As such, this raises real concerns about compatibility with ComReg's legal requirements (under current and future law) including in relation to non-discriminatory treatment and fairness. Three requests that ComReg's proposal is modified such that the asymmetric caps which take account of spectrum awarded in previous auctions are removed.

These issues are examined in more detail in the following sections.

5. The Auction Mechanism

General Points on CCA

In January this year, Three submitted a report to ComReg, prepared by NERA Economic Consulting (NERA), which analysed several aspects of the proposed award. ComReg has already had the opportunity to consider the NERA report, so it will not be repeated here; however, in summary, it explained that many national regulatory authorities (NRAs) are moving away from the CCA mechanism because:

- Aggregation risk is less important now than in previous awards, given that there are more bands and more spectrum generally available (We note that one of the main arguments in favour of the CCA is the risk that spectrum might not be aggregated across time-slices, which in turn arose from ComReg's proposals for inclusion of the 2.1GHz band);

- CCA can lead to grossly asymmetric price outcomes for bidders winning the same spectrum;

- In certain circumstances, CCA incentivises spiteful bidding; and
- CCA auctions are complex and lack the transparency required for a bidder to know at any point how much they are likely to pay for any particular package of spectrum lots.

In support of the decision to propose a CCA mechanism, ComReg has offered several arguments, including:

- it provides for aggregation of a package of spectrum across different bands;

  Three is of the view, given the fact that following this award the total quantity of spectrum allocated for mobile/fixed communications will be 1,100MHz across 9 bands, that aggregation of a particular portfolio is not a significant concern for this award.

- it provides for aggregation across time-slices; and

  Three's view is that the time-slices are a construct only of ComReg's proposal to deal with issues in the 2.1GHz band. As stated below, Three does not agree with ComReg's proposal for the 2.1GHz band, and notwithstanding this, Three does not agree that it is appropriate to apply the time slices to any other band in the award (see further comments below).

- other auction mechanisms are open to gaming, particularly demand reduction.

  Three is of the view that this concern is overstated. ComReg has not provided evidence that that other award mechanisms (in the context of this award) would be more vulnerable to gaming behaviour, especially gaming that could reduce the efficiency of the auction outcome. In any case, ComReg proposes to set minimum prices close to the expected market value, an approach that substantially reduces any incentive for demand reduction. On the other hand, NERA's report has highlighted how a CCA is vulnerable to spiteful bidding, especially in situations of predictable asymmetries in demand and price setting power across a limited pool of bidders.

ComReg's fear of demand reduction is anyway misplaced. As revenue is not a core objective (and reserve prices are high anyway), demand reduction is only problematic if bidders reduce demand too much, as this could prevent an efficient outcome. However, in the context of this auction where there are three strong MNOs, bidders are most unlikely to concede spectrum if this would compromise their ability to compete efficiently in the downstream market.

A significant drawback of the CCA is that it not only deters early demand reduction, it may also deter valuation-based demand reduction. Bidders with predictably lower marginal valuations may be tempted to exaggerate demand so as to retain pricing pressure on rivals and prevent outcomes where they must pay more than stronger rivals. Strong bidders may retaliate by exaggerating their demand. At the same time, bidders still have contradictory incentives to move the auction as quickly as possible to an acceptable outcome. This creates a risk that bids not truly reflective of valuation combine to create an inefficient auction outcome. These problems may be exacerbated in multi-band auctions, because there is more scope for strategic bidding and bidders may have predictable strengths and weaknesses in different bands.

In paragraph 7.63, ComReg "*notes that bidders paying comparable amounts is not an objective of the Proposed Award*." It is noted that obtaining any minimum award revenue, or any minimum price per lot is not an objective of the award either. The purpose of the auction is to determine the most efficient allocation. It is accepted that as the demand for particular lots approaches the supply available, then bidders will be considering whether to buy an incremental lot. The incremental value for the additional lot may be less than the bidder's core target, which means that it will be bought only at a lower price per lot. In a competitive award where demand initially exceeds supply, and where operators have similar demand, then it should be expected that the award will deliver similar pricing per lot for all winning bidders. If the outcome of the award is that bidders pay significantly different prices for equivalent lots, and where this is a feature of the award, then the award fails to treat all bidders fairly. This is a case of poor hygiene, where the result is contaminated by the apparatus, and such a proposal would fail to meet ComReg's obligation to provide for a non-discriminatory award process.

It is noted that ComReg plans to use the prices for 2.1GHz spectrum in the auction as a proxy for the market value of this spectrum. This proxy will be used to determine how much Eir would be required to pay as a fee for liberalisation of its 3G Licence for the remaining term. Significant variations in price would undermine that proxy. As an example of this challenge, ComReg should consider the difficulty that Ofcom had in setting prices for renewal of 900 MHz and 1800 MHz spectrum in the UK, which in part flowed from the use of a CCA for the award of 800 MHz and 2600 MHz and absence of clear benchmark prices for those bands. The process, including a series of consultations and a legal challenge, ran for over four years.

In relation to alternative auction mechanisms, ComReg seems to be reluctant to use other formats because they are new or have not been used in Ireland before; however the same applied to CCA when it was first used in 2012, and for new bidders when the 3.6GHz band was awarded in 2017. For this type of award, it is to be expected that all serious bidders will prepare for the process regardless of the mechanism used. It is further noted that CCA has only been used twice before in Ireland, and under different circumstances, so this prior use in itself does not guarantee success in the current award.

Specific Problems with CCA as Proposed

The use of a CCA auction mechanism together with asymmetric caps between bidders is a particular concern for Three. We set out in detail the risk that this combination poses to the efficiency and fairness of the process below. We must also point out that this is an increasingly widely recognised problem with using the CCA to allocate spectrum. There is an emerging academic literature that highlights the potential for inefficiency and grossly asymmetric pricing if a CCA is used in situations where there are predictable asymmetries (such as differential caps or starting positions) between bidders[7]. This is one of the factors, as highlighted above, leading regulators that previously used the CCA to return to using formats inspired by the

[7] Marsden and Sorensen, "Strategic Bidding in Combinatorial Clock Auctions – a Bidder Perspective", Handbook of Spectrum Auctions, Cambridge University Press, 2017.

traditional Simultaneous Multiple Round Auction (SMRA), such as the clock auction format. for new awards.

A current example that is particularly relevant to Ireland is the forthcoming award of 700MHz, 1.4GHz, and 2.1GHz bands in the Netherlands, where the Dutch Ministry of Economic Affairs asked DotEcon to recommend an auction model. Prior to considering the award mechanism, the Ministry decided that there should be caps which take into account existing spectrum holdings. There are three mobile network operators in the market following the merger of T-Mobile and Tele2 in 2018. The differences in the spectrum currently held by the three MNOs mean that the maximum amount of spectrum that each MNO can acquire in the auction under these caps will vary.

DotEcon's recommendation is to use an SMRA-Clock hybrid format. In its report to the Ministry, DotEcon highlight the reasons why a CCA or other second-price auction mechanisms are not suitable for use where asymmetric caps apply[8]:

> "*If a combinatorial format had to be used, there would be a choice between formats that use a pay-as-bid rule (such as the CMRA and the SCA) and those that employ a second pricing approach (such as the CCA, which sets prices on the basis of opportunity costs calculated from the bids made by bidders, and the ECCA, which sets prices with reference to the largest bids that competitors could make under the activity rules). Given the simplicity of pay-as-bid pricing*[23] and the potential concerns about the impact of the asymmetry in the amount of spectrum that different bidders can *acquire under the caps on bidding behaviour, we would prefer a pay-as-bid format over a format that relies on opportunity-cost based pricing.*[24] "
>
> *"* [24] *. . . In this respect, using a second price rule is potentially more of a concern where spectrum caps have an asymmetric impact on bidders' ability to bid for additional spectrum in the auction. This is the case under the spectrum caps proposed for the auction. Under such asymmetric constraints the ability of bidders to set each other's prices is uneven and attempts to exploit this asymmetry through strategic bidding may result in inefficient outcomes."*

Clearly, DotEcon has identified the same problem with the use of a CCA with asymmetrical caps, and as a result has recommended against the use of CCA in the Netherlands. It is difficult to see how the same logic does not apply in similar circumstances in Ireland.

Three asked NERA to review the use of CCA and caps as proposed in ComReg Document No. 19/59. NERA's comments are included in Appendix 2 of this document. The analysis and examples provided clearly demonstrate problems with the CCA auction mechanism, and how this is exacerbated by ComReg's proposal for caps. Given this information, it is difficult to see how the proposals in ComReg Document No. 19/59 can be squared with ComReg's statutory obligations.

Further comments are provided below on the effect of ComReg's proposed caps.

[8] "Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum", DotEcon, July 2019. Prepared for the Dutch Ministry of Economic Affairs.

Bidder Information

ComReg has not stated clearly what information it is proposing to provide to bidders at each stage of the award. We ask that ComReg specify and consult on a clear information policy for the award.

6. No Intervention Required For Current Assignments

The current distribution of spectrum holdings between the three mobile network operators (excluding 3.6GHz) emerged from the 2012 multiband award, followed by the merger of Three and O2 in 2014. The merger was cleared by the European Commission following an investigation which specifically examined the distribution of spectrum and decided that there was no resulting impediment to competition, stating "*The fact that, after the merger, there will be spectrum asymmetry is not, as such, anticompetitive"*.

In the consultation document, ComReg itself points out in section 7.221 that:

- market shares of the mobile network operators (MNOs) post-Merger have been relatively static, with a small re-distribution away from MNOs to mobile virtual network operators (MVNOs);
- there does not appear to have been any further concentration downstream post-Merger; and
- the Herfindahl-Hirschman Index (HHI) (taking all operators other than the MNOs to be a single entity) of the mobile market based on revenue share has fallen slightly from 0.346 to 0.322.

In addition, DotEcon notes that ". . . *the available evidence (including the views of the Commission at the time of the Merger) would suggest that a post-award spectrum asymmetry at least at the same level as after the Merger is unlikely to be problematic and there does not seem to be any particular need or justification to seek to actively reduce the current differences in MNO spectrum holdings on competition grounds*".

In December 2014, Vodafone sought to have ComReg carry out an assessment of spectrum holdings following the merger of O2 and Three. In response, ComReg states that "*Vodafone has not provided, nor is ComReg not aware [sic] of, any facts that demonstrate that the merged entity has, or is likely in the future to use the spectrum controlled by it inefficiently or ineffectively, or in any way that would require intervention by ComReg using its radio spectrum management powers."*

ComReg itself states in paragraph 4.191 of the consultation document that " . . . *asymmetric outcomes may be compatible with a diversity of operators engaging in effective downstream competition provided the asymmetry is not too extreme".* So, neither ComReg nor DotEcon seem to be saying that there is an asymmetry of spectrum holding at present which is causing any competition issue that needs to be corrected.

In addition, the latest quarterly market information[9] shows that Three's own retail market share was 35.3% (inc MBB & M2M) or 32.3% (ex MBB & M2M). Three's network carries almost all MVNO traffic -Three carries Tesco Mobile Ireland (TMI), Lycamobile and Virgin Media as MVNOs - which brings the market share carried on Three's network to 44.2% (inc MBB & M2M) or 44.7% (ex MBB & M2M). Eir, on the other hand accounts for just 16.3% or 19.7% market share respectively, which is less than half of the market share carried on Three's network.

The above shows that Three is already a much more efficient user of spectrum than Eir. If all other variables were equal, then Three could have twice as much spectrum as Eir and still use it more efficiently by this metric.

Further, it is not the case that Three provides less value to its customers, and in fact the Three network carries 65% of all mobile data traffic in Ireland[10], which is significantly more than both Eir and Vodafone combined. Again, if all other factors were equal, Three could be assigned more than 50% of all mobile spectrum available and still be the most efficient user of spectrum.

The above shows that there is no existing disparity or asymmetry of spectrum holdings that needs to be corrected for in the proposed award[11]. Further, it seems that both DotEcon and ComReg itself share this view, which makes ComReg's proposals for caps based on existing holdings in the proposed award surprising, disproportionate and contrary to ComReg's statutory obligations because of the effect they would have.

As explained in section 7 below, Three is not arguing that ComReg should proceed without any spectrum caps. We recognise that spectrum caps may play a role as a precautionary measure to prevent extreme outcomes that could create future competition concerns. In Ireland, the best way to do this is with symmetric caps on spectrum available in the auction, either for individual bands (700 MHz) or across groups of similar bands (e.g. 2.3GHz and 2.6GHz).

7. Caps

Caps within an auction

In paragraphs 4.133 and 4.134, ComReg sets out the primary reasons for using an auction to award spectrum:

- *"Spectrum auctions are designed to incentivise bidders to express their willingness to pay for spectrum rights, and aims to assign the available rights of use of spectrum to the bidders who value it the most. An appropriately designed auction extracts*

[9] ComReg 19/57R2

[10] In Q1 2019, Three's network carried 76.4TB of data, which is 65% of total mobile network traffic 118TB as per ComReg's Q1 market report (19/57R2)

[11] Three notes that as part of ComReg's role to prevent excessive hoarding of spectrum, it can monitor / take action if it considers there is inefficient use of spectrum / excessive holdings of spectrum post award under Regulation 9(11) of the Authorisation Regulations.

information regarding bidders' willingness to pay for the rights of use of spectrum thereby enabling an assignment to the bidders who value the spectrum most;

- *"By ensuring that those bidders who value the spectrum the most obtain the rights being offered, auctions should result in an efficient outcome in terms of assignment;*

For an award to be efficient, the outcome should be determined by competition between the bidders, and not by any external influencing factors. Caps are often used within awards, in order to prevent extreme outcomes, and this is the reason stated in paragraph 7.184 for competition caps:

- *"ComReg has previously stated that the main purpose of a competition cap is to ensure that the distribution of spectrum rights in an award is determined by competition among bidders, subject to ensuring that extreme asymmetric outcomes which could harm downstream competition do not emerge from the award.*"

Three agrees that the award outcome should be determined by competition between bidders, and also that it can be wise to have competition caps in order to prevent extreme outcomes, however, caution must be taken when setting caps to make sure they do not compromise the delivery of an efficient and fair outcome. The caps must not disadvantage any bidder unduly, particularly where there is no concern about downstream competition being harmed. ComReg has not identified any 'extreme asymmetry' in the market currently or provided sufficient evidence / justification that the proposed competition caps are necessary to prevent against this happening as an outcome of the proposed award.

Proposed Caps

ComReg has proposed two caps in the auction:

1. A sub-1GHz cap of 35MHz (7 lots of 2x5MHz); and
2. An overall cap of somewhere between 375 MHz and 420 MHz.

The consultation document does not specify which existing assignments precisely will count towards the cap in each time-slice; however it seems from ComReg's analysis that it will be all existing 3G and Liberalised Use licences in the following bands:

- 800MHz and 900MHz for the sub-1GHz cap; and
- The above plus 1800MHz, 2.1GHz and 3.6GHz for the overall cap.

It seems that Eir's use of the of 2.3 GHz is not counted towards the spectrum caps, even though this band is to be included in the award. ComReg should specify precisely which existing assignments are to be counted towards the cap, and the reasons why.

Three notes that it is a new departure for ComReg to count spectrum from bands that are not included within the award against the caps. For all previous spectrum auctions, only the bands that were actually available in the award were considered for the purpose of the award cap. It is not clear how the caps will apply during the different time periods relevant for the

award. ComReg has proposed two time slices but these do not correspond exactly with the expiry dates for spectrum bands that are outside of the award.

The various dates and time periods that must be considered are as follows:

- December 2020, commencement of Time Slice 1 (TS1);
- October 2022, expiry of 3 of 4 3G licences;
- March 2027, expiry of Eir licence, end of TS1;
- March 2027 to End 2035, Time Slice 2(TS2);
- July 2030, expiry of 2012 licences; and
- July 2032, expiry of 3.6GHz licences.

Any bidder's holding of spectrum from bands that are outside of the award will vary over time, and ComReg needs to explain how this will be taken into account for the caps.

For example:

- Licences for 9 out of 12 of the 2.1GHz lots expire in 2022. Our assumption is that they will not count towards the overall cap in TS1 as they will have expired for most of the term, but this needs to be clarified. This would leave only Eir's 2.1GHz existing spectrum to count towards the TS1 cap.
- Liberalised Use licences in the 800MHz, 900MHz and 1800MHz bands expire in 2030, at least 5 years before the end-date for the new licences. Unless there is a third time-slice, then existing licensees are de facto penalised for having held those licences even after they have expired.
- Similarly, the 3.6GHz licences expire in 2032.

Again, ComReg needs to explain how the existing licences will be counted during the various different time periods, and explain the rationale for those choices. It is not sufficient to leave these matters to be resolved at the time of expiry of existing licences, as ComReg can give no certainty in this regard.

Caps that apply only during an award process nonetheless can have long-lasting effects. It should be noted that there is considerable inertia in spectrum holdings, and in Ireland no spectrum in all of the bands under consideration has ever been sold or transferred to a different user. Three paid substantial sums of money at previous spectrum auctions and at that time was unaware that Three could be perversely punished in this way for its investment in the market. The possibility that bidding for spectrum in previous auctions could act as a disadvantage in future auctions acts as a disincentive to investment going forward.

Other issues arise regarding the inclusion of 3.6GHz spectrum within caps. The 3.6GHz licences are awarded across 9 different geographical regions, and apart from Three, all of the other winning bidders were allocated a different number of lots in different geographical regions. There is just a single geographical region proposed for this award, so it is presumed that the largest number of lots for each licensee across all regions would be counted for the purposes of the cap, though ComReg has not made this clear.

The Sub-1GHz Cap

With respect to the sub-1GHz cap, we note that ComReg regards the 700 MHz spectrum as being most suitable for use by mobile network operators[12]. Further, ComReg's analysis throughout section 7.7 and in tables 8, 9, and 10 only considers matters relating to mobile network operators and MVNOs. We therefore conclude that ComReg's analysis relates soley to the distribution of spectrum among the three existing market MNOs and focuses on what ComReg perceives to be a disparity between Eir and Three.

The 700MHz band is important for early and widespread roll-out of 5G services. It will be a "greenfield band" from the commencement of the licences, and as a pioneer band for 5G services in Europe the ecosystem will be well developed. The 800MHz and 900MHz bands have existing use, and so will not be as easily available for 5G. The 700MHz band is particularly important for rural coverage in Ireland given the low rural population density.

It seems to Three that ComReg has set out to restrict Three's ability to bid for 700MHz spectrum when compared to the two other mobile network operators in the market: "4.158 *. . . . . in contrast, the competition caps proposed (see Chapter 7) would provide Vodafone with the opportunity to be assigned 2×15 MHz 700 MHz Duplex compared with 2×10 MHz for Three*." The same disparity applies when comparing Three to Eir under the proposed caps. It is unclear what ComReg's reasoning or justification is for placing such a restriction on Three. As shown above in Section 6, there is no existing spectrum asymmetry that warrants intervention by ComReg, and that view is shared by both ComReg and DotEcon.

We suppose therefore that ComReg's concern is that at least three operators secure a critical mass of sub-1 GHz spectrum to support both 5G and legacy services. We submit that the only way to achieve this objective would be to set a cap of 2x10 MHz per bidder. This approach would be symmetric across bidders and would eliminate gaming concerns. The downside is that there would be no competition in the auction between existing MNOs for 700 MHz, and this would have to come from new entrants, but this should be acceptable if ComReg lacks any competition rationale for picking the winners.

ComReg would make a procedural error in developing this proposal as it would fail to ensure that any measures taken by it are proportionate having regard to the objectives set out in section 12 of the 2002 Act. ComReg has proposed an award that would discriminate against one particular market player (Three) with no objective or reasoned basis for such treatment. In doing so, ComReg has not identified the market issue it is seeking to remedy and has not carried out an adequate Regulatory Impact Assessment of that measure as is required by Ministerial Policy Direction No. 6. ComReg has not demonstrated that the proposed measure which disadvantages Three is proportionate or justified. It also does not have regard to the objective to promote efficient investment and innovation in new and enhanced infrastructure as provided for in Regulation 16 of the Framework Regulations 2011.

[12] E.g. Paragraphs 2.31 to 2.35 of Document 19/59.

The current distribution is optimal

In the first place, it should be noted all lots of spectrum in the sub-1GHz bands are 2x5MHz duplex lots. There are currently 13 lots available, and all were awarded in the 2012 MBSA. They are assigned as follows: Vodafone 4 lots; Eir 4 lots; Three 5 lots.

Given that there are only 13 lots, and that all are assigned among 3 licensees, the current distribution is the closest that is possible to parity among the existing three MNOs. Absolute parity could be achieved if all MNOs had only 4 lots, but this would leave one lot unused, which would be inefficient, i.e. the current distribution represents the minimum disparity for efficient use, and the disparity is only 1 lot. It makes no difference which MNO is assigned the additional lot; if the 5th lot was assigned to either Eir or Vodafone, then the disparity would remain exactly the same. The current distribution represents the closest that is possible to parity between the three MNOs for efficient use of the available spectrum, and no one operator is at a particular disadvantage.

900MHz is not a direct substitute for 700MHz

ComReg seems to have assumed that 900MHz and 700MHz licences are interchangeable, which is erroneous. There are significant differences at the beginning and end of the licences:

- 700MHz will be available for use immediately as greenfield spectrum for 5G, whereas 900MHz is in use to carry legacy services;
- as a pioneer band for 5G, networks and devices will be available earlier in the 700MHz band; and
- the existing 900MHz licences will expire in 2030, whereas 700MHz will be awarded to 2035 at a minimum.

These differences will lead to different use over time and different valuations.

The proposed sub-1GHz cap is asymmetric and disadvantages Three

ComReg's proposal to impose a sub-1GHz cap equivalent to a maximum of 7 lots per MNO, and to count existing spectrum holdings towards that cap would place Three at a disadvantage in the proposed auction. There are three MNOs who currently hold sub-1GHz spectrum, and ComReg's analysis is based on the distribution of spectrum between these three. As Vodafone and Eir will hold 4 sub-1GHz lots at the time of the award and Three will hold 5, a cap of 7 lots means that Three can only bid to obtain an additional 2 lots of 700 MHz, whereas Vodafone and Eir can bid to obtain 3. Clearly, in a competitive process where there are three likely participants and one is restricted relative to the other two, this is unfair and inequitable and no legal or objective reasoning has been provided for this treatment.

The logic of ComReg's proposal is that it would be acceptable for either Vodafone or Eir to bid for and win 3 of the available lots in the 700MHz band, but not Three. Further, ComReg has provisionally decided that it would be acceptable for Vodafone and Eir to each win 3 of the available 6 lots and for Three to win none (leading to a significant sub-1GHz disparity). No such outcome is possible for any of the other bidders, because if Three obtains its maximum allowed (2) and either of the other MNOs obtains its maximum (3) then there is always an additional lot available for the other bidder. Of the 3 competing market players, Three is the only one that could be left in a position to win no spectrum. The proposed caps specifically

provide for an extremely asymmetrical outcome in the 700MHz band, which is what ComReg seems to be trying to avoid.

The proposed sub-1GHz cap also discriminates against Three on price

The proposed cap allows two of the existing MNOs (except Three) to express incremental values for 1, 2 or 3 lots. Three cannot express an incremental value for a third lot as its bids are capped at two. As ComReg proposes to use a CCA format, this means that Three's value for a third lot cannot be reflected in the price determination for other winning bidders. Under the proposal, Eir and Vodafone would each have the ability to express a value for 50% more spectrum than Three would. This may lead to extreme differences in price paid for equivalent lots with Three paying substantially more than Vodafone or Eir. This is discriminatory against Three (without any objective basis) and means that our rivals may obtain a windfall gain. 700MHz is also likely to have the highest price per MHz of spectrum sold in this award, thus exacerbating the effect.

In Appendix 2 to this document NERA provides examples of possible price outcomes for the award of 700 MHz if a CCA mechanism is used as proposed. Example 2 demonstrates the discriminatory effect on pricing if an asymmetric cap, as proposed by ComReg, is used.

Perverse outcomes

Perversely, NERA's examples also show that if a CCA is used to award 700 MHz, bidders with predictably higher values for a 3rd lot are advantaged over others. This is true whether or not an asymmetric cap is used. In the case of Ireland, this means that Vodafone (which has higher market share) would be advantaged versus Eir (lower market share) and Three (also high market share but starts with more sub-1 GHz lot of spectrum). In the case where the efficient outcome is an even split of the spectrum, then the CCA pricing rule ensures that the weakest bidder always pays the most and the strongest bidder the least.

With the overlay of the asymmetric cap, Three is the obvious victim because it now faces paying opportunity cost that it cannot reciprocate. However, any benefit to Eir from weakening Three may be offset by its relative weakness versus Vodafone; this is because it is now cheaper and potentially more tempting for Vodafone to try to reduce Eir to 1 block as it no longer has to pay the opportunity cost of denying a 3rd block to Three. In short, ComReg's proposal to combine CCA with caps that count existing spectrum gives the greatest advantage to the (uncapped) MNO with the largest retail market share.

The situation becomes more complex again if you overlay the proposed asymmetric cap in the higher frequency bands. In these bands, Eir likely has much more flexibility to bid for surplus spectrum owing to its higher cap and lower capacity needs. Accordingly, Eir may be tempted to overstate its demand in other bands, as a way to match Vodafone's greater pricing power at 700 MHz. This type of behaviour may lead to bidders submitting bid sets that reflect strategic consideration rather than true valuations, resulting in perverse price outcomes and increasing the risk of an inefficient outcome.

The Overall Cap - Alternative Proposal

Three disagrees with ComReg's specific proposal to apply an overall cap based on total spectrum holdings. As discussed previously, the cap is arbitrary and lacks justification, as ComReg has not articulated a competition case as to why such a cap is required. Three recognises that there is a competition rationale to prevent one or two MNOs from acquiring an excessively large a share of spectrum in this award; however this objective can be achieved by imposing a symmetric cap across all bidders. No linkage with existing holdings is required.

A cap that accounts for existing holdings introduces an unacceptable asymmetry between bidders in the forthcoming auction. Specifically, it will enable one large bidder (Eir) to bid for significantly more spectrum than its two rivals. It also gives Vodafone more flexibility than Three. This is particularly significant in the context of ComReg's proposal to implement a CCA, as the cap would create a huge asymmetry in the ability of MNOs to impose prices on each other. In particular, as illustrated in the example developed by NERA in Appendix 2, it leaves Three vulnerable to paying higher prices for equivalent spectrum than its rivals, because Three cannot express its full value of being denied incremental spectrum.

Fortunately, there is a simple fix that can address these serious concerns. ComReg should adopt a symmetric cap across all bands above 1GHz in the auction. We propose that ComReg adopt a cap of not less than 150 MHz per bidder across the 2.1GHz, 2.3GHz and 2.6GHz bands.

A symmetric cap at 150 MHz or more would offer significant advantages over an asymmetric auction cap based on existing holdings:

- It would ensure at least three winners of capacity spectrum in the auction. It would also eliminate the possibility that two bidders alone could dominate this spectrum. This should address all competition concerns.
- It would ensure that all bidders have symmetric bidding power. This creates a more level playing field in the auction, which is especially important if a CCA is used. This will reduce the likelihood of there being large differences in pricing between bidders buying similar amounts of spectrum.
- It would be consistent with past auctions in Ireland, including 3.6 GHz. It would therefore be in line with bidder's legitimate expectations for this award.

Undermining of previous auction results

The spectrum in the 800MHz and 900MHz bands was awarded in ComReg's 2012 multiband spectrum auction, and the 3.6GHz was also awarded in an auction in 2017. ComReg is of the view that they were efficient award processes and has proposed to use a similar process again for this award. Since completing the award in 2012, the Three Group acquired Telefonica Ireland leading to the merger of the two MNOs. This merger was cleared by the European Commission following detailed examination, including consideration of the spectrum holdings relevant for the mobile market. The European Commission concluded that there was no competition issue arising from the fact that the merged company would hold more spectrum than other competitors in the market.

The 3.6GHz band is still undergoing transition, and (with one exception) no operator has launched commercial services using that spectrum since the award – it is still at the development stage. It is assumed that ComReg still regards that the process was efficient, and that the outcome represents an efficient distribution of the spectrum in the band.

If the outcome of the 3.6GHz auction was efficient, then it is wholly incorrect to include this spectrum within the cap for the next award. It is an efficient outcome that Three was awarded 15MHz of spectrum more than Eir, or 40MHz more than Imagine, or 65MHz more than Airspan. Equally it is an efficient outcome that Vodafone was awarded 5MHz more than Three.

If this is an efficient outcome, then it would be incorrect that these differences in spectrum holding should be allowed to somehow "count against" bidders in the auction that is now proposed. This would mean that the effect of the 3.6GHz award is that Three can only buy or even express a value for 65MHz less spectrum than Imagine, or 40MHz less than Airspan simply because Three won more spectrum than they did in the 3.6GHz auction (an efficient outcome). This means that the outcome of the 3.6GHz award has a negative feedback effect on the MBSA that is now proposed, and the more successful a bidder was in the 3.6GHz auction the more negatively it affects them in the new MBSA. This undermines the efficient outcome of the 3.6GHz award.

If this was known at the time of the 3.6GHz auction, then bidders could have modified their bids accordingly, however it was not. Thus, the proposal to use a cap that includes 3.6GHz is contrary to the requirement to provide regulatory certainty.

Current Proposal is contrary to ComReg's statutory obligations

Three's view is that ComReg's current proposals are contrary to the following statutory obligations:

- Section 12 of 2002 Act which sets out that ComReg's objectives include being non-discriminatory and proportionate. In particular:
    - Regulation 16 of the Framework Regulations with ComReg's objectives to promote efficient investment and innovation in new and enhanced infrastructures, be non-discriminatory, proportionate and promote regulatory predictability by ensuring a consistent regulatory approach;
    - Regulation 11 of the Authorisation Regulations outlines that where ComReg decides to limit rights of use to particular operators it must: (a) give due weight to the need to maximise benefits for users and to facilitate the development of competition, and it shall grant such rights of use on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in section 12 of the Act of 2002 and Regulations 16 and 17 of the Framework Regulations.

For the reasons explained in this section, we have a real concern that ComReg's cap proposals are not compatible with the above legal requirements.

Proposed Solution

Three suggests that ComReg's award proposal should be revised in accordance with its statutory obligations. We propose the following cap structure:

- All spectrum caps should be symmetric and limited to bands available in the auction.
- At 700 MHz, the most appropriate cap is 2x10 MHz per operator. If ComReg prefers instead to have 2x15 MHz cap, then it must not use a CCA to allocate this band, as format is discriminatory given predictable asymmetries between MNOs.
- For bands above 1GHz, there should be a symmetric cap based only on spectrum in the auction. In Three's view, a cap no lower than 150 MHz per operator across 2.1GHz, 2.3GHz and 2.5GHz would provide all bidders with the flexibility they need to pursue realistic targets.

8. Coverage Obligations

ComReg has proposed to include 'precautionary' coverage obligations for any bidder who obtains spectrum in the 700MHz band within 7 years. This includes:

- a 3 Mbit/s service to 99% of the population and 92% of the geographic area of Ireland; and
- a 30 Mbit/s service to 95% of the population, 90% of motorways, and 80% of primary roads.

However, ComReg has not yet specified the percentage of coverage probability associated with these coverage obligations, which is quite important for radio coverage design (e.g: 92% of geographic area but with 85% coverage probability, or 90% coverage probability).

It is also worth noticing that landlords, whether individuals or companies, with a large portfolio of tower assets will be encouraged to inflate their prices around specific locations associated coverage requirements. Therefore, spectrum licensees should have some degree of flexibility as to how to achieve their coverage. This would allow operators to move away from landlords who sought to charge excessive rents from "captive" customers.

We assume that the number of sites to be rolled out as specified in table 24 is for the full duration of the license. We request that ComReg confirm this.

Bearing in mind that Ireland has a particularly challenging rural population profile, these obligations are at the upper-end of the what network operators could be expected to meet under competitive commercial conditions. Three supports ComReg's proposals in this regard for coverage but, cautions that any further obligations would likely act as a deterrent to bidders in the auction.

Additional Coverage

Three is aware that even with the above obligations, there may still be some locations where it is desirable to improve coverage, but not viable to do so under normal circumstances. ComReg observes that 'interventionist' obligations are ideally achieved via a sequential step in a spectrum award or through a separate process. Such mechanisms may provide advantages for the State in ensuring that the societal benefits obtained exceed the costs of any such obligations.

ComReg could add a stage to the award process in which winning bidders could further offer to trade licensee fees for coverage of these intervention areas.

We propose that ComReg allocate the coverage obligations in a separate reverse auction stage, using a second price sealed bid auction, similar to the standard format used for assignment rounds.

A sealed bid should be acceptable if coverage obligations are being sold independently from spectrum, as bidder values should be largely based on their own private estimates of roll-out costs, so price discovery is not required to alleviate common value uncertainty. The obligations would be awarded to the operators that submit the lowest bids, and they would pay a price based on the smallest losing bids. This approach provides excellent incentives for straightforward value-based bidding.

This format is also very flexible and it opens up an opportunity for ComReg to explore alternative structures for the design of coverage obligation lots and the types of bids permitted. For example, ComReg could divide the coverage obligations into regional obligations. This approach would allow the market to explore a broader range of solutions for allocating rural coverage across the three MNOs.

9. Time Slices

ComReg proposes that the 2.1 GHz band be divided into two time slices, one covering the period between the expiry of the Vodafone / Three licences and the later expiry of Eir's licence, and one for the remainder of the full licence term. Three disagrees with this approach, as it involves the creation of artificial lots with durations that do not correspond to bidders' real demands, and also makes the auction unnecessarily complex. We propose that ComReg instead adopts two categories of longer duration lots, one category starting when the Vodafone / Three licences expire, and the other when the Eir licences expire.

There is no real demand for short-term time slices. Bidders are planning the transition of 2100 MHz to support 4G and 5G, and require long-term certainty of ownership to support new investment in the band. The situation is not the same as in 2012, when bidders with 900 and 1800 MHz blocks had potential high value for short term extensions to ensure 2G service continuity. With 3G approaching its end date, operators have more flexibility to adapt to the loss of this spectrum and, with three instead of four incumbents, the risk of any MNO not winning back valuable 2.1GHz spectrum is anyway low.

In Germany, the regulator (BNetzA) faced a similar situation in its 2019 spectrum auction, with 80 MHz of spectrum at 2100 MHz due to expire by 2021, but the remaining 40 MHz not due

to expire until 2026 (5 years later). After consulting with the industry, it rejected the time slice approach, and settled on selling two categories of lot: “long licences” starting in 2021 and “shorter licences” starting in 2026. All the licences expire in 2040, so the shortest duration available was 15 years. This approach was effective in selling all the spectrum to the three MNOs plus one new entrant in a highly competitive process.

ComReg should adopt the same approach in Ireland as in Germany with two categories of licence with common long-term expiry dates. This approach offers several advantages over time slicing:

- All licences have meaningful durations, so have standalone value without having to be combined with other licences in packages. This makes them easier to value and will make bidding decisions in the auction simpler. It also removes the necessity for combinatorial bidding, so a simpler auction design – such the hybrid clock-SMRA format proposed by DotEcon in the Netherlands could be adopted.

- With no time slicing at 2.1GHz, there would be no need to time slice other capacity bands. Therefore, a simpler lot structure consisting only of long-term licences can be adopted.

- Lots in the two licence categories can be given the same eligibility points as each other and as equivalent spectrum in the 2.3GHz and 2.5GHz bands, so as to facilitate switching between them in the auction. This should encourage straightforward bidding in the auction and promote price discovery.

As discussed further in Section 11, we also urge ComReg to adopt the same licence durations of up to 20 years as used in Germany. This would enable ComReg to sell 2.1 GHz in two categories, one of 20 years and one of 15 years. Longer durations are necessary to support long-term investments in new technologies. Having shorter licence durations in Ireland than in other European countries, such as Germany, would put the Irish economy at a competitive disadvantage in terms of enabling 5G and our digital future.

If, notwithstanding these arguments, ComReg decides to proceed with time slicing at 2.1GHz, it should not adopt the same time-slices in the 2.3GHz and 2.6GHz bands, for the following reasons:

1. The 2.3GHz and 2.6GHz bands are close substitutes for long-term incremental network capacity suitable for immediate deployment of 4G and, later, 5G. These bands will support new networks that will require long-term investment. Bidders in Ireland should get the opportunity to bid for clean licences covering the maximum licence term. This approach is the norm across Europe.

2. Although 2.1GHz is an alternative band for network capacity, for various reasons it is not as close a substitute for 2.3GHz and 2.6GHz as the other two bands are for each other. This is primarily because there are legacy issues concerning 2.1GHz deployment, and the two new bands will have a different commencement date than the 2.1GHz band in TS1.

3. Having time slices introduces a risk that bidders bid strategically for packages that break up bands over time which they do not expect to win but could be relevant for

price setting or obscuring price discovery. Whether or not this behaviour is particularly likely, ComReg should not facilitate it. If bidders make mistakes, this could lead to perverse and inefficient outcomes, with spectrum lying fallow for some time periods.

4. Adding time slices for 2.3GHz and 2.6GHz needlessly complicates the auction, requiring the use of package bidding and increasing the number of bid options. Removing the time slicing could make it possible to switch to a simpler auction format, such as the hybrid clock-SMRA proposed in the Netherlands, that would better meet ComReg's objectives. Even if a CCA is used, reducing the number of bid options would reduce the risk of bidder error and foreclose some strategic bidding options.

In conclusion, we urge ComReg to revisit its support for time slicing, which involves creating artificial lots that do not reflect bidder's real demands. There are better, simpler approaches, which would make bidding simpler and less risky, increasing the likelihood of an efficient auction outcome.

10. The 2.1GHz Licences

ComReg has proposed to provide the option for all existing licensees to liberalise some or all existing 2.1 GHz rights of use from the time of the substantive decisions concerning the present Proposed Award (expected to be H1 2020). "*Having carefully considered DotEcon's assessment, including its current benchmarking results for 2.1 GHz rights, ComReg does not propose to apply any additional fees for any liberalisation of existing 2.1 GHz licences for the period up until 15 October 2022*." Three agrees that there is no reliable method to derive the appropriate fee for this period

We note that Eir has previously committed (when the award was made) to pay the licence fees as specified and to operate its 3G licence according to the restrictions therein. These restrictions include the limitation that only 3G service can be provided. If Eir is to now be given an option to "liberalise" that licence, and if Eir takes up that option, then there must be some additional value to having the licence liberalised – otherwise Eir would not choose to accept the amendment. Given that the Eir licence for 2.1GHz will not expire for over 7 years, this increase in value is considerable, and would be a "windfall gain" for Eir alone. On this basis, there should be no circumstance under which Eir's licence is liberalised without payment of an additional fee.

Instead of trying to cater for liberalisation as proposed, ComReg should consider giving Eir the opportunity to "surrender its 2.1GHz spectrum back to ComReg to be re-awarded as liberalised spectrum. Future spectrum usage fees for the 3G licence would not then be incurred by Eir (although any remaining stage payments of spectrum access fees would still remain to be paid). This same option could be extended to both Vodafone and Three and if taken up by all three licensees, it would allow for liberalisation of all of the 2.1GHz band from the date of the award, elimination of time-slices from the award, and avoid the need to extend Three's licences. If Eir declines, then its current 3G licence should remain unamended until its expiry.

Extension to Three's 2.1GHz licences

ComReg proposes to:

- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing "A Licence" – which would commence on 25 July 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz A Licence);
- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing "B Licence" – which would commence on 2 October 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz B Licence);
- attach conditions to both the Interim 2.1 GHz A and B licences by reference to the current licence conditions in each of the existing "A Licence" and "B Licence", respectively, save for the removal of any obsolete conditions; and
- base the licence fees for each of the Interim 2.1 GHz A and B licences by reference to the licence fees for Vodafone's and Eir's existing 2.1 GHz licences, but updated to current day levels by reference to the overall consumer price index (CPI).

Three does not agree that this is an appropriate solution to the problem of different licence expiry dates. ComReg is required to provide for continuity in order to avoid disruption to consumers, and Three accepts that it would be desirable to have common expiry dates for the 12 lots licensed to Three and Vodafone.

The proposed licence fee for extension is inappropriate and without rationale. ComReg will be well aware that the 3G licences were awarded under different circumstances than exist today, and valuations in 2002 were completely different to those that apply now. It is noted that two different licence types were issued in 2002, the "A" licence and the "B" licence. Different conditions are contained in both licences (and it would not be a simple task to quantify these differences), and different spectrum access fees were applied also. As the spectrum access fees have already been fully paid for the two licences, this should not be applied again when the purpose of the extension is to facilitate continuity of service while simplifying ComReg's re-award.

Notwithstanding the above, it is notable that ComReg does not propose to amend the licence conditions (save for the removal of any obsolete conditions) with the exception of the price. There is no logical reason why ComReg would seek to link the price for extension of Three's "A" licence to that of the "B" licence awarded to Vodafone in 2002 or Eir in 2007. The proposal to increase those licence fees by the change in CPI since 2002 is also without logical explanation. ComReg is well aware that the market value for award of liberalised spectrum today is significantly lower than for 3G service in 2002. ComReg's own estimate of the current market value for a 15 year licence is between €0.197 and €0.234 per MHz.pop, whereas ComReg is proposing to impose a fee for the licence extension that is multiples of this.

ComReg's proposal for 3G licence extension fees stands in contrast with the proposal to liberalise Eir's 3G licence up to 2027, which will be for free unless the value for 2.1GHz in the award exceeds the original licence fee. ComReg's approach does not represent equivalent treatment to Eir in largely comparable circumstances.

The proposed licence fee for licence extension is excessive, and is not acceptable to Three. We will assist ComReg in making the award simpler, and we agree that having multiple different expiry dates is not desirable, however this proposal would penalise Three by imposing inappropriate fees for licence extensions that are designed to facilitate the award process. This solution might be acceptable if appropriate extension fees were applied.

11. Licence Duration

At this time, the award is planned to take place during Q3 2020, however it is quite likely that licences awarded as a result of this process will not issue until the end of 2020. This is approximately the same time for transposition of the EECC into Irish law (the latest date is 21st December 2020) and EECC will take direct effect at that point in time. It is noted that in the meantime no action should be taken which would contradict EECC. ComReg has made reference to this new regulatory framework in its consultation, however, there seems to be little analysis of how ComReg's proposals comply with the requirements of the EECC which will likely be implemented by the time ComReg grants licenses under this award..

ComReg's proposal would see licence durations for the "Greenfield bands" (700MHz, 2.3GHz, 2.6GHz) of 15 years, and for the 2.1GHz band licence durations would be somewhat less than that at approximately 13 years. Three does not believe this proposal satisfies the obligations on National Regulatory Authorities (NRAs) as set out in Article 49 of the EECC. Article 49(2) sets out a minimum licence duration of 15 years and also provides for regulatory predictability over at least 20 years so that where a licence duration is of at least 15 years the general criteria for an extension of that licence needs to be set out in advance of granting rights of use i.e. at this stage.

> " *. . . 2. Where Member States grant individual rights of use for radio spectrum for which harmonised conditions have been set by technical implementing measures in accordance with Decision No 676/2002/EC in order to enable its use for wireless broadband electronic communications services ('wireless broadband services') for a limited period, they shall ensure regulatory predictability for the holders of the rights over a period of at least 20 years regarding conditions for investment in infrastructure which relies on the use of such radio spectrum, taking account of the requirements referred to in paragraph 1 of this Article. This Article is subject, where relevant, to any modification of the conditions attached to those rights of use in accordance with Article 18.*
>
> *To that end, Member States shall ensure that such rights are valid for a duration of at least 15 years and include, where necessary to comply with the first subparagraph, an adequate extension thereof, under the conditions laid down in this paragraph.*

> *Member States shall make available the general criteria for an extension of the duration of rights of use, in a transparent manner, to all interested parties in advance of granting rights of use, as part of the conditions laid down under Article 55(3) and (6). Such general criteria shall relate to . . .*"

Three has previously submitted comments to ComReg explaining why licence durations of greater than 15 years are required, so we will not repeat those here. We do wish to highlight that this is a particular concern for 5G networks. It will take a number of years yet before networks can be rolled-out and terminal equipment disseminated to a reasonable population. It will be several years before operators can expect to begin making a return on the investment in spectrum and networks.

Contrary to paragraph 6.102, it is noted that in the 2012 MBSA, the full licence duration was 17 years, as compared to 13 years here for 2.1GHz. In paragraph 6.120 ComReg states "As between Options 1 and 2 above, ComReg considers Option 1 to be preferable in light of the previous discussion about the suitability of 15 years duration, including that this would be consistent with the approach in the 2012 MBSA". This is not correct. ComReg's examination of other European countries does nothing to indicate that 15 is adequate, in fact it seems that 15 is the minimum, and 20 is more typical.

ComReg needs to review the proposals for licence duration against its obligations set out in EECC:

- to promote investment in high capacity networks;
- to act pursuant to the connectivity objective;
- regarding licence duration and how extensions are to be obtained set out in Article 49 of EECC.

Three is advised that under the principle of vertical direct effect a member state must not undermine / compromise the purpose of the EECC prior to its implementation. This would include the purpose of the EECC in articles 49 and 50 in ensuring legal certainty for operators regarding the duration of the spectrum license (regulatory certainty for 20 years required) and clarity in relation to the renewal of such licenses (procedures and mechanisms etc).

In addition, under the principle of indirect effect or conforming interpretation the EECC should be treated as being of 'persuasive' value in interpreting current Irish law requirements. This would include the interpretation of any 'grey areas' in relation to ComReg's relevant statutory objectives and powers (we note that ComReg's position of being 'mindful' of the EECC – including as outlined in this Consultation – acknowledges the relevance of this legal principle).

12. Minimum Prices

ComReg plans to derive the minimum licence fee by benchmarking to find the expected market value, and to split the upfront vs annual fees in a ratio of 4:6. Three agrees with the proposed split, and believes that the overall approach could be acceptable with some minor but important amendments.

ComReg needs to avoid the possibility of choking off demand by setting reserve prices too high. Benchmarking can only give reasonable indications of market price if the samples are taken from several comparable awards, and there is always a margin for error. We are now at the early stages of the 5G wave of spectrum awards, so the sample of awards that are comparable is still small. In the 5G era, most bidders will be adding to an existing spectrum portfolio, so will have an incremental value for more spectrum. This is not reflective of previous awards where market entry and/or renewal of existing licences were the primary concerns. Total revenues derived from the harmonised spectrum bands have declined in recent years, whereas the volume of spectrum in use has increased, so valuations can be expected to be lower in the 5G era.

Setting the minimum price slightly low is unlikely to have any impact on a competitive award process; however, setting it a little too high could prevent a bidder from entering the application stage, making the auction less competitive and potentially leaving some spectrum unsold. There is little or nothing to be lost by ComReg setting the minimum price at some margin below the benchmark, but there is increased risk of an inefficient award by setting it at or above the benchmark.

DotEcon has pointed out that the distributions of the licence price observations used in its samples do not follow a normal distribution, but rather are positively skewed with a long upper tail of higher values. DotEcon has recommended the use of a geometric mean rather than arithmetic mean to derive the benchmark prices (which itself demonstrates that the process is prone to error or interpretation). Three does not agree that this approach gives enough certainty that the benchmark prices will avoid choking off demand.

For the above reason, it is necessary to include a margin so that we can be reasonably sure that the auction has room to identify the efficient market outcome, ideally following a period of price discovery. Three believes ComReg has included some incorrect references in its benchmark and that these should be removed. Three also proposes that ComReg include a margin for price discovery. Reducing the minimum price by one standard deviation would achieve this without reducing the effectiveness of the minimum prices. We do not agree that using the geometric mean by itself provides this margin.

We note that in Table 13, DotEcon has included 800MHz and 900MHz spectrum in the samples for 700MHz. This is not appropriate, as 700MHz is to be awarded when there is already significant volume of sub-1GHz spectrum in use. It will most likely be used for 5G services which will have different business plans to those that existed over previous years for 2G, 3G, or 4G. It is to be expected that the market value for 700MHz will be less than that which applied in 2012 for 800MHz and 900MHz. Including these samples, in Three's view, sets the reserve too high, increasing the risk of choking demand at the application stage. We also believe that using samples from the previous 10 years is inappropriate, as the business cases for acquiring spectrum 10 years ago would not be comparable to those that exist today. If benchmarking is to be used, then the samples must be comparable.

For similar reasons to those outlined above, Three believes the benchmark for 2.1GHz spectrum is incorrect. Spectrum sold in the 3G era will have significantly different business cases and valuations than those of today. The benchmark should be adjusted to use only recent samples.

13. Licence Conditions

MVNO Obligations

In chapter 8 of the Consultation document, ComReg seeks views on whether it would be appropriate to include MVNO conditions in the licences. Three makes the following observations:

- Existing MVNOs have made a positive contribution to retail competition. ComReg's own analysis shows that there has been a re-distribution of market share away from MNOs in recent years, and the HHI has fallen from 0.346 to 0.322;
- There is no identified barrier to entry into the market by MVNOs that would be resolved by the imposition of mandatory MVNO conditions in licences;
- An MVNO obligation might act as a barrier to a new entrant bidder, particularly if they intended to buy only spectrum above 1GHz;
- Applying an MVNO obligation only to some bands might skew the auction towards certain bands and deliver an inefficient outcome.

For these reasons, it is neither necessary nor desirable to include an MVNO condition in the award licences.

Spectrum Transfers

Three agrees that the transfer and lease Regulations should apply to all bands in the award.

Three would also welcome the signing into law of the Statutory Instrument proposed to deal with leasing of spectrum.

Transition

Transition processes, if any, should favour the new spectrum licensee, and not the existing spectrum holder. While striking a balance between the need to provide for continuity of existing services and avoiding delay to new ones, ComReg should support licensees that that are willing to develop the market and not companies that only want to "sweat" their existing old assets. We should avoid the approach taken for the 3.6GHz spectrum award, where outgoing licensees held priority over new ones.

VoIP/VoWi-fi/VoLTE

Three does not agree with ComReg's proposal to mandate provision of native voice over Wi-fi (VoWi-fI) or voice over LTE (VoLTE) services as part of the spectrum award. This is in contradiction with the "technology neutral" approach normally taken by ComReg. It is possible that there will be a new entrant bidder in the auction who intends to focus only on data

provision. For this bidder a mandatory requirement to provide native VoIP or VoLTE represents an unnecessary burden that is a barrier to their acquisition of spectrum. This would particularly be the case if they intended to bid for a relatively small portion of the total spectrum available. Similarly, an existing licensee might wish to acquire additional spectrum from the new bands and intend to optimise their network in such a way that the incremental spectrum is used only to provide additional data capacity, while maintaining voice service on other technologies. This might be the most efficient configuration for that particular network, however it is ruled out if ComReg include a mandatory VoLTE/VoIP requirement.

Three is of the view that all licensees who provide voice service will eventually introduce the SIP/IMS technology when they are sure that the customer experience over a mobile network will be as good as that which customers have so far experienced with circuit-switch voice. This is not yet the case today for voice over VoWi-Fi and VoLTE. ComReg should let licensees decide whether or when it is most appropriate to introduce services like VoLTE.

We note that VoWi-fi is normally supplied over a fixed broadband service (normally using wired/fibre infrastructure), and that it would be incorrect to include any requirement in spectrum licences to require a wireless provider to invest in infrastructure to provide fixed network services. This would be an inappropriate condition that would discriminate against wireless only service providers in favour of wired ones.

Appendix 1 Legal Framework and Statutory Objectives

ComReg is obliged, when awarding spectrum and licenses to adhere to general regulatory principles, specific regulatory obligations and must also adhere to its statutory objectives and functions. These are all centred around the principles of non-discrimination, fairness, maintaining competition and investment in the market, ensuring regulatory certainty and consistency and efficiency of spectrum. We set out some of the relevant legislative provisions below, with key parts underlined.

Communications Regulation Act 2002

Objectives of Commission

12. (1) The objectives of the Commission in exercising its functions shall be as follows—

(a) in relation to the provision of electronic communications networks, electronic communications services and associated facilities—

i. to promote competition,

ii. to contribute to the development of the internal market, and

iii. to promote the interests of users within the Community,

12. (2) In relation to the objectives referred to in subsection (1)(a), the Commission shall take all reasonable measures which are aimed at achieving those objectives, including—

(b) in so far as contributing to the development of the internal market is concerned—

i. removing remaining obstacles to the provision of electronic communications networks, electronic communications services and associated facilities at Community level,

ii. encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity,

iii. ensuring that, in similar circumstances, <u>there is no discrimination in the treatment of undertakings providing electronic communications networks and services and associated facilities</u>, and

iv. co-operating with electronic communications national regulatory authorities in other Member States of the Community and with the Commission of the Community in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of Community law in this field, and

(c) in so far as promotion of the interests of users within the Community is concerned—

i. ensuring that all users have access to a universal service,

ii. ensuring a high level of protection for consumers in their dealings with suppliers, in particular by ensuring the availability of simple and inexpensive dispute resolution procedures carried out by a body that is independent of the parties involved,

iii. contributing to ensuring a high level of protection of personal data and privacy,

iv. promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available electronic communications services,

v. encouraging access to the internet at reasonable cost to users,

vi. addressing the needs of specific social groups, in particular disabled users, and

vii. ensuring that the integrity and security of public communications networks are maintained.

12. (3) In carrying out its functions, the Commission shall seek to ensure that measures taken by it are proportionate having regard to the objectives set out in this section.

12 (5) In carrying out its functions, the Commission shall have regard to international developments with regard to electronic communications networks and electronic communications services, associated facilities, postal services, the radio frequency spectrum and numbering.

12 (6) The Commission shall take the utmost account of the desirability that the exercise of its functions aimed at achieving the objectives referred to in subsection (1)(a) does not result in discrimination in favour of or against particular types of technology for the transmission of electronic communications services.

S.I. No. 333/2011 - European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011

Objectives of the Regulator

16. (1) In addition to, but without prejudice to, its objectives under section 12 of the Act of 2002, the Regulator shall—

(a) unless otherwise provided for in Regulation 17, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations having particular regard to those designed to ensure effective competition,

(b) in so far as the promotion of competition is concerned—

i. ensure that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality, and

ii. ensure that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector,

(c) in so far as contributing to the development of the internal market is concerned, co-operate with BEREC in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of European Union law in the field of electronic communications, and

(d) in so far as promotion of the interests of users within the European Union is concerned—

i. address the needs of specific social groups, in particular, elderly users and users with special social needs, and

ii. promote the ability of end-users to access and distribute information or use applications and services of their choice.

16 (2) In pursuit of its objectives under paragraph (1) and under section 12 of the Act of 2002, the Regulator shall apply objective, transparent, non-discriminatory and proportionate regulatory principles by, among other things—

(a) promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods,

(b) ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services,

(c) safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure based competition,

(d) promoting efficient investment and innovation in new and enhanced infrastructures, including by ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, while ensuring that competition in the market and the principle of non-discrimination are preserved,

(e) taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State.

Management of radio frequencies for electronic communications services

17. (1) The Regulator shall, subject to any directions issued by the Minister under section 13 of the Act of 2002 and having regard to its objectives under section 12 of the Act of 2002, Regulation 16 and Article 8a of the Framework Directive, ensure—

(a) the effective management of radio frequencies for electronic communications services,

(b) that spectrum allocations used for electronic communications services and issuing of general authorisations or individual rights of use for such radio frequencies are based on objective, transparent, non-discriminatory and proportionate criteria, and

(c) that harmonisation of the use of radio frequency spectrum across the European Union is promoted, consistent with the need to ensure its effective and efficient use and in pursuit of benefits for the consumer such as economies of scale and interoperability of services, having regard to all decisions and measures adopted by the European Commission in accordance with the Radio Spectrum Decision.

Publication of procedures

A 2.49 Regulation 9(4)(a) of the Authorisation Regulations requires that ComReg, having regard to the provisions of Regulation 17 of the Framework Regulations, establish open, objective, transparent, non-discriminatory and proportionate procedures for the granting of rights of use for radio frequencies and cause any such procedures to be made publicly available.

Procedures for limiting the number of rights of use to be granted for radio frequencies

A 2.55 Regulation 11(2) of the Authorisation Regulations requires that, when granting the limited number of rights of use for radio frequencies it has decided upon, ComReg does so "…on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in Section 12 of the 2002 Act and Regulations 16 and 17 of the Framework Regulations."

A 2.56 Regulation 11(4) provides that where it decides to use competitive or comparative selection procedures, ComReg must, inter alia, ensure that such procedures are fair, reasonable, open and transparent to all interested parties.

Fees for spectrum rights of use

A 2.57 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use which reflect the need to ensure the optimal use of the radio frequency spectrum.

A 2.58 ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

S.I. No. 335/2011 - European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011

Rights of use for radio frequencies

9. (2) The Regulator may grant individual rights of use for radio frequencies by way of a licence where it considers that one or more of the following criteria are applicable—

(a) it is necessary to avoid harmful interference,

(b) it is necessary to ensure technical quality of service,

(c) it is necessary to safeguard the efficient use of spectrum, or

(d) it is necessary to fulfil other objectives of general interest as defined by or on behalf of the Government or a Minister of the Government in conformity with European Union law.

9. (10) The Regulator shall not limit the number of rights of use for radio frequencies to be granted except where this is necessary to ensure the efficient use of radio frequencies in accordance with Regulation 11.

9. (11) The Regulator shall ensure that radio frequencies are efficiently and effectively used having regard to section 12(2)(*a*) of the Act of 2002 and Regulations 16(1) and 17(1) of the Framework Regulations. The Regulator shall ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies. For this purpose the Regulator may take appropriate measures such as mandating the sale or the lease of rights of use for radio frequencies.

Procedure for limiting the number of rights of use to be granted for radio frequencies

11. (1) Where the Regulator considers that the number of rights of use to be granted for radio frequencies should be limited or that the duration of existing rights of use for radio frequencies should be extended other than in accordance with the terms specified in the rights of use it shall, without prejudice to sections 13 and 37 of the Act of 2002,—

(a) give due weight to the need to maximise benefits for users and to facilitate the development of competition, and

(b) give all interested parties, including users and consumers, the opportunity to express their views in accordance with Regulation 12 of the Framework Regulations.

11. (2) The Regulator may decide, having taken into account the matters referred to in paragraph (1)(a) and (b), that the number of rights of use for radio frequencies referred to in that paragraph ought to be limited and, where the Regulator so decides, it shall grant such rights of use on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in section 12 of the Act of 2002 and Regulations 16 and 17 of the Framework Regulations.

11. (4) Where the Regulator decides to use a competitive or comparative selection procedure for the purpose of granting rights of use for radio frequencies, the Regulator may extend the maximum period of 6 weeks referred to in Regulation 9(8) for as long as is necessary to ensure that such procedures are fair, reasonable, open and transparent to all interested parties, but by no longer than 8 months.

Directive (EU) 2018/1972 establishing the European Electronic Communications Code

Recital 23

The regulatory framework should, in addition to the existing three primary objectives of promoting competition, the internal market and end-user interests, pursue an additional connectivity objective, articulated in terms of outcomes: widespread access to and take-up of very high capacity networks for all citizens of the Union and Union businesses on the basis

of reasonable price and choice, effective and fair competition, open innovation, efficient use of radio spectrum,

Recital 62

Electronic communications broadband networks are becoming increasingly diverse in terms of technology, topology, medium used and ownership. Therefore, regulatory intervention must rely on detailed information regarding network roll-out in order to be effective and to target the areas where it is needed. That information is essential for the purpose of promoting investment, increasing connectivity across the Union and providing information to all relevant authorities and citizens.
Article 3

2. In the context of this Directive, the national regulatory and other competent authorities as well as BEREC, the Commission and the Member States shall pursue each of the following general objectives, which are not listed in order of priority:

> (a) promote connectivity and access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all citizens and businesses of the Union;

[The spectrum award will facilitate the deployment of very high capacity networks as defined under the EECC.]

Article 49 – Duration of Rights

1. Where Member States authorise the use of radio spectrum through individual rights of use for a limited period, they shall ensure that the right of use is granted for a period that is appropriate in light of the objectives pursued in accordance with Article 55(2), taking due account of the need to ensure competition, as well as, in particular, effective and efficient use of radio spectrum, and to promote innovation and efficient investments, including by allowing for an appropriate period for investment amortisation.

2. Where Member States grant individual rights of use for radio spectrum for which harmonised conditions have been set by technical implementing measures in accordance with Decision No 676/2002/EC in order to enable its use for wireless broadband electronic communications services ('wireless broadband services') for a limited period, they shall ensure regulatory predictability for the holders of the rights over a period of at least 20 years regarding conditions for investment in infrastructure which relies on the use of such radio spectrum, taking account of the requirements referred to in paragraph 1 of this Article. This Article is subject, where relevant, to any modification of the conditions attached to those rights of use in accordance with Article 18.

   To that end, Member States shall ensure that such rights are valid for a <u>duration of at least 15 years</u> and include, where necessary to comply with the first subparagraph, an adequate extension thereof, under the conditions laid down in this paragraph.

   Member States shall make available the general criteria for an extension of the duration of rights of use, in a transparent manner, to all interested parties in advance of granting rights of use, as part of the conditions laid down under Article 55(3) and (6). Such general criteria shall relate to:

(a) the need to ensure the effective and efficient use of the radio spectrum concerned, the objectives pursued in points (a) and (b) of Article 45(2), or the need to fulfil general interest objectives related to ensuring safety of life, public order, public security or defence; and

(b) the need to ensure undistorted competition.

At the latest two years before the expiry of the initial duration of an individual right of use, the competent authority shall conduct an objective and forward-looking assessment of the general criteria laid down for extension of the duration of that right of use in light of point (c) of Article 45(2). Provided that the competent authority has not initiated enforcement action for non-compliance with the conditions of the rights of use pursuant to Article 30, it shall grant the extension of the duration of the right of use unless it concludes that such an extension would not comply with the general criteria laid down in point (a) or (b) of the third subparagraph of this paragraph.

On the basis of that assessment, the competent authority shall notify the holder of the right as to whether the extension of the duration of the right of use is to be granted.

If such extension is not to be granted, the competent authority shall apply Article 48 for granting rights of use for that specific radio spectrum band.

Any measure under this paragraph shall be proportionate, non-discriminatory, transparent and reasoned.

By way of derogation from Article 23, interested parties shall have the opportunity to comment on any draft measure pursuant to the third and the fourth subparagraphs of this paragraph for a period of at least three months.

This paragraph is without prejudice to the application of Articles 19 and 30.

When establishing fees for rights of use, Member States shall take account of the mechanism provided for under this paragraph.

3. Where duly justified, Member States may derogate from paragraph 2 of this Article in the following cases:

(a) in limited geographical areas, where access to high-speed networks is severely deficient or absent and this is necessary to ensure achievement of the objectives of Article 45(2);

(b) for specific short-term projects;

(c) for experimental use;

(d) for uses of radio spectrum which, in accordance with Article 45(4) and (5), can coexist with wireless broadband services; or

(e) for alternative use of radio spectrum in accordance with Article 45(3).

4. Member States may adjust the duration of rights of use laid down in this Article to ensure the simultaneous expiry of the duration of rights in one or several bands.

Appendix 2 – Comments provided by NERA

Three asked NERA Economic Consulting (NERA) to review ComReg's proposals to use a combinatorial clock auction (CCA) together with asymmetric caps for this award. NERA is one of the world's leading experts on the use of the CCA, having advised bidders in the majority of auctions using this format worldwide, and also having implemented a CCA to award AWS spectrum in Mexico. Two of their team members were also involved in developing the CCA format in previous roles at DotEcon.

NERA advised that the CCA is not a good format for this award. They were particularly concerned about the use of a CCA for the 700 MHz band, given predictable asymmetries between bidders, especially if an asymmetric cap based on existing holdings was used. They said that this could result in highly asymmetric price outcomes, and that the process would predictably favour some bidders over others. They also highlighted the risk of gaming behaviour, especially given the inclusion of many bands and the use of a further asymmetric cap based on all spectrum holdings. They said that there was a material risk that the auction could result in a bad outcome for Ireland involving some combination of high overall prices, highly asymmetric prices and an inefficient award of spectrum across bidders.

To illustrate these points, NERA provided a number of simplified examples that show the scope for perverse pricing outcomes if ComReg proceeds with using a CCA with asymmetric caps.

Potential drawbacks of discriminatory pricing

In most auction markets, when bidders bid for the same thing at the same time, all winners pay the same unit price, as determined by the market. As ComReg acknowledges, the CCA uses a discriminatory pricing rule that may lead to bidders paying very different prices for the same thing. NERA previously provided a report to Three that expressed concern about the unfairness and other inefficiencies that may flow from not using a uniform price rule in the context of this award. Asymmetric price outcomes may be unfair, and a regulator implementing such an approach has a duty to demonstrate a clear efficiency rationale for deviating from uniform pricing.

In the consultation document, ComReg dismisses NERA's objection to discriminatory pricing in the context of Ireland's multiband award (Paragraphs 7.63-7.64). However, the arguments it presents in defense of the CCA are partial and superficial:

- ComReg argues that "*bidders paying comparable amounts is not an objective of the Proposed Award*." NERA agrees but says this misses the point. ComReg has a duty not to discriminate between bidders and having bidders pay different prices for the same thing is potentially discriminatory. To justify not using uniform pricing, ComReg should demonstrate that there is an efficiency rationale that can justify such discrimination.

- ComReg argues that uniform pricing "*may not be compatible with an efficient assignment because bidders (in a limited field of potential bidders) have incentives to keep prices down*", owing to incentives for strategic demand reduction. NERA acknowledges that incentives for demand reduction may be stronger in an SMRA or clock auction than in a CCA. However, demand reduction is only one of many forms of strategic play that might impact the efficiency of a complex multi-band auction and is typically one of the least distortive because, in a spectrum auction, bidders usually have a fairly good idea what spectrum they need and will not concede further spectrum without a fight. For this award, given the limited field of potential bidders and their predictable demands, NERA argues that a much bigger risk to efficiency is that bidders manipulate their bid amounts as a tool to put price pressure on rivals, a strategy made possible by the discriminatory pricing rule of the CCA.

- ComReg argues that "*a uniform price may result in lots going unsold unnecessarily or being assigned inefficiently to a bidder who is not the bidder that values them most, simply because in some cases it is impossible to achieve an efficient outcome with uniform prices when there are complementarities between lots*." NERA recognizes that this is a possibility, but does not agree that it is particularly likely, given the nature of the available spectrum and bidder demands. Such risks could also be lessened by not having time slicing for 2.3 GHz and 2.5 GHz, as argued by Three above.

Potential for asymmetric prices at 700 MHz

A simple example using the 700 MHz band illustrates the potential for gross unfairness when using a CCA to allocate 700 MHz in a scenario where there are only three strong bidders (i.e. the three MNOs in Ireland). Suppose there are 6 lots available and all three bidders are capped at 3 lots each. Further, suppose that the efficient outcome is to allocate 2 lots to each bidder, but all bidders have some value above reserve for a 3rd lot. If all bidders bid to value, then each bidder will win 2 lots and pay the sum of the values for a 3rd lot expressed by the two other bidders. By definition, this means that the bidder with the highest value for the 3rd lot will pay the least, and the bidder with the lowest value for the 3rd lot will pay the most. This is illustrated in example 1 below.

In general, valuations for marginal spectrum can be expected to trend with market share. Therefore, other factors being equal, this approach will predictably lead to the strongest incumbent paying less than the weakest incumbent for the same amount of spectrum. The greater the market share disparity and resulting gap in valuations between bidders, the greater the likely difference in price (assuming bidders bid straightforwardly).

Example 1: Asymmetric prices

This example illustrates the discriminatory nature of the opportunity cost pricing rule in the CCA, even under symmetric spectrum caps.

For illustrative purposes, we focus on the 700 MHz band with 6 identical lots available. Suppose there are only three strong bidders (i.e. the three MNOs in Ireland), and all three bidders are symmetrically capped at three lots each. We assume the following simple valuations for three lots:

Bidder	2x5 MHz	2x10 MHz	2x15 MHz
THR	€40	€110	€130
VOD	€50	€120	€170
EIR	€40	€100	€115

If the reserve price is set at e.g. €10, the efficient outcome is to allocate two lots to each bidder. With the valuations above, this yields a total value of €330, which is more than any other feasible combination of bids and unsold lots at reserve price.

In this example, all bidders have a positive value above reserve price for a 3rd lot. These are the marginal values that set prices. If all bidders bid full valuation, then each bidder will win two lots and pay the sum of the valuations for a 3rd lot expressed by the two other bidders.

Bidder	Winning package	Price	Price setting bids
THR	2x10 MHz	€65	€50 (VOD 3rd) + €15 (EIR 3rd)
VOD	2x10 MHz	€35	€20 (THR 3rd) + €15 (EIR 3rd)
EIR	2x10 MHz	€70	€20 (THR 3rd) + €50 (VOD 3rd)

The bidder with the highest value for the 3rd lot (VOD) will pay the least, while the bidder with the lowest value for the 3rd lot (EIR) will pay the most. Under these simple, yet realistic, demand conditions, the CCA produces prices that are discriminatory against weaker bidders. This follows immediately from the opportunity cost pricing rule in the CCA.

This example illustrates the discriminatory nature of the opportunity cost pricing rule in the CCA, even under symmetric spectrum caps.

Impact of asymmetric spectrum caps

Now consider the same example but suppose that one of the bidders is uniquely capped at 2 lots. The other two bidders can express a value for a 3rd lot, but the capped bidder cannot.

The two uncapped bidders are guaranteed to secure one of their 2 lots at reserve, and only pay each other's opportunity cost for the other lot. In contrast, the capped bidder will always pay more, as it must pay opportunity cost for both lots that it wins. Thus, the capped bidder enters the auction at a significant disadvantage.[13]

The asymmetry in prices paid under these conditions could be large, depending on the valuation structure. The package bid structure does protect a "weaker bidder" against a scenario where they might win only 1 lot at a price at which they would prefer nothing (relevant only if their value for 1 lot is less than half their value for 2 lots). However, this is not an attractive feature for a bidder that expects to win 2 lots but has a predictably modest value for a 3rd block or is prevented by caps from expressing a value for 3rd block.

Example 2: Asymmetric caps

This example illustrates the impact of asymmetric caps on the opportunity cost pricing rule in the CCA. Again, for simplicity, we focus on the 700 MHz band with 6 identical lots available. Continuing from Example 1, suppose bidder valuations are as follows:

Bidder	2x5 MHz	2x10 MHz	2x15 MHz
THR	€40	€110	Not allowed
VOD	€50	€120	€170
EIR	€40	€100	€115

The only difference to Example 1 is that THR is capped at two lots, so a bid for 2x15 MHz is not allowed. This does not change the result, and the efficient outcome is for each bidder to win two lots. However, it does change the price outcome.

Bidder	Winning package	Price	Price setting bids
THR	2x10 MHz	€65	€50 (VOD 3rd) + €15 (EIR 3rd)
VOD	2x10 MHz	€25	€15 (EIR 3rd) + €10 reserve price
EIR	2x10 MHz	€60	€50 (VOD 3rd) + €10 reserve price

Observe that the prices paid by VOD and EIR are now €10 less than in Example 1, whereas THR has to pay the same price. This change occurs because THR is not able to express a value for the 3rd lot, thus reducing the opportunity cost price for its two rivals. The asymmetry of prices is therefore increased.

This result holds generally for the caps proposed by ComReg (two lots for Three, and three lots for Vodafone/Eir). Assuming no entrant bidder and no unallocated lots, there are six possible outcomes/scenarios for the 700 MHz band (in terms of the number of 2x5 MHz lots):

[13] A detailed example is provided in Annex 1, example 2.

Bidder	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
THR	2	1	1	2	2	0
VOD	2	3	2	3	1	3
EIR	2	2	3	1	3	3

For each of these six scenarios, the total post-auction allocation of sub-1 GHz spectrum at 700, 800 and 900 MHz is as follows:

Bidder	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
THR	7	6	6	7	7	5
VOD	6	7	6	7	5	7
EIR	6	6	7	5	7	7

In the first three scenarios, one MNO has 7 lots while two other MNOs have 6 lots. In the final three scenarios, one MNO has 5 lots while two other MNOs have 7 lots.

The table below illustrates the built-in asymmetry in pricing when asymmetric spectrum caps are imposed. In all six scenarios, Vodafone and Eir are effectively granted one lot at reserve price. This follows directly from the fact that Three is unable to express a value for a 3rd lot.

	Price setting bids					
Bidder	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
THR	VOD 7 EIR 7	EIR 7	VOD 7	EIR 6 EIR 7	VOD 6 VOD 7	N/A
VOD	EIR 7 **reserve**	THR 7 EIR 7 **reserve**	THR 7 **reserve**	EIR 6 EIR 7 **reserve**	**reserve**	THR 6 THR 7 **reserve**
EIR	VOD 7 **reserve**	THR 7 **reserve**	THR 7 VOD 7 **reserve**	**reserve**	VOD 6 VOD 7 **reserve**	THR 6 THR 7 **reserve**

It should be clear from these examples that using a CCA design to award 700 MHz if bidders have these demand structures would be discriminatory. This is true with symmetric caps and even more so if, as proposed, an asymmetric cap is used. In this case, the format obviously disadvantages the bidder with the lowest value for a 3rd lot, which is likely Eir (given its lower market share), and advantages the bidder with the expected highest value, which is likely Vodafone (given its higher market share and slightly lower pre-existing sub-1 GHz holdings versus Three). Overlaying an asymmetric cap weakens Three versus the other two bidders, but it does nothing to address the asymmetry between Eir and Vodafone. Indeed, the predictable reduction in price for Vodafone flowing from the restriction on Three might even encourage Vodafone to pursue a more aggressive bid strategy, to the detriment of Eir.

Such discrimination may also have an efficiency impact. Firstly, policies that increase the cost of an essential input for some MNOs and not others may differentially affect their ability to invest in the downstream market. Secondly, when you confront bidders with an auction design that obviously advantages some players over others, it is only reasonable to expect that the disadvantaged bidders will look for opportunities to manipulate their bids to try to neutralise the advantage of their rivals. In particular, bidders may be incentivised to overstate their willingness to pay for incremental spectrum so as to place reciprocal price pressure on rivals.

Impact of extending example to a multiband setting

The same concerns identified at 700 MHz also apply in a multi-band setting, but the advantages and disadvantages of particular bidders may vary across bands. In Example 3, NERA consider the setup proposed by ComReg with multiple bands and two caps based on existing holdings. For simplicity, they ignore time slices. The example illustrates the scope for large price differences to emerge between bidders as result of the asymmetric cap.

Example 3: Multi band context

We assume a 70 MHz cap for sub 1-GHz spectrum, and a 375 MHz cap for all useable spectrum (i.e. at the lower end of the range considered by ComReg. Suppose that the auction produces an outcome in which spectrum is divided roughly equally between the three MNOs, as follows:

	THR	VOD	EIR	
700 MHz FDD	20	20	20	Awarded in auction
800 MHz FDD	*20*	*20*	*20*	*Existing holdings*
900 MHz FDD	*30*	*20*	*20*	*Existing holdings*
Sub 1 GHz	**70**	**60**	**60**	
1800 MHz FDD	*70*	*50*	*30*	*Existing holdings*
2100 MHz FDD	40	40	40	Awarded in auction
2300 MHz TDD	40	30	30	Awarded in auction
2600 MHz FDD	40	50	50	Awarded in auction
2600 MHz TDD	15	15	10	Awarded in auction
3500 MHz TDD	*100*	*105*	*85*	*Existing holdings*
Sup 1 GHz	**305**	**290**	**245**	
Overall MHz	**375**	**350**	**305**	
MHz won in auction	155	155	150	

In this example, THR does not have much pricing power as it wins a package that reaches both spectrum caps. In contrast, although VOD and EIR win similar amounts of spectrum in the auction, these amounts are less than their spectrum caps, and as a result these bidders do have pricing power.

Suppose that all bidders follow a strategy of repeating a price setting bid for a large package until clock prices have doubled, and then drop straight to the outcome above. Such price setting bids may be as follows:

	THR	VOD	EIR
700 MHz FDD	20	30	30
800 MHz FDD	*20*	*20*	*20*
900 MHz FDD	*30*	*20*	*20*
Sub 1 GHz	**70**	**70**	**70**
1800 MHz FDD	*70*	*50*	*30*
2100 MHz FDD	60	60	60
2300 MHz TDD	30	30	50
2600 MHz FDD	45	60	80
2600 MHz TDD	0	0	0
3500 MHz TDD	*100*	*105*	*85*
Sup 1 GHz	**305**	**305**	**305**
Overall MHz	**375**	**375**	**375**
MHz bid in auction	155	180	220
Bid value	**78,923,068**	**96,385,788**	**102,735,876**

All these price setting bids are deliberately constructed such that (i) all spectrum caps are fully used, (ii) price-setting bids are biased towards more expensive packages, and (iii) all combinations of two bids are feasible winning combinations.

With these price setting bids, auction prices break down as follows:

	THR	VOD	EIR
THR price setting bid	-	78,923,068	78,923,068
VOD price setting bid	96,385,788	-	96,385,788
EIR price setting bid	102,735,876	102,735,876	-
Value of unsold lots	4,762,572	13,493,932	16,668,976
Max alternative value	**203,884,236**	**195,152,876**	**191,977,832**
THR winning bid	-	69,813,526	69,813,526
VOD winning bid	69,813,522	-	69,813,522
EIR winning bid	69,019,760	69,019,760	-

Max winning value	**138,833,282**	**138,833,286**	**139,627,048**
Auction price	**65,050,954**	**56,319,590**	**52,350,784**

In this case, THR pays roughly €10m more than VOD and roughly €13m more than EIR (although EIR wins a slightly smaller package). The price difference is an artefact of the asymmetric cap which allowed EIR and VOD to impose prices on THR that could not be reciprocated.

This example assumes some degree of strategic bidding. NERA think this is a reasonable assumption, given the obvious scope for bidders to improve relative outcomes by manipulating bid values for larger packages. This is possible because there is only a small pool of bidders with relatively predictable valuation structures. Moreover, there is a material risk that bidders are much more aggressive in their strategic bidding. For example, consider the possibility that Eir deliberately overbids for packages containing larger, unwinnable quantities of spectrum in higher frequency bands as a way to try and reciprocate potential price pressure from Vodafone in the sub-1 GHz band.

Lessons from theory and practice

NERA pointed out that there is now a substantial academic literature showing that combinatorial auctions, such as the CCA, have a mixed track record with regard to outcome efficiency versus more traditional auction formats.[14] In particular, contrary to initial expectations, the CCA format has not been very effective in discouraging strategic bids that deviate from valuations, even if it has changed the type of strategic bidding.[15]

NERA note that the Dutch Ministry of Economic Affairs has just released a DotEcon report on their upcoming multiband auction for spectrum in the 700, 1400 and 2100 MHz bands, which recommends a hybrid SMRA-clock auction with a uniform pricing rule.[16] Consistent with NERA's arguments and the examples developed above, DotEcon argues that the CCA format is problematic if implemented with asymmetric spectrum caps:

> *"If a combinatorial format had to be used, there would be a choice between formats that use a pay-as-bid rule (such as the CMRA and the SCA) and those that employ a second pricing approach (such as the CCA, which sets prices on the basis of opportunity costs calculated from the bids made by bidders, and the ECCA, which sets prices with reference to the largest*

[14] See, for example, papers by Kagel, Lien and Milgrom (2010), Bichler, Shabalin and Wolf (2013), and Bichler, Goeree, Mayer and Shabalin (2014), which report the results of lab experiments comparing the efficiency of CCA-type auctions versus standard formats, such as the SMRA. In each case, the CCA performed poorly, especially in more complex settings.

[15] For a discussion of this issue, see: Marsden and Sorensen, "Strategic Bidding in Combinatorial Clock Auctions – a Bidder Perspective", Handbook of Spectrum Auctions, Cambridge University Press, 2017.

[16] "Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum", DotEcon, July 2019. Prepared for the Dutch Ministry of Economic Affairs.

bids that competitors could make under the activity rules). Given the simplicity of pay-as-bid pricing and the potential concerns about the impact of the asymmetry in the amount of spectrum that different bidders can acquire under the caps on bidding behaviour, we would prefer a pay-as-bid format over a format that relies on opportunity-cost based pricing.

Where bidders are strongly motivated by relative performance, they may also be concerned about placing bids that ensure that others pay sufficiently high prices for their winnings. In this respect, using a second price rule is potentially more of a concern where spectrum caps have an asymmetric impact on bidders' ability to bid for additional spectrum in the auction. This is the case under the spectrum caps proposed for the auction. Under such asymmetric constraints the ability of bidders to set each other's prices is uneven and attempts to exploit this asymmetry through strategic bidding may result in inefficient outcomes."

The situation in the Netherlands is not unlike the situation in Ireland. In both cases, the market has in recent years been reduced from four MNOs to three MNOs after a merger, and this has in turn led regulators to propose asymmetric caps (capping the merged entity harder due to relatively large spectrum holdings in some bands).

The use of a CCA to assign multiple bands simultaneously, as proposed in Ireland, greatly increases the scope for strategic use of package bids to set prices for rivals in situations where there is a limited pool of bidders and demand structures are fairly predictable. For example, a bidder that is in a weak position at 700 MHz may overbid in another band as a way of placing reciprocal pressure on a stronger rival to back down.

According to NERA, regulators that run CCAs have tended to underplay the scope for strategic overbidding in the CCA, on the basis that this is risky. In practice, such behaviour is often not particularly risky because MNOs have fairly predictable demand and valuation hierarchies. The very same factors that ComReg highlights as potential triggers for demand reduction may also drive incentives for overbidding in a CCA. Moreover, ComReg should be much more worried about overbidding because if bidders overplay their hands, as this could lead to both high prices and inefficiencies in the auction outcome.

This is not an abstract concern. There have been repeated examples of CCAs producing peculiar results in which bidders pay unusually high prices or major MNOs are knocked out of key bands, including:

the 2012 UK 4G auction (800 and 2600 MHz), where Telefonica O2 won no spectrum at 2.6 GHz, whereas spectrum leader EE won 2x35 MHz, but prices were low compared to the high level of some bids submitted;

the 2013 Austrian 4G auction (800, 1800), where our sister company Three Austria won only 2x5 MHz across the 800 and 900 MHz bands in a 3-player auction, and all bidders paid exceptionally high prices; and

the 2019 Canadian 5G auction (600 MHz), where one national operator (Bell) failed to win any spectrum and the other two (Rogers and TELUS) paid very high prices.

In NERA's view, the CCA works best in markets where a losing bidder is setting (symmetric) prices for winning bidders. Unfortunately, this is not the standard scenario for most spectrum auctions in Europe, where there is typically a small pool of established MNOs competing for incremental spectrum. For the forthcoming Irish auction, ComReg cannot rely on an entrant to resolve this problem. Instead ComReg should implement an auction format that is robust to all competition scenarios, including a thin market with only three MNOs participating. As in the Netherlands, the hybrid clock-SMRA better is a better fit for this requirement than the CCA.

Conclusions

NERA recommends against the use of a CCA for the forthcoming multi-band auction in Ireland. The format cannot be relied on to produce an efficient allocation of spectrum nor prices that fairly reflect the market value. This is because there are strong incentives for bidders to distort their bids either as defensive or offensive strategies that manipulate prices paid by rivals, incentives that flow directly from the predictable asymmetries across a limited pool of bidders. NERA recommends that ComReg consider using DotEcon's hybrid clock-SMRA design, as used for the UK 5G award (2018) and proposed for the forthcoming Netherlands 5G award. NERA notes that ComReg's proposal to set high reserve prices ensures substantial revenues even if there is low competition and diminishes any incentives for demand reduction associated with this pay-your-bid format.

If ComReg decided, despite these drawbacks, to proceed with a CCA, then NERA recommends that ComReg consider the following changes:

Setting a low symmetric cap (2x10 MHz) at 700 MHz that removes scope for asymmetric price setting by MNOs in this band, relying instead on entrant bidders and/or the reserve price bids to set opportunity cost in this key band

Setting a symmetric cap across the high frequency bands (e.g. 150 MHz or higher across 2.1GHz, 2.3 GHz and 2.5 GHz), so pricing power is more balanced across operators.

Simplifying the lot structure by abandoning time slicing, so as to reduce the number of package bid options (at 2.1GHz, there could be two categories of long-term licences with different starting dates but common expiry dates, as proposed by Three above).

1.9 Virgin Media

Virgin Media response to:

Consultation: Proposed Multi Band Spectrum Award – including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz bands

ComReg 19/59R

7th August 2019

Summary

Virgin Media Ireland Limited ('**Virgin Media**') welcomes the opportunity to respond to ComReg's Consultation ('**the Consultation**') on its Response to Consultation on the Proposed Multi Band Spectrum Award ('**ComReg 19/59R'**).

Virgin Media sees the multiband spectrum award consultation as very significant because of its potential positive impact on the competitive environment in the telecommunications industry, among mobile operators in particular, and the knock on benefits for end-users in Ireland.

While fully recognising the importance of this consultation process and ComReg's associated objectives, Virgin Media believes that consideration should be given to the introduction of measures to ensure there is no potential impact on existing operators. Virgin Media's response focuses on the 700MHz band and the potential for interference with the existing networks of operators. In this response we provide some more information and also submit a proposal for ComReg's consideration.

Introduction

Electronic communications service (ECS) providers are operating in an intensely competitive environment. The multiband spectrum award should allow both operators (mobile in particular) and end-users to reap a range of benefits by allowing for the provision of a broader range of services and technologies. This is a big step forward and could lead to some interesting industry innovations and end user offers.

While Virgin Media fully recognises the potential beneficial impacts of this award, for example in terms of the facilitation of the provision of 5G services and also rural connectivity, we believe that it is important to ensure that existing networks are not unintentionally adversely affected by interference from the 700MHz band. Such interference could negatively impact on the television and broadband services for the existing customers of these networks and result in a negative end user experience. The 700MHz band in particular could interfere with existing networks.

In its Consultation, ComReg acknowledges the importance of avoiding interference with existing networks and on any potential future development and indeed has a number of requirements already in place to help limit the potential for unintentional interference. However, Virgin Media believes that ComReg should consider putting in place a provision that would require mobile operators to provide advance notice of the activation of the 700MHz band to potentially affected operators allowing them to consider the implications for their network and, where relevant, take action to limit interference on their end-users service.

Virgin Media has provided some more detail in the next section.

700MHz Band Coexistence with Virgin Media's HFC Infrastructure

All proposed FDD UL & FDD DL frequencies in the 700MHz band are currently used by Virgin Media to relay broadband services over our HFC infrastructure (see Figure 1 below).

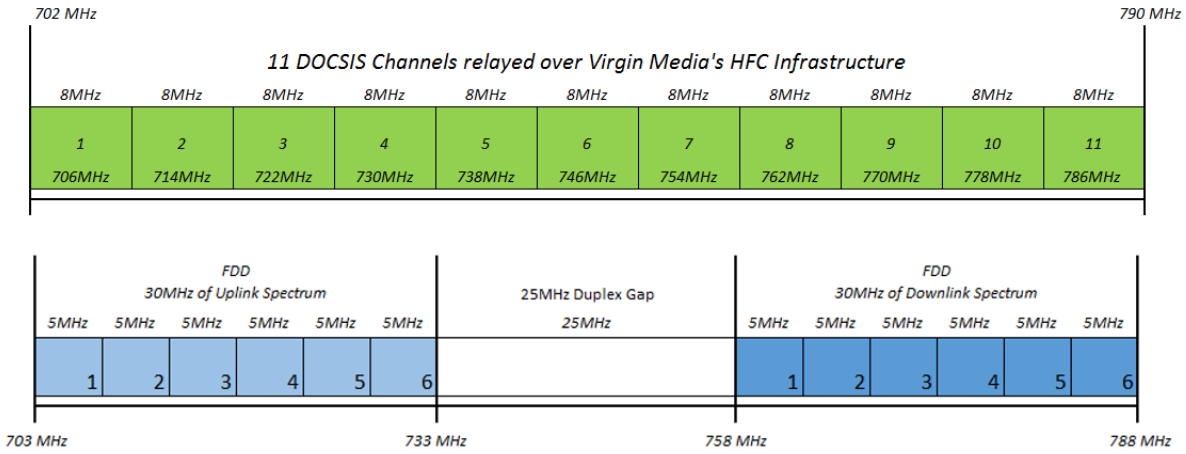


Figure 1: The 700MHz Duplex Band Plan & Virgin Media's current use of this spectrum

Ingress into Virgin Media's network from high powered downlink transmissions from MNO's base stations in the spectral area 758 -788MHz and/or lower powered uplink transmissions from MNOs' customers' handsets and fixed networks, in close proximity to HFC infrastructure, in the spectral area 703-733MHz, have the potential to reduce SNR and adversely impact on the quality of service Virgin Media provides. To facilitate the completion of proactive works to minimise ingress and interference in advance of the launch of services in the 700MHz band, Virgin Media suggests that ComReg considers the introduction of a requirement on MNOs to provide advance information to other potentially affected network operators including Virgin Media. We suggest that the information in the table below, or similar, is provided by all Mobile Network Operators that have been awarded a block or multiple blocks of FDD UL & DL spectrum to Virgin Media in situations where we operate in proximity to the relevant base stations:

Table 1 *Information required from MNOs in advance of 700MHz Band Service Launch from Base Stations*			
Item	*Description of Requirement*	*Format*	*Need by Date*
1	*MNO Operator Name*	*As used in ComReg's siteviewer interactive map*	*A minimum of 4 months in advance of service launch/transmission in allocated DL spectrum (earlier notice if possible)*
2	*Site ID for each base station from which service in the 700MHz band will be delivered over FDD DL & UL spectrum*	"	"
3	*Site Coordinates: Easting/Northing & Latitude/Longitude*	"	"
4	*Date on which the MNO expects to start delivering service from the base station in the 700MHz band*	*XX/XX/20XX*	"
5	*DL Azimuth Radiation Pattern for each sector antenna in use from the base station and for all antennae combined*	*Format to be agreed with MNOs*	"
6	*Gain of the antennae, for each antenna in the 700MHz DL spectral area*	*XX.XdB*	"
7	*DL power per channel that will be across the antenna's terminals, for each antenna*	*XX.XdBm*	"
8	*DL and UL spectrum that will be used from site by the MNO*	*DL XXX MHz - XXXMHz* *UL XXXMHz - XXXMHz* *Multiple entries if 2 or more non adjacent 5MHz UL and/or DL blocks are allocated to a single MNO*	"
9	*Advance notice of any planned changes in DL transmit power in the 700MHz DL band from the base station*	*For each 5 MHz DL block from each sector antenna please indicate the power increase/decrease:* *From XX.X dBm to YY.YdBm*	*3 month's notice when increasing Tx power.* *1 month's notice when decreasing Tx power.*

In terms of practicalities, Virgin Media would need to provide an MNO specific Virgin Media e-mail address to each MNO that operates services in the 700MHz band, to facilitate effective information exchange, query responses etc.

The information requested in Table 1 would be required only for base stations located within or in close proximity to the Virgin Media's infrastructure footprint. Details for base stations that are located more than 10kms away from the periphery of Virgin Media's infrastructure would not be required because there is less risk of any adverse impact. In order to facilitate this process, Virgin Media would provide mapping to identify our network footprint + 10km zone to all MSOs awarded spectrum in the 700MHz band.

1.10 Vodafone Ireland

Confidential

Proposed Multi Band Spectrum Award

700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands

ComReg Document 19/59 - Response to Consultation

Executive Summary

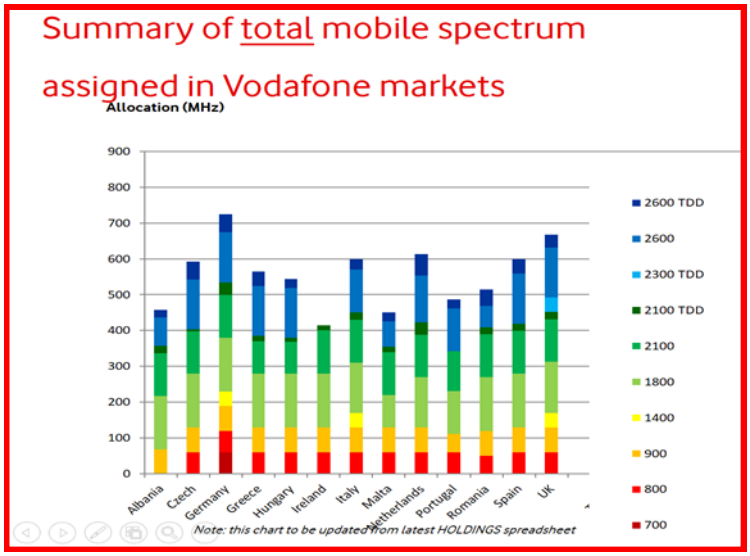
I. Vodafone welcome the opportunity to respond to ComReg consultation 19/65 – 'Proposed Multi Band Spectrum Award Including the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz Bands'

II. We would like to acknowledge the comprehensive work that ComReg have completed in preparation for this consultation, particularly the set of Connectivity Studies published in Dec 2018. This has ensured a comprehensive analysis of the current state of coverage in Ireland and a more considered quantification of the additional investment needed to increase coverage to higher levels.

III. In our previous submissions, we discussed the vital role that spectrum plays in the communications value chain and submitted that the efficient allocation and assignment of spectrum, and efficient processes for the awards of mobile spectrum, are a key support to the Irish economy and should be a key policy priority for ComReg.

IV. We also illustrated that there is less spectrum allocated to mobile operators in Ireland than other European countries.

Fig 1 2018 Spectrum Assignments in EU markets where Vodafone operate



Vodafone Confidential Response –

V. This proposed spectrum auction provides the opportunity for operators to increase spectrum allocation to match that in these other countries and so allow Irish consumers and business to gain access to high quality services, full use of available handsets and the advantage of pan European services. We welcome the recognition that ComReg have afforded to the importance of benchmarking Irish spectrum allocations against European norms. This supports the capability of Ireland to avail of leading edge pan-European mobile services.

VI. In our response we suggest some changes to the Proposed Award and provide commentary on specific areas of the ComReg paper, however the primary consideration for all stakeholders must be to ensure Ireland is at the forefront of Europe and to achieve that this award process must progress promptly and with certainty on timelines. We note that it now almost 5 years since ComReg published "Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands" Reference Number: 14/101 Posted: 30th September 2014, and we still do not have a date fixed for the award of this band. In order to attract Ireland's share of the investment across Europe in rollout of 5G we must now be clear on timing and progress with pace.

VII. Since the publication of 14/101 , the market has significantly changed in Ireland. Customers demand for increased volumes of data is soaring. Almost all users now have phones that can use the 2.6GHz spectrum. Meanwhile prices for data have fallen and operators are challenged to identify commercially efficient ways of satisfying the ever increasing demand for increased capacity. All of these factors drive the absolute requirement to make more spectrum available for mobile customers in the short term.

VIII. Any objective measure of the intensity of use of spectrum by mobile customers compared to other radio users would show the very high efficiency of the mobile industry in using spectrum resources.

IX. We broadly agree with the set of frequency bands that ComReg have chosen to include in this auction process however it is also necessary that, in parallel with this award, ComReg issue a clear plan for a future auction of the other bands discussed in ComReg Doc 18/60, namely additional 700MHz Spectrum, the complete 1.4GHz band and spectrum in the 26GHz band.

X. We note the following from the Vodafone submission to ComReg's Draft Spectrum Management strategy 2016 to 2018. Vodafone:

a) Believes that Ireland must ensure we have spectrum assignments in line with other European countries.

b) Believes that a digital single market for European customers will bring benefits for Irish customers - this requires moving towards a consistent policy environment for spectrum across EC countries.

c) insists that greater alignment on timing of licences across the EU is necessary to facilitate the Digital Single Market and achieve economies of scale

d) agrees auction objectives should include efficient use of spectrum and increasing access to mobile broadband services, but believes that positive discrimination towards possible new entrants should be avoided

XI. We are pleased that ComReg acknowledge in their Proposal document the benefit of alignment with European norms for volume of spectrum assigned and timing of awards and suggest that this should be a key part of the decision-making as the Award format is finalized.

XII. In addition, we strongly support ComReg's approach in aligning with European standard band plans. This is key to having effective networks in Ireland as the scale of our customer base cannot drive technology development of base-station or terminal equipment. We therefore must make maximum use of international standards to benefit from the rapid developments that are being made in new technologies.

XIII. Many of the principles issues surrounding this auction have been consulted on a number of times and suitable formats are now well established. This should facilitate the production of a reasonably accurate timetable of forthcoming awards. As stated above, certainty will ensure Ireland is in a position to attract investment for future spectrum allocation and network rollout.

Vodafone Confidential Response –

XIV. Our response is structured as follows.

- We put forward a Proposal to change the design of Time Slices in the Auction, we believe that the proposed design can be significantly simplified, bringing benefits for all parties.

- We then provide Vodafone comments on each section of the Proposal document. This includes commentary on why we believe the coverage targets chosen exceed realistic Precautionary Coverage levels in both the 700MHz and Other bands.

XV. We look forward to early progress in the ComReg decisions required and the setting of dates for the Award process.

Time Slice Complexity

1. In our experience, the CCA auction type that ComReg propose is complex. It is key to the effective running of a CCA auction that operators bid to the value of lots offered. To do this operators need to be able to value correctly the different lots and the combinations of different lots that are on offer.

2. The current proposed design is very complex. This will make it very difficult for operators to value with any accuracy the combinations of spectrum on offer. In this regard we put forward proposals on an alternative approach to the Auction design, one that is designed to reduce complexity in the preferred CCA auction format.

Change A - Move from Two Time Slices to a Single Time Period

3. The main factor driving uncertainty in value is the two Time Slice design with the possibility of winning different quantity of spectrum in each times slice. We submit that the two Time Slices proposed in this auction cause more difficulty that the time-slices used in the 2012 auction. The two times slices in the 2012 auction were approximately 2 and 15 years. Operators could treat Time Slice 1 as a transition period and make short-term arrangements to serve customers without making significant network investment. Equipment Investment was focused on efficiently using the much longer Time Slice 2. In addition, it was feasible in 2012 to forecast 2014 demand and so bid correctly for Time Slice 2.

4. In contrast, the proposal in ComReg 19/59 creates two Time Slices that are approximately 7 and 8 year long. Each operator will need to have adequate spectrum and installed equipment to serve customer in both Time Slices as no temporary solutions could cover a period of 7 or 8 years. However, neither of the time periods of 7 or 8 years give an operator sufficient opportunity to recover the cost of equipment investment. In addition, it is considerably more difficult for companies to anticipate any change in demand in 2027 and bid appropriately in 2020 for spectrum required at that later date. An alternative solution to this two Time Slice design is thus highly desirable.

5. Vodafone suggest that ComReg propose a single start date for all of the high band spectrum being awarded in this auction. A suitable date would be 1 Jun 2021. ComReg could then offer all of the current 3G licence holders the opportunity to surrender their 3G licences at this date. Use of all of the capacity bands 2.1, 2.3 and 2.6 GHz could be auctioned in a single time period, from this 1 Jun 2021 date to the end of licence.

6. While Operators would lose the remaining value of the upfront payments made in their original 3G licence they would gain by not having to make the high ongoing payment associated with those licenses.

7. ComReg would also ensure that the bands would be auctioned in a more efficient way as bidders can more accurately establish values on the spectrum.

8. Consumers and Business customers would gain as operators could make investment that is more efficient in network having the same spectrum assignment for the longer license period.

9. We note in addition that this proposal would address some of the issues raised by eir in their submission, as they would not have to bid for and pay for spectrum in 2020 that would not be used until 2027.

Change B. Remove Uncertain Transition in the 2.3 GHz band.

10. The current proposed auction design has a number of complications generated by issues in the 2.3GHz band. These complications are principally related to the current use by eir of parts of this band for the legacy RurTel Service. A very valuable portion of spectrum is being made unavailable in a large geographic area of the country for an unspecified time. In Kerry, for example, this spectrum is being used to serve 2 customers. This is an extreme example of inefficient use of spectrum.

11. We note that eir have now a new assignment of 3.6GHz spectrum available. In fact, they have had 3.6GHz spectrum for some time and as part of 3.6GHz Transition requested Vodafone to continue use of their old 3.6GHz assignment in the Blackvalley area of Kerry to support fixed

customers. This indicates that eir can use this 3.6GHz spectrum to provide a service for any remaining RurTel customers.

12. As eir would gain most from the early surrender of the 3G licences proposed in Change A above, we further suggest that ComReg could tie the early surrender of their 3G licence to an eir agreement on fixed dates for the surrender of 2.3 GHz spectrum.

13. The adoption of these two solutions proposed in Change A and Change B above would have a major impact in simplifying the auction. The gains would be

- Changing the two time-slices proposed into a single time period
- Remove the proposed different block sizes in the 2.3GHz band, making all lot sides equal.
- Removing the very uncertain transition in the 2.3GHz band
- Removing the need to value the combination of frequency specific and assigned blocks.
- The auction could run on straightforward primary and assignment rounds.
- Operators will be able to invest once in sites – producing a more efficient and better outcome for customers.
- It partially addresses some of the concerns around the licence duration.
- It aligns licence finish dates and removes future complexity.

Comment on Individual Sections of ComReg 19/59

Reference: Chapter 2 Studies (Section 2.2 of ComReg Doc 19/59)

14. Vodafone welcome the Connectivity Studies published by ComReg in December 2018. We have supported the work of the Governments Taskforce on Mobile and Broadband Coverage and believe that these studies make a strong contribution to the understanding of the quantity of work required to increase coverage from current levels.

15. We would caution however that the studies overstate the development of coverage that will occur without intervention. There are several reasons for this:

- A significant portion of operator budget has been taken with the roll-out of replacement sites. For example in Dublin up to 30 sites a year are lost as buildings are re-developed, forcing operators to build alternative sites just to maintain coverage.
- Due to the use of multiple frequency bands requiring many antennae, and the extensive implementation of tower sharing among operators, much of the tower infrastructure available now required structural upgrade. This increases the cost of adding frequency bands on sites to much higher figure than assumed in Oxera calculations. One specific example of Oxera underestimating cost is that they assume a labour cost of €500 for upgrades. Our experience is that the labour cost is more typically € 5,000 per site, including the planning work.
- The count of new sites being built per year has reduced since the data set used by ComReg.
- In a small number of areas sites have not been built because all operators have failed to receive the required planning permission.

16. We note this important quote from ComReg's own analysis of the likely roll-out 18/103

In the light of these cost estimates, Oxera estimates that there will likely be a commercial incentive to extend 30 Mbit/s MBB coverage to a level in the lower 90 percentile range of population in the period up to 2025. Oxera observes that policy or regulatory interventions could accelerate and/or extend coverage beyond these levels, to a certain extent, but this would require stakeholders to assess carefully the costs and benefits involved.

17. From Vodafone's own analysis of coverage benefit we agree that there is no commercial incentive to roll-out coverage beyond a figure in the lower 90% range of population. Given the additional constraints imposed by Planning Permission refusal etc. a figure of 90% would be the likely final figure reached without intervention.

BB-PPDR Spectrum Management considerations (Section 2.3 of ComReg Doc 19/59)

18. We note the comprehensive analysis carried out by ComReg of BB_PPDR proposals spectrum management considerations, and agree strongly that solutions should be sought for these requirements outside the 700MHz FDD bands.

Licence Timeframes – EECC (Section 2.4 of ComReg Doc 19/59)

19. We note that the new European Electronic Communications Code specifies a Licence Duration of at least 15 +5 years. The "+5" being an automatic extension for licences in-use.

20. ComReg's currently propose only a 15 year licence for spectrum won from the beginning of Time-slice 1, and approximately 8 years for any different spectrum won in the time-slice 2. In addition, Transition Arrangements may also reduce the effective Licence Duration.

21. These timescales are too short to allow operators to invest efficiently in network equipment to support customers.

22. It is essential that ComReg align with the requirements of the Code and to extend the proposed licence duration at least comply with the 15+5 specified.

Comments on Consideration of Submissions to Doc 18/60. 19/59

Chapter 3

Administrative assignment of 2.1GHz (Section 3.2 of ComReg Doc 19/59)

23. We note the inputs from Three, reported in section 3.2, concerning a proposal for Administrative Assignment of 2.1Ghz.

24. This suggestion has merit, and we anticipate there may be a future time where Administrative Assignment will have advantage over auction as a way of renewing spectrum licences. These processes would likely involve detailed discussion of coverage improvements and other social gain in return for the renewal.

25. Given the current timing, where there is a relatively short period left to end of licence, and given that there are a number of other bands being auctioned, we agree with ComReg that an auction is the best way to award the 2.1 GHz spectrum at this time.

26. Administrative Assignment could be considered in future process, where there is a mature market with active Spectrum Leasing.

Early Liberalisation (Section 3.3 of ComReg 19/59)

27. We note the eir comments on spectrum imbalance in the 2.1GHz band and the obstacle that this places to Spectrum Liberalisation and we agree that Spectrum imbalance in the 2.1GHz band is still a significant issue.

28. While ComReg suggest that that Three's excess spectrum holding has not yet had significant effect on market shares, we believe that this is a timing issue. Three have had to undertake significant work to merge the Three and O2 network thus delaying their ability to take full advantage of their spectrum holding. In completing this work their additional spectrum delivers accost advantage in the medium to longer term as it very significantly reduces or removes the need to build extra sites to cope with network capacity requirements. While

revenue or market share may not reflect this advantage at this point the reality of the impact on costs of the spectrum imbalance is clear.

29. [redacted]

30. Vodafone are now caught between the need to deliver larger capacity to customers and the risk of allowing Three to exploit further their double holding of spectrum at 2.1GHz.

31. On balance, we want to proceed with early liberalisation once we have fixed dates for the auction.

ComReg assessment of Respondents Views (Section 3.4 of ComReg Doc 19/59)

32. We anticipate that the 26GHz will be required in the medium term. As we suggested previously this band could be auctioned at a later date along with the remaining bands discussed in our Introduction.

Issues concerning proposal to include 2.1GHz band Chapter 5

Proposed 2.1 GHz licence period alignment (Section 5.4)

33. In our Change A above we propose the alignment of licence period for all operators. If this is not done at least the alignment of start dates for both Three licenses and Vodafone's license should be carried out.

Whether "Time Slices" should be applied to any of the other Award Bands. (Section 5.5)

34. See our Change A proposal above where we propose that ComReg amend the design of the auction to reduce to a single Time Slice.

35. In considering whether, to apply Time Slices to other award bands Vodafone believe that ComReg overstate the interchangeability of equipment.

36. From discussions we have had from our BTS equipment suppliers we understand that Radio Equipment now available has very limited flexibility to work in multiple bands. Whereas 1800 and 2.1GHz can operate from the same BTS, no other band switching is available. In addition, this dual-band BTS equipment is only available at a 100% premium. In practice therefore operators will likely purchase a band specific BTS radio equipment.

37. This will limit options in moving from band to band between Time Slices as both the proposed Time Slices are too short to economically use equipment in spectrum unavailable in the other Time Slice. We recommend therefore that Time Slices are not applied to Other Bands in this award process.

Early liberalisation (Section 5.6)

38. We note DotEcon proposal that "On the basis of the above, we therefore recommend that the MNOs would be allowed to liberalise their existing 2.1 GHz licences at any time from the point at which ComReg publishes its final decisions in relation to this proposed award until the expiry date of the corresponding licence"

39. Our view is that, in order to prevent significant competitive distortion in the market, ComReg should only introduce Early Liberalisation when the date for the next Auction process has been fixed. This would appear to be consistent with the recommendation of DotEcon.

Key Aspects of the Proposed Award Spectrum Chapter 6

Limited number of individual rights on a national basis (Section 6.1)

40. We agree that these licences should be awarded on a national basis. This will promote consistent services for customers nationwide and prevent "cherry picking" of the most profitable areas.

Band plans and compatibility considerations (Section 6.2)

41. ComReg have published their band plans in the 700MHz, 2.1 GHz, 2.3 GHz, and 2.6 GHz bands. In each of these bands, we agree with the proposed band plan structure.

42. We can work with the proposed compatibility considerations in the 700MHz, 2.1 GHz, and 2.6 GHz bands but have the following observations on the proposed compatibility considerations in the 2.3GHz band.

43. Very significant restrictions are proposed on rollout in those sections of the 2.3GHz band that overlap with the eir RurTel service.

44. We submit that these restrictions do not fairly balance the benefit of the served customers with the general population.

45. We note for example that the RurTel service supports just 2 customers in Kerry. The Plum co-ordination proposal is that all of Kerry and a part of Cork are then an effective exclusion zone for use of this spectrum. Thus a service for 2 people denies use of this spectrum to the 462,000 people in Kerry and others in other counties.

46. This raises two significant issues.

Issue 1: We believe that the technical co-ordination process proposed by Plum is excessively cautious. The combination of worst-case assumptions and approximations creates much larger exclusion areas than that would be required in practice. We note that Vodafone successfully reuses 2.1GHz spectrum at multiple sites in Kerry.

Issue 2 We submit that it would be entirely within ComReg's powers, and consistent with their objective to ensure that spectrum is used efficiently, they should insist that eir find an alternative solution for these RurTel customers in a specified time period.

47. Given eir now have access to 3.6GHz spectrum another solution is clearly technically possible for these customers. ComReg should set a fixed timetable for eir to move from the 2.3GHz band.

48. Allowing eir to stay indefinitely on this spectrum creates a number of complexity issues with the auction process, including the different lot sizes in the 2.3GHz band and the mixing of fixed frequency lots and spectrum assigned though a separate Assignment round.

49. This complexity creates significant difficulty for operators in valuing this spectrum as the Transition is open ended.

50. Importantly this uncertain Transition creates a competitive distortion in the auction process as eir could buy this spectrum more cheaply and then move out of RurTel to increase its value.

51. As per our proposal in Change B above, ComReg should insist that as part of this award process eir set a fixed timetable to replace RurTel in alternative spectrum.

Licence duration (Section 6.3)

52. We note that the new European Electronic Communications Code specifies a Licence Duration of at least 15 +5 years. The "+5" being an automatic extension for licences in-use.

53. ComReg's currently propose only a 15 year licence for spectrum won from the beginning of Time-slice 1, and approximately 8 years for any different spectrum won in the time-slice 2. In addition, Transition Arrangements may also reduce the effective Licence Duration.

54. These timescales are too short to allow operators to invest efficiently in network equipment to support customers.

55. We urge ComReg to extend the proposed licence duration at least comply with the 15+5 specified by the ECC code.

56. If we have Time Slices or spectrum transition in any band then this 15+5 year period should be from the date spectrum is fully available to the licensee.

Comments on Award Type and Format Section Chapter 7

Views of respondents to Doc 18/60 and Considerations for Proposed Award (Sections 7.2 &7.3)

57. In line with our response to previous documents Vodafone support the view that open, simultaneous, multi-round auctions (whether SMRA or CCA) are the most efficient way to assign new spectrum.

58. Some of the points we made in previous submissions are worth reviewing. Quoting from Vodafone's Response to ComReg document: Draft Radio Spectrum Management Strategy 2016 to 2018. Reference: ComReg 15/131

"Vodafone agree that spectrum play a vital role in the communications value chain and the efficient allocation and assignment of spectrum and efficient processes for the awards of mobile spectrum are a key support to the Irish economy and should be a key policy priority for ComReg. "

Vodafone supports the view that open, simultaneous, multi-round auctions (whether SMRA or CCA) are the most efficient way to assign new spectrum.

The GSMA supports the RSPG view that simultaneous, multi-round auctions (whether SMRA or CCA) are the most efficient way to assign new spectrum.

Comparing the MBSA with other auctions Vodafone participated in there were several factors contributed to this being the most complex auction:
- The use of two time-slots
- The unduly complex assignment stage (owing to the two slots)

If ComReg are minded to do another CCA, we ask that they keep to a more standard Design. "

59. In the context of what is now proposed complexity is principally driven by the Time Slice structure of the lots available but also by the varying lots in the 2.3GHz band. Apart from the advantage that a single Time Slice would bring to encouraging investment and to simplifying Transition, offering the spectrum across a single Time Slice would greatly simplify the auction by reducing the number of combinations of lots that could be bid for. This would enable operators to value effectively both the lots on offer and the value of different outcomes of the Assignment stage.

Lot size of generic spectrum (Section 7.4)

60. Vodafone agree that 5 MHz is the best block size to use. This allows bidders to plan for guard bands, where required, as well as the larger traffic carrying assignments.

Frequency-Generic or Frequency-Specific Lots (Section 7.5)

61. From our experience in the 2012 MBSA and subsequent auctions run by ComReg, we submit that the process of running a Primary Round with Frequency Generic lots and a separate Assignment round has worked well and where possible this should be the design used.

62. In ComReg's current proposals we note that some frequency specific lots are proposed for the 2.3GHz band. If no progress is made on an alternative solution for the RurTel co-ordination then we agree that it is best to award these as Frequency Specific lots.

Competition Caps (Section 7.7)

63. Vodafone agree that Competition Caps are a necessary part of the award process to ensure that extreme asymmetric results are not produced.

64. We support ComReg's proposal to have separate Competition Caps for the sub 1GHz band and an overall cap for spectrum to support mobile services.

Sub 1GHz -

65. Given Ireland's low population density it is likely that any service for mobile units will use frequencies below 1GHz . To support competition these sub-1GHz frequencies should be distributed among operators.
66. We agree with the value 70MHz (2x35) proposed for sub-1GHz spectrum, for the reasons given in Document 19/59.

Overall Cap:

67. For the overall figure, we submit that the value range proposed by ComReg are reasonable and we favour the 480 MHz figure.
68. These positions are consistent with our response to previous consultations; for example, in responding to ComReg 15/131

    "In assessing the optimum caps to apply in an auction ComReg must have regard for the existing holding of operators but also the technical capability of different spectrum bands. In the MBSA, it was correct to apply a cap to sub-1GHz spectrum as this spectrum has very different propagation characteristic to the 1800MHz band. Future auction should take account of total spectrum assigned to operators but should also have regard for the different values of the bands in which it is held."

Fees (Section 7.8)

69. We agree with principal of splitting the fee proposed on a 40/60 basis between upfront and ongoing charges. ComReg should ensure that minimum prices are conservative, see our note on Benchmark Approach below.

Benchmarking Approach for Minimum Prices & ComReg Assessment (Sections 7.9 & 7.10)

70. Vodafone's position on Reserve prices remains the same as in previous submissions. The opening price for spectrum in the auction should not be set at the final prices reached in auctions in other countries. In these other countries, final auction prices may have driven by

factors such as distortions in the auction process. The effect of any of these distortions should not carried forward into succeeding auctions.

71. We quote again from the GSMA position detailed in the document "GSMA Response to the RSPG Report on Efficient Awards and Efficient Use of Spectrum"

" Reserve prices

The GSMA believes the RSPG report does not adequately address the question of reserve prices (other than commenting that higher reserve prices may mitigate strategic demand reduction). The underlying issue is that Europe's national authorities are unable to agree a coherent and defensible position on reserve prices, particularly where some authorities, or their governments, are focused on maximising rents from the mobile industry, while others regard spectrum as an input to the digital economy and focus on the greater benefits that result from its efficient and cost-effective assignment.

Reserve prices serve one purpose only - to establish the opportunity cost of the next best use, and therefore to ensure that, if spectrum is sold, it sells for a higher price than the value to the next alternative user; and if it remains unsold, it will still be of marginal value to that next best user, and can be assigned to them.

There are multiple examples of mobile auctions around the world where spectrum has remained unsold and yet it has not been assigned to, or even sought by, the alternative users – all as a consequence of the reserve price being set too high.

A well-designed and well-run auction will reveal the market value of the spectrum. Using an inflated reserve price to attempt to second-guess the market value reveals a crisis of confidence that an authority will be able to design and execute an efficient auction.

It is also common practice in some markets for authorities to take spectrum auction prices in other territories (in particular Europe) and use them to set their own reserve prices. This can result in a ratcheting up of prices over time, and a further departure from efficient pricing. European regulators should demonstrate consistently the correct use of reserve prices and

auctions, and demonstrate their commitment to genuinely market-based awards and corresponding consumer benefits. "

72. In addition to this general principle, we believe that reserve prices should be reduced for the following specific reasons:

    - Results from outside Europe should be excluded, as their markets are very different.

    - We can observe that prices for some bands such as the 2.1GHz are clearly trending downwards, see ComReg 1959b Figure 3: Observations from 2.1 GHz licences. This downwards trend is discussed elsewhere in the document (section on early surrender of 3G licences) but there is no process for downward trends to be reflected in the benchmark figure chosen.

    - In the 2.3GHz band, the various co-ordination restrictions and the uncertain Transition will significantly reduce the value of this band. This reduction is not reflected in the Benchmark figure.

73. We agree the points Nera make, quoted in Section 7.318. "The significant increase in supply of spectrum and limited ability of operators to monetize 5G services means ComReg should expect spectrum prices per MHz to fall relative to the 2012 4G auction"

74. We ask ComReg to re-examine and reduce the Reserve prices.

Comments on Licence Conditions Chapter 8

Introduction and Service and technology neutrality (Sections 8.1 & 8.2)

75. Vodafone support the granting of Services and Technology Neutral licenses.

Coverage and rollout obligations (Section 8.4)

76. ComReg include a very extensive section on coverage requirements that may attach to the new licence.

700MHz

77. In principle, Vodafone agree that any coverage requirements that ComReg attach to this award process should be on a precautionary principle. We note from Page 11 Proposals for the 700MHz band

> "As outlined in its draft Regulatory Impact Assessment (RIA) of the various options, ComReg's proposed approach is to set coverage obligations which are precautionary"

And also

> "precautionary' coverage obligations refer to obligations which do not exceed the levels of coverage that might be expected anyway from well- functioning competition between network operators; "

78. Having set this as a principle we believe that ComReg have incorrectly predicted a future high level of coverage. This high level is in excess of the roll-out that we expect to happen without intervention.

Quoting from ComReg 18/103

"In the light of these cost estimates, Oxera estimates that there will likely be a commercial incentive to extend 30 Mbit/s MBB coverage to a level in the lower 90 percentile range of population in the period up to 2025. Oxera observes that policy or regulatory interventions

could accelerate and/or extend coverage beyond these levels, to a certain extent, but this would require stakeholders to assess carefully the costs and benefits involved."

79. The target of 30Mbit at cell-edge is a reasonable target to aim for, but operators should be able to work to achieve this using all of the frequency resources that they have available and frequency aggregation where useful.

80. The coverage section discuses incidental coverage but it is not clear whether this incidental coverage is part of licence coverage requirements. In addition, drive tests and other coverage measurements are reviewed but their role in licence conditions and compliance is unclear.

81. Vodafone propose that using radio-planning tools already established by ComReg to measure covered population wold provide the best basis for compliance measurement Sharing the parameters used by ComReg in this tool would ensure an efficient compliance process

82. This population coverage should be calculated with reference to an RSRP of -105dBm. This is the appropriate level to use allowing for the use of Band Aggregation. .

Roll-out for other bands (also refers to Annex 9)

83. We refer also to Annex 9 Draft Rollout RIA - Performance Bands.
84. ComReg have proposed an obligation to roll-out large quantity of sites in the "Other bands", 2.1GHz, 2.3GHz and 2.6GHz. The obligation proposed is a roll-out of 1200, 550, and 550 sites respectively in these bands.

85. Vodafone submit that these proposed obligations are excessive, considerably more than the Precautionary level that ComReg claim to aim for.

86. It is inaccurate to label these bands as 'Performance Bands'. Generally Mobile Operators will use these bands to provide high quality services matching the capacity demands of customers in each sites area. Another use of these additional bands can be to provide high capacity solutions in areas such as railway stations. Because there are fewer customers per site

customers in rural areas can often obtain a better service (measured by data-rates) from sites with less frequency bands installed than customers in areas with higher population.

87. These additional bands are best implemented through customer driven processes that will change the bands required on sites from time to time depending on demand.

88. The quality of service experienced by the Customer is driven by multiple factors among which the number of bands is not the most significant. As all bands will be technology and service neutral the previous justification for having separate coverage requirements in the 2.1GHz 3G band do not apply.

89. In addition these obligations make it very inefficient to procure small quantities of spectrum in a band (e.g. with 10 MHz of 2.3GHz an operator would have the full obligation) whereas this small quantity of spectrum could provide a useful role for operators in limited locations. This increases the risk of having blocks of spectrum in each band unsold in the auction process.

90. Most mobiles now in use in the market can already use the 2.6 GHz FDD band but the date of support for the other bands is uncertain. Setting target for these bands in the short term is not appropriate particularly any figure less than 5 years. We are buying spectrum to cover a 20-year period installing equipment in advance of demand is not efficient as equipment available tends to continually improve

91. As ComReg recognise the interchangeable nature of the three bands 2.1, 2.3 and 2.6 GHz we suggest they set a single rollout target for use of spectrum from any of these performance/capacity bands. ComReg could set a condition that compels operators winning spectrum from these Other Bands to use at least one of these bands on 500 sites in within 5 years. This would be a suitable figure to prevent spectrum hoarding.

92. An alternative would be to align the roll-out requirements with the figure for the 3.6GHz licences. This would require a roll-out of 131 sites nationwide.

Other elements of coverage proposal

93. There are a number of other choices made by ComReg in the Coverage Proposals that we believe are useful to promote the best service to customers :
    - Population is a better driver of coverage than geographic area.
    - Measuring Outdoor coverage gives the most consistent results.
    - Including a requirement for WiFi and volte is appropriate.

94. In general, any milestone dates should run post Transition.

Focus Group Outputs

95. ComReg have included a long list of individual locations as a coverage requirement in Chapter 8. Vodafone has a number of observations on this list but note also that it is not clear how this list aligns with a Precautionary principal.

96. Many of the sites listed are on State property locations. At a number of the site types listed, we have had specific issues in accessing suitable sites on this state land. In fact, we have brought a number of these sites access issues to the attention of the Mobile and Broadband Taskforce. We can give some example of the issues we have had:
    - The IDA proposed a joint operator access in 2011, which was tendered but did not proceed. There is no consistent process for access to IDA property.
    - Hospitals – the HSE has set un-economically high prices for access to Hospital properties, we have brought this to the attention of the Task force but this has not yet changed.
    - IrishRail have proposed uneconomic prices for access to additional Railway station sites

97. In addition to Site Access areas we have experienced numerous Planning Permission issues at these locations. For example " Visitor Attraction centres". Many of these are located in National Parks, designated as areas of Special Amenity. Despite our efforts to propose suitable infrastructure Planning Permission has been consistently turned down in these areas

98. Vodafone will continue to cooperate with the governments Mobile and Broadband Taskforce, to assist with the rollout of additional coverage and to help seek solutions for access to state lands for enable increased coverage. However, solutions to many of these issues are not within the control of Operators and it unsafe at this stage to set a timescale in which the Taskforce will succeed in solving these issues.

99. Without a solution to these site access and planning permission issues, we do not think any operator can guarantee coverage of 100% of these locations. If these sites were made available to us by the State, we would be happy to commit to covering 100% of these locations in 7 years but without a prior commitment on site access, the requirement should be approximately 50%.

Comments on Transition arrangements & preparatory licences. Chapter 9

100. In discussing Transition arrangements, we draw ComReg's attention to our proposed Change A above. Whatever solution is chosen, the following general points on Transition are relevant.

101. We agree that the Transition Process in the 2012 MBSA worked well. However, we submit that the Transition of 3.6GHz spectrum has not worked well and it is important that lessons be learnt from both events. .

- In 2012, the transition plan was agreed with 2 months from the end of the auction. (Vodafone wrote to ComReg confirming agreement to the plan 12 Dec 2102)
- The Plan proposed all that changes were completed in a six-month period, January to June 2013.

102. By contrast the Transition of 3.6GHz spectrum has not worked well. It is now two years past the start date of the licenses and we do not have complete Transition or even a complete Transition Plan.

103. To avoid this ComReg should seek to have equal motivation for all parties to any Plan produced and they should also strictly define the time to produce a Transition Plan as part of the Award process.

104. The time for Execution of the Transition Plan should also be defined. There appears to be no reason why this period should be longer than one year.

Time Slice 1 Transition (Section 9.1)

105. ComReg to commit to produce Transition Plan in defined time. This should be 4-5 months maximum.

Time Slice 2 Transition (Section 9.2)

106. Again ComReg must commit to Produce a plan in defined time

RurTel transition (Section 9.3)

107. An open-ended Transition in respect of RurTel is completely unacceptable.

Annex: 3

108. Draft spectrum management assessment – amount of 700 MHz Duplex spectrum in Proposed Award. We agree with the analysis, and the conclusion reached that PPDR should not be accommodated in the 700MHz Duplex spectrum

2 Three Submissions

2.1 Three Email 9 December 2019

From: Tom Hickey
To: James Eivers
Subject: Response to Consultation Document 19/59
Date: 09 December 2019 12:04:37

Dear James

I refer to Three's response to ComReg consultation document 19/59 on the proposed multiband spectrum award. Three has submitted a non-confidential version of this response, which includes one amendment to correct a mistake in the identity of a licensee referred to in the original confidential submission. The non-confidential version also contains a number of minor grammatical and typographical corrections that do not in any way change the content of the response, but improve its readability. It is Three's preference that the corrected version of the response is published. If necessary, in the interest of transparency, ComReg can also publish the response without these corrections and/or the table below showing all of the changes.

Page, Location	Amendment	Comment
P26, paragraph 3	"Airspan" has been changed to "Imagine"	This was an incorrect reference
Header, all pages	Change "confidential" to "non-confidential"	
P2, paragraph 2, bullet 3, last paragraph	Replace "," with "." Capital replaced by lower case Insert "the"	
P3, paragraph 2	Insert "the"	
P4, bullet 2	Insert "this"	
P5, paragraph 3, paragraph 4	Insert "s" Change "This" to "These"	
P10, paragraph 3	Insert "it"	
P24, paragraph 4	Insert "lot of"	
P26, paragraph 3	Delete "than"	
P28, paragraph 6, paragraph 7	Insert "s" Replace "contiguity" with "continuity"	
P29, paragraph 6	Replace "it" with "in"	
P31, paragraph 5	Insert "have"	
P36, paragraph 3	Delete "yet"	

Best Regards
Tom

Tom Hickey

[redacted]

2.2 Three Response 07 August 2019

Multi-Band Spectrum Award

Response to Document 19/59 from Three

7th August 2019

1. Summary

ComReg has published a proposal to award spectrum by auction in 2020. This will be the largest single award to date of spectrum for wireless communications. It is essential that ComReg gets the process right, as it will directly influence network investment over the next decade and will also be a key factor influencing the pace at which Ireland adopts 5G.

Three does not agree that a Combinatorial Clock Auction (CCA) is the best auction mechanism for this award, and we particularly disagree with the proposal to use a CCA in combination with caps that count existing assignments. This would have a discriminatory effect on Three which is unwarranted and disproportionate, and we believe ComReg should revisit this proposal. We also have concerns regarding the detail of proposals for inclusion of 2,1GHz in the award. A summary of our views is provided below, with more detailed analysis in the following sections.

I. Scope of Bands Included in this Award

Three agrees with ComReg's proposals regarding the inclusion of the following bands:

- in the 700MHz band, 2x30MHz of FDD only;
- in the 2.3GHz band, 100MHz of TDD;
- In the 2.6GHz band, 2x70MHz of FDD, and 50MHz TDD.

Three also agrees that the 1.4GHz band and the 26GHz band should not be included in this award. We see difficulties around ComReg's proposals for inclusion of the 2.1GHz band. We urge ComReg to reconsider its approach to 2.1 GHz so as to provide continuity of existing services while allowing existing licences transition to new liberalised ones.

II. Combinatorial Clock Auction

Three disagrees with the choice of spectrum auction format proposed by ComReg and considers that other mechanisms are more appropriate and should be strongly considered.

In January 2019, Three submitted a document to ComReg which was prepared by NERA. Among other things, that report outlined why many national regulatory authorities (NRAs) and international best practice is moving away from the CCA format, including that the format: (i) may lead to grossly asymmetric price outcomes for bidders, (ii) can encourage spiteful bidding and (iii) is often too complex and lacks transparency. In addition, with the increase in number of bands available for mobile, it is easier for MNOs to manage aggregation risk without the need for package bidding, thereby diminishing the main advantage of the CCA. We asked NERA to further examine ComReg's proposals as outlined in document 19/59, and information on that analysis is presented below with some examples in Appendix 2. These examples highlight serious concerns with the use of CCA for this award in the manner proposed by ComReg.

Three is of the view that if ComReg was to proceed with this proposal, there would be a real concern as regards the proposal's compatibility with the current (and future) legislative and regulatory regimes, and in particular regarding ComReg's obligations to structure awards in a fair, objective and non-discriminatory manner.

III. Spectrum Caps

Three disagrees with the specific proposal for competition caps, and asks that ComReg revise the proposal for both the sub-1GHz cap and the overall cap. The cap structure proposed is structured in such a way that disadvantages Three disproportionately and without basis *vis a vis* other operators, and this is a particular issue when combined with a CCA auction.

Three is of the view that ComReg has not identified any legal or objective basis for the inclusion of the asymmetric caps. Put differently, ComReg has not identified why the particular caps proposed are needed to prevent extreme spectrum asymmetry. Three also objects to proposal to set caps that take account of previously awarded spectrum bands, as this approach may distort the auction outcome, and ComReg could alternatively address any concerns it may have about the post-auction distribution of spectrum using symmetric caps based solely on spectrum in the auction.

In particular, Three objects to the proposal to use a CCA auction, together with award spectrum caps that count spectrum which is not included in the award itself. This leads to asymmetrical effects in the auction and to discriminatory treatment of Three as a result, with no objective or fair basis for such treatment.

The combination of asymmetric caps and use of a CCA auction format (with a second price rule) is problematic for the following reasons:

- it discriminates against one the three existing mobile network operators for spectrum (Three) in favour of the two others (Vodafone and Eir) with no objective or reasoned basis for such treatment;
- it would likely prevent an efficient allocation of resources because it precludes Three from bidding for spectrum for which it might have the highest value;
- it discriminates against one operator (Three) regarding the price it has to pay with no objective or reasoned basis for such treatment, i.e. it creates a situation in which some MNOs may predictably pay less than others for spectrum, which is equivalent to a windfall gain;
- it is not proportionate, because there are other measures that ComReg could use to achieve its objectives (e.g. a symmetric cap).

In Three's view, there would be a procedural failure if ComReg was to proceed in implementing this combination of asymmetric caps with the CCA award format, because it has not undertaken the necessary competition analysis to show its proposed measures are "*objective, non-discriminatory and proportionate**".*** There is a substantial risk that implementing ComReg's proposed sub-1 GHz cap would lead to an inefficient outcome, as it creates options for bidders with higher caps to win larger quantities of spectrum at a price below what Three

would have been willing to pay. We note that, in similar circumstances, DotEcon has recently advised against the use of a CCA in the Netherlands[1], citing the same flaws that we highlight here concerning use of asymmetric caps.

Three sees this as a major difficulty with the current proposal, and respectfully requests that ComReg modify its proposals following the consultation to eliminate the problem. This should be addressed early in the development of the award process to avoid delay to the commencement of new licences.

Three proposes an alternative cap structure which we are confident would be more likely to deliver an efficient and non-discriminatory auction process than the current proposals:

- All spectrum caps should be symmetric and limited to bands available in the auction;
- At 700 MHz, the most appropriate cap is 2x10 MHz per operator. If ComReg prefers instead to have 2x15 MHz cap, then it must not use a CCA to allocate this band, as format is discriminatory given predictable asymmetries between MNOs;
- For bands above 1GHz, there should be a symmetric cap based only on spectrum in the auction. In Three's view, a cap no lower than 150 MHz per operator across 2.1GHz, 2.3GHz and 2.5GHz would provide all bidders with the flexibility they need to pursue realistic targets.

IV. 2.1 GHz Band

ComReg proposed to include the re-licensing of 2.1GHz spectrum as part of this process. This introduces several complications into the award, including the liberalisation of existing licences and time-slices. ComReg proposes to reduce the number of time-slices in the award:

- by providing that Three may apply to extend its existing 3G licences to expire at the same time as the Vodafone 3G licence;
- if extended, the two 3G licences of Three will be unaltered except for the significant matter of fees, which it is proposed will be based on the original fee of the Vodafone and Eir licence (increased by CPI); and
- all existing 3G licences can be liberalised from December 2020.

Three notes that the proposal does not reduce the award to two uniform time-slices:

- 700MHz, 2.3GHz, and 2.6GHz will commence in approximately December 2020;
- 2.1GHz will commence in October 2022.

ComReg is proposing that Three should apply to extend its licences in order to simplify ComReg's proposed award, however the proposed licence fee for extension is inappropriate and without rationale. ComReg is well aware that the 3G licences were awarded under different circumstances, and in fact there are two different types of licence. ComReg's own

[1] "Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum", DotEcon, July 2019. Prepared for the Dutch Ministry of Economic Affairs".

benchmarking indicates that the current value for a liberalised 2.1GHz licence in Ireland is a fraction of the fee proposed[2]. There is no link between the 3G licence awarded to Vodafone in 2002 and a liberalised licence issued to Three in 2020. Further, to apply a CPI adjustment makes no sense in these circumstances.

ComReg's proposal for 3G licence extension fees stands in contrast with the proposal to liberalise Eir's 3G licence up to 2027, which will be for free unless the value for 2.1GHz in the award exceeds the original licence fee. It is questionable why the treatment is so different in both cases. Three urges ComReg to revisit this proposal; we provide alternative suggestions below.

V. Time Slices

ComReg proposes that the 2.1 GHz band be divided into two time slices, one covering the period between the expiry of the Vodafone / Three licences and the later expiry of Eir's licence, and one for the remainder of the full licence term. Three disagrees with this approach, as it involves the creation of artificial lot with durations that do not correspond to bidders' real demands, and also makes the auction unnecessarily complex. We propose that ComReg instead adopts two categories of longer duration lots, one category starting when the Vodafone and Three licences expire, and the other when the Eir licences expire. We set out a number of advantages of making this change, including the important benefit that it will simplify the auction process. We note that the German regulator, BNetzA, adopted this approach instead of time slices for its award of 2.1 GHz in 2019.

If, notwithstanding these arguments, ComReg decides to proceed with time slicing at 2.1GHz, it should not adopt the same time-slices in the 2.3GHz and 2.6GHz bands, as this introduces unnecessary risk and complexity into the auction. This licences should be sold as single blocks with long-term durations.

VI. Licence Duration

ComReg proposes to issue licences with a maximum duration of 15 years for most bands, but 13 years for the 2.1GHz band. Three has previously explained why this is inadequate to promote network investment and is likely to reduce the rate of roll-out of the new services to be delivered with 5G. Three believes this would be contrary to ComReg's objective under the new European Electronic Communications Code (EECC) to promote investment in high capacity networks and contrary to its objective of connectivity. It is also directly at-odds with Article 49 EECC, which requires a minimum duration of 15 years, with licensees given certainty at the outset of what they must do to ensure the licence duration is 20 years. ComReg has set out in Document 19/59 that it has taken account of EECC in relation to its proposals. The EECC will likely be transposed into Irish law or take direct effect before the licences are issued in this award, and in any event, in the meantime, ComReg is legally required to desist from any action that would undermine the Directive. In Three's view ComReg must amend the proposal in order to be compliant with Article 49 of the EECC.

[2] €€0.197 to 0.234 per MHz.Pop for 15 years.

We note that other countries in Europe are moving to longer licence terms. Most recently, in 2019, Germany adopted 20 year and 15 year terms for award of 2.1GHz licences that will run until 2040. ComReg should adopt a similar approach, so as to promote investment in 5G and the competitiveness of the Irish economy within Europe.

VII. Roll-Out / Coverage Obligations

Three supports ComReg's proposals in this regard but cautions that any further obligations would likely act as a deterrent to bidders in the auction. ComReg proposes to include 'precautionary' coverage obligations for any bidder who obtains spectrum in the 700MHz band. This includes:

- a 3 Mbit/s service to 99% of the population and 92% of the geographic area of Ireland; and
- a 30 Mbit/s service to 95% of the population, 90% of motorways, and 80% of primary roads.

Bearing in mind that Ireland has a particularly challenging rural population profile, these obligations are at the upper-end of what network operators could be expected to meet under competitive commercial conditions.

Three is aware that even with the above obligations, there may still be some locations where it is desirable to improve coverage, but not viable to so under normal circumstances. For these areas, the award process gives ComReg a one-off opportunity to develop a mechanism whereby bidders can contract to provide coverage as part of their licence, and we make some suggestions in this regard.

VIII. Minimum Price

ComReg plans to derive the minimum licence fee by benchmarking to find the expected market value, and to split the upfront vs annual fees in a ratio of 4:6. Three agrees with the proposed split, and believes that the overall approach could be acceptable with some minor but important amendments.

It is accepted that setting reserve prices too high can choke off demand and lead to an inefficient auction outcome. Benchmarking always carries a risk of error as it is not possible to entirely recreate the circumstances of the award that is to be run. For this reason, it is necessary to include a margin so that we can be reasonably sure that the auction has the "space" necessary to allow for bids to identify an efficient outcome, ideally with some degree of price discovery over multiple bidding rounds.

Three believes ComReg has included some incorrect references in its benchmark and that these should be removed. ComReg should also include a margin so that it is the auction which determines the outcome, and Three suggests that reducing the minimum price by one standard deviation would achieve this without reducing the effectiveness of the minimum prices. We do not agree that using the geometric mean provides a sufficient margin to allow for efficient price discovery.

IX. Legal Context

Three notes that ComReg is obliged, when structuring awards and awarding 'rights of use' to adhere to both specific spectrum regulatory obligations and its statutory objectives and functions. These obligations require ComReg (when structuring such awards), in particular, to (a) guarantee non-discrimination, fairness, objective treatment as well as legal certainty and consistency and (b) enhance competition, efficient use of spectrum and investment in the market. We set out the legal sources for these in Appendix 1 and cross-refer to these in this submission.

Three is of the view that the current proposal for the award structure raises real concerns about compatibility with these legal requirements (as further outlined below). In particular, Three notes that the EECC will likely be transposed into Irish law or take direct effect before the licences are issued in this award, and in any event, in the meantime, ComReg is required to interpret Irish law in conformity with the EECC and required to desist from any action that would undermine the Directive[3]. ComReg ought to amend its proposal in relation to license duration in order to be compliant with Article 49 of EECC.

[3] Three is advised it is well established in EU caselaw that Member States (the concept of which has been interpreted broadly in EU caselaw and likely applies to State bodies / regulators), must not undermine a Directive in the period following its publication (and pre implementation) per Inter-Environnement Wallonie (Case C-129/96)) and Manglod v Helm (Case C-144/04).

2. Background

In ComReg Document No. 19/59, ComReg sets out its proposals for what will be the largest award to date of radio spectrum that is harmonised for use for electronic communications (470MHz). The spectrum is suitable for use by mobile and fixed access services and includes a "pioneer band" for 5G. The outcome of this process will have a hugely important influence on the shape of competition for wireless services over the next decade, and the speed at which Ireland transitions into the 5G era. As we move from 2G, 3G, 4G, and now add 5G, the diversity of services supported will grow. Depending on the use case, 5G will need to stretch to cover dense machine-to-machine applications, high bandwidth services, and also ultra-reliable communications.

The rate at which new technology is deployed, the extent of coverage, and the investment available to propagate and deliver those services all depend on a process that delivers successful and fair outcomes. It is important that ComReg gets it right.

The investment case for mobile and wireless networks has always had some challenges, and demands for faster, better, and more diverse services have continued to grow since digital services were first introduced using GSM. Overall sector revenues have been in decline as a result of regulation, competition, and substitution by over the top services for the past decade (total mobile revenue has fallen by 23% since Q2 2008, and mobile ARPU has fallen by 38% from €40.87 to €25.08 in the same time). Operators must maintain multi-generational networks (2G, 3G, 4G) while also providing for ever-growing demand for speed and coverage, and rolling out a new generation of equipment (5G). Three expects to see a 5-fold increase in network traffic over the next 5 years, with a 10-fold increase in end user speed.

Still, it is in our national interest that early investment is made in 5G so that Ireland remains competitive relative to its peers in Europe. Even though ComReg has a specific objective to promote efficient investment[4], there are relatively limited tools that ComReg has at its disposal to facilitate investment and innovation . Allocating spectrum in a timely and effective way is one of them. It is worth noting that Irish operators have already invested €932m in acquiring radio spectrum licences since 2012, and this is before any network is built or service delivered.

The effects of this award will influence wireless communications markets in Ireland for the foreseeable future. The 700 MHz band should allow for improvements in rural coverage, while the other bands allow for an increased density of high-speed communications where more capacity is needed. The 700MHz band is particularly important as it is the first pioneer band for 5G that is good for providing rural coverage and building penetration.

ComReg needs to define a process that will award the spectrum in an efficient way, will ensure that competition and investment in the market is not impeded, and is in accordance with the functions and objectives laid out in legislation. Three agrees with many aspects of ComReg's proposals; however, in a few critical areas they fall short. Three respectfully submits that the award should not proceed as described in the current proposal.

[4] Regulation 16 (2)(d) of the Framework Regulations.

The current award is planned to run during Q3 2020, and licences are likely to be issued in Q4 2020. This is the same time that the new EECC is to be transposed into Irish law, and it will, in any event, have direct effect no later than 21st December 2020.

The EECC is relevant to this consultation:

- it sets out objectives for regulators (NRAs) to facilitate the roll-out of high capacity wireless networks and ensure connectivity;
- it details minimum requirements on NRAs for spectrum award processes; and
- it sets minimum durations for spectrum licences in certain bands.

Many of the requirements in the existing framework carry over into the EECC; however, there are also some new requirements. ComReg ought to amend its proposal to be in line with the EECC, in addition to the existing regulatory framework. In particular, ComReg must look again at its approach to licence duration and transparency regarding the process to obtain extensions of licences from 15 to 20 years.

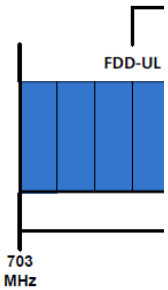
In the following sections, Three provides detailed comments on ComReg's proposals, with alternative suggestions, where appropriate.

3. The Spectrum for Award

The 700MHz band

Though the 700MHz band has the least spectrum (in MHz) of all to be awarded, it is important. Spectrum in the lower UHF bands tend to be better for providing rural coverage and building penetration. The 700 MHz band has also been identified as a 5G "pioneer band" for Europe so it can be expected that there will be a good supply of network and terminal equipment. Any network operator who is planning to build or maintain a mobile broadband service or planning to roll-out any of the 5G services will be likely to carefully consider obtaining some spectrum in this band.

ComReg proposes to award 60 MHz (i.e. 2×30 MHz) of spectrum in the band in its current award. The spectrum is to be divided into lots as shown below.



Three agrees with the proposal to award the 2x30MHz of Frequency Division Duplex (FDD) spectrum. We note that there is also a possibility to use the centre-band as Time Division Duplex (TDD) channels; however, the ecosystem to support this use is not well developed yet, and Three agrees that it should not be included in the award at this time.

The FDD band-plan is being adopted as standard across Europe, and the specification has been developed to protect adjacent services from interference. Three agrees with ComReg that no further measures are required.

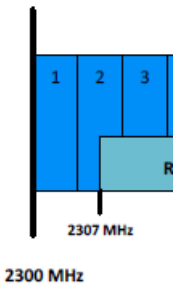
In Document 19/59, ComReg provides some analysis of the requirement to provide spectrum for Public Protection and Disaster Relief (PPDR), and considers whether is necessary or desirable to reserve some of the 700MHz FDD spectrum for PPDR. LS Telcom has examined and reported on this matter for ComReg. The study is quite comprehensive, and we have no reason to disagree with the conclusions.

The LS Telecom study found that *"2×6 MHz would be sufficient to support PPDR usage in Ireland"*, and that there are several options to provide that. Six options are provided in Table 2 of ComReg's document. Three agrees that any of Options A, B, or C are preferable to options D, E, or F. This is because the latter three all reduce the spectrum that might be available for commercial services. There are other spectrum options available to meet the requirement for PPDR, including the 400 MHz band (2x3MHz); Band 28B (2×3 MHz), and Band 68 (2×5 MHz). There may also be options for PPDR deployment in the 410-430 MHz and the 450-470 MHz bands. In addition to these dedicated spectrum options, the requirement may be met by using hybrids of dedicated and commercial networks.

On this basis, it would not be efficient or justifiable to disadvantage commercial networks by limiting the amount of 700MHz FDD spectrum in the award.

The 2.3GHz Band

There is 100MHz of spectrum available for award in the 2.3GHz band, and ComReg proposes to award it as 20 individual TDD lots of 5MHz each. ComReg's band-plan is shown below:



Three agrees with the proposal to make the full 100MHz available, divided into TDD lots. ComReg has also formed the view that no technical restrictions are required beyond the

introduction of restricted blocks between 2,390 MHz and 2,400 MHz. Three has not identified any reason to disagree with this.

The use of this band by Eir to provide Rurtel services to a very small number of customers presents a number of issues for the award of the band. In the first place, it is noted that the channels do not align with ComReg's band plan, which means that 25MHz of spectrum is impaired. The Rurtel service supports only a very small number of customers (2 in Kerry, 8 in Galway, and 77 in Donegal), leading to the conclusion that it is a very inefficient use of spectrum, given the potential high value alternative use of providing mobile services. The small number of customers in Kerry and Galway is especially noteworthy. In Figure 10 of the consultation document, ComReg presents exclusion/coordination zones that would be required around the Rurtel stations. These are surprisingly large considering the number of customers served, and in fact a substantial part of the geography of Ireland is within the coordination zones.

It seems that Rurtel is an old system running old technology, with limited remaining use. It is not clear when the licences were issued, or for what duration; however, it seems likely that they are annually renewable licences. Given that this is an old system serving a small and diminishing number of customers, and that there is no long term licence expectation, it should be possible to set a termination date for the Rurtel system, if an alternative means is available to serve the relevant customers. In the longer term, these customers will be served by the National Broadband Plan; indeed, it seems likely that most of these customers could already be served by alternative networks. Eir itself claims to already cover 99% of the Geography of Ireland[5] with its mobile service, in which case it is to be expected that the Rurtel system could be replaced by a terminal station that operates to Eir's mobile network. The addition of a fixed user antennae should increase the coverage beyond that available for mobile service. On the basis of the above information, ComReg should set a date for the switch-off of Rurtel, which should be achievable before the end of 2021.

In the meantime, Eir should be required to reduce the bandwidth used by Rurtel to the minimum required. Donegal has the highest number of users at just 77. Even though some repeaters may be required, it seems difficult to justify the use of a full 20 MHz in any of the three locations. Eir should be required to reduce this bandwidth to the minimum necessary, and to justify that bandwidth in each location.

In addition to the above, ComReg should ensure that if Eir is a winning bidder for any 2.3GHz spectrum then in the assignment round, the algorithm gives priority to maximising the extent to which the same spectrum is assigned to Eir as is used for Rurtel. This could easily be achieved within the assignment algorithm. In the alternative, Eir should be required to re-tune Rurtel to operate on the same spectrum that is assigned to Eir in the 2.3GHz band (if any).

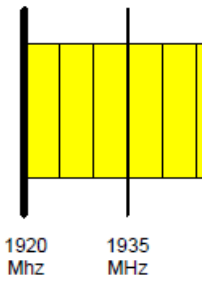
If ComReg does not provide for the above, then Eir would have a natural advantage over all other bidders for 2.3GHz in the assignment round. This arises because the exclusion zones would be likely to have a greater effect to suppress the value of the impaired spectrum for bidders other than Eir. If Eir itself is the new licensee sharing spectrum with Rurtel, then it will have a greater ability and incentive to minimise the coordination areas while avoiding interference between the two networks.

[5] https://www.siliconrepublic.com/comms/eir-mobile-network-investment-ireland-4g-5g

In the event that an operator other than Eir is required to share with Rurtel, then the coordination procedure should be designed so that it does not unduly delay the new licensee from using the spectrum. The procedure that was proposed by ComReg following the recent 3.6GHz award is not suitable, as it favours outgoing licensees over new ones. In the 2.3GHz band, the procedure should be that a new operator provides notice of intention to commence service within the coordination area, and the onus should be on Eir to demonstrate that an issue exists or the roll-out goes ahead by default.

The 2.1GHz Band

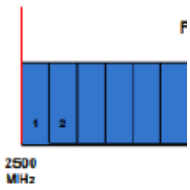
This is the only legacy band that ComReg is considering for inclusion in the award. The fact that it is already in use to provide 3G services causes several complications for its inclusion in the award, which we comment on later. With respect to the band-plan that should be used, Three agrees that it should be the 2x60MHz of FDD spectrum as shown in the plan below. This is a long-established band for mobile services, and the standard specifications have been adequate to ensure coexistence with adjacent services. There is no need for additional guard bands.



The 2.6GHz band

The 2.6GHz band consists of 190MHz and ComReg plans to make the full band available in the award. Three agrees with this.

The 2.6 GHz band has been standardised within Europe for several years, and is in common use. It can be configured in both FDD mode and TDD mode, with the primary band configuration having 50MHz for TDD in between the 2x70MHz for FDD. This is the most common configuration adopted across Europe, although variants with more TDD are possible. ComReg has proposed to adopt the primary configuration as shown below, to provide 2x70MHz FDD, and to use 2x5MHz of restricted lots to provide isolation between the two duplex modes. Three agrees with this.



The 26GHz Band

We note that there is a requirement under Article 54 of the new European Electronic Communications Code (EECC) that spectrum in the 26GHz band should be made available by 31 December 2020 for wireless broadband services:

> *"Article 54: Coordinated timing of assignments for specific 5G bands*
>
> *1. By 31 December 2020, for terrestrial systems capable of providing wireless broadband services, Member States shall, where necessary in order to facilitate the roll-out of 5G, take all appropriate measures to:*
>
> *(b) allow the use of at least 1 GHz of the 24,25-27,5 GHz band, provided that there is clear evidence of market demand and of the absence of significant constraints for migration of existing users or band clearance. . . ."*

We also note that the characteristics of the 26GHz band are significantly different to those that are to be awarded, and that the network and device ecosystem is less advanced.

ComReg has recently completed an award of spectrum for fixed links in this band[6]. There are several issues to be considered in order to optimise this band before an award, and reconfiguration might be necessary. Three is of the view that a separate consultation is required to resolve these matters. Accordingly, we agree that this band should be held back to be awarded in a separate process, so as not to delay the award of the lower frequency spectrum.

The 1.4GHz Band

As previously stated, Three agrees that this band should not be awarded at this time. In particular, the ecosystem for the wider band is not yet developed, and operators would benefit from greater certainty regarding the business case for deployment of supplemental downlink using these frequencies. We look forward to participating in a separate consultation on the terms of award for this spectrum in due course.

[6] https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/26-ghz-spectrum-award/

4. Key Aspects of the Award Process

There are three individual aspects to ComReg's proposed award process that combine to raise serious concerns:

1. Use of a Combinatorial Clock Auction (CCA) mechanism including second price rule for the award;

2. Use of caps based on existing spectrum holdings unsupported by any clear competition rationale; and

3. The use of caps that apply asymmetrically across bidders: one for sub-1GHz spectrum and one for all spectrum in the auction.

ComReg proposes that existing licenced spectrum should count towards the cap. ComReg has not specified exactly which bands and existing licences will be taken into consideration for the purposes of this cap, although it seems from the analysis that the cap will take account of all spectrum awarded in the 2012 multi-band award, and the 2017 3.6GHz award. It is unclear how current 2.1GHz spectrum is to be counted during different periods of Time Slice 1.

The combination of these aspects of the proposed award create a process that is discriminatory, in particular against Three. The approach disadvantages Three without justification and may lead to an inefficient auction outcome. As such, this raises real concerns about compatibility with ComReg's legal requirements (under current and future law) including in relation to non-discriminatory treatment and fairness. Three requests that ComReg's proposal is modified such that the asymmetric caps which take account of spectrum awarded in previous auctions are removed.

These issues are examined in more detail in the following sections.

5. The Auction Mechanism

General Points on CCA

In January this year, Three submitted a report to ComReg, prepared by NERA Economic Consulting (NERA), which analysed several aspects of the proposed award. ComReg has already had the opportunity to consider the NERA report, so it will not be repeated here; however, in summary, it explained that many national regulatory authorities (NRAs) are moving away from the CCA mechanism because:

- Aggregation risk is less important now than in previous awards, given that there are more bands and more spectrum generally available (We note that one of the main arguments in favour of the CCA is the risk that spectrum might not be aggregated across time-slices, which in turn arose from ComReg's proposals for inclusion of the 2.1GHz band);

- CCA can lead to grossly asymmetric price outcomes for bidders winning the same spectrum;

- In certain circumstances, CCA incentivises spiteful bidding; and
- CCA auctions are complex and lack the transparency required for a bidder to know at any point how much they are likely to pay for any particular package of spectrum lots.

In support of the decision to propose a CCA mechanism, ComReg has offered several arguments, including:

- it provides for aggregation of a package of spectrum across different bands;

  Three is of the view, given the fact that following this award the total quantity of spectrum allocated for mobile/fixed communications will be 1,100MHz across 9 bands, that aggregation of a particular portfolio is not a significant concern for this award.

- it provides for aggregation across time-slices; and

  Three's view is that the time-slices are a construct only of ComReg's proposal to deal with issues in the 2.1GHz band. As stated below, Three does not agree with ComReg's proposal for the 2.1GHz band, and notwithstanding this, Three does not agree that it is appropriate to apply the time slices to any other band in the award (see further comments below).

- other auction mechanisms are open to gaming, particularly demand reduction.

  Three is of the view that this concern is overstated. ComReg has not provided evidence that that other award mechanisms (in the context of this award) would be more vulnerable to gaming behaviour, especially gaming that could reduce the efficiency of the auction outcome. In any case, ComReg proposes to set minimum prices close to the expected market value, an approach that substantially reduces any incentive for demand reduction. On the other hand, NERA's report has highlighted how a CCA is vulnerable to spiteful bidding, especially in situations of predictable asymmetries in demand and price setting power across a limited pool of bidders.

ComReg's fear of demand reduction is anyway misplaced. As revenue is not a core objective (and reserve prices are high anyway), demand reduction is only problematic if bidders reduce demand too much, as this could prevent an efficient outcome. However, in the context of this auction where there are three strong MNOs, bidders are most unlikely to concede spectrum if this would compromise their ability to compete efficiently in the downstream market.

A significant drawback of the CCA is that it not only deters early demand reduction, it may also deter valuation-based demand reduction. Bidders with predictably lower marginal valuations may be tempted to exaggerate demand so as to retain pricing pressure on rivals and prevent outcomes where they must pay more than stronger rivals. Strong bidders may retaliate by exaggerating their demand. At the same time, bidders still have contradictory incentives to move the auction as quickly as possible to an acceptable outcome. This creates a risk that bids not truly reflective of valuation combine to create an inefficient auction outcome. These problems may be exacerbated in multi-band auctions, because there is more scope for strategic bidding and bidders may have predictable strengths and weaknesses in different bands.

In paragraph 7.63, ComReg "*notes that bidders paying comparable amounts is not an objective of the Proposed Award*." It is noted that obtaining any minimum award revenue, or any minimum price per lot is not an objective of the award either. The purpose of the auction is to determine the most efficient allocation. It is accepted that as the demand for particular lots approaches the supply available, then bidders will be considering whether to buy an incremental lot. The incremental value for the additional lot may be less than the bidder's core target, which means that it will be bought only at a lower price per lot. In a competitive award where demand initially exceeds supply, and where operators have similar demand, then it should be expected that the award will deliver similar pricing per lot for all winning bidders. If the outcome of the award is that bidders pay significantly different prices for equivalent lots, and where this is a feature of the award, then the award fails to treat all bidders fairly. This is a case of poor hygiene, where the result is contaminated by the apparatus, and such a proposal would fail to meet ComReg's obligation to provide for a non-discriminatory award process.

It is noted that ComReg plans to use the prices for 2.1GHz spectrum in the auction as a proxy for the market value of this spectrum. This proxy will be used to determine how much Eir would be required to pay as a fee for liberalisation of its 3G Licence for the remaining term. Significant variations in price would undermine that proxy. As an example of this challenge, ComReg should consider the difficulty that Ofcom had in setting prices for renewal of 900 MHz and 1800 MHz spectrum in the UK, which in part flowed from the use of a CCA for the award of 800 MHz and 2600 MHz and absence of clear benchmark prices for those bands. The process, including a series of consultations and a legal challenge, ran for over four years.

In relation to alternative auction mechanisms, ComReg seems to be reluctant to use other formats because they are new or have not been used in Ireland before; however the same applied to CCA when it was first used in 2012, and for new bidders when the 3.6GHz band was awarded in 2017. For this type of award, it is to be expected that all serious bidders will prepare for the process regardless of the mechanism used. It is further noted that CCA has only been used twice before in Ireland, and under different circumstances, so this prior use in itself does not guarantee success in the current award.

Specific Problems with CCA as Proposed

The use of a CCA auction mechanism together with asymmetric caps between bidders is a particular concern for Three. We set out in detail the risk that this combination poses to the efficiency and fairness of the process below. We must also point out that this is an increasingly widely recognised problem with using the CCA to allocate spectrum. There is an emerging academic literature that highlights the potential for inefficiency and grossly asymmetric pricing if a CCA is used in situations where there are predictable asymmetries (such as differential caps or starting positions) between bidders[7]. This is one of the factors, as highlighted above, leading regulators that previously used the CCA to return to using formats inspired by the

[7] Marsden and Sorensen, "Strategic Bidding in Combinatorial Clock Auctions – a Bidder Perspective", Handbook of Spectrum Auctions, Cambridge University Press, 2017.

traditional Simultaneous Multiple Round Auction (SMRA), such as the clock auction format. for new awards.

A current example that is particularly relevant to Ireland is the forthcoming award of 700MHz, 1.4GHz, and 2.1GHz bands in the Netherlands, where the Dutch Ministry of Economic Affairs asked DotEcon to recommend an auction model. Prior to considering the award mechanism, the Ministry decided that there should be caps which take into account existing spectrum holdings. There are three mobile network operators in the market following the merger of T-Mobile and Tele2 in 2018. The differences in the spectrum currently held by the three MNOs mean that the maximum amount of spectrum that each MNO can acquire in the auction under these caps will vary.

DotEcon's recommendation is to use an SMRA-Clock hybrid format. In its report to the Ministry, DotEcon highlight the reasons why a CCA or other second-price auction mechanisms are not suitable for use where asymmetric caps apply[8]:

> "*If a combinatorial format had to be used, there would be a choice between formats that use a pay-as-bid rule (such as the CMRA and the SCA) and those that employ a second pricing approach (such as the CCA, which sets prices on the basis of opportunity costs calculated from the bids made by bidders, and the ECCA, which sets prices with reference to the largest bids that competitors could make under the activity rules). Given the simplicity of pay-as-bid pricing*[23] and the potential concerns about the impact of the asymmetry in the amount of spectrum that different bidders can *acquire under the caps on bidding behaviour, we would prefer a pay-as-bid format over a format that relies on opportunity-cost based pricing.*[24] "
>
> *"*[24] *. . . In this respect, using a second price rule is potentially more of a concern where spectrum caps have an asymmetric impact on bidders' ability to bid for additional spectrum in the auction. This is the case under the spectrum caps proposed for the auction. Under such asymmetric constraints the ability of bidders to set each other's prices is uneven and attempts to exploit this asymmetry through strategic bidding may result in inefficient outcomes."*

Clearly, DotEcon has identified the same problem with the use of a CCA with asymmetrical caps, and as a result has recommended against the use of CCA in the Netherlands. It is difficult to see how the same logic does not apply in similar circumstances in Ireland.

Three asked NERA to review the use of CCA and caps as proposed in ComReg Document No. 19/59. NERA's comments are included in Appendix 2 of this document. The analysis and examples provided clearly demonstrate problems with the CCA auction mechanism, and how this is exacerbated by ComReg's proposal for caps. Given this information, it is difficult to see how the proposals in ComReg Document No. 19/59 can be squared with ComReg's statutory obligations.

Further comments are provided below on the effect of ComReg's proposed caps.

[8] "Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum", DotEcon, July 2019. Prepared for the Dutch Ministry of Economic Affairs.

Bidder Information

ComReg has not stated clearly what information it is proposing to provide to bidders at each stage of the award. We ask that ComReg specify and consult on a clear information policy for the award.

6. No Intervention Required For Current Assignments

The current distribution of spectrum holdings between the three mobile network operators (excluding 3.6GHz) emerged from the 2012 multiband award, followed by the merger of Three and O2 in 2014. The merger was cleared by the European Commission following an investigation which specifically examined the distribution of spectrum and decided that there was no resulting impediment to competition, stating "*The fact that, after the merger, there will be spectrum asymmetry is not, as such, anticompetitive"*.

In the consultation document, ComReg itself points out in section 7.221 that:

- market shares of the mobile network operators (MNOs) post-Merger have been relatively static, with a small re-distribution away from MNOs to mobile virtual network operators (MVNOs);
- there does not appear to have been any further concentration downstream post-Merger; and
- the Herfindahl-Hirschman Index (HHI) (taking all operators other than the MNOs to be a single entity) of the mobile market based on revenue share has fallen slightly from 0.346 to 0.322.

In addition, DotEcon notes that ". . . *the available evidence (including the views of the Commission at the time of the Merger) would suggest that a post-award spectrum asymmetry at least at the same level as after the Merger is unlikely to be problematic and there does not seem to be any particular need or justification to seek to actively reduce the current differences in MNO spectrum holdings on competition grounds*".

In December 2014, Vodafone sought to have ComReg carry out an assessment of spectrum holdings following the merger of O2 and Three. In response, ComReg states that "*Vodafone has not provided, nor is ComReg not aware [sic] of, any facts that demonstrate that the merged entity has, or is likely in the future to use the spectrum controlled by it inefficiently or ineffectively, or in any way that would require intervention by ComReg using its radio spectrum management powers."*

ComReg itself states in paragraph 4.191 of the consultation document that " . . . *asymmetric outcomes may be compatible with a diversity of operators engaging in effective downstream competition provided the asymmetry is not too extreme".* So, neither ComReg nor DotEcon seem to be saying that there is an asymmetry of spectrum holding at present which is causing any competition issue that needs to be corrected.

In addition, the latest quarterly market information[9] shows that Three's own retail market share was 35.3% (inc MBB & M2M) or 32.3% (ex MBB & M2M). Three's network carries almost all MVNO traffic -Three carries Tesco Mobile Ireland (TMI), Lycamobile and Virgin Media as MVNOs - which brings the market share carried on Three's network to 44.2% (inc MBB & M2M) or 44.7% (ex MBB & M2M). Eir, on the other hand accounts for just 16.3% or 19.7% market share respectively, which is less than half of the market share carried on Three's network.

The above shows that Three is already a much more efficient user of spectrum than Eir. If all other variables were equal, then Three could have twice as much spectrum as Eir and still use it more efficiently by this metric.

Further, it is not the case that Three provides less value to its customers, and in fact the Three network carries 65% of all mobile data traffic in Ireland[10], which is significantly more than both Eir and Vodafone combined. Again, if all other factors were equal, Three could be assigned more than 50% of all mobile spectrum available and still be the most efficient user of spectrum.

The above shows that there is no existing disparity or asymmetry of spectrum holdings that needs to be corrected for in the proposed award[11]. Further, it seems that both DotEcon and ComReg itself share this view, which makes ComReg's proposals for caps based on existing holdings in the proposed award surprising, disproportionate and contrary to ComReg's statutory obligations because of the effect they would have.

As explained in section 7 below, Three is not arguing that ComReg should proceed without any spectrum caps. We recognise that spectrum caps may play a role as a precautionary measure to prevent extreme outcomes that could create future competition concerns. In Ireland, the best way to do this is with symmetric caps on spectrum available in the auction, either for individual bands (700 MHz) or across groups of similar bands (e.g. 2.3GHz and 2.6GHz).

7. Caps

Caps within an auction

In paragraphs 4.133 and 4.134, ComReg sets out the primary reasons for using an auction to award spectrum:

- *"Spectrum auctions are designed to incentivise bidders to express their willingness to pay for spectrum rights, and aims to assign the available rights of use of spectrum to the bidders who value it the most. An appropriately designed auction extracts*

[9] ComReg 19/57R2

[10] In Q1 2019, Three's network carried 76.4TB of data, which is 65% of total mobile network traffic 118TB as per ComReg's Q1 market report (19/57R2)

[11] Three notes that as part of ComReg's role to prevent excessive hoarding of spectrum, it can monitor / take action if it considers there is inefficient use of spectrum / excessive holdings of spectrum post award under Regulation 9(11) of the Authorisation Regulations.

information regarding bidders' willingness to pay for the rights of use of spectrum thereby enabling an assignment to the bidders who value the spectrum most;

- *"By ensuring that those bidders who value the spectrum the most obtain the rights being offered, auctions should result in an efficient outcome in terms of assignment;*

For an award to be efficient, the outcome should be determined by competition between the bidders, and not by any external influencing factors. Caps are often used within awards, in order to prevent extreme outcomes, and this is the reason stated in paragraph 7.184 for competition caps:

- *"ComReg has previously stated that the main purpose of a competition cap is to ensure that the distribution of spectrum rights in an award is determined by competition among bidders, subject to ensuring that extreme asymmetric outcomes which could harm downstream competition do not emerge from the award.*"

Three agrees that the award outcome should be determined by competition between bidders, and also that it can be wise to have competition caps in order to prevent extreme outcomes, however, caution must be taken when setting caps to make sure they do not compromise the delivery of an efficient and fair outcome. The caps must not disadvantage any bidder unduly, particularly where there is no concern about downstream competition being harmed. ComReg has not identified any 'extreme asymmetry' in the market currently or provided sufficient evidence / justification that the proposed competition caps are necessary to prevent against this happening as an outcome of the proposed award.

Proposed Caps

ComReg has proposed two caps in the auction:

1. A sub-1GHz cap of 35MHz (7 lots of 2x5MHz); and
2. An overall cap of somewhere between 375 MHz and 420 MHz.

The consultation document does not specify which existing assignments precisely will count towards the cap in each time-slice; however it seems from ComReg's analysis that it will be all existing 3G and Liberalised Use licences in the following bands:

- 800MHz and 900MHz for the sub-1GHz cap; and
- The above plus 1800MHz, 2.1GHz and 3.6GHz for the overall cap.

It seems that Eir's use of the of 2.3 GHz is not counted towards the spectrum caps, even though this band is to be included in the award. ComReg should specify precisely which existing assignments are to be counted towards the cap, and the reasons why.

Three notes that it is a new departure for ComReg to count spectrum from bands that are not included within the award against the caps. For all previous spectrum auctions, only the bands that were actually available in the award were considered for the purpose of the award cap. It is not clear how the caps will apply during the different time periods relevant for the

award. ComReg has proposed two time slices but these do not correspond exactly with the expiry dates for spectrum bands that are outside of the award.

The various dates and time periods that must be considered are as follows:

- December 2020, commencement of Time Slice 1 (TS1);
- October 2022, expiry of 3 of 4 3G licences;
- March 2027, expiry of Eir licence, end of TS1;
- March 2027 to End 2035, Time Slice 2(TS2);
- July 2030, expiry of 2012 licences; and
- July 2032, expiry of 3.6GHz licences.

Any bidder's holding of spectrum from bands that are outside of the award will vary over time, and ComReg needs to explain how this will be taken into account for the caps.

For example:

- Licences for 9 out of 12 of the 2.1GHz lots expire in 2022. Our assumption is that they will not count towards the overall cap in TS1 as they will have expired for most of the term, but this needs to be clarified. This would leave only Eir's 2.1GHz existing spectrum to count towards the TS1 cap.
- Liberalised Use licences in the 800MHz, 900MHz and 1800MHz bands expire in 2030, at least 5 years before the end-date for the new licences. Unless there is a third time-slice, then existing licensees are de facto penalised for having held those licences even after they have expired.
- Similarly, the 3.6GHz licences expire in 2032.

Again, ComReg needs to explain how the existing licences will be counted during the various different time periods, and explain the rationale for those choices. It is not sufficient to leave these matters to be resolved at the time of expiry of existing licences, as ComReg can give no certainty in this regard.

Caps that apply only during an award process nonetheless can have long-lasting effects. It should be noted that there is considerable inertia in spectrum holdings, and in Ireland no spectrum in all of the bands under consideration has ever been sold or transferred to a different user. Three paid substantial sums of money at previous spectrum auctions and at that time was unaware that Three could be perversely punished in this way for its investment in the market. The possibility that bidding for spectrum in previous auctions could act as a disadvantage in future auctions acts as a disincentive to investment going forward.

Other issues arise regarding the inclusion of 3.6GHz spectrum within caps. The 3.6GHz licences are awarded across 9 different geographical regions, and apart from Three, all of the other winning bidders were allocated a different number of lots in different geographical regions. There is just a single geographical region proposed for this award, so it is presumed that the largest number of lots for each licensee across all regions would be counted for the purposes of the cap, though ComReg has not made this clear.

The Sub-1GHz Cap

With respect to the sub-1GHz cap, we note that ComReg regards the 700 MHz spectrum as being most suitable for use by mobile network operators[12]. Further, ComReg's analysis throughout section 7.7 and in tables 8, 9, and 10 only considers matters relating to mobile network operators and MVNOs. We therefore conclude that ComReg's analysis relates soley to the distribution of spectrum among the three existing market MNOs and focuses on what ComReg perceives to be a disparity between Eir and Three.

The 700MHz band is important for early and widespread roll-out of 5G services. It will be a "greenfield band" from the commencement of the licences, and as a pioneer band for 5G services in Europe the ecosystem will be well developed. The 800MHz and 900MHz bands have existing use, and so will not be as easily available for 5G. The 700MHz band is particularly important for rural coverage in Ireland given the low rural population density.

It seems to Three that ComReg has set out to restrict Three's ability to bid for 700MHz spectrum when compared to the two other mobile network operators in the market: "4.158 *. . . . . in contrast, the competition caps proposed (see Chapter 7) would provide Vodafone with the opportunity to be assigned 2×15 MHz 700 MHz Duplex compared with 2×10 MHz for Three*." The same disparity applies when comparing Three to Eir under the proposed caps. It is unclear what ComReg's reasoning or justification is for placing such a restriction on Three. As shown above in Section 6, there is no existing spectrum asymmetry that warrants intervention by ComReg, and that view is shared by both ComReg and DotEcon.

We suppose therefore that ComReg's concern is that at least three operators secure a critical mass of sub-1 GHz spectrum to support both 5G and legacy services. We submit that the only way to achieve this objective would be to set a cap of 2x10 MHz per bidder. This approach would be symmetric across bidders and would eliminate gaming concerns. The downside is that there would be no competition in the auction between existing MNOs for 700 MHz, and this would have to come from new entrants, but this should be acceptable if ComReg lacks any competition rationale for picking the winners.

ComReg would make a procedural error in developing this proposal as it would fail to ensure that any measures taken by it are proportionate having regard to the objectives set out in section 12 of the 2002 Act. ComReg has proposed an award that would discriminate against one particular market player (Three) with no objective or reasoned basis for such treatment. In doing so, ComReg has not identified the market issue it is seeking to remedy and has not carried out an adequate Regulatory Impact Assessment of that measure as is required by Ministerial Policy Direction No. 6. ComReg has not demonstrated that the proposed measure which disadvantages Three is proportionate or justified. It also does not have regard to the objective to promote efficient investment and innovation in new and enhanced infrastructure as provided for in Regulation 16 of the Framework Regulations 2011.

[12] E.g. Paragraphs 2.31 to 2.35 of Document 19/59.

The current distribution is optimal

In the first place, it should be noted all lots of spectrum in the sub-1GHz bands are 2x5MHz duplex lots. There are currently 13 lots available, and all were awarded in the 2012 MBSA. They are assigned as follows: Vodafone 4 lots; Eir 4 lots; Three 5 lots.

Given that there are only 13 lots, and that all are assigned among 3 licensees, the current distribution is the closest that is possible to parity among the existing three MNOs. Absolute parity could be achieved if all MNOs had only 4 lots, but this would leave one lot unused, which would be inefficient, i.e. the current distribution represents the minimum disparity for efficient use, and the disparity is only 1 lot. It makes no difference which MNO is assigned the additional lot; if the 5th lot was assigned to either Eir or Vodafone, then the disparity would remain exactly the same. The current distribution represents the closest that is possible to parity between the three MNOs for efficient use of the available spectrum, and no one operator is at a particular disadvantage.

900MHz is not a direct substitute for 700MHz

ComReg seems to have assumed that 900MHz and 700MHz licences are interchangeable, which is erroneous. There are significant differences at the beginning and end of the licences:

- 700MHz will be available for use immediately as greenfield spectrum for 5G, whereas 900MHz is in use to carry legacy services;
- as a pioneer band for 5G, networks and devices will be available earlier in the 700MHz band; and
- the existing 900MHz licences will expire in 2030, whereas 700MHz will be awarded to 2035 at a minimum.

These differences will lead to different use over time and different valuations.

The proposed sub-1GHz cap is asymmetric and disadvantages Three

ComReg's proposal to impose a sub-1GHz cap equivalent to a maximum of 7 lots per MNO, and to count existing spectrum holdings towards that cap would place Three at a disadvantage in the proposed auction. There are three MNOs who currently hold sub-1GHz spectrum, and ComReg's analysis is based on the distribution of spectrum between these three. As Vodafone and Eir will hold 4 sub-1GHz lots at the time of the award and Three will hold 5, a cap of 7 lots means that Three can only bid to obtain an additional 2 lots of 700 MHz, whereas Vodafone and Eir can bid to obtain 3. Clearly, in a competitive process where there are three likely participants and one is restricted relative to the other two, this is unfair and inequitable and no legal or objective reasoning has been provided for this treatment.

The logic of ComReg's proposal is that it would be acceptable for either Vodafone or Eir to bid for and win 3 of the available lots in the 700MHz band, but not Three. Further, ComReg has provisionally decided that it would be acceptable for Vodafone and Eir to each win 3 of the available 6 lots and for Three to win none (leading to a significant sub-1GHz disparity). No such outcome is possible for any of the other bidders, because if Three obtains its maximum allowed (2) and either of the other MNOs obtains its maximum (3) then there is always an additional lot available for the other bidder. Of the 3 competing market players, Three is the only one that could be left in a position to win no spectrum. The proposed caps specifically

provide for an extremely asymmetrical outcome in the 700MHz band, which is what ComReg seems to be trying to avoid.

The proposed sub-1GHz cap also discriminates against Three on price

The proposed cap allows two of the existing MNOs (except Three) to express incremental values for 1, 2 or 3 lots. Three cannot express an incremental value for a third lot as its bids are capped at two. As ComReg proposes to use a CCA format, this means that Three's value for a third lot cannot be reflected in the price determination for other winning bidders. Under the proposal, Eir and Vodafone would each have the ability to express a value for 50% more spectrum than Three would. This may lead to extreme differences in price paid for equivalent lots with Three paying substantially more than Vodafone or Eir. This is discriminatory against Three (without any objective basis) and means that our rivals may obtain a windfall gain. 700MHz is also likely to have the highest price per MHz of spectrum sold in this award, thus exacerbating the effect.

In Appendix 2 to this document NERA provides examples of possible price outcomes for the award of 700 MHz if a CCA mechanism is used as proposed. Example 2 demonstrates the discriminatory effect on pricing if an asymmetric cap, as proposed by ComReg, is used.

Perverse outcomes

Perversely, NERA's examples also show that if a CCA is used to award 700 MHz, bidders with predictably higher values for a 3rd lot are advantaged over others. This is true whether or not an asymmetric cap is used. In the case of Ireland, this means that Vodafone (which has higher market share) would be advantaged versus Eir (lower market share) and Three (also high market share but starts with more sub-1 GHz spectrum). In the case where the efficient outcome is an even split of the spectrum, then the CCA pricing rule ensures that the weakest bidder always pays the most and the strongest bidder the least.

With the overlay of the asymmetric cap, Three is the obvious victim because it now faces paying opportunity cost that it cannot reciprocate. However, any benefit to Eir from weakening Three may be offset by its relative weakness versus Vodafone; this is because it is now cheaper and potentially more tempting for Vodafone to try to reduce Eir to 1 block as it no longer has to pay the opportunity cost of denying a 3rd block to Three. In short, ComReg's proposal to combine CCA with caps that count existing spectrum gives the greatest advantage to the (uncapped) MNO with the largest retail market share.

The situation becomes more complex again if you overlay the proposed asymmetric cap in the higher frequency bands. In these bands, Eir likely has much more flexibility to bid for surplus spectrum owing to its higher cap and lower capacity needs. Accordingly, Eir may be tempted to overstate its demand in other bands, as a way to match Vodafone's greater pricing power at 700 MHz. This type of behaviour may lead to bidders submitting bid sets that reflect strategic consideration rather than true valuations, resulting in perverse price outcomes and increasing the risk of an inefficient outcome.

The Overall Cap - Alternative Proposal

Three disagrees with ComReg's specific proposal to apply an overall cap based on total spectrum holdings. As discussed previously, the cap is arbitrary and lacks justification, as ComReg has not articulated a competition case as to why such a cap is required. Three recognises that there is a competition rationale to prevent one or two MNOs from acquiring an excessively large a share of spectrum in this award; however this objective can be achieved by imposing a symmetric cap across all bidders. No linkage with existing holdings is required.

A cap that accounts for existing holdings introduces an unacceptable asymmetry between bidders in the forthcoming auction. Specifically, it will enable one large bidder (Eir) to bid for significantly more spectrum than its two rivals. It also gives Vodafone more flexibility than Three. This is particularly significant in the context of ComReg's proposal to implement a CCA, as the cap would create a huge asymmetry in the ability of MNOs to impose prices on each other. In particular, as illustrated in the example developed by NERA in Appendix 2, it leaves Three vulnerable to paying higher prices for equivalent spectrum than its rivals, because Three cannot express its full value of being denied incremental spectrum.

Fortunately, there is a simple fix that can address these serious concerns. ComReg should adopt a symmetric cap across all bands above 1GHz in the auction. We propose that ComReg adopt a cap of not less than 150 MHz per bidder across the 2.1GHz, 2.3GHz and 2.6GHz bands.

A symmetric cap at 150 MHz or more would offer significant advantages over an asymmetric auction cap based on existing holdings:

- It would ensure at least three winners of capacity spectrum in the auction. It would also eliminate the possibility that two bidders alone could dominate this spectrum. This should address all competition concerns.
- It would ensure that all bidders have symmetric bidding power. This creates a more level playing field in the auction, which is especially important if a CCA is used. This will reduce the likelihood of there being large differences in pricing between bidders buying similar amounts of spectrum.
- It would be consistent with past auctions in Ireland, including 3.6 GHz. It would therefore be in line with bidder's legitimate expectations for this award.

Undermining of previous auction results

The spectrum in the 800MHz and 900MHz bands was awarded in ComReg's 2012 multiband spectrum auction, and the 3.6GHz was also awarded in an auction in 2017. ComReg is of the view that they were efficient award processes and has proposed to use a similar process again for this award. Since completing the award in 2012, the Three Group acquired Telefonica Ireland leading to the merger of the two MNOs. This merger was cleared by the European Commission following detailed examination, including consideration of the spectrum holdings relevant for the mobile market. The European Commission concluded that there was no competition issue arising from the fact that the merged company would hold more spectrum than other competitors in the market.

The 3.6GHz band is still undergoing transition, and (with one exception) no operator has launched commercial services using that spectrum since the award – it is still at the development stage. It is assumed that ComReg still regards that the process was efficient, and that the outcome represents an efficient distribution of the spectrum in the band.

If the outcome of the 3.6GHz auction was efficient, then it is wholly incorrect to include this spectrum within the cap for the next award. It is an efficient outcome that Three was awarded 15MHz of spectrum more than Eir, or 40MHz more than Imagine, or 65MHz more than Airspan. Equally it is an efficient outcome that Vodafone was awarded 5MHz more than Three.

If this is an efficient outcome, then it would be incorrect that these differences in spectrum holding should be allowed to somehow "count against" bidders in the auction that is now proposed. This would mean that the effect of the 3.6GHz award is that Three can only buy or even express a value for 65MHz less spectrum than Airspan, or 40MHz less than Airspan simply because Three won more than spectrum than they did in the 3.6GHz auction (an efficient outcome). This means that the outcome of the 3.6GHz award has a negative feedback effect on the MBSA that is now proposed, and the more successful a bidder was in the 3.6GHz auction the more negatively it affects them in the new MBSA. This undermines the efficient outcome of the 3.6GHz award.

If this was known at the time of the 3.6GHz auction, then bidders could have modified their bids accordingly, however it was not. Thus, the proposal to use a cap that includes 3.6GHz is contrary to the requirement to provide regulatory certainty.

Current Proposal is contrary to ComReg's statutory obligations

Three's view is that ComReg's current proposals are contrary to the following statutory obligations:

- Section 12 of 2002 Act which sets out that ComReg's objectives include being non-discriminatory and proportionate. In particular:
    - Regulation 16 of the Framework Regulations with ComReg's objectives to promote efficient investment and innovation in new and enhanced infrastructures, be non-discriminatory, proportionate and promote regulatory predictability by ensuring a consistent regulatory approach;
    - Regulation 11 of the Authorisation Regulations outlines that where ComReg decides to limit rights of use to particular operators it must: (a) give due weight to the need to maximise benefits for users and to facilitate the development of competition, and it shall grant such rights of use on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in section 12 of the Act of 2002 and Regulations 16 and 17 of the Framework Regulations.

For the reasons explained in this section, we have a real concern that ComReg's cap proposals are not compatible with the above legal requirements.

Proposed Solution

Three suggests that ComReg's award proposal should be revised in accordance with its statutory obligations. We propose the following cap structure:

- All spectrum caps should be symmetric and limited to bands available in the auction.
- At 700 MHz, the most appropriate cap is 2x10 MHz per operator. If ComReg prefers instead to have 2x15 MHz cap, then it must not use a CCA to allocate this band, as format is discriminatory given predictable asymmetries between MNOs.
- For bands above 1GHz, there should be a symmetric cap based only on spectrum in the auction. In Three's view, a cap no lower than 150 MHz per operator across 2.1GHz, 2.3GHz and 2.5GHz would provide all bidders with the flexibility they need to pursue realistic targets.

8. Coverage Obligations

ComReg has proposed to include 'precautionary' coverage obligations for any bidder who obtains spectrum in the 700MHz band within 7 years. This includes:

- a 3 Mbit/s service to 99% of the population and 92% of the geographic area of Ireland; and
- a 30 Mbit/s service to 95% of the population, 90% of motorways, and 80% of primary roads.

However, ComReg has not yet specified the percentage of coverage probability associated with these coverage obligations, which is quite important for radio coverage design (e.g: 92% of geographic area but with 85% coverage probability, or 90% coverage probability).

It is also worth noticing that landlords, whether individuals or companies, with a large portfolio of tower assets will be encouraged to inflate their prices around specific locations associated coverage requirements. Therefore, spectrum licensees should have some degree of flexibility as to how to achieve their coverage. This would allow operators to move away from landlords who sought to charge excessive rents from "captive" customers.

We assume that the number of sites to be rolled out as specified in table 24 is for the full duration of the license. We request that ComReg confirm this.

Bearing in mind that Ireland has a particularly challenging rural population profile, these obligations are at the upper-end of the what network operators could be expected to meet under competitive commercial conditions. Three supports ComReg's proposals in this regard for coverage but, cautions that any further obligations would likely act as a deterrent to bidders in the auction.

Additional Coverage

Three is aware that even with the above obligations, there may still be some locations where it is desirable to improve coverage, but not viable to do so under normal circumstances. ComReg observes that 'interventionist' obligations are ideally achieved via a sequential step in a spectrum award or through a separate process. Such mechanisms may provide advantages for the State in ensuring that the societal benefits obtained exceed the costs of any such obligations.

ComReg could add a stage to the award process in which winning bidders could further offer to trade licensee fees for coverage of these intervention areas.

We propose that ComReg allocate the coverage obligations in a separate reverse auction stage, using a second price sealed bid auction, similar to the standard format used for assignment rounds.

A sealed bid should be acceptable if coverage obligations are being sold independently from spectrum, as bidder values should be largely based on their own private estimates of roll-out costs, so price discovery is not required to alleviate common value uncertainty. The obligations would be awarded to the operators that submit the lowest bids, and they would pay a price based on the smallest losing bids. This approach provides excellent incentives for straightforward value-based bidding.

This format is also very flexible and it opens up an opportunity for ComReg to explore alternative structures for the design of coverage obligation lots and the types of bids permitted. For example, ComReg could divide the coverage obligations into regional obligations. This approach would allow the market to explore a broader range of solutions for allocating rural coverage across the three MNOs.

9. Time Slices

ComReg proposes that the 2.1 GHz band be divided into two time slices, one covering the period between the expiry of the Vodafone / Three licences and the later expiry of Eir's licence, and one for the remainder of the full licence term. Three disagrees with this approach, as it involves the creation of artificial lot with durations that do not correspond to bidders' real demands, and also makes the auction unnecessarily complex. We propose that ComReg instead adopts two categories of longer duration lots, one category starting when the Vodafone / Three licences expire, and the other when the Eir licences expire.

There is no real demand for short-term time slices. Bidders are planning the transition of 2100 MHz to support 4G and 5G, and require long-term certainty of ownership to support new investment in the band. The situation is not the same as in 2012, when bidders with 900 and 1800 MHz blocks had potential high value for short term extensions to ensure 2G service contiguity. With 3G approaching its end date, operators have more flexibility to adapt to the loss of this spectrum and, with three instead of four incumbents, the risk of any MNO not winning back valuable 2.1GHz spectrum is anyway low.

In Germany, the regulator (BNetzA) faced a similar situation in its 2019 spectrum auction, with 80 MHz of spectrum at 2100 MHz due to expire by 2021, but the remaining 40 MHz not due

to expire until 2026 (5 years later). After consulting with the industry, it rejected the time slice approach, and settled on selling two categories of lot: "long licences" starting in 2021 and "shorter licences" starting in 2026. All the licences expire in 2040, so the shortest duration available was 15 years. This approach was effective in selling all the spectrum to the three MNOs plus one new entrant in a highly competitive process.

ComReg should adopt the same approach in Ireland as in Germany with two categories of licence with common long-term expiry dates. This approach offers several advantages over time slicing:

- All licences have meaningful durations, so have standalone value without having to be combined with other licences in packages. This makes them easier to value and will make bidding decisions in the auction simpler. It also removes the necessity for combinatorial bidding, so a simpler auction design – such the hybrid clock-SMRA format proposed by DotEcon in the Netherlands could be adopted.

- With no time slicing at 2.1GHz, there would be no need to time slice other capacity bands. Therefore, a simpler lot structure consisting only of long-term licences can be adopted.

- Lots in the two licence categories can be given the same eligibility points as each other and as equivalent spectrum in the 2.3GHz and 2.5GHz bands, so as to facilitate switching between them in the auction. This should encourage straightforward bidding in the auction and promote price discovery.

As discussed further in Section 11, we also urge ComReg to adopt the same licence durations of up to 20 years as used in Germany. This would enable ComReg to sell 2.1 GHz in two categories, one of 20 years and one of 15 years. Longer durations are necessary to support long-term investments in new technologies. Having shorter licence durations in Ireland than it other European countries, such as Germany, would put the Irish economy at a competitive disadvantage in terms of enabling 5G and our digital future.

If, notwithstanding these arguments, ComReg decides to proceed with time slicing at 2.1GHz, it should not adopt the same time-slices in the 2.3GHz and 2.6GHz bands, for the following reasons:

1. The 2.3GHz and 2.6GHz bands are close substitutes for long-term incremental network capacity suitable for immediate deployment of 4G and, later, 5G. These bands will support new networks that will require long-term investment. Bidders in Ireland should get the opportunity to bid for clean licences covering the maximum licence term. This approach is the norm across Europe.

2. Although 2.1GHz is an alternative band for network capacity, for various reasons it is not as close a substitute for 2.3GHz and 2.6GHz as the other two bands are for each other. This is primarily because there are legacy issues concerning 2.1GHz deployment, and the two new bands will have a different commencement date than the 2.1GHz band in TS1.

3. Having time slices introduces a risk that bidders bid strategically for packages that break up bands over time which they do not expect to win but could be relevant for

price setting or obscuring price discovery. Whether or not this behaviour is particularly likely, ComReg should not facilitate it. If bidders make mistakes, this could lead to perverse and inefficient outcomes, with spectrum lying fallow for some time periods.

4. Adding time slices for 2.3GHz and 2.6GHz needlessly complicates the auction, requiring the use of package bidding and increasing the number of bid options. Removing the time slicing could make it possible to switch to a simpler auction format, such as the hybrid clock-SMRA proposed in the Netherlands, that would better meet ComReg's objectives. Even if a CCA is used, reducing the number of bid options would reduce the risk of bidder error and foreclose some strategic bidding options.

In conclusion, we urge ComReg to revisit its support for time slicing, which involves creating artificial lots that do not reflect bidder's real demands. There are better, simpler approaches, which would make bidding simpler and less risky, increasing the likelihood of an efficient auction outcome.

10. The 2.1GHz Licences

ComReg has proposed to provide the option for all existing licensees to liberalise some or all existing 2.1 GHz rights of use from the time of the substantive decisions concerning the present Proposed Award (expected to be H1 2020). "*Having carefully considered DotEcon's assessment, including its current benchmarking results for 2.1 GHz rights, ComReg does not propose to apply any additional fees for any liberalisation of existing 2.1 GHz licences for the period up until 15 October 2022*." Three agrees that there is no reliable method to derive the appropriate fee for this period

We note that Eir has previously committed (when the award was made) to pay the licence fees as specified and to operate its 3G licence according to the restrictions therein. These restrictions include the limitation that only 3G service can be provided. If Eir is to now be given an option to "liberalise" that licence, and if Eir takes up that option, then there must be some additional value to having the licence liberalised – otherwise Eir would not choose to accept the amendment. Given that the Eir licence for 2.1GHz will not expire for over 7 years, this increase in value is considerable, and would be a "windfall gain" for Eir alone. On this basis, there should be no circumstance under which Eir's licence is liberalised without payment of an additional fee.

Instead of trying to cater for liberalisation as proposed, ComReg should consider giving Eir the opportunity to "surrender its 2.1GHz spectrum back to ComReg to be re-awarded as liberalised spectrum. Future spectrum usage fees for the 3G licence would not then be incurred by Eir (although any remaining stage payments of spectrum access fees would still remain to be paid). This same option could be extended to both Vodafone and Three and if taken up by all three licensees, it would allow for liberalisation of all of the 2.1GHz band from the date of the award, elimination of time-slices from the award, and avoid the need to extend Three's licences. If Eir declines, then its current 3G licence should remain unamended until its expiry.

Extension to Three's 2.1GHz licences

ComReg proposes to:

- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing "A Licence" – which would commence on 25 July 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz A Licence);
- upon receipt of an appropriate application from Three, grant it interim 2.1 GHz rights of use - comprised of the frequencies in its existing "B Licence" – which would commence on 2 October 2022 and fully expire on 15 October 2022 (Interim 2.1 GHz B Licence);
- attach conditions to both the Interim 2.1 GHz A and B licences by reference to the current licence conditions in each of the existing "A Licence" and "B Licence", respectively, save for the removal of any obsolete conditions; and
- base the licence fees for each of the Interim 2.1 GHz A and B licences by reference to the licence fees for Vodafone's and Eir's existing 2.1 GHz licences, but updated to current day levels by reference to the overall consumer price index (CPI).

Three does not agree that this is an appropriate solution to the problem of different licence expiry dates. ComReg is required to provide for continuity in order to avoid disruption to consumers, and Three accepts that it would be desirable to common expiry dates for the 12 lots licensed to Three and Vodafone.

The proposed licence fee for extension is inappropriate and without rationale. ComReg will be well aware that the 3G licences were awarded under different circumstances than exist today, and valuations in 2002 were completely different to those that apply now. It is noted that two different licence types were issued in 2002, the "A" licence and the "B" licence. Different conditions are contained in both licences (and it would not be a simple task to quantify these differences), and different spectrum access fees were applied also. As the spectrum access fees have already been fully paid for the two licences, this should not be applied again when the purpose of the extension is to facilitate continuity of service while simplifying ComReg's re-award.

Notwithstanding the above, it is notable that ComReg does not propose to amend the licence conditions (save for the removal of any obsolete conditions) with the exception of the price. There is no logical reason why ComReg would seek to link the price for extension of Three's "A" licence to that of the "B" licence awarded to Vodafone in 2002 or Eir in 2007. The proposal to increase those licence fees by the change in CPI since 2002 is also without logical explanation. ComReg is well aware that the market value for award of liberalised spectrum today is significantly lower than for 3G service in 2002. ComReg's own estimate of the current market value for a 15 year licence is between €0.197 and €0.234 per MHz.pop, whereas ComReg is proposing to impose a fee for the licence extension that is multiples of this.

ComReg's proposal for 3G licence extension fees stands in contrast with the proposal to liberalise Eir's 3G licence up to 2027, which will be for free unless the value for 2.1GHz in the award exceeds the original licence fee. ComReg's approach does not represent equivalent treatment to Eir in largely comparable circumstances.

The proposed licence fee for licence extension is excessive, and is not acceptable to Three. We will assist ComReg in making the award simpler, and we agree that having multiple different expiry dates is not desirable, however this proposal would penalise Three by imposing inappropriate fees for licence extensions that are designed to facilitate the award process. This solution might be acceptable if appropriate extension fees were applied.

11. Licence Duration

At this time, the award is planned to take place during Q3 2020, however it is quite likely that licences awarded as a result of this process will not issue until the end of 2020. This is approximately the same time for transposition of the EECC into Irish law (the latest date is 21st December 2020) and EECC will take direct effect at that point in time. It is noted that in the meantime no action should be taken which would contradict EECC. ComReg has made reference to this new regulatory framework in its consultation, however, there seems to be little analysis of how ComReg's proposals comply with the requirements of the EECC which will likely be implemented by the time ComReg grants licenses under this award..

ComReg's proposal would see licence durations for the "Greenfield bands" (700MHz, 2.3GHz, 2.6GHz) of 15 years, and for the 2.1GHz band licence durations would be somewhat less than that at approximately 13 years. Three does not believe this proposal satisfies the obligations on National Regulatory Authorities (NRAs) as set out in Article 49 of the EECC. Article 49(2) sets out a minimum licence duration of 15 years and also provides for regulatory predictability over at least 20 years so that where a licence duration is of at least 15 years the general criteria for an extension of that licence needs to be set out in advance of granting rights of use i.e. at this stage.

> " *. . . 2. Where Member States grant individual rights of use for radio spectrum for which harmonised conditions have been set by technical implementing measures in accordance with Decision No 676/2002/EC in order to enable its use for wireless broadband electronic communications services ('wireless broadband services') for a limited period, they shall ensure regulatory predictability for the holders of the rights over a period of at least 20 years regarding conditions for investment in infrastructure which relies on the use of such radio spectrum, taking account of the requirements referred to in paragraph 1 of this Article. This Article is subject, where relevant, to any modification of the conditions attached to those rights of use in accordance with Article 18.*
>
> *To that end, Member States shall ensure that such rights are valid for a duration of at least 15 years and include, where necessary to comply with the first subparagraph, an adequate extension thereof, under the conditions laid down in this paragraph.*

> *Member States shall make available the general criteria for an extension of the duration of rights of use, in a transparent manner, to all interested parties in advance of granting rights of use, as part of the conditions laid down under Article 55(3) and (6). Such general criteria shall relate to . . .*"

Three has previously submitted comments to ComReg explaining why licence durations of greater than 15 years are required, so we will not repeat those here. We do wish to highlight that this is a particular concern for 5G networks. It will take a number of years yet before networks can be rolled-out and terminal equipment disseminated to a reasonable population. It will be several years before operators can expect to begin making a return on the investment in spectrum and networks.

Contrary to paragraph 6.102, it is noted that in the 2012 MBSA, the full licence duration was 17 years, as compared to 13 years here for 2.1GHz. In paragraph 6.120 ComReg states "As between Options 1 and 2 above, ComReg considers Option 1 to be preferable in light of the previous discussion about the suitability of 15 years duration, including that this would be consistent with the approach in the 2012 MBSA". This is not correct. ComReg's examination of other European countries does nothing to indicate that 15 is adequate, in fact it seems that 15 is the minimum, and 20 is more typical.

ComReg needs to review the proposals for licence duration against its obligations set out in EECC:

- to promote investment in high capacity networks;
- to act pursuant to the connectivity objective;
- regarding licence duration and how extensions are to be obtained set out in Article 49 of EECC.

Three is advised that under the principle of vertical direct effect a member state must not undermine / compromise the purpose of the EECC prior to its implementation. This would include the purpose of the EECC in articles 49 and 50 in ensuring legal certainty for operators regarding the duration of the spectrum license (regulatory certainty for 20 years required) and clarity in relation to the renewal of such licenses (procedures and mechanisms etc).

In addition, under the principle of indirect effect or conforming interpretation the EECC should be treated as being of 'persuasive' value in interpreting current Irish law requirements. This would include the interpretation of any 'grey areas' in relation to ComReg's relevant statutory objectives and powers (we note that ComReg's position of being 'mindful' of the EECC – including as outlined in this Consultation – acknowledges the relevance of this legal principle).

12. Minimum Prices

ComReg plans to derive the minimum licence fee by benchmarking to find the expected market value, and to split the upfront vs annual fees in a ratio of 4:6. Three agrees with the proposed split, and believes that the overall approach could be acceptable with some minor but important amendments.

ComReg needs to avoid the possibility of choking off demand by setting reserve prices too high. Benchmarking can only give reasonable indications of market price if the samples are taken from several comparable awards, and there is always a margin for error. We are now at the early stages of the 5G wave of spectrum awards, so the sample of awards that are comparable is still small. In the 5G era, most bidders will be adding to an existing spectrum portfolio, so will have an incremental value for more spectrum. This is not reflective of previous awards where market entry and/or renewal of existing licences were the primary concerns. Total revenues derived from the harmonised spectrum bands have declined in recent years, whereas the volume of spectrum in use has increased, so valuations can be expected to be lower in the 5G era.

Setting the minimum price slightly low is unlikely to have any impact on a competitive award process; however, setting it a little too high could prevent a bidder from entering the application stage, making the auction less competitive and potentially leaving some spectrum unsold. There is little or nothing to be lost by ComReg setting the minimum price at some margin below the benchmark, but there is increased risk of an inefficient award by setting it at or above the benchmark.

DotEcon has pointed out that the distributions of the licence price observations used in its samples do not follow a normal distribution, but rather are positively skewed with a long upper tail of higher values. DotEcon has recommended the use of a geometric mean rather than arithmetic mean to derive the benchmark prices (which itself demonstrates that the process is prone to error or interpretation). Three does not agree that this approach gives enough certainty that the benchmark prices will avoid choking off demand.

For the above reason, it is necessary to include a margin so that we can be reasonably sure that the auction has room to identify the efficient market outcome, ideally following a period of price discovery. Three believes ComReg has included some incorrect references in its benchmark and that these should be removed. Three also proposes that ComReg include a margin for price discovery. Reducing the minimum price by one standard deviation would achieve this without reducing the effectiveness of the minimum prices. We do not agree that using the geometric mean by itself provides this margin.

We note that in Table 13, DotEcon has included 800MHz and 900MHz spectrum in the samples for 700MHz. This is not appropriate, as 700MHz is to be awarded when there is already significant volume of sub-1GHz spectrum in use. It will most likely be used for 5G services which will have different business plans to those that existed over previous years for 2G, 3G, or 4G. It is to be expected that the market value for 700MHz will be less than that which applied in 2012 for 800MHz and 900MHz. Including these samples, in Three's view,sets the reserve too high, increasing the risk of choking demand at the application ,stage. We also believe that using samples from the previous 10 years is inappropriate, as the business cases for acquiring spectrum 10 years ago would not be comparable to those that exist today. If benchmarking is to be used, then the samples must be comparable.

For similar reasons to those outlined above, Three believes the benchmark for 2.1GHz spectrum is incorrect. Spectrum sold in the 3G era will have significantly different business cases and valuations than those of today. The benchmark should be adjusted to use only recent samples.

13. Licence Conditions

MVNO Obligations

In chapter 8 of the Consultation document, ComReg seeks views on whether it would be appropriate to include MVNO conditions in the licences. Three makes the following observations:

- Existing MVNOs have made a positive contribution to retail competition. ComReg's own analysis shows that there has been a re-distribution of market share away from MNOs in recent years, and the HHI has fallen from 0.346 to 0.322;
- There is no identified barrier to entry into the market by MVNOs that would be resolved by the imposition of mandatory MVNO conditions in licences;
- An MVNO obligation might act as a barrier to a new entrant bidder, particularly if they intended to buy only spectrum above 1GHz;
- Applying an MVNO obligation only to some bands might skew the auction towards certain bands and deliver an inefficient outcome.

For these reasons, it is neither necessary nor desirable to include an MVNO condition in the award licences.

Spectrum Transfers

Three agrees that the transfer and lease Regulations should apply to all bands in the award.

Three would also welcome the signing into law of the Statutory Instrument proposed to deal with leasing of spectrum.

Transition

Transition processes, if any, should favour the new spectrum licensee, and not the existing spectrum holder. While striking a balance between the need to provide for continuity of existing services and avoiding delay to new ones, ComReg should support licensees that that are willing to develop the market and not companies that only want to "sweat" their existing old assets. We should avoid the approach taken for the 3.6GHz spectrum award, where outgoing licensees held priority over new ones.

VoIP/VoWi-fi/VoLTE

Three does not agree with ComReg's proposal to mandate provision of native voice over Wi-fi (VoWi-fI) or voice over LTE (VoLTE) services as part of the spectrum award. This is in contradiction with the "technology neutral" approach normally taken by ComReg. It is possible that there will be a new entrant bidder in the auction who intends to focus only on data

provision. For this bidder a mandatory requirement to provide native VoIP or VoLTE represents an unnecessary burden that is a barrier to their acquisition of spectrum. This would particularly be the case if they intended to bid for a relatively small portion of the total spectrum available. Similarly, an existing licensee might wish to acquire additional spectrum from the new bands and intend to optimise their network in such a way that the incremental spectrum is used only to provide additional data capacity, while maintaining voice service on other technologies. This might be the most efficient configuration for that particular network, however it is ruled out if ComReg include a mandatory VoLTE/VoIP requirement.

Three is of the view that all licensees who provide voice service will eventually introduce the SIP/IMS technology when they are sure that the customer experience over a mobile network will be as good as that which customers have so far experienced with circuit-switch voice. This is not yet the case yet today for voice over VoWi-Fi and VoLTE. ComReg should let licensees decide whether or when it is most appropriate to introduce services like VoLTE.

We note that VoWi-fi is normally supplied over a fixed broadband service (normally using wired/fibre infrastructure), and that it would be incorrect to include any requirement in spectrum licences to require a wireless provider to invest in infrastructure to provide fixed network services. This would be an inappropriate condition that would discriminate against wireless only service providers in favour of wired ones.

Appendix 1 Legal Framework and Statutory Objectives

ComReg is obliged, when awarding spectrum and licenses to adhere to general regulatory principles, specific regulatory obligations and must also adhere to its statutory objectives and functions. These are all centred around the principles of non-discrimination, fairness, maintaining competition and investment in the market, ensuring regulatory certainty and consistency and efficiency of spectrum. We set out some of the relevant legislative provisions below, with key parts underlined.

Communications Regulation Act 2002

Objectives of Commission

12. (1) The objectives of the Commission in exercising its functions shall be as follows—

(a) in relation to the provision of electronic communications networks, electronic communications services and associated facilities—

i. to promote competition,

ii. to contribute to the development of the internal market, and

iii. to promote the interests of users within the Community,

12. (2) In relation to the objectives referred to in subsection (1)(a), the Commission shall take all reasonable measures which are aimed at achieving those objectives, including—

(b) in so far as contributing to the development of the internal market is concerned—

i. removing remaining obstacles to the provision of electronic communications networks, electronic communications services and associated facilities at Community level,

ii. encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity,

iii. ensuring that, in similar circumstances, <u>there is no discrimination in the treatment of undertakings providing electronic communications networks and services and associated facilities</u>, and

iv. co-operating with electronic communications national regulatory authorities in other Member States of the Community and with the Commission of the Community in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of Community law in this field, and

(c) in so far as promotion of the interests of users within the Community is concerned—

i. ensuring that all users have access to a universal service,

ii. ensuring a high level of protection for consumers in their dealings with suppliers, in particular by ensuring the availability of simple and inexpensive dispute resolution procedures carried out by a body that is independent of the parties involved,

iii. contributing to ensuring a high level of protection of personal data and privacy,

iv. promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available electronic communications services,

v. encouraging access to the internet at reasonable cost to users,

vi. addressing the needs of specific social groups, in particular disabled users, and

vii. ensuring that the integrity and security of public communications networks are maintained.

12. (3) In carrying out its functions, the Commission shall seek to ensure that measures taken by it are proportionate having regard to the objectives set out in this section.

12 (5) In carrying out its functions, the Commission shall have regard to international developments with regard to electronic communications networks and electronic communications services, associated facilities, postal services, the radio frequency spectrum and numbering.

12 (6) The Commission shall take the utmost account of the desirability that the exercise of its functions aimed at achieving the objectives referred to in subsection (1)(a) does not result in discrimination in favour of or against particular types of technology for the transmission of electronic communications services.

S.I. No. 333/2011 - European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011

Objectives of the Regulator

16. (1) In addition to, but without prejudice to, its objectives under section 12 of the Act of 2002, the Regulator shall—

(a) unless otherwise provided for in Regulation 17, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations having particular regard to those designed to ensure effective competition,

(b) in so far as the promotion of competition is concerned—

i. ensure that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality, and

ii. ensure that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector,

(c) in so far as contributing to the development of the internal market is concerned, co-operate with BEREC in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of European Union law in the field of electronic communications, and

(d) in so far as promotion of the interests of users within the European Union is concerned—

i. address the needs of specific social groups, in particular, elderly users and users with special social needs, and

ii. promote the ability of end-users to access and distribute information or use applications and services of their choice.

16 (2) In pursuit of its objectives under paragraph (1) and under section 12 of the Act of 2002, the Regulator shall apply objective, transparent, non-discriminatory and proportionate regulatory principles by, among other things—

(a) promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods,

(b) ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services,

(c) safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure based competition,

(d) promoting efficient investment and innovation in new and enhanced infrastructures, including by ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings and by permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, while ensuring that competition in the market and the principle of non-discrimination are preserved,

(e) taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State.

Management of radio frequencies for electronic communications services

17. (1) The Regulator shall, subject to any directions issued by the Minister under section 13 of the Act of 2002 and having regard to its objectives under section 12 of the Act of 2002, Regulation 16 and Article 8a of the Framework Directive, ensure—

(a) the effective management of radio frequencies for electronic communications services,

(b) that spectrum allocations used for electronic communications services and issuing of general authorisations or individual rights of use for such radio frequencies are based on objective, transparent, non-discriminatory and proportionate criteria, and

(c) that harmonisation of the use of radio frequency spectrum across the European Union is promoted, consistent with the need to ensure its effective and efficient use and in pursuit of benefits for the consumer such as economies of scale and interoperability of services, having regard to all decisions and measures adopted by the European Commission in accordance with the Radio Spectrum Decision.

Publication of procedures

A 2.49 Regulation 9(4)(a) of the Authorisation Regulations requires that ComReg, having regard to the provisions of Regulation 17 of the Framework Regulations, establish open, objective, transparent, non-discriminatory and proportionate procedures for the granting of rights of use for radio frequencies and cause any such procedures to be made publicly available.

Procedures for limiting the number of rights of use to be granted for radio frequencies

A 2.55 Regulation 11(2) of the Authorisation Regulations requires that, when granting the limited number of rights of use for radio frequencies it has decided upon, ComReg does so "…on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in Section 12 of the 2002 Act and Regulations 16 and 17 of the Framework Regulations."

A 2.56 Regulation 11(4) provides that where it decides to use competitive or comparative selection procedures, ComReg must, inter alia, ensure that such procedures are fair, reasonable, open and transparent to all interested parties.

Fees for spectrum rights of use

A 2.57 Regulation 19 of the Authorisation Regulations permits ComReg to impose fees for rights of use which reflect the need to ensure the optimal use of the radio frequency spectrum.

A 2.58 ComReg is required to ensure that any such fees are objectively justified, transparent, non-discriminatory and proportionate in relation to their intended purpose and take into account the objectives of ComReg as set out in Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations.

S.I. No. 335/2011 - European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011

Rights of use for radio frequencies

9. (2) The Regulator may grant individual rights of use for radio frequencies by way of a licence where it considers that one or more of the following criteria are applicable—

(a) it is necessary to avoid harmful interference,

(b) it is necessary to ensure technical quality of service,

(c) it is necessary to safeguard the efficient use of spectrum, or

(d) it is necessary to fulfil other objectives of general interest as defined by or on behalf of the Government or a Minister of the Government in conformity with European Union law.

9. (10) The Regulator shall not limit the number of rights of use for radio frequencies to be granted except where this is necessary to ensure the efficient use of radio frequencies in accordance with Regulation 11.

9. (11) The Regulator shall ensure that radio frequencies are efficiently and effectively used having regard to section 12(2)(*a*) of the Act of 2002 and Regulations 16(1) and 17(1) of the Framework Regulations. The Regulator shall ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies. For this purpose the Regulator may take appropriate measures such as mandating the sale or the lease of rights of use for radio frequencies.

Procedure for limiting the number of rights of use to be granted for radio frequencies

11. (1) Where the Regulator considers that the number of rights of use to be granted for radio frequencies should be limited or that the duration of existing rights of use for radio frequencies should be extended other than in accordance with the terms specified in the rights of use it shall, without prejudice to sections 13 and 37 of the Act of 2002,—

(a) give due weight to the need to maximise benefits for users and to facilitate the development of competition, and

(b) give all interested parties, including users and consumers, the opportunity to express their views in accordance with Regulation 12 of the Framework Regulations.

11. (2) The Regulator may decide, having taken into account the matters referred to in paragraph (1)(a) and (b), that the number of rights of use for radio frequencies referred to in that paragraph ought to be limited and, where the Regulator so decides, it shall grant such rights of use on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate and which give due weight to the achievement of the objectives set out in section 12 of the Act of 2002 and Regulations 16 and 17 of the Framework Regulations.

11. (4) Where the Regulator decides to use a competitive or comparative selection procedure for the purpose of granting rights of use for radio frequencies, the Regulator may extend the maximum period of 6 weeks referred to in Regulation 9(8) for as long as is necessary to ensure that such procedures are fair, reasonable, open and transparent to all interested parties, but by no longer than 8 months.

Directive (EU) 2018/1972 establishing the European Electronic Communications Code

Recital 23

The regulatory framework should, in addition to the existing three primary objectives of promoting competition, the internal market and end-user interests, pursue an additional connectivity objective, articulated in terms of outcomes: widespread access to and take-up of very high capacity networks for all citizens of the Union and Union businesses on the basis

of reasonable price and choice, effective and fair competition, open innovation, efficient use of radio spectrum,

Recital 62

Electronic communications broadband networks are becoming increasingly diverse in terms of technology, topology, medium used and ownership. Therefore, regulatory intervention must rely on detailed information regarding network roll-out in order to be effective and to target the areas where it is needed. That information is essential for the purpose of promoting investment, increasing connectivity across the Union and providing information to all relevant authorities and citizens.
Article 3

2. In the context of this Directive, the national regulatory and other competent authorities as well as BEREC, the Commission and the Member States shall pursue each of the following general objectives, which are not listed in order of priority:

> (a) promote connectivity and access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all citizens and businesses of the Union;

[The spectrum award will facilitate the deployment of very high capacity networks as defined under the EECC.]

Article 49 – Duration of Rights

1. Where Member States authorise the use of radio spectrum through individual rights of use for a limited period, they shall ensure that the right of use is granted for a period that is appropriate in light of the objectives pursued in accordance with Article 55(2), taking due account of the need to ensure competition, as well as, in particular, effective and efficient use of radio spectrum, and to promote innovation and efficient investments, including by allowing for an appropriate period for investment amortisation.

2. Where Member States grant individual rights of use for radio spectrum for which harmonised conditions have been set by technical implementing measures in accordance with Decision No 676/2002/EC in order to enable its use for wireless broadband electronic communications services ('wireless broadband services') for a limited period, they shall ensure regulatory predictability for the holders of the rights over a period of at least 20 years regarding conditions for investment in infrastructure which relies on the use of such radio spectrum, taking account of the requirements referred to in paragraph 1 of this Article. This Article is subject, where relevant, to any modification of the conditions attached to those rights of use in accordance with Article 18.

   To that end, Member States shall ensure that such rights are valid for a <u>duration of at least 15 years</u> and include, where necessary to comply with the first subparagraph, an adequate extension thereof, under the conditions laid down in this paragraph.

   Member States shall make available the general criteria for an extension of the duration of rights of use, in a transparent manner, to all interested parties in advance of granting rights of use, as part of the conditions laid down under Article 55(3) and (6). Such general criteria shall relate to:

(a) the need to ensure the effective and efficient use of the radio spectrum concerned, the objectives pursued in points (a) and (b) of Article 45(2), or the need to fulfil general interest objectives related to ensuring safety of life, public order, public security or defence; and

(b) the need to ensure undistorted competition.

At the latest two years before the expiry of the initial duration of an individual right of use, the competent authority shall conduct an objective and forward-looking assessment of the general criteria laid down for extension of the duration of that right of use in light of point (c) of Article 45(2). Provided that the competent authority has not initiated enforcement action for non-compliance with the conditions of the rights of use pursuant to Article 30, it shall grant the extension of the duration of the right of use unless it concludes that such an extension would not comply with the general criteria laid down in point (a) or (b) of the third subparagraph of this paragraph.

On the basis of that assessment, the competent authority shall notify the holder of the right as to whether the extension of the duration of the right of use is to be granted.

If such extension is not to be granted, the competent authority shall apply Article 48 for granting rights of use for that specific radio spectrum band.

Any measure under this paragraph shall be proportionate, non-discriminatory, transparent and reasoned.

By way of derogation from Article 23, interested parties shall have the opportunity to comment on any draft measure pursuant to the third and the fourth subparagraphs of this paragraph for a period of at least three months.

This paragraph is without prejudice to the application of Articles 19 and 30.

When establishing fees for rights of use, Member States shall take account of the mechanism provided for under this paragraph.

3. Where duly justified, Member States may derogate from paragraph 2 of this Article in the following cases:

(a) in limited geographical areas, where access to high-speed networks is severely deficient or absent and this is necessary to ensure achievement of the objectives of Article 45(2);

(b) for specific short-term projects;

(c) for experimental use;

(d) for uses of radio spectrum which, in accordance with Article 45(4) and (5), can coexist with wireless broadband services; or

(e) for alternative use of radio spectrum in accordance with Article 45(3).

4. Member States may adjust the duration of rights of use laid down in this Article to ensure the simultaneous expiry of the duration of rights in one or several bands.

Appendix 2 – Comments provided by NERA

Three asked NERA Economic Consulting (NERA) to review ComReg's proposals to use a combinatorial clock auction (CCA) together with asymmetric caps for this award. NERA is one of the world's leading experts on the use of the CCA, having advised bidders in the majority of auctions using this format worldwide, and also having implemented a CCA to award AWS spectrum in Mexico. Two of their team members were also involved in developing the CCA format in previous roles at DotEcon.

NERA advised that the CCA is not a good format for this award. They were particularly concerned about the use of a CCA for the 700 MHz band, given predictable asymmetries between bidders, especially if an asymmetric cap based on existing holdings was used. They said that this could result in highly asymmetric price outcomes, and that the process would predictably favour some bidders over others. They also highlighted the risk of gaming behaviour, especially given the inclusion of many bands and the use of a further asymmetric cap based on all spectrum holdings. They said that there was a material risk that the auction could result in a bad outcome for Ireland involving some combination of high overall prices, highly asymmetric prices and an inefficient award of spectrum across bidders.

To illustrate these points, NERA provided a number of simplified examples that show the scope for perverse pricing outcomes if ComReg proceeds with using a CCA with asymmetric caps.

Potential drawbacks of discriminatory pricing

In most auction markets, when bidders bid for the same thing at the same time, all winners pay the same unit price, as determined by the market. As ComReg acknowledges, the CCA uses a discriminatory pricing rule that may lead to bidders paying very different prices for the same thing. NERA previously provided a report to Three that expressed concern about the unfairness and other inefficiencies that may flow from not using a uniform price rule in the context of this award. Asymmetric price outcomes may be unfair, and a regulator implementing such an approach has a duty to demonstrate a clear efficiency rationale for deviating from uniform pricing.

In the consultation document, ComReg dismisses NERA's objection to discriminatory pricing in the context of Ireland's multiband award (Paragraphs 7.63-7.64). However, the arguments it presents in defense of the CCA are partial and superficial:

- ComReg argues that "*bidders paying comparable amounts is not an objective of the Proposed Award*." NERA agrees but says this misses the point. ComReg has a duty not to discriminate between bidders and having bidders pay different prices for the same thing is potentially discriminatory. To justify not using uniform pricing, ComReg should demonstrate that there is an efficiency rationale that can justify such discrimination.

- ComReg argues that uniform pricing "*may not be compatible with an efficient assignment because bidders (in a limited field of potential bidders) have incentives to keep prices down*", owing to incentives for strategic demand reduction. NERA acknowledges that incentives for demand reduction may be stronger in an SMRA or clock auction than in a CCA. However, demand reduction is only one of many forms of strategic play that might impact the efficiency of a complex multi-band auction and is typically one of the least distortive because, in a spectrum auction, bidders usually have a fairly good idea what spectrum they need and will not concede further spectrum without a fight. For this award, given the limited field of potential bidders and their predictable demands, NERA argues that a much bigger risk to efficiency is that bidders manipulate their bid amounts as a tool to put price pressure on rivals, a strategy made possible by the discriminatory pricing rule of the CCA.

- ComReg argues that "*a uniform price may result in lots going unsold unnecessarily or being assigned inefficiently to a bidder who is not the bidder that values them most, simply because in some cases it is impossible to achieve an efficient outcome with uniform prices when there are complementarities between lots*." NERA recognizes that this is a possibility, but does not agree that it is particularly likely, given the nature of the available spectrum and bidder demands. Such risks could also be lessened by not having time slicing for 2.3 GHz and 2.5 GHz, as argued by Three above.

Potential for asymmetric prices at 700 MHz

A simple example using the 700 MHz band illustrates the potential for gross unfairness when using a CCA to allocate 700 MHz in a scenario where there are only three strong bidders (i.e. the three MNOs in Ireland). Suppose there are 6 lots available and all three bidders are capped at 3 lots each. Further, suppose that the efficient outcome is to allocate 2 lots to each bidder, but all bidders have some value above reserve for a 3rd lot. If all bidders bid to value, then each bidder will win 2 lots and pay the sum of the values for a 3rd lot expressed by the two other bidders. By definition, this means that the bidder with the highest value for the 3rd lot will pay the least, and the bidder with the lowest value for the 3rd lot will pay the most. This is illustrated in example 1 below.

In general, valuations for marginal spectrum can be expected to trend with market share. Therefore, other factors being equal, this approach will predictably lead to the strongest incumbent paying less than the weakest incumbent for the same amount of spectrum. The greater the market share disparity and resulting gap in valuations between bidders, the greater the likely difference in price (assuming bidders bid straightforwardly).

Example 1: Asymmetric prices

This example illustrates the discriminatory nature of the opportunity cost pricing rule in the CCA, even under symmetric spectrum caps.

For illustrative purposes, we focus on the 700 MHz band with 6 identical lots available. Suppose there are only three strong bidders (i.e. the three MNOs in Ireland), and all three bidders are symmetrically capped at three lots each. We assume the following simple valuations for three lots:

Bidder	2x5 MHz	2x10 MHz	2x15 MHz
THR	€40	€110	€130
VOD	€50	€120	€170
EIR	€40	€100	€115

If the reserve price is set at e.g. €10, the efficient outcome is to allocate two lots to each bidder. With the valuations above, this yields a total value of €330, which is more than any other feasible combination of bids and unsold lots at reserve price.

In this example, all bidders have a positive value above reserve price for a 3rd lot. These are the marginal values that set prices. If all bidders bid full valuation, then each bidder will win two lots and pay the sum of the valuations for a 3rd lot expressed by the two other bidders.

Bidder	Winning package	Price	Price setting bids
THR	2x10 MHz	€65	€50 (VOD 3rd) + €15 (EIR 3rd)
VOD	2x10 MHz	€35	€20 (THR 3rd) + €15 (EIR 3rd)
EIR	2x10 MHz	€70	€20 (THR 3rd) + €50 (VOD 3rd)

The bidder with the highest value for the 3rd lot (VOD) will pay the least, while the bidder with the lowest value for the 3rd lot (EIR) will pay the most. Under these simple, yet realistic, demand conditions, the CCA produces prices that are discriminatory against weaker bidders. This follows immediately from the opportunity cost pricing rule in the CCA.

This example illustrates the discriminatory nature of the opportunity cost pricing rule in the CCA, even under symmetric spectrum caps.

Impact of asymmetric spectrum caps

Now consider the same example but suppose that one of the bidders is uniquely capped at 2 lots. The other two bidders can express a value for a 3rd lot, but the capped bidder cannot.

The two uncapped bidders are guaranteed to secure one of their 2 lots at reserve, and only pay each other's opportunity cost for the other lot. In contrast, the capped bidder will always pay more, as it must pay opportunity cost for both lots that it wins. Thus, the capped bidder enters the auction at a significant disadvantage.[13]

The asymmetry in prices paid under these conditions could be large, depending on the valuation structure. The package bid structure does protect a "weaker bidder" against a scenario where they might win only 1 lot at a price at which they would prefer nothing (relevant only if their value for 1 lot is less than half their value for 2 lots). However, this is not an attractive feature for a bidder that expects to win 2 lots but has a predictably modest value for a 3rd block or is prevented by caps from expressing a value for 3rd block.

Example 2: Asymmetric caps

This example illustrates the impact of asymmetric caps on the opportunity cost pricing rule in the CCA. Again, for simplicity, we focus on the 700 MHz band with 6 identical lots available. Continuing from Example 1, suppose bidder valuations are as follows:

Bidder	2x5 MHz	2x10 MHz	2x15 MHz
THR	€40	€110	Not allowed
VOD	€50	€120	€170
EIR	€40	€100	€115

The only difference to Example 1 is that THR is capped at two lots, so a bid for 2x15 MHz is not allowed. This does not change the result, and the efficient outcome is for each bidder to win two lots. However, it does change the price outcome.

Bidder	Winning package	Price	Price setting bids
THR	2x10 MHz	€65	€50 (VOD 3rd) + €15 (EIR 3rd)
VOD	2x10 MHz	€25	€15 (EIR 3rd) + €10 reserve price
EIR	2x10 MHz	€60	€50 (VOD 3rd) + €10 reserve price

Observe that the prices paid by VOD and EIR are now €10 less than in Example 1, whereas THR has to pay the same price. This change occurs because THR is not able to express a value for the 3rd lot, thus reducing the opportunity cost price for its two rivals. The asymmetry of prices is therefore increased.

This result holds generally for the caps proposed by ComReg (two lots for Three, and three lots for Vodafone/Eir). Assuming no entrant bidder and no unallocated lots, there are six possible outcomes/scenarios for the 700 MHz band (in terms of the number of 2x5 MHz lots):

[13] A detailed example is provided in Annex 1, example 2.

Bidder	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
THR	2	1	1	2	2	0
VOD	2	3	2	3	1	3
EIR	2	2	3	1	3	3

For each of these six scenarios, the total post-auction allocation of sub-1 GHz spectrum at 700, 800 and 900 MHz is as follows:

Bidder	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
THR	7	6	6	7	7	5
VOD	6	7	6	7	5	7
EIR	6	6	7	5	7	7

In the first three scenarios, one MNO has 7 lots while two other MNOs have 6 lots. In the final three scenarios, one MNO has 5 lots while two other MNOs have 7 lots.

The table below illustrates the built-in asymmetry in pricing when asymmetric spectrum caps are imposed. In all six scenarios, Vodafone and Eir are effectively granted one lot at reserve price. This follows directly from the fact that Three is unable to express a value for a 3rd lot.

	Price setting bids					
Bidder	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**	**Scenario 6**
THR	VOD 7 EIR 7	EIR 7	VOD 7	EIR 6 EIR 7	VOD 6 VOD 7	N/A
VOD	EIR 7 **reserve**	THR 7 EIR 7 **reserve**	THR 7 **reserve**	EIR 6 EIR 7 **reserve**	**reserve**	THR 6 THR 7 **reserve**
EIR	VOD 7 **reserve**	THR 7 **reserve**	THR 7 VOD 7 **reserve**	**reserve**	VOD 6 VOD 7 **reserve**	THR 6 THR 7 **reserve**

It should be clear from these examples that using a CCA design to award 700 MHz if bidders have these demand structures would be discriminatory. This is true with symmetric caps and even more so if, as proposed, an asymmetric cap is used. In this case, the format obviously disadvantages the bidder with the lowest value for a 3rd lot, which is likely Eir (given its lower market share), and advantages the bidder with the expected highest value, which is likely Vodafone (given its higher market share and slightly lower pre-existing sub-1 GHz holdings versus Three). Overlaying an asymmetric cap weakens Three versus the other two bidders, but it does nothing to address the asymmetry between Eir and Vodafone. Indeed, the predictable reduction in price for Vodafone flowing from the restriction on Three might even encourage Vodafone to pursue a more aggressive bid strategy, to the detriment of Eir.

Such discrimination may also have an efficiency impact. Firstly, policies that increase the cost of an essential input for some MNOs and not others may differentially affect their ability to invest in the downstream market. Secondly, when you confront bidders with an auction design that obviously advantages some players over others, it is only reasonable to expect that the disadvantaged bidders will look for opportunities to manipulate their bids to try to neutralise the advantage of their rivals. In particular, bidders may be incentivised to overstate their willingness to pay for incremental spectrum so as to place reciprocal price pressure on rivals.

Impact of extending example to a multiband setting

The same concerns identified at 700 MHz also apply in a multi-band setting, but the advantages and disadvantages of particular bidders may vary across bands. In Example 3, NERA consider the setup proposed by ComReg with multiple bands and two caps based on existing holdings. For simplicity, they ignore time slices. The example illustrates the scope for large price differences to emerge between bidders as result of the asymmetric cap.

Example 3: Multi band context

We assume a 70 MHz cap for sub 1-GHz spectrum, and a 375 MHz cap for all useable spectrum (i.e. at the lower end of the range considered by ComReg. Suppose that the auction produces an outcome in which spectrum is divided roughly equally between the three MNOs, as follows:

	THR	VOD	EIR	
700 MHz FDD	20	20	20	Awarded in auction
800 MHz FDD	*20*	*20*	*20*	*Existing holdings*
900 MHz FDD	*30*	*20*	*20*	*Existing holdings*
Sub 1 GHz	**70**	**60**	**60**	
1800 MHz FDD	*70*	*50*	*30*	*Existing holdings*
2100 MHz FDD	40	40	40	Awarded in auction
2300 MHz TDD	40	30	30	Awarded in auction
2600 MHz FDD	40	50	50	Awarded in auction
2600 MHz TDD	15	15	10	Awarded in auction
3500 MHz TDD	*100*	*105*	*85*	*Existing holdings*
Sup 1 GHz	**305**	**290**	**245**	
Overall MHz	**375**	**350**	**305**	
MHz won in auction	155	155	150	

In this example, THR does not have much pricing power as it wins a package that reaches both spectrum caps. In contrast, although VOD and EIR win similar amounts of spectrum in the auction, these amounts are less than their spectrum caps, and as a result these bidders do have pricing power.

Suppose that all bidders follow a strategy of repeating a price setting bid for a large package until clock prices have doubled, and then drop straight to the outcome above. Such price setting bids may be as follows:

	THR	VOD	EIR
700 MHz FDD	20	30	30
800 MHz FDD	*20*	*20*	*20*
900 MHz FDD	*30*	*20*	*20*
Sub 1 GHz	**70**	**70**	**70**
1800 MHz FDD	*70*	*50*	*30*
2100 MHz FDD	60	60	60
2300 MHz TDD	30	30	50
2600 MHz FDD	45	60	80
2600 MHz TDD	0	0	0
3500 MHz TDD	*100*	*105*	*85*
Sup 1 GHz	**305**	**305**	**305**
Overall MHz	**375**	**375**	**375**
MHz bid in auction	155	180	220
Bid value	**78,923,068**	**96,385,788**	**102,735,876**

All these price setting bids are deliberately constructed such that (i) all spectrum caps are fully used, (ii) price-setting bids are biased towards more expensive packages, and (iii) all combinations of two bids are feasible winning combinations.

With these price setting bids, auction prices break down as follows:

	THR	VOD	EIR
THR price setting bid	-	78,923,068	78,923,068
VOD price setting bid	96,385,788	-	96,385,788
EIR price setting bid	102,735,876	102,735,876	-
Value of unsold lots	4,762,572	13,493,932	16,668,976
Max alternative value	**203,884,236**	**195,152,876**	**191,977,832**
THR winning bid	-	69,813,526	69,813,526
VOD winning bid	69,813,522	-	69,813,522
EIR winning bid	69,019,760	69,019,760	-

Max winning value	**138,833,282**	**138,833,286**	**139,627,048**
Auction price	**65,050,954**	**56,319,590**	**52,350,784**

In this case, THR pays roughly €10m more than VOD and roughly €13m more than EIR (although EIR wins a slightly smaller package). The price difference is an artefact of the asymmetric cap which allowed EIR and VOD to impose prices on THR that could not be reciprocated.

This example assumes some degree of strategic bidding. NERA think this is a reasonable assumption, given the obvious scope for bidders to improve relative outcomes by manipulating bid values for larger packages. This is possible because there is only a small pool of bidders with relatively predictable valuation structures. Moreover, there is a material risk that bidders are much more aggressive in their strategic bidding. For example, consider the possibility that Eir deliberately overbids for packages containing larger, unwinnable quantities of spectrum in higher frequency bands as a way to try and reciprocate potential price pressure from Vodafone in the sub-1 GHz band.

Lessons from theory and practice

NERA pointed out that there is now a substantial academic literature showing that combinatorial auctions, such as the CCA, have a mixed track record with regard to outcome efficiency versus more traditional auction formats.[14] In particular, contrary to initial expectations, the CCA format has not been very effective in discouraging strategic bids that deviate from valuations, even if it has changed the type of strategic bidding.[15]

NERA note that the Dutch Ministry of Economic Affairs has just released a DotEcon report on their upcoming multiband auction for spectrum in the 700, 1400 and 2100 MHz bands, which recommends a hybrid SMRA-clock auction with a uniform pricing rule.[16] Consistent with NERA's arguments and the examples developed above, DotEcon argues that the CCA format is problematic if implemented with asymmetric spectrum caps:

> *"If a combinatorial format had to be used, there would be a choice between formats that use a pay-as-bid rule (such as the CMRA and the SCA) and those that employ a second pricing approach (such as the CCA, which sets prices on the basis of opportunity costs calculated from the bids made by bidders, and the ECCA, which sets prices with reference to the largest*

[14] See, for example, papers by Kagel, Lien and Milgrom (2010), Bichler, Shabalin and Wolf (2013), and Bichler, Goeree, Mayer and Shabalin (2014), which report the results of lab experiments comparing the efficiency of CCA-type auctions versus standard formats, such as the SMRA. In each case, the CCA performed poorly, especially in more complex settings.

[15] For a discussion of this issue, see: Marsden and Sorensen, "Strategic Bidding in Combinatorial Clock Auctions – a Bidder Perspective", Handbook of Spectrum Auctions, Cambridge University Press, 2017.

[16] "Recommended auction model for the award of 700, 1400 and 2100 MHz spectrum", DotEcon, July 2019. Prepared for the Dutch Ministry of Economic Affairs.

bids that competitors could make under the activity rules). Given the simplicity of pay-as-bid pricing and the potential concerns about the impact of the asymmetry in the amount of spectrum that different bidders can acquire under the caps on bidding behaviour, we would prefer a pay-as-bid format over a format that relies on opportunity-cost based pricing.

Where bidders are strongly motivated by relative performance, they may also be concerned about placing bids that ensure that others pay sufficiently high prices for their winnings. In this respect, using a second price rule is potentially more of a concern where spectrum caps have an asymmetric impact on bidders' ability to bid for additional spectrum in the auction. This is the case under the spectrum caps proposed for the auction. Under such asymmetric constraints the ability of bidders to set each other's prices is uneven and attempts to exploit this asymmetry through strategic bidding may result in inefficient outcomes."

The situation in the Netherlands is not unlike the situation in Ireland. In both cases, the market has in recent years been reduced from four MNOs to three MNOs after a merger, and this has in turn led regulators to propose asymmetric caps (capping the merged entity harder due to relatively large spectrum holdings in some bands).

The use of a CCA to assign multiple bands simultaneously, as proposed in Ireland, greatly increases the scope for strategic use of package bids to set prices for rivals in situations where there is a limited pool of bidders and demand structures are fairly predictable. For example, a bidder that is in a weak position at 700 MHz may overbid in another band as a way of placing reciprocal pressure on a stronger rival to back down.

According to NERA, regulators that run CCAs have tended to underplay the scope for strategic overbidding in the CCA, on the basis that this is risky. In practice, such behaviour is often not particularly risky because MNOs have fairly predictable demand and valuation hierarchies. The very same factors that ComReg highlights as potential triggers for demand reduction may also drive incentives for overbidding in a CCA. Moreover, ComReg should be much more worried about overbidding because if bidders overplay their hands, as this could lead to both high prices and inefficiencies in the auction outcome.

This is not an abstract concern. There have been repeated examples of CCAs producing peculiar results in which bidders pay unusually high prices or major MNOs are knocked out of key bands, including:

the 2012 UK 4G auction (800 and 2600 MHz), where Telefonica O2 won no spectrum at 2.6 GHz, whereas spectrum leader EE won 2x35 MHz, but prices were low compared to the high level of some bids submitted;

the 2013 Austrian 4G auction (800, 1800), where our sister company Three Austria won only 2x5 MHz across the 800 and 900 MHz bands in a 3-player auction, and all bidders paid exceptionally high prices; and

the 2019 Canadian 5G auction (600 MHz), where one national operator (Bell) failed to win any spectrum and the other two (Rogers and TELUS) paid very high prices.

In NERA's view, the CCA works best in markets where a losing bidder is setting (symmetric) prices for winning bidders. Unfortunately, this is not the standard scenario for most spectrum auctions in Europe, where there is typically a small pool of established MNOs competing for incremental spectrum. For the forthcoming Irish auction, ComReg cannot rely on an entrant to resolve this problem. Instead ComReg should implement an auction format that is robust to all competition scenarios, including a thin market with only three MNOs participating. As in the Netherlands, the hybrid clock-SMRA better is a better fit for this requirement than the CCA.

Conclusions

NERA recommends against the use of a CCA for the forthcoming multi-band auction in Ireland. The format cannot be relied on to produce an efficient allocation of spectrum nor prices that fairly reflect the market value. This is because there are strong incentives for bidders to distort their bids either as defensive or offensive strategies that manipulate prices paid by rivals, incentives that flow directly from the predictable asymmetries across a limited pool of bidders. NERA recommends that ComReg consider using DotEcon's hybrid clock-SMRA design, as used for the UK 5G award (2018) and proposed for the forthcoming Netherlands 5G award. NERA notes that ComReg's proposal to set high reserve prices ensures substantial revenues even if there is low competition and diminishes any incentives for demand reduction associated with this pay-your-bid format.

If ComReg decided, despite these drawbacks, to proceed with a CCA, then NERA recommends that ComReg consider the following changes:

Setting a low symmetric cap (2x10 MHz) at 700 MHz that removes scope for asymmetric price setting by MNOs in this band, relying instead on entrant bidders and/or the reserve price bids to set opportunity cost in this key band

Setting a symmetric cap across the high frequency bands (e.g. 150 MHz or higher across 2.1GHz, 2.3 GHz and 2.5 GHz), so pricing power is more balanced across operators.

Simplifying the lot structure by abandoning time slicing, so as to reduce the number of package bid options (at 2.1GHz, there could be two categories of long-term licences with different starting dates but common expiry dates, as proposed by Three above).

3 Vodafone email 08.10.2019

From:	Farrell, Eamon, Vodafone Ireland
To:	James Eivers; XX ANDREW CORCORAN
Cc:	Joseph Coughlan; Market Framework Consult
Subject:	RE: [Confidential] Vodafone Submission to ComReg Document 1959.
Date:	08 October 2019 11:32:39
Attachments:	image002.png image003.png image004.png Vodafone Consultation Response to Comreg Doc 1959 MBSA v1.4 nonconfidential version_Redacted.pdf

Dear James,

Thank you for your email below.

Firstly, our comment on the Spectrum cap should have read *"For the overall figure, we submit that the value range proposed by ComReg are reasonable and we favour the 420MHz figure"*.

Secondly we now attach a non-confidential version of our submission that we are happy for ComReg to publish.

[redacted]

Regards

Eamon

Eamon Farrell
Strategic Network Programmes Manager
STAT- External Affairs

Vodafone Ireland Limited, Registered Office:
MountainView, Leopardstown, Dublin 18,
Registered in Ireland: No. 326967
[redacted]

[redacted]
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The future is exciting.
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4 Rurtel System Requests for Information

4.1 Comreg Information Request of Eir 26.09.2019

From: Conor Berkeley
Sent: 26 September 2019 15:59
To: XX WILLIAM MCCOUBREY
Subject: [Confidential] Information request regarding Eir's licences in the 2.3 GHz Band (RurTel Network)

Hi William,

As you will be aware, ComReg is currently progressing its proposals for a Multi-Band Spectrum Award ("MBSA") to assign rights of use in the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz bands.

ComReg's current proposals are set out in ComReg **Document 19/59R** and submissions from interested parties to this consultation have now been received, including a submission from Eir.

As part of the MBSA process, ComReg commissioned Plum to conduct an analysis of Eir's RurTel network in the 2.3 GHz band, the results of which are published in Document 19/59d. The information which informed this study was obtained from Eir and as such ComReg now requires an update to this information and any new information that may be available since the last correspondence from Eir on 3 December 2018.

In this regard, please see attached a letter requesting this information for your urgent attention. A hardcopy will follow in the post today.

Please let me know if you have any questions regarding the information requested.

Kind regards,

Conor

Conor Berkeley
Bainisteoir, Comhoiriúnacht & Forbairt Speictrim
Manager, Spectrum Compatibility & Development
An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
Uimh. a hAon Lárcheantar na nDugaí, Sráid na nGildeanna, BÁC 1, Éire, D01 E4X0
One Dockland Central, Guild Street, Dublin 1, Ireland, D01 E4X0
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Suíomh | Website www.comreg.ie

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

27 September 2019

Mr William McCoubrey
Eircom PLC t/a Eir
2022 Bianconi Avenue
Citywest Business Campus
Dublin 24

By registered post

Information request regarding Eir's licences in the 2.3 GHz Band used for its RurTel network

Dear William,

Background

As you will be aware, ComReg is currently progressing its proposals for a Multi-Band Spectrum Award ("MBSA") to assign rights of use in the 700 MHz, 2.1 GHz, 2.3 GHz and 2.6 GHz bands. ComReg's current proposals are set out in ComReg **Document 19/59R** and submissions from interested parties to this consultation have now been received, including a submission from Eir.

Consideration of Eir's current Wireless Telegraphy Act licences in the frequency ranges 2308 – 2326 MHz and 2402 – 2420 MHz (i.e. Eir's RurTel licences) has formed part of ComReg's MBSA proposals in relation to the 2.3 GHz band. See, for example:

- **ComReg Document 19/59d** ("Plum 2.3 GHz Sharing Analysis") which sets out Plum Consulting Ltd's (Plum) analysis of the potential compatibility between future MFCN base stations and the existing RurTel network;
- **Section 6.2.3 of Document 19/59R** which sets out ComReg's 2.3 GHz band plan proposals and in-band compatibility considerations;
- **Section 7.5.1 of Document 19/59R** which sets out ComReg's proposals for frequency-generic or frequency-specific lots; and
- **Section 9.3 of Document 19/59R** which sets out ComReg's transition arrangements proposals in respect of Eir's RurTel network.

In relation to the technical characteristics of Eir's RurTel network used to develop Document 19/59d, Plum modelled the interference from MFCN base stations ("BS") into RurTel BS receivers based on a number of assumptions. Specifically, due to the limited information currently available on RurTel BS receiver performance, three received power levels at the RurTel BS receiver were assumed[1] by which to calculate a low, medium and high received power level. In the modelling, the composite interference areas surrounding RurTel BS receivers were determined (see Section 6.2.3 of Document 19/59R). The RurTel BS receive parameters and assumed modelling parameters are outlined in A.2 and A.3 of Document 19/59d respectively.

[1] Specifically, the three power levels are -45 dBm (maximum), -62 dBm (median) and -94.5 dBm (minimum)

Annex C of Document 19/59d sets out the RurTel site location data and site names used in Plum's modelling. This is based on an Eir 2009 dataset of its RurTel licences[2] containing a number of technical parameters, including: locations (eastings and northings) of BS, EIRP of all deployed transmitters, and the antenna height of transmitters and receivers. Plum conducted its analysis based on this dataset noting a number of modifications to BS coordinates due to bad data (i.e. locations in the sea). The original 2009 Dataset is at ANNEX 1 to this letter.

ComReg notes that, in its submission to 19/59R, Eir did not provide any observations or comments in relation to the 2.3 GHz band analysis contained in 19/59d.

Previous interactions with Eir, including information requests

As you will also be aware, ComReg has engaged with Eir staff on numerous occasions in order to obtain relevant information regarding Eir's RurTel network. To-date, the correspondence between ComReg and Eir has consisted of:

- a meeting between Eir and ComReg staff on 20 November 2017;
- ComReg's written information request of 28 November 2017 and Eir's response to same of 15 January 2018; and
- ComReg's further written information request of 12 November 2018 and Eir's response to same of 3 December 2018.

ComReg acknowledges and appreciates Eir's co-operation in relation to the information provided to-date. However, in order to progress ComReg's considerations of its MBSA proposals for the 2.3 GHz band ComReg now requests Eir to provide updated and further information on its RurTel network particularly in relation to:

- number of active customers on the RurTel network;
- migration activities and locations of remaining RurTel customers; and
- technical parameters,

as detailed below.

Information Request

1. Number of active customers on the RurTel network

In its response of 3 December 2018, Eir identified 87 active customers on the RurTel network: 2 in Kerry, 77 in Donegal and 8 in Galway.

i. Please identify the current number of active customers on the RurTel network for each of the three geographic areas identified below:

[2] This dataset was provided by Eir in April 2009 following a request from ComReg relating to a 2.3 GHz MoU with the UK.

Geographical Area	Kerry Area	Donegal Area	Galway Area	Total
Number of Active Customers				

2. Migration activities and locations of remaining RurTel customers

In its response of 15 January 2018, Eir indicated that there was ongoing analysis in relation to the number of customers served from each base station and their locations.

In its December 2018 correspondence Eir indicated that: *"Surveys are to be carried out to investigate the feasibility of providing alternative fixed voice solutions (e.g. Fixed Cellular Service) for the few remaining customers active on the Kerry and Galway RurTel systems. If it is feasible to migrate all of the active customers to an alternative fixed voice solution then the systems would be decommissioned following customer migration. A similar exercise would then be conducted for Donegal."*

In that regard, ComReg requests the following information on Eir's migration activities and plans.

ii. Please provide details of any migration activities carried out, sites decommissioned, RurTel licences cancelled etc since Eir's December 2018 response;

iii. Please provide details on the results of Eir's investigation to provide alternative fixed voice solutions for the remaining customers active on each of the Kerry and Galway RurTel systems (currently understood by ComReg to be 2 and 8, respectively), and what was the outcome of this investigation;

iv. For each customer currently active on the Kerry and Galway RurTel systems (if any), please:
   a. identify the customer premises co-ordinates (in the format of latitude (DD MM SS) and longitude (DD MM SS)) or the customer's address and Eircode; and
   b. indicate which RurTel BS from which the customer is being provided service.

v. Please provide details on Eir's migration activities and plans for the Donegal RurTel system, including whether an exercise similar to that understood to be carried out for Kerry and Galway has been carried out or is planned to be carried out in the near future, and what was the outcome of this exercise.

vi. For each customer currently active on the Donegal RurTel system (if any), please:
   a. identify the customer premises co-ordinates (in the format of Latitude (DD MM SS) and Longitude (DD MM SS)) or the customer's address and Eircode; and
   b. indicate which RurTel BS from which the customer is being provided service.

vii. Please provide details of any ongoing analysis in relation to the number of customers served from each BS and their locations.

In relation to ComReg's request for information on the locations of remaining RurTel customers and GDPR obligations, it should be noted that ComReg is required by legislation to process personal data

related to its regulatory functions. In the present case, ComReg is carrying out tasks in the public interest and in the exercise of its official authority. Among other things, the GDPR provides that processing shall be lawful if and to the extent that the "processing is necessary for compliance with a legal obligation to which the controller is subject".

3. Technical Parameters

In response to ComReg's request of 12 November 2018 of technical details of the RurTel network (see Annex 2 to this letter), Eir stated in its response of 3 December 2018 that:

> *"We are not currently in a position to answer this question. The records on the network systems are insufficient to provide the details requested. Physical surveys are required."*

In that regard, ComReg requests the following information.

viii. Please provide updated information in relation to the technical parameters of the RurTel network (as described in Annex 02 to this letter) and the results of any physical surveys that have been completed by Eir; and

ix. In the absence of updated information on the technical parameters requested in (viii) above, Eir is requested to provide comments and observations in relation to the technical assumptions made by Plum in ComReg Document 19/59d. For example, as their accuracy or otherwise. Specifically, ComReg requests comments and observations in relation to:
   a. the RurTel Base Station Receive Parameters and Assumed Modelling Parameters outlined in **A.2** and **A.3 of Document 19/59d** respectively; and
   b. the RurTel site location and site names data in **Appendix C of Document 19/59d**.

ComReg would be grateful if Eir would provide the requested information by COB Friday 11 October 2019.

ComReg may rely on and/or publish some of the above information if required and, in this regard, Eir is invited to clearly identify in its response what material it considers to be genuinely confidential and the reasons for same.

Please note that ComReg reserves its rights to seek the above information under section 13D of the Communications Regulation Act 2002 (as amended).

If you wish to discuss any of the above, please feel free to contact me.

Yours sincerely

Conor Berkeley

Manager, Spectrum Compatibility & Development

Annex 1

	Transmit Freq.	Units	Transmit Site	Location (NG)	Lat.	Long.	Antenna height(m)	Emission	Receive Site	Location(NG)	Lat.	Long.	Bearing	Dist. (Km)	Power (dBW)	EIRP (dBW)	Gain (dBi)	Polariz.
Rurtel	2408.0	MHz	Baureagh DK	E08820N06125	51N4733	09W3714	008.0	2M00G7EJT	Gearha DK	E09550N06425	51N4915	09W3057	066.0	07.9	00.0	01.0	06.0	V
Rurtel	2314.0	MHz	Gearha DK	E09550N06425	51N4915	09W3057	008.0	2M00G7EJT	Killarney DK	E09951N09251	52N0432	09W2757	007.0	28.5	00.0	01.0	06.0	v
Rurtel	2314.0	MHz	Gearha DK	E09550N06425	51N4915	09W3057	008.0	2M00G7EJT	Knockbrack	E09825N06990	51N5220	09W2839	025.0	06.3	00.0	01.0	06.0	v
Rurtel	2322.0	MHz	Gearha DK	E09550N06425	51N4915	09W3057	008.0	2M00G7EJT	Currabeg DK	E09550N07040	51N5234	09W3104	359.0	06.2	00.0	01.0	06.0	v
Rurtel	2310.0	MHz	Capparoe DK	E081100N069300	51N5148	09W4334	030.0	2M00G7EJT	Clogherane	E007890N05550	51N4420	09W4512	188.0	14.0	00.0	01.0	06.0	V
Rurtel	2318.0	MHz	Capparoe DK	E081100N069300	51N5148	09W4334	030.0	2M00G7EJT	Inchee DK	E110230N077190	51N5623	09W1820	073.5	30.2	00.0	01.0	06.0	v
Rurtel	2318.0	MHz	Capparoe DK	E081100N069300	51N5148	09W4334	030.0	2M00G7EJT	Derryquinn	E07100N06490	51N4918	09W5216	065.0	11.0	00.0	01.0	06.0	v
Rurtel	2404.0	MHz	Currabeg DK	E09550N07065	51N5242	09W3104	008.0	2M00G7EJT	Capparoe DK	E08110N06930	51N5150	09W4330	263.0	14.5	00.0	01.0	06.0	v
Rurtel	2404.0	MHz	Eskine DK	E07410N07240	51N5323	09W4944	008.0	2M00G7EJT	Capparoe DK	E08110N06930	51N5150	09W4330	112.0	07.7	00.0	01.0	06.0	v
Rurtel	2410.0	MHz	Eskine DK	E07410N07240	51N5323	09W4944	008.0	2M00G7EJT	Tullakeel	E06985N07120	51N5241	09W5325	073.0	04.4	00.0	01.0	06.0	v
Rurtel	2316.0	MHz	Slieveduff DK	E08310N07320	51N5356	09W4155	008.0	2M00G7EJT	Eskine DK	E07401N07250	51N5326	09W4949	264.0	09.1	00.0	01.0	06.0	v
Rurtel	2412.0	MHz	Inchee DK	E110230N077190	51N5623	09W1820	020.0	2M00G7EJT	Drommycolman	E10225N07140	51N5311	09W2512	233.0	09.9	00.0	01.0	06.0	v
Rurtel	2412.0	MHz	Inchee DK	E110230N077190	51N5623	09W1820	020.0	2M00G7EJT	Capparoe DK	E081100N069300	51N5150	09W4330	253.8	30.2	00.0	01.0	06.0	v
Rurtel	2418.0	MHz	Inchee DK	E11023N07719	51N5623	09W1820	020.0	2M00G7EJT	Knockaninane DK	E10245N09370	52N0512	09W2524	334.0	18.3	00.0	01.0	06.0	v
Rurtel	2326.0	MHz	Bealdarrig DK	E08215N07815	51N5635	09W4251	008.0	2M00G7EJT	Eirk DK	E08699N07840	51N5647	09W3838	086.0	04.8	00.0	01.0	06.0	v
Rurtel	2414.0	MHz	Eirk DK	E08340N07840	51N5644	09W4146	008.0	2M00G7EJT	Blackvalley Sch DK	E08695N08300	51N5916	09W3845	036.0	05.8	00.0	01.0	06.0	v
Rurtel	2420.0	MHz	Eirk DK	E08699N07840	51N5647	09W3838	008.0	2M00G7EJT	Derrylahan	E08888N07890	51N5704	09W3659	074.0	02.0	00.0	01.0	06.0	
Rurtel	2402.0	MHz	Lady's view DK	E09035N08045	51N5756	09W3544	008.0	2M00G7EJT	Derrynahierka	E09050N08085	51N5809	09W3537	019.0	00.4	00.0	01.0	06.0	
Rurtel	2408.0	MHz	Lady's view DK	E09035N08045	51N5756	09W3544	008.0	2M00G7EJT	Killarney DK	E09951N09252	52N0432	09W2757	036.0	15.2	00.0	01.0	06.0	v
Rurtel	2308.0	MHz	Blackvalley Sch DK	E08695N08300	51N5916	09W3845	008.0	2M00G7EJT	Lady's view DK	E09035N08045	51N5756	09W3544	126.0	04.3	00.0	01.0	06.0	v
Rurtel	2320.0	MHz	Blackvalley Sch DK	E08695N08300	51N5916	09W3845	008.0	2M00G7EJT	Cockow	E08280N08075	51N5760	09W4220	240.0	04.7	00.0	01.0	06.0	v
Rurtel	2314.0	MHz	Killarney DK	E099510N092519	52N0432	09W2757	020.0	2M00G7EJT	Inchee DK	E110230N077190	51N5623	09W1820	144.0	18.7	00.0	01.0	06.0	v
Rurtel	2308.0	MHz	Knockaninane DK	E10245N09370	52N0512	09W2524	008.0	2M00G7EJT	Lady's view DK	E09035N08045	51N5756	09W3544	221.0	17.9	00.0	01.0	06.0	v
Rurtel	2324.0	MHz	Knockaninane DK	E10245N09370	52N0512	09W2524	008.0	2M00G7EJT	Inchee DK	E11023N07719	51N5623	09W1820	154.0	18.3	00.0	01.0	06.0	v
Rurtel	2404.0	MHz	Srahmore DK	E09750N20160	53N0319	09W3144	008.0	2M00G7EJT	Lettermaghera DK	E09571N29950	53N5603	09W3517	358.0	97.9	00.0	01.0	06.0	v
Rurtel	2322.0	MHz	Knock DK	E08550N22510	53N1550	09W4258	008.0	2M00G7EJT	Lettercallow DK	E08888N22801	53N1727	09W3960	048.0	04.5	00.0	01.0	06.0	v
Rurtel	2318.0	MHz	Mervue DK	E132100N226990	53N1720	09W0106	070.0	2M00G7EJT	Knockletterfore DK	E105800N244100	53N2619	09W2504	302.0	31.4	00.0	01.0	06.0	v
Rurtel	2408.0	MHz	Lettercallow DK	E08888N22801	53N1727	09W3960	008.0	2M26F7W	Camus DK	E09495N23680	53N2215	09W3443	033.0	10.7	00.0	01.0	06.0	v
Rurtel	2320.0	MHz	Camus DK	E09495N23680	53N2215	09W3443	008.0	2M00G7EJT	Feaghroe DK	E08340N24360	53N2547	09W4516	299.0	13.4	00.0	01.0	06.0	v
Rurtel	2402.0	MHz	Feaghroe DK	E08340N24360	53N2547	09W4516	008.0	2M00G7EJT	Ballinahinch DK	E07999N24865	53N2827	09W4828	325.0	06.1	00.0	01.0	06.0	v
Rurtel	2412.0	MHz	Knockletterfore DK	E105800N244100	53N2619	09W2504	030.0	2M00G7EJT	Mervue DK	E132100N226990	53N1720	09W0106	121.9	31.4	00.0	01.0	06.0	v
Rurtel	2418.0	MHz	Knockletterfore DK	E105800N244100	53N2619	09W2504	030.0	2M00G7EJT	Camus DK	E09495N23680	53N2215	09W3443	235.0	13.1	00.0	01.0	06.0	v
Rurtel	2324.0	MHz	Ballinahinch DK	E07999N24865	53N2827	09W4828	008.0	2M00G7EJT	Knockletterfore DK	E10580N24410	53N2621	09W2500	099.0	26.2	00.0	01.0	06.0	v
Rurtel	2308.0	MHz	Ballinahinch DK	E07999N24865	53N2827	09W4828	008.0	2M00G7EJT	Creggs DK	E071400N252400	53N3021	09W5619	294.0	09.4	00.0	01.0	06.0	v
Rurtel	2420.0	MHz	Clifden O'Malley DK	E067400N249900	53N2857	09W5952	040.0	2M26F7W	Creggs DK	E071400N252400	53N3021	09W5619	056.4	04.7	00.0	01.0	06.0	v
Rurtel	2312.0	MHz	Lehanagh DK	E08550N25085	53N2943	09W4332	008.0	2M00G7EJT	Bunowen DK	E08145N26185	53N3535	53N3535	199	40.3	00.0	01.0	06.0	v
Rurtel	2320.0	MHz	Lehanagh DK	E08550N25085	53N2943	09W4332	008.0	2M00G7EJT	Feaghroe DK	E08340N24360	53N2547	09W4516	195.0	07.5	00.0	01.0	06.0	v
Rurtel	2320.0	MHz	Creggs DK	E071400N252400	53N3021	09W5619	008.0	2M00G7EJT	Feaghroe DK	E083400N243600	53N2547	09W4516	125.0	14.9	00.0	01.0	06.0	v
Rurtel	2410.0	MHz	Poundertran DK	E08895N25510	53N3203	09W4030	008.0	2M26F7W	Kilmeelickin DK	E0092500N256500	53N3251	09W3719	067.0	03.8	00.0	01.0	06.0	v
Rurtel	2318.0	MHz	Tullyconor DK	E08215N26085	53N3503	09W4647	008.0	2M00G7EJT	Bunowen DK	E08145N26185	53N3535	09W4727	324.0	01.2	00.0	01.0	06.0	v
Rurtel	2406.0	MHz	Bunowen DK	E08145N26185	53N3535	09W4727	008.0	2M00G7EJT	Lehanagh DK	E08550N25085	53N2943	09W4332	158.0	11.7	00.0	01.0	06.0	v
Rurtel	2320.0	MHz	Inishturk DK	E06125N27475	53N4214	10W0605	016.0	2M00G7EJT	Minaun Heights DK	E06700N30279	53N5726	10W0135	010.0	28.6	00.0	01.0	06.0	v
Rurtel	2408.0	MHz	Garranty DK	E06200N27500	53N4223	10W0525	008.0	2M00G7EJT	Inishturk DK	E06125N27475	53N4214	10W0605	250.0	00.8	00.0	01.0	06.0	v
Rurtel	2316.0	MHz	Castlebar DK	E114700N290000	53N5109	09W1747	060.0	2M00G7EJT	Croaghmoyle DK	E109850N298300	53N5534	09W2221	329.0	09.6	00.0	01.0	06.0	v
Rurtel	2410.0	MHz	Croaghmoyle DK	E109850N298300	53N5534	09W2221	008.0	2M00G7EJT	Castlebar DK	E114700N290000	53N5109	09W1744	148.6	09.6	00.0	01.0	06.0	v
Rurtel	2420.0	MHz	Croaghmoyle DK	E109850N298300	53N5534	09W2221	008.0	2M26F7W	Castlebar DK	E114700N290000	53N5109	09W1744	148.6	09.6	00.0	01.0	06.0	v
Rurtel	2326.0	MHz	Lettermaghera DK	E09571N29950	53N5603	09W3517	008.0	2M00G7EJT	Croughmoyle DK	E10980N29820	53N5531	09W2224	094.0	14.1	00.0	01.0	06.0	v
Rurtel	2308.0	MHz	Achill Sound DK	E074380N300230	53N5610	09W5447	012.0	2M00G7EJT	Minaun Heights DK	E067000N302790	53N5726	10W0135	287.6	07.8	00.0	01.0	06.0	v
Rurtel	2402.0	MHz	Minaun Heights DK	E067000N302790	53N5726	10W0135	020.0	2M00G7EJT	Achill Sound DK	E074380N300230	53N5610	09W5447	107.5	07.8	00.0	01.0	06.0	v
Rurtel	2414.0	MHz	Minaun Hieghts DK	E067000N302790	53N5726	10W0135	020.0	2M00G7EJT	Inishturk DK	E06125N27475	53N4214	10W0605	190.0	28.6	00.0	01.0	06.0	v
Rurtel	2326.0	MHz	Ballysaggart DK	E17285N37151	54N3528	08W2512	008.0	2M00G7EJT	Mulmosog DK	E17390N27580	54N4345	08W2340	179.0	95.7	00.0	01.0	06.0	v
Rurtel	2412.0	MHz	Rossally Bar DK	E19810N37240	54N3559	08W0146	008.0	2M26F7W	Ballysaggart DK	E172850N371510	54N3528	08W2512	268.0	25.3	00.0	01.0	06.0	v
Rurtel	2326.0	MHz	Loughmuilt DK	E176300N380200	54N4009	08W2203	008.0	2M00G7EJT	Mulmosog DK	E174100N275800	54N4355	08W2330	206.3	04.9	00.0	01.0	16.0	v
Rurtel	2314.0	MHz	Barnesmore DK	E203700N385300	54N4256	07W5633	015.0	2M00G7EJT	Mongorry Hill DK	E223510N404860	54N5327	07W3801	045.4	27.8	00.0		06.0	v

	Transmit Freq.	Units	Transmit Site	Location (NG)	Lat.	Long.	Antenna height(m)	Emission	Receive Site	Location(NG)	Lat.	Long.	Bearing	Dist. (Km)	Power (dBW)	EIRP (dBW)	Gain (dBi)	Polariz.
Rurtel	2406.0	MHz	Meenakillew DK	E17275N38545	54N4259	08W2522	008.0	2M00G7EJT	Loughmuilt DK	E17619N38080	54N4029	08W2209	143.0	05.8	00.0	01.0	06.0	V
Rurtel	2316.0	MHz	Leamagowra DK	E167400N386300	54N4325	08W3022	008.0	2M00G7EJT	Maghera DK	E151800N190800	52N5800	08W4300	285.7	16.2	00.0	16.0	16.0	V
Rurtel	2322.0	MHz	Leamagowra DK	E167400N386300	54N4325	08W3022	008.0	2M00G7EJT	Maum DK	E166700N388400	54N4435	08W3100	341.2	02.2	00.0	16.0	16.0	V
Rurtel	2414.0	MHz	Mulmosog DK	E174600N387100	54N4352	08W2340	008.0	2M00G7EJT	Barnesmore DK	E203710N385350	54N4258	07W5633	093.1	29.2	00.0	34.8	34.8	V
Rurtel	2416.0	MHz	Maum DK	E16670N38840	54N4433	08W3102	008.0	2M00G7EJT	Leamagowra DK	E16740N38630	54N4325	08W3022	161.0	02.2	00.0	05.0	05.0	V
Rurtel	2310.0	MHz	Maum Valley DK	E167000N388600	54N4439	08W3045	008.0	2M00G7EJT	Maum DK	E166700N388400	54N4435	08W3100	235.9	00.4	00.0	16.0	16.0	V
Rurtel	2314.0	MHz	Tully DK	E227800N390100	54N4529	07W3405	008.0	2M00G7EJT	Mongorry Hill DK	E223510N404860	54N5327	07W3801	344.1	15.4	00.0	16.0	16.0	V
Rurtel	2312.0	MHz	Eirernagh DK	E19630N39340	54N4718	08W0327	008.0	2M00G7EJT	Carrickagh DK	E19730N39630	54N4852	08W0231	19	03.1	00.0	01.0	06.0	V
Rurtel	2412.0	MHz	Eifernagh DK	E19630N39340	54N4718	08W0327	008.0	2M00G7EJT	Carrickagh DK	E19940N39680	54N4908	08W0034	042.0	04.6	00.0	01.0	06.0	v
Rurtel	2324.0	MHz	Cloghan DK	E194700N393600	54N4725	08W0457	008.0	2M00G7EJT	Eifernagh DK	E196300N393400	54N4720	08W0325	097.1	01.6	00.0	16.0	16.0	V
Rurtel	2314.0	MHz	Rowantree DK	E205200N394500	54N4754	07W5509	008.0	2M00G7EJT	Mongorry Hill DK	E223510N404860	54N5327	07W3801	060.6	21.0	00.0	25.2	25.2	V
Rurtel	2414.0	MHz	Aghaveagh DK	E207400N394600	54N4757	07W5306	008.0	2M00G7EJT	Barnesmore DK	E203710N385350	54N4258	07W5633	201.8	10.0	00.0	01.0	06.0	v
Rurtel	2310.0	MHz	Tullybeg DK	E175700N394900	54N4805	08W2240	008.0	2M00G7EJT	Maghera DK	E151800N190800	52N5800	08W4300	260.0	24.2	00.0	16.0	16.0	V
Rurtel	2326.0	MHz	Tullybeg DK	E175700N394900	54N4805	08W2240	008.0	2M00G7EJT	Mulmosog DK	E174100N275800	54N4355	08W2330	184.5	19.2	00.0	16.0	16.0	V
Rurtel	2312.0	MHz	Carrickagh DK	E19930N39630	54N4852	08W0039	008.0	2M00G7EJT	Toneyancil Hill DK	E19730N39630	54N4852	08W0231	270.0	02.0	00.0	01.0	06.0	v
Rurtel	2406.0	MHz	Toneyancil Hill DK	E197300N396300	54N4852	08W0231	008.0	2M00G7EJT	Carricagh DK	E19930N39630	54N4855	08W0039	090.0	02.0	00.0	27.5	27.5	V
Rurtel	2414.0	MHz	Toneyancil Hill DK	E197300N396300	54N4852	08W0231	008.0	2M00G7EJT	Barnesmore DK	E203710N385350	54N4258	07W5633	149.6	12.7	00.0	16.0	16.0	V
Rurtel	2412.0	MHz	Truiragh DK	E182000N398700	54N5009	08W1649	008.0	2M00G7EJT	Loughanuce DK	E181400N417400	55N0014	08W1725	357.9	18.7	00.0	10.0	10.0	V
Rurtel	2322.0	MHz	Boulty Patrick DK	E195500N398700	54N5010	08W0412	008.0	2M00G7EJT	Murren Hill DK	E221510N442335	55N1339	07W3943	030.7	50.8	00.0	01.0	06.0	V
Rurtel	2326.0	MHz	Boulty Patrick DK	E195500N398700	54N5010	08W0412	008.0	2M00G7EJT	Mulmosog DK	E174100N275800	54N4355	08W2330	223.0	31.3	00.0	27.5	27.5	V
Rurtel	2418.0	MHz	Fintown Valley DK	E20875N39907	54N5021	07W5150	008.0	2M00G7EJT	Fintown DK	E18901N40225	54N5204	08W1016	279.0	20.0	00.0	01.0	06.0	V
Rurtel	2414.0	MHz	Treantaboy DK	E217559N403997	54N5300	07W4335	008.0	2M00G7EJT	Barnesmore DK	E203710N385350	54N4258	07W5633	216.8	23.2	00.0	21.3	21.3	V
Rurtel	2402.0	MHz	Mongorry Hill DK	E223500N404800	54N5325	07W3801	016.0	2M00G7EJT	Letterkenny DK	E217000N411400	54N5701	07W4402	315.7	09.3	00.0	01.0	06.0	v
Rurtel	2326.0	MHz	Dungloe DK	E176800N411900	54N5715	08W2144	040.0	2M00G7EJT	Mulmosog DK	E174600N387100	54N4355	08W2336	184.8	24.9	00.0	31.0	31.0	V
Rurtel	2316.0	MHz	Fintown DK	E194200N412600	54N5739	08W0526	008.0	2M00G7EJT	Maghera DK	E151800N190800	52N5800	08W4300	242.7	47.7	00.0	20.0	20.0	V
Rurtel	2308.0	MHz	Loughanure DK	E181400N417400	55N0013	08W1727	008.0	2M00G7EJT	Brinlack DK	E184200N431200	55N0740	08W1450	011.2	14.1	00.0	01.0	06.0	v
Rurtel	2314.0	MHz	Glenmore DK	E264560N422855	55N0256	06W5923	008.0	2M00G7EJT	Mongorry Hill DK	E223510N404860	54N5327	07W3801	247.2	44.8	00.0	01.0	06.0	v
Rurtel	2312.0	MHz	Creeslough DK	E201300N424800	55N0414	07W5847	008.0	2M00G7EJT	Glassan DK	E202600N426600	55N0515	07W5730	035.9	02.2	00.0	16.0	16.0	V
Rurtel	2406.0	MHz	Creaslough DK	E201300N424800	55N0414	07W5847	008.0	2M26F7W	Glassan DK	E202600N426600	55N0515	07W5730	035.9	02.2	00.0	01.0	06.0	v
Rurtel	2308.0	MHz	Cashelnagor DK	E191800N424900	55N0417	08W0742	008.0	2M00G7EJT	Tory Island DK	E186700N445800	55N1535	08W1230	346.2	21.5	00.0	27.5	27.5	V
Rurtel	2402.0	MHz	Asdevlin DK	E239200N426000	55N0447	07W2310	008.0	2M00G7EJT	Letterkenny DK	E217000N411400	54N5701	07W4402	237.2	26.6	00.0	27.5	27.5	V
Rurtel	2418.0	MHz	Asdevlin DK	E239200N426000	55N0447	07W2310	008.0	2M00G7EJT	Bunnaton DK	E230100N436900	55N1045	07W3135	320.6	14.2	00.0	11.0	11.0	V
Rurtel	2326.0	MHz	Glassan DK	E202600N426600	55N0512	07W5733	008.0	2M00G7EJT	Ballyhark North DK	E21755N44101	55N1257	07W4327	046.0	20.8	00.0	01.0		v
Rurtel	2412.0	MHz	Glassan DK	E202600N426600	55N0512	07W5733	008.0	2M00G7EJT	Murren Hill DK	E210900N497900	55N4340	07W4935	163.9	29.9	00.0	21.0	21.0	V
Rurtel	2408.0	MHz	Brinlack DK	E182000N431900	55N0802	08W1656	008.0	2M00G7EJT	Dungloe DK	E176800N411900	54N5715	08W2140	194.3	20.7	00.0	27.5	27.5	V
Rurtel	2408.0	MHz	Meenaharnish DK	E24561N43320	55N0838	07W1705	008.0	2M26F7W	Evisbreedy DK	E24307N43480	55N0931	07W1927	303.0	03.0	00.0	01.0	06.0	v
Rurtel	2324.0	MHz	Evisbreedy DK	E24307N43480	55N0931	07W1927	008.0	2M00G7EJT	Asdevlin DK	E23920N42600	55N0450	07W2305	204.0	09.6	00.0		06.0	v
Rurtel	2324.0	MHz	Bunnaton DK	E230100N436900	55N1042	07W3139	008.0	2M00G7EJT	Asdevlin DK	E239200N426000	55N0450	07W2305	140.5	14.2	00.0	16.0	16.0	V
Rurtel	2322.0	MHz	Owenerk DK	E233000N441000	55N1254	07W2853	008.0	2M00G7EJT	Chara DK	E232300N442100	55N1330	07W2930	328.0	01.3	00.0	16.0	16.0	V
Rurtel	2412.0	MHz	Ballyhark North DK	E21755N44101	55N1257	07W4327	008.0	2M26F7W	Ballinahinch DK	E221960N446010	55N1538	07W3916	042.0	06.7	00.0	01.0	06.0	v
Rurtel	2406.0	MHz	Chara DK	E232300N442100	55N1330	07W2933	008.0	2M00G7EJT	Bunnaton DK	E230100N436900	55N1045	07W3135	203.3	05.6	00.0	01.0	06.0	v
Rurtel	2318.0	MHz	Murren Hill DK	E221510N442335	55N1339	07W3943	008.0	2M00G7EJT	Boulty Patrick DK	E195500N398700	54N5010	08W0412	211.1	50.8	00.0	01.0	06.0	V
Rurtel	2324.0	MHz	Murren Hill DK	E221510N442335	55N1339	07W3943	008.0	2M00G7EJT	Asdevlin DK	E239200N426000	55N0450	07W2305	133.0	24.1	00.0	01.0	06.0	v
Rurtel	2308.0	MHz	Tory Island DK	E186700N445800	55N1532	08W1233	008.0	2M00G7EJT	Brinlack DK	E184200N431200	55N0740	08W1450	189.5	14.8	00.0	20.0	20.0	V
Rurtel	2324.0	MHz	Ballinahinch DK	E22196N44601	55N1538	07W3916	008.0	2M00G7EJT	Asdevlin DK	E23920N42600	55N0450	07W2305	140.0	26.4	00.0	01.0	06.0	v
Rurtel	2416.0	MHz	Lughveen DK	E19481N49900	55N4413	08W0457	008.0	2M00G7EJT	Boulty Patrick DK	E195500N398700	54N5010	08W0412	180.0	100.3	00.0	01.0	06.0	v

Annex 2

ANNEX 1: INFORMATION REQUEST

1. RURTEL NETWORK TECHNICAL PARAMETERS REQUEST

Table 1 below outlines the technical parameters required to conduct detailed compatibility analysis for Eir's Rurtel Network. Please fill in all the blank fields **for each station.**

Table 1: Rurtel Network Technical Parameters

Parameter		Details	Comments
Rurtel System Details			
Rurtel Base Station Name			
Location (Eastings Northings)			
Height (a.s.l.) (m)**			
Height (a.g.l.) (m)**			
Number of customers supported on station			
Timeframe for decommissioning of site			
Frequency			
Transmit Frequency (MHz)			
Receive Frequency (MHz)			
Channel Bandwidth (MHz)			
Equipment Characteristics			
Transmitter Power (dBm)**			
Antenna	Make & Model**		
	Gain (dBi)**		
	Feeder Loss (dB)		
Antenna Radiation Pattern[2]**			
Receiver Selectivity**			

[2] Please provide files / details separately
** mandatory fields

Parameter	Details	Comments
Modulation scheme **		
Receiver Details		
Receiver location		
Receiver Height (a.s.l.) (m)		
Receiver Height (a.g.l.) (m)		
Timeframe for decommissioning of site		
Receiver Noise Figure (dB)		
Receiver Noise Floor, N (dBm)		
Interference Threshold C/(N+I) (dB) **		
Received Signal Strength, C (dBm)		
Propagation Environment		
Path Loss Model	ITU-R Rec. 452	
Link availability (% time) **		
Representative Link Budgets**		

4.2 Eir Response to ComReg 31.10.2019

From: "William Mccoubrey" [redacted]
Date: Thursday 31 October 2019 at 17:22:54
To: "Conor Berkeley" [redacted]>
Subject: Re: [Confidential] Information request regarding Eir's licences in the 2.3 GHz Band (RurTel Network)

Hi Conor,

Please see below for customer / transmitter location details.

Regards,
William

ii) eir has now fully decommissioned the Rurtel system in Kerry, there are no active customers, all base station sites are been deactivated and Rurtel licences have been cancelled.

iii) Kerry - as per i) there are no active customers on the Kerry system

Galway - eir has 4 active customers on the Galway Rurtel system based on the Costello and Inagh Valley areas, each customer location has been surveyed and eir continue to assess opportunities to provide alternate voice solutions for these customers particularly as mobile voice service is enhanced in these areas.

iv) Kerry - No active customers

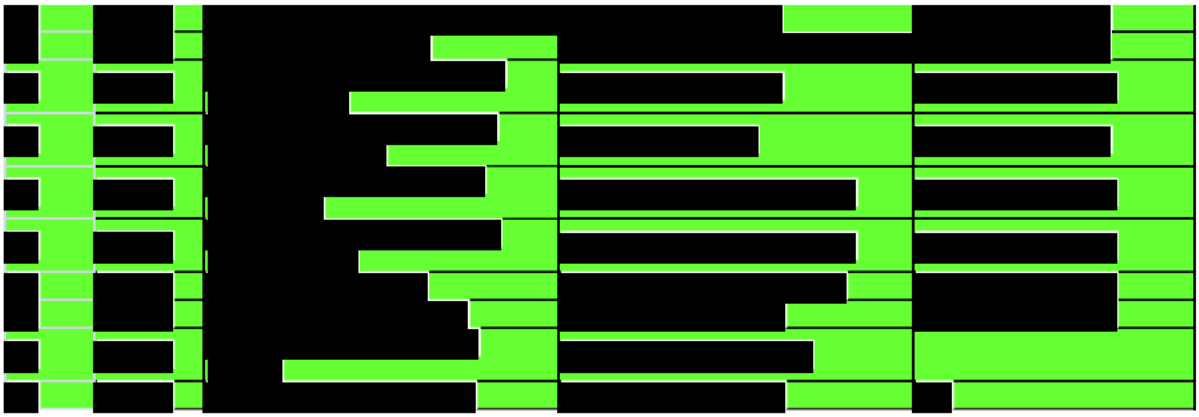
a) Galway - 4 active customers

b) Galway - Rurtel Base Station Locations

Base Station Site	County	X	Y
Ballinahinch DK	Galway	79990	248650
Bunowen DK	Galway	81450	261850
Camus DK	Galway	94950	236800
Feaghroe DK	Galway	83400	243600
Knockletterfore DK	Galway	105800	244100
Lettercallow DK	Galway	88880	228010
Maghera DK	Galway	151800	190800
Mervue DK	Galway	132100	226990

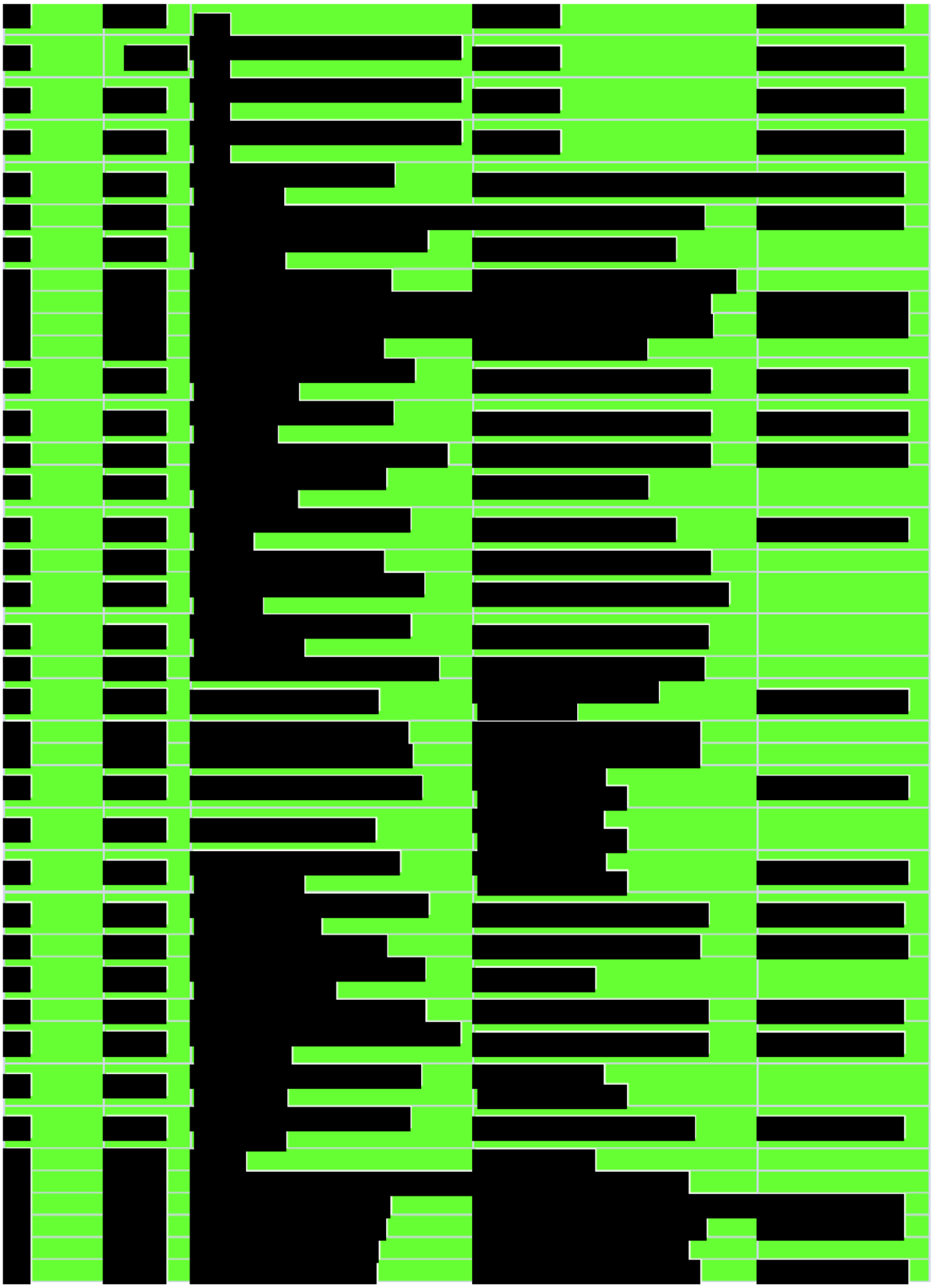
v) Donegal - eir has 76 active customers on the Donegal Rurtel system, each customer location has been surveyed and eir continue to assess opportunities to provide alternate voice solutions for these customers particularly as mobile voice service is enhanced in these areas.

cct_type	cct_no	cust_name	cust_add	XY coordinates



cct_type	cct_no	cust_name	cust_add	XY coordinates

cct_type	cct_no	cust_name	cust_add	XY coordinates



b) Donegal Base Stations

Base Station Site	County	X	Y
Asdevlin DK	Donegal	239200	426000
Ballyhark North DK	Donegal	217550	441010
Ballysaggart DK	Donegal	172850	371510
Barnesmore DK	Donegal	203700	385300
Boulty Patrick DK	Donegal	195500	398700
Bunnaton DK	Donegal	230100	436900
Carricagh DK	Donegal	199300	396300
Chara DK	Donegal	232300	442100
Creaslough DK	Donegal	201300	424800

Eifernagh DK	Donegal	196300	393400
Evisbreedy DK	Donegal	243070	434800
Fintown DK	Donegal	194200	412600
Leamagowra DK	Donegal	167400	386300
Lehanagh DK	Donegal	85500	250850
Letterkenny DK	Donegal	217000	411400
Loughmuilt DK	Donegal	176300	380200
Maum DK	Donegal	166700	388400
Mongorry Hll DK	Donegal	223500	404800
Mulmosog DK	Donegal	174600	387100
Murren Hill DK	Donegal	221510	442335
Toneyancil Hill DK	Donegal	197300	396300
Tullybeg DK	Donegal	175700	394900

On Tue, 8 Oct 2019 at 16:45, Conor Berkeley [redacted] > wrote:

Hi William,

In reference to your request below to extend the deadline for the response to Friday 1st of November, as discussed on our call today I can confirm that ComReg will grant your request for extension in this instance. It is ComReg's expectation that the results and information of the mentioned surveys will be available to ComReg on the 1st November.

Please find attached a copy of the letter which will be sent tomorrow (9 October) in the post.

Kind regards,

Conor

From: Conor Berkeley
Sent: 01 October 2019 10:28
To: 'William Mccoubrey' <[redacted]>
Subject: RE: [Confidential] Information request regarding Eir's licences in the 2.3 GHz Band (RurTel Network)

Hi William,

Thanks for your email, would you be available for a call today? It may provide an opportunity to clarify the information we are looking for and what might be possible in the timeframe provided.

Kind Regards,

Conor

From: William Mccoubrey [mailto:[redacted]]
Sent: 30 September 2019 14:19
To: Conor Berkeley <[redacted]>
Subject: Re: [Confidential] Information request regarding Eir's licences in the 2.3 GHz Band (RurTel Network)

Hi Conor,

A key member of staff required to respond to the information request is currently on leave. I am therefore requesting that the deadline for response be extended to Friday, 1st November. I hope you are able to accommodate this request.

Regards,

William

4.3 ComReg Information Request of Eir 01.11.2019

On Fri, 1 Nov 2019 at 10:59, Conor Berkeley [redacted] wrote:

Hi William,

Thank you for providing the information below and I appreciate you meeting our agreed date of 1 November to provide this.

I note that you have confirmed that Galway have four active customers but provided no information on location. There also seems to be a duplicate of Donegal information below. Perhaps this is an error, can you confirm and provide the customer locations for Galway?

I also note that you have included the following stations below which have been cancelled following a request from Eir:

Galway
Maghera DK cancelled on the 5th October 2018
Bunowen DK cancelled on 21st February 2019

Could you clarify the above please?

Kind regards,
Conor

4.4 Eir Response to ComReg 08.11.19

From: William Mccoubrey [mailto:[redacted]
Sent: 08 November 2019 08:53
To: Conor Berkeley <[redacted]
Subject: Re: [Confidential] Information request regarding Eir's licences in the 2.3 GHz Band (RurTel Network)

Hi Conor,

Apologies for the omissions and the subsequent delay.

Galway customers:

cct_no	cust_name	cust_add	XY coordinates
[redacted]	[redacted]	[redacted]	[redacted]

Donegal customers: There were two lists. One for Donegal North and one for Donegal South. By accident you received two copies of Donegal North. The full Donegal list follows:

cct_type	cct_no	cust_name	cust_add	XY coordinates
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Cancelled stations: the cancelled stations should not have been included in the list. Thank you for drawing this to my attention.

Let me know if you need anything else.

Regards,

William

4.5 ComReg Information Request of Eir 21.11.2019

From: Conor Berkeley
Sent: 21 November 2019 16:35
To: William Mccoubrey' <[redacted]
Subject: RE: [Confidential] Information request regarding Eir's licences in the 2.3 GHz Band (RurTel Network)

Hi William,

Thank you for taking my call earlier today and for your correspondence to date in relation to the information you have provided for the RurTel network. As discussed on our call, in relation to the request for information in the letter sent 27 September 2019, I note that Eir have not provided a response in relation to some of the requested information set out in the letter.

Could you please provide a response to the following questions (highlighted in red below) and in particular provide indication of timelines for migration of the remaining 4 customers in Galway and any updates with regards to migration plans for the Donegal Network including details of alternative fixed voice services are you considering?

1. Number of active customers on the RurTel network

Geographical Area	Kerry Area	Donegal Area	Galway Area	Total
Number of Active Customers	0	76	4	80

2. Migration activities and locations of remaining RurTel customers

ComReg request the following information on Eir's migration activities and plans:

ii. Please provide details of any migration activities carried out, sites decommissioned, RurTel licences cancelled etc. since Eir's December 2018 response;
Eir response includes confirmation of decommissioning of Kerry network, 4 remaining customers in Galway and 76 active customers in Donegal.

iii. Please provide details on the results of Eir's investigation to provide alternative fixed voice solutions for the remaining customers active on each of the Kerry and Galway RurTel systems (currently understood by ComReg to be 2 and 8, respectively), and what was the outcome of this investigation;
Can you provide any additional information with regards to alternative fixed voice solutions being considered in Galway for the 4 remaining customers and timelines for migration of these customers?

iv. For each customer currently active on the Kerry and Galway RurTel systems (if any), please:
a. identify the customer premises co-ordinates (in the format of latitude (DD MM SS) and longitude (DD MM SS)) or the customer's address and Eircode;
Eir provided customer locations in its response for Galway (4) and Donegal (76)

b. indicate which RurTel BS from which the customer is being provided service.

v. Please provide details on Eir's migration activities and plans for the Donegal RurTel system, including whether an exercise similar to that understood to be carried out for Kerry and Galway has been carried out or is planned to be carried out in the near future, and what was the outcome of this exercise.
Can you provide any additional information on the Donegal network particularly in relation to timelines for migration and what alternative fixed voice solution is being considered?

vi. For each customer currently active on the Donegal RurTel system (if any), please:
a. identify the customer premises co-ordinates (in the format of Latitude (DD MM SS) and Longitude (DD MM SS)) or the customer's address and Eircode; and
Eir provided customer locations in its response

b. indicate which RurTel BS from which the customer is being provided service.

vii. Please provide details of any ongoing analysis in relation to the number of customers served from each BS and their locations.
Are further surveys to be carried out following these customer surveys and can you provide detail of such work?

3. Technical Parameters

viii. Please provide updated information in relation to the technical parameters of the RurTel network (as described in Annex 02 to this letter) and the results of any physical surveys that have been completed by Eir; and

ix. In the absence of updated information on the technical parameters requested in (viii) above, Eir is requested to provide comments and observations in relation to the technical assumptions made by Plum in ComReg Document 19/59d. For example, as their accuracy or otherwise. Specifically, ComReg requests comments and observations in relation to:

a. the RurTel Base Station Receive Parameters and Assumed Modelling Parameters outlined in **A.2** and **A.3 of Document 19/59d** respectively; and

b. the RurTel site location and site names data in **Appendix C of Document 19/59d**.

I would appreciate if you could provide the requested information above by **Wednesday 27th November**.

Please note that ComReg may publish the information provided as part of this request and as such, any information deemed confidential by Eir should be identified as such.

Kind regards,
Conor

Conor Berkeley
Bainisteoir, Comhoiriúnacht & Forbairt Speictrim
Manager, Spectrum Compatibility & Development

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
Uimh a hAon Lárcheantar na nDugaí, Sráid na nGildeanna, BÁC 1, Éire, D01 E4X0
One Dockland Central, Guild Street, Dublin 1, Ireland, D01 E4X0

Teil | Tel [redacted]

Rphost | Email [redacted]

Suíomh | Website www.comreg.ie

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

4.6 Eir Response to ComReg 05.12.19

From: William Mccoubrey [mailto[redacted]
Sent: 05 December 2019 12:17
To: Conor Berkeley
Subject: Re: [Confidential] Information request regarding Eir's licences in the 2 3 GHz Band (RurTel Network)
Hi Conor,
Apologies for the delay in getting back to you Please see responses below
Regards,
William
On Thu, 21 Nov 2019 at 16:35, Conor Berkeley[redacted] wrote:

Hi William,
Thank you for taking my call earlier today and for your correspondence to date in relation to the information you have provided for the RurTel network As discussed on our call, in relation to the request for information in the letter sent 27 September 2019, I note that Eir have not provided a response in relation to some of the requested information set out in the letter
Could you please provide a response to the following questions (highlighted in red below) and in particular provide indication of timelines for migration of the remaining 4 customers in Galway and any updates with regards to migration plans for the Donegal Network including details of alternative fixed voice services are you considering?

1. Number of active customers on the RurTel network

Geographical Area	Kerry Area	Donegal Area	Galway Area	Total
Number of Active Customers	0	76	4	80

2. Migration activities and locations of remaining RurTel customers
ComReg request the following information on Eir's migration activities and plans:

ii Please provide details of any migration activities carried out, sites decommissioned, RurTel licences cancelled etc since Eir's December 2018 response;

Eir response includes confirmation of decommissioning of Kerry network, 4 remaining customers in Galway and 76 active customers in Donegal

iii Please provide details on the results of Eir's investigation to provide alternative fixed voice solutions for the remaining customers active on each of the Kerry and Galway RurTel systems (currently understood by ComReg to be 2 and 8, respectively), and what was the outcome of this investigation;

Can you provide any additional information with regards to alternative fixed voice solutions being considered in Galway for the 4 remaining customers and timelines for migration of these customers?

See attached spreadsheets containing results of FCS availability surveys

iv For each customer currently active on the Kerry and Galway RurTel systems (if any), please:

a identify the customer premises co-ordinates (in the format of latitude (DD MM SS) and longitude (DD MM SS)) or the customer's address and Eircode;

Eir provided customer locations in its response for Galway (4) and Donegal (76)

b indicate which RurTel BS from which the customer is being provided service

v Please provide details on Eir's migration activities and plans for the Donegal RurTel system, including whether an exercise similar to that understood to be carried out for Kerry and Galway has been carried out or is planned to be carried out in the near future, and what was the outcome of this exercise

Can you provide any additional information on the Donegal network particularly in relation to timelines for migration and what alternative fixed voice solution is being considered?

Survey indicates FCS available for the majority of customers in Donegal but because there are customers with no FCS signal at the extremity of the networks it requires all repeaters to remain working to provide service to them

vi For each customer currently active on the Donegal RurTel system (if any), please:

a identify the customer premises co-ordinates (in the format of Latitude (DD MM SS) and Longitude (DD MM SS)) or the customer's address and Eircode; and

Eir provided customer locations in its response

b indicate which RurTel BS from which the customer is being provided service

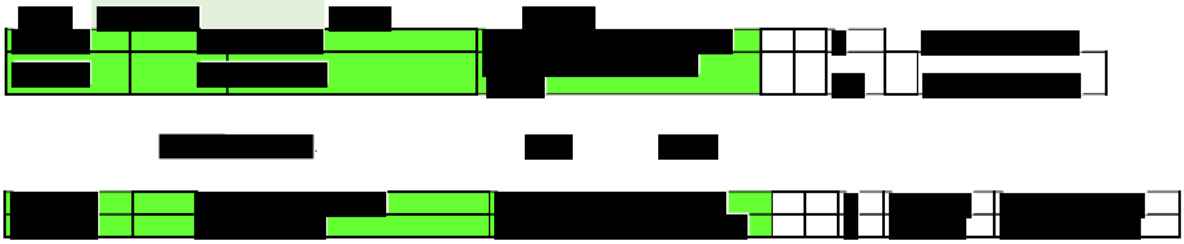
Please see attached Donegal Rurtel details final spreadsheets attached

Repeaters directly connecting to customers with no presently available available FCS options shown below but they are mainly at the end of a chain of repeaters so all preceding repeaters are also required to remain in the network as their backhaul

Donegal Rurtel customers v Base stations with no alternative sercice.

[redacted]

Galway Rurtel customers v Base Station details



vii Please provide details of any ongoing analysis in relation to the number of customers served from each BS and their locations

Are further surveys to be carried out following these customer surveys and can you provide detail of such work?

Further surveys will be carried out to evaluate some expected improvements in FCS coverage resulting from eir Mobile network upgrades

3. Technical Parameters

viii Please provide updated information in relation to the technical parameters of the RurTel network (as described in Annex 02 to this letter) and the results of any physical surveys that have been completed by Eir; and

Due to the age of the equipment and absence of vendor support, detailed technical parameters are not available

ix In the absence of updated information on the technical parameters requested in (viii) above, Eir is requested to provide comments and observations in relation to the technical assumptions made by Plum in ComReg Document 19/59d For example, as their accuracy or otherwise Specifically, ComReg requests comments and observations in relation to:

a the RurTel Base Station Receive Parameters and Assumed Modelling Parameters outlined in **A.2** and **A.3 of Document 19/59d** respectively; and

- The antenna heights used in the Plum model are required to verify interference footprint These look too large if contour masking is taken into account Additionally, it seems to be wrongly assumed that customer end stations use Omni antenna
- Some sites used in the calculations have already been ceased
- Assumptions are made that Rurtel complies to ETSI specifications EN 300 636 but it was designed more than 10 years before that document was released so any assumptions may be invalid and cannot be relied upon Making comparisons with LTE standards is even less relevant because they were released at a later date There is no reliable information available regarding co-channel and/or adjacent channel interference rejection
- There is approximately 68 operational point – to – multipoint links not 47 as stated in the Plum document Furthermore, all the customer sites use Yagi of Grid directional antenna – not 10 dB Omni antenna as assumed
- Rurtel Base Stations are all assumed to use Uplink Band of 2307 – 02327 MHz but this is incorrect Some TX on 23xx MHz and Rx on 24xx MHz from the surrounding Customer Stations or Repeater station The network inverts the High/Low frequency on each radio Hop This convention also applies to Customer Stations (Frequencies for Donegal are shown in attached spreadsheet)
- Repeater Stations generally use 10 dBi Omni antenna for Multipoint broadcast Repeater Stations and Customer Stations use 10/17/21 dBi antenna to communicate with the Upstream Station
- Appendix C is not accurate and additionally details of the Point – Multipoint Radio Paths is not clear
- In light of the above observations we do not consider that the Plum report can be relied upon to predict interference between MFCN and Rurtel

b the RurTel site location and site names data in **Appendix C of Document 19/59d**

The information iin the Appendix is out of date and needs to be updated
I would appreciate if you could provide the requested information above by **Wednesday 27th November**
Please note that ComReg may publish the information provided as part of this request and as such, any information deemed confidential by Eir should be identified as such

Response contains customer information (names, telephone numbers, and addresses) that is not to be published

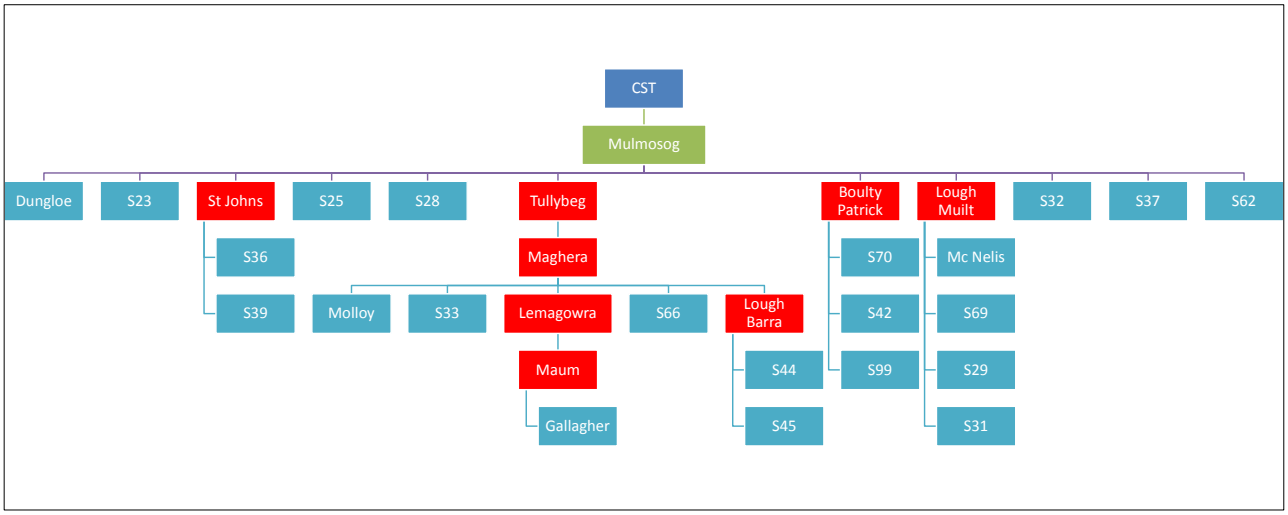
Kind regards,
Conor

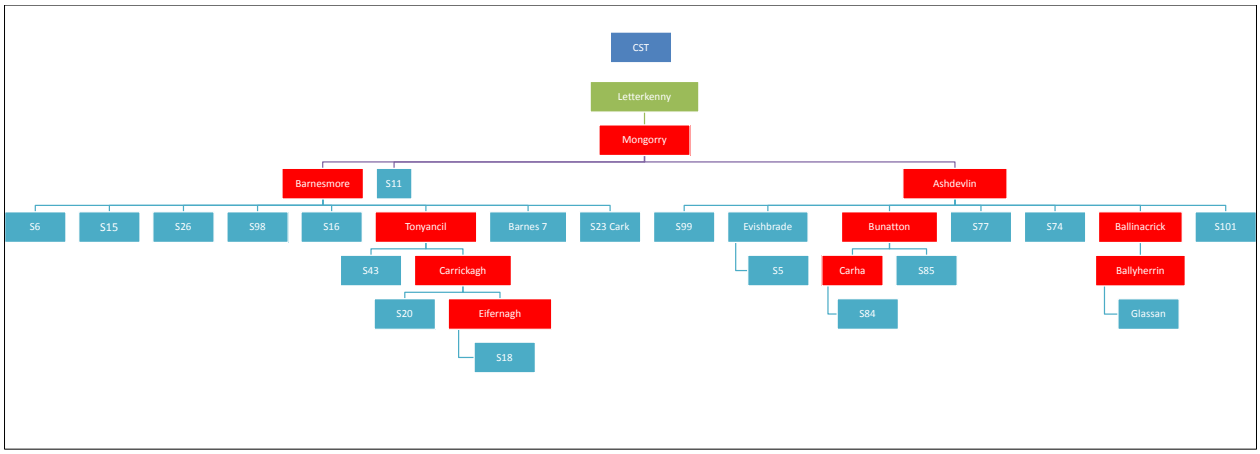
Conor Berkeley
Bainisteoir, Comhoiriúnacht & Forbairt Speictrim
Manager, Spectrum Compatibility & Development
An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
Uimh. a hAon Lárcheantar na nDugaí, Sráid na nGildeanna, BÁC 1, Éire, D01 E4X0
One Dockland Central, Guild Street, Dublin 1, Ireland, D01 E4X0
Teil | Tel +353 1[redacted]

Rphost | Email[redacted]
Suíomh | Website www.comreg.ie

4.7 Eir Map attachments to ComReg 05.12.2019


Bunatton
Carha
Glassan
Ashdelvin
Lough Barra
Mangorry
Carrickagh
Maghera
Mulmosog
S36 S39
Barnesmore
Loughmuilt
St Johns
S62
Blue Stack Mts
DONEGAL
LONDONDERRY
TRABANE
OMAGH
Inishowen
Letterkenny
Strabane
Castlederg
Newtownstewart
Omagh


CST
Mulmosog
Dungloe
S23
St Johns
S25
S28
Tullybeg
Boulty Patrick
Lough Muilt
S32
S37
S62
S36
S39
Maghera
S70
S42
S99
Mc Nelis
S69
S29
S31
Molloy
S33
Lemagowra
S66
Lough Barra
Maum
Gallagher
S44
S45


CST
Letterkenny
Mongorry
Barnesmore
S11
Ashdevlin
S6
S15
S26
S98
S16
Tonyancil
Barnes 7
S23 Cark
S99
Evishbrade
Bunatton
S77
S74
Ballinacrick
S101
S43
Carrickagh
S5
Carha
S85
Ballyherrin
S20
Eifernagh
S84
Glassan
S18

4.8 Eir Spreadsheet containing RurTel Repeater locations sent to ComReg 05.12.2019

iQ.linkXG Site List

Site Id	Site Name	Site Location Id	Latitude	Longitude	Grnd. Elev (m)
RTL01	RTL01 Asdevlin DK rurtel		55-04-47.13 N	7-23-10.18 W	0.00
RTL02	RTL Ballinahinch DK rurtel		53-28-27.11 N	9-48-27.58 W	0.00
RTL03	RTL Ballyhark North DK		55-12-57.01 N	7-43-27.29 W	0.00
RTL04	RTL Ballysaggart DK		54-35-27.76 N	8-25-12.14 W	0.00
RTL05	RTL Barnesmore DK		54-42-56.35 N	7-56-33.29 W	0.00
RTL06	RTL Boulty Patrick DK		54-50-09.71 N	8-04-12.14 W	0.00
RTL07	RTL Bunnaton DK		55-10-41.92 N	7-31-38.99 W	0.00
RTL09	RTL Camus DK		53-22-15.42 N	9-34-42.52 W	77.00
RTL11	RTL Carricagh DK		54-48-52.16 N	8-00-39.20 W	0.00
RTL12	RTL Chara DK		55-13-29.58 N	7-29-32.54 W	0.00
RTL13	RTL Creaslough DK		55-04-13.89 N	7-58-46.73 W	0.00
RTL14	RTL Eifernagh DK		54-47-18.32 N	8-03-27.07 W	0.00
RTL16	RTL Evisbreedy DK		55-09-30.55 N	7-19-27.23 W	0.00
RTL17	RTL Feaghroe DK		53-25-46.58 N	9-45-16.03 W	0.00
RTL18	RTL Finstown DK		54-57-39.21 N	8-05-25.99 W	0.00
RTL23	Knockletterfore DK		53-26-18.86 N	9-25-03.65 W	0.00
RTL25	Leamagowra DK		54-43-24.94 N	8-30-21.60 W	0.00
RTL26	Lehanagh DK		53-29-42.66 N	9-43-31.84 W	0.00
RTL27	Lettercallow DK		53-17-26.71 N	9-39-59.62 W	0.00
RTL28	Letterkenny DK		54-56-59.48 N	7-44-04.76 W	0.00
RTL29	Loughmuilt DK		54-40-09.44 N	8-22-02.52 W	0.00
RTL31	Maum DK		54-44-32.69 N	8-31-01.58 W	0.00
RTL32	Mervue DK		53-17-19.98 N	9-01-05.83 W	0.00
RTL33	Mongorry Hill DK		54-53-25.08 N	7-38-01.47 W	0.00
RTL34	Mulmusog DK		54-43-52.30 N	8-23-39.55 W	0.00
RTL35	Murren Hill DK		55-13-39.29 N	7-39-42.93 W	0.00
RTL36	Toneyancil		54-48-52.14 N	8-02-31.21 W	0.00
RTL37	Tullybeg		54-48-04.77 N	8-22-40.42 W	0.00

28 records(s) matched the query.

4.9 Eir Spreadsheets containing results of FCS availability surveys sent to ComReg 05.12.2019

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