An Coimisiún um
Rialáil Cumarsáide
Commission for
Communications Regulation

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

Response to Consultation and Draft Decision

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Chapter 1

1 Introduction

1.1 In October 2018, ComReg consulted further on the future use of the 410 – 415.5 MHz / 420 – 425.5 MHz band with Consultation Document 18/92[1] in which ComReg considered the type of award mechanism that might be used, the approach to setting fees, and appropriate licence conditions to attach to any new potential licences.

1.2 Eight interested parties responded to Consultation 18/92 (non-confidential versions of which are published alongside this paper – ComReg Document 19/23s):

- The 450 MHz Alliance;
- EirGrid Group ("EirGrid");
- Electricity Supply Board Networks Limited ("ESBN");
- Huawei Technologies Co. Limited ("Huawei");
- Joint Radio Company Limited ("JRC");
- Northern Ireland Electricity Networks Limited ("NIE Networks");
- Nokia UK Limited ("Nokia"); and
- Western Power Distribution ("WPD").

1.3 This document sets out ComReg's response to the submissions received to Document 18/92 and it's Draft Decision on the award format, spectrum fees and licence conditions for new spectrum rights of use in the band at issue.

1.4 ComReg is publishing, alongside this response to consultation and decision:

- Document 19/23a[2] – A Plum Consulting London LLP ("Plum") report for ComReg on potential use and associated technical requirements of the band;
- Document 19/23b[3] – An analysis prepared by ComReg's economic and award design expert DotEcon Limited ("DotEcon"), of the submissions

[1] ComReg Document 18/92 - Further Consultation on the Release of the 410 - 415.5 / 420 - 425.5 MHz Sub-band – Published 24 October 2018.
[2] ComReg Document 19/23a – Plum Report: Potential use of the 400 MHz band in Ireland – Published March 2019.
[3] ComReg Document 19/23b – DotEcon Report – Award of Licences for the use of Radio Frequencies in the 400 MHz band – Published March 2019.

received in response to Document 18/92 relating to the award design and fee structure; and

- Document 19/23s[4] – Non-confidential submissions to ComReg Document 18/92.

1.5 In arriving at the draft decisions set out in this document, ComReg has had regard to the statutory functions, objectives and duties relevant to its management of the radio frequency spectrum, the most relevant of which are summarised in Annex 1. ComReg has had regard to all relevant information available to it including:

- submissions received to Consultation 18/92;
- the independent expert advice and recommendations of its economic and award design consultant, DotEcon and its technical consultant Plum; and
- International developments including work in the Electronic Communications Committee, the European Telecommunications Standards Institute and the International Telecommunications Union[5] concerning the use of the band.

1.6 Outline of the document:

- **Chapter 2** sets out developments in the 400 MHz Band
- **Chapter 3** sets out ComReg's response to Draft RIA and updated draft assignment RIA;
- **Chanter 4** details ComReg's response and final position on award format and spectrum fees;
- **Chapter 5** sets out ComReg's response to Licence Conditions and final position on same;
- **Chapter 6** contains ComReg's Draft Decision Instrument;
- **Chapter 7** details how to submit comments and next steps in the process;
- **Annex 1** details the Legal Basis;
- **Annex 2** details the Proposed BEMs; and
- **Annex 3** shows the 400 MHz Band Plan.

[4] ComReg Document 19/23s – Non-confidential submissions to ComReg Document 18/92.
[5] The ITU is the United Nations specialized agency for information and communication technologies.

Chapter 2

2 The 400 MHz spectrum for award

2.1 This chapter details ComReg's general position on the harmonisation of the usage of the radio spectrum and then examines recent harmonisation actions in international bodies regarding the 400 MHz band that have taken place since the publication of Document 18/92 which ComReg is taking into consideration.

ComReg's position on spectrum harmonisation

2.2 ComReg's position on the harmonisation of the use of the radio spectrum resource has most recently been described in section 4 of its Radio Spectrum Strategy Statement ComReg Document 18/118[6] and is summarised as follows:

- The international harmonisation process plays a key role in determining the demand for and the supply of radio spectrum, given its benefits in terms of facilitating economies of scale in the manufacture of radio equipment (which lowers both the cost of deploying wireless networks and the cost of wireless devices for consumers), and the minimisation of interference between users;
- International harmonisation with the benefits detailed above is particularly important for countries with a small population, such as Ireland, where the small scale offered limits industry's ability to adapt the technology roadmaps adopted by often global suppliers of radio equipment;
- In ComReg's experience, the appropriate release of harmonised spectrum bands has proven to be generally very successful in facilitating the delivery of services to end-users; and
- Harmonised radio spectrum measures are set by a number of bodies including the International Telecommunications Union, the European Conference of Postal and Telecommunication Administrations and the European Telecommunications Standards Institute.

2.1 Developments within the European Telecommunications

[6] ComReg Document 18/118 – Radio Spectrum Management Strategy Statement for managing the radio spectrum 2019 - 2021 - published 20 December 2018.

Standards Institute ("ETSI"[7])

2.3 In Document 18/92, ComReg noted ETSI work item DTR/ERM-562[8]. ETSI was This work item was examining the Critical Infrastructure Utility Operations requirements for Smart Grid systems, other radio systems and future radio spectrum access arrangements below 1.5 GHz. ETSI has since completed its work and has published its final report – ETSI TR 103 492[9].

2.4 The ETSI Report considers:

- the functional requirements for existing and future radio systems suitable for controlling critical national infrastructure utility systems; and
- the long-term spectrum requirements for critical national infrastructure utility systems; and

2.5 The ETSI Report also considers the requirements of a Smart Grid including:

2.6 Tele-protection;

- SCADA[10] systems;
- Distributed Automation;
- Dynamic Asset Management;
- Resilient Mobile Voice Communications; and
- Close Circuit Television.

The ETSI Report acknowledges that while recent developments facilitate carriage of critical utility communications over commercially available networks, utilities still have some uniquely demanding requirements such as enhanced resilience, geographic coverage, and high levels of security. ComReg has taken TR 103 492 into consideration in Chapter 3.

2.7 In addition, ETSI notes in TR 103 492 that the narrowband, wideband and broadband requirements for a Smart Grid will need 2 × 3 MHz of spectrum, ideally in the 450 – 470 MHz range or if that is not possible then anywhere in the 380 -

[7] The European Telecommunications Standards Institute (ETSI), produces globally-applicable standards for Information and Communications Technologies, including fixed, mobile, radio, converged, broadcast and internet technologies. ETSI are officially recognised by the European Union as a European Standards Organization.

[8] ETSI work item 'DTR/ERM-562' - https://bit.ly/2phCuSi

[9] "Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements"
https://www.etsi.org/deliver/etsi_tr/103400_103499/103492/01.01.01_60/tr_103492v010101p.pdf

[10] Supervisory Control and Data Acquisition.

470 MHz range. This supports ComReg's preliminary view, first set out in Doc 18/92 and unchanged, as to how much spectrum a Smart Grid needs.

2.2 Developments within the European Conference of Postal and Telecommunication Administrations

Changes to emission limits

2.8 A number of recent developments have taken place within the European Conference of Postal and Telecommunications Administrations ("The CEPT")[11], specifically in the Electronic Communications Committee ("The ECC")[12].

2.9 In March 2019, following public consultation, the ECC adopted and published ECC Decision (19)02[13]. It covers land mobile systems and considers harmonised use of the 410 - 430 MHz range.

2.10 As discussed in Document 18/92, ECC Decision (19)02 specifies the Least Restrictive Technical Conditions for narrowband and wideband land mobile systems operating within a number of frequency ranges including the 410 – 430 MHz This is discussed further in section 5.5 of this document.

New Provision for Broadband Public Protection and Disaster Relief ("BB-PPDR") services

2.11 The International Telecommunications Union ("ITU") adopted a report in 2016 (ITU-R M.2291)[14] which describes PPDR communications as predominantly mission critical because they aid in the daily protection of life and property and in response, rescue and recovery efforts during emergencies and disasters[15].

[11] The CEPT's activities included co-operation on commercial, operational, regulatory and technical standardisation issues. Today 48 countries are members of CEPT. See for www.cept.org/cept/ more details.

[12] The ECC considers and develops policies on electronic communications activities in a European context, taking account of European and international legislations and regulations – see www.cept.org/ecc/ for more details.

[13] ECC Decision (19)02 - Land mobile systems in the frequency ranges 68-87.5 MHz, 146-174 MHz, 406.1-410 MHz, 410-430 MHz, 440-450 MHz, and 450-470 MHz – 8 March 2019.

[14] ITU-R M.2291 - The use of International Mobile Telecommunications (IMT) for broadband Public Protection and Disaster Relief (PPDR) applications.

[15] See document ITU-R M.2291 - The use of International Mobile Telecommunications (IMT) for broadband Public Protection and Disaster Relief (PPDR) applications – November 2016.

2.12 Within the EU, the Law Enforcement Work Party ("LEWP")[16] has stated that mission critical operations require secure, reliable and available communications without the risk of failures in individual and group communications.

2.13 In 2015 the ECC published Report 218[17] which summarised the conclusions on spectrum compatibility options for BB-PPDR as derived from ECC Reports 239 and 240. Given the lack of standardisation activities covering the 410 – 430 MHz band by 3GPP[18], ETSI and other international organisations, the ECC studies did not adequately deal with the 410 – 430 MHz band and as noted by ComReg in Document 17/67, ECC Decision (16)02[19] (resulting from those three reports) excluded the provision of BB-PPDR within the band 410 – 430 MHz.

2.14 There is now a 3GPP work item[20] to develop a standard for PMR/PAMR[21] and PPDR equipment in the 410 – 430 MHz band. There is also ETSI work item EN 303 505[22] for land mobile broadband radio equipment used for public protection and disaster relief. ECC Report 283[23] (September 2018) examines compatibility and sharing studies relating to the introduction of broadband and narrowband systems in the 410 – 430 MHz band. ComReg noted these studies in Consultation 18/92.

2.15 Arising from those studies, and following public consultation, an updated ECC Decision (16)02 was placed before and adopted by the ECC at its March 2019 meeting. This updated Decision includes the provision to harmonise the use of BB-PPDR in parts of the 410 – 430 MHz band.

[16] Radio Communications Expert Group of the Law Enforcement Working Party which is officially reporting to JHA (Justice & Home Affairs) within the Council of the European Union.

[17] ECC Report 218 - Harmonised conditions and spectrum bands for the implementation of future European Broadband Public Protection and Disaster Relief (BB-PPDR) systems (October 2015).
See also:
- ECC Report 239 - Compatibility and sharing studies for BB PPDR systems operating in the 700 MHz range (September 2015).
- ECC Report 240 - Compatibility studies regarding Broadband PPDR and other radio applications in 410-430 MHz and 450-470 MHz and adjacent bands (September 2015).

[18] The 3rd Generation Partnership Project (3GPP) unites telecommunications standard development organizations and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.

[19] ECC Decision (16)02 - Harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems.

[20] https://portal.3gpp.org/ngppapp/TdocList.aspx?meetingId=18670

[21] Private Mobile Radio and Public Access Mobile Radio.

[22] ETSI Work Item DEN/ERM-TGDMR-362 due for publication in February 2020.

[23] ECC Report 283 – Compatibility and sharing studies related to the introduction of broadband and narrowband systems in the bands 410 – 430 MHz and 450 – 470 MHz – Published 14 September 2018.

2.16 ComReg notes the importance of BB-PPDR as expressed by the work of the ECC, the ITU and LEWP, and considers that mission critical BB-PPDR type applications serve an important purpose to society and require careful consideration.

2.17 Further, in its Radio Spectrum Management Strategy Statement for 2019 – 2021[24], noting recent developments, ComReg committed to monitor, investigate and contribute to the spectrum management considerations in respect of BB-PPDR. Therefore, throughout the 400 MHz consultation process, ComReg has had regard to the harmonisation of the 400 MHz band for the use of BB-PPDR services.

BB-PPDR Spectrum Needs

2.18 The revised ECC Decision (16)02, adopted and published in March 2019, addresses the harmonised Least Restrictive Technical Conditions ("LRTC") for implementing BB-PPDR radio systems in the 400 MHz and 700 MHz ranges. The revised decision now provides harmonised technical parameters in the 410 – 417 MHz / 420 – 427 MHz bands, as outlined below.

2.19 ECC Decision (16)02 now states that:

(i). CEPT administrations wishing to introduce BB-PPDR in the 700 MHz band may apply least restrictive technical conditions to these three ranges:

- 698 – 703 MHz (uplink) / 753 – 758 MHz (downlink)
- 703 – 733 MHz (uplink) / 758 – 788 MHz (downlink)
- 733 – 736 MHz (uplink) / 788 – 791 MHz (downlink)

(ii). Because use of the wider 400 MHz band can offer national flexibility alongside the 700 MHz range, CEPT administrations wishing to introduce additional spectrum for BB-PPDR in the 400 MHz band may apply Least Restrictive Technical Conditions with channelling arrangements of 1.4 MHz, 3 MHz and 5 MHz in the following paired ranges:

- 450.5 – 456 MHz (uplink) / 460.5 – 466 MHz (downlink)
- 452 – 457.5 MHz (uplink) / 462 – 467.5 MHz (downlink)
- 410 – 415 MHz (uplink) / 420 – 425 MHz (downlink)
- 411 – 416 MHz (uplink) / 421 – 426 MHz (downlink)
- 412 – 417 MHz (uplink) / 422 – 427 MHz (downlink)

[24] ComReg Document 18/118 – Radio Spectrum management Strategy Statement 2019 to 2021 – Published 20 December 2019.

2.20 The latest revised ECC Decision (16)02 is relevant to this consultation as the 410 – 417 MHz / 420 – 427 MHz band is likely to be of considerable interest to BB-PPDR:

- the CEPT, 3GPP and ETSI harmonisation work to date may lead to wider development of BB-PPDR equipment for this band. Huawei and Nokia both state, in their responses to Consultation 18/92, that suitable equipment is available in this band;
- the 410 – 417 MHz / 420 – 427 MHz band has similar propagation characteristics to the 380 – 400 MHz band used in the established Tetra network. This may facilitate greater utilisation of existing Tetra network elements (such as sites) in any future BB-PPDR network; and
- as noted in Consultation 18/92, the 450 – 470 MHz range is currently allocated to and used extensively by PMR (Business Radio) and other similar licence types and is thus unsuitable for deployment of wideband type applications like Smart Grid and BB-PPDR. ComReg's view in this regard is unchanged.

2.21 Responses to this consultation to date indicate demand for 2 × 3 MHz of 400 MHz spectrum for the provision of Smart Grid. The updated draft RIA in Chapter 3 concludes that the 410 – 413 MHz / 420 – 423 MHz range is suitable and critical for the provision of Smart Grid.

2.22 In line with ECC Decision (16)02, and in order to have flexibility and to ensure sufficient spectrum for BB-PPDR, ComReg proposes to set aside 2 × 3 MHz of the 400 MHz band for the provision of future BB-PPDR, specifically the range 414 – 417 MHz / 424 – 427 MHz. The range available for the award would therefore be reduced from 410 – 415.5 MHz / 420 – 425.5 MHz to 410 – 414 MHz / 420 – 424 MHz. This would not reduce the quantum of spectrum for Smart Grid use identified in Consultation 18/92.

2.23 ComReg is of the preliminary view that the above proposal would provide the most efficient use of this spectrum.

2.24 To facilitate the allocation of spectrum for future BB-PPDR use, some existing trunked radio licensees that currently operate from 415.7750 – 417 MHz / 425.7750 – 427 MHz would be required to migrate to spectrum in the 417 – 418.9875 MHz / 427 – 428.9875 MHz range. Given the limited usage of the available spectrum for trunked radio systems in Ireland, and the availability of one hundred and fifty nine 2 × 12.5 kHz channels in the 417 – 418.9875 MHz / 427 – 428.9875 MHz range, ComReg is of the view that it can accommodate the migration of existing users and any future applicants.

2.3 Summary

2.25 While ComReg is making a provision for the possible future use of 2 × 3 MHz of spectrum for BB-PPDR service(s) in the band from 414 – 417 MHz / 424 – 427 MHz, the use of this spectrum for BB-PPDR does not form part of this award process and will be dealt with separately, in due course.

2.26 The spectrum that will form this award is in two parts:

- Part A - 2 × 3 MHz for Smart Grids.
- Part B -2 × 1 MHz (413 – 414 / 423 – 424 MHz) for all uses.

2.27 The updated proposed band plan for the award is in Annex 3.

Chapter 3

3 Response to Draft Regulatory Impact Assessment ("RIA") and Updated Draft Assignment RIA

3.1 Introduction and background

3.1 In Chapter 3 of Document 18/92, ComReg set out its draft Assignment RIA having regard to, among other things, its statutory remit in managing the radio spectrum (see Annex 1) and its previously expressed views on different assignment methods for spectrum rights of use (Section 4.8 of Document 17/67).

3.2 Background - draft Assignment RIA in Document 18/92

3.2 The draft Assignment RIA identified three regulatory options:

- **Option 1: Assign all rights of use to the 400 MHz band on a service and technology neutral basis.**
  - All eligible bidders could compete for rights of use across all available spectrum, regardless of their intended use.
- **Option 2: Limit all rights of use to the 400 MHz band for the provision of Smart Grid.**
  - Rights of use across all available spectrum would be limited to provision of Smart Grid. Only Network Utility Operators in Ireland (electricity, gas or water) would be eligible to compete across all available spectrum.
- **Option 3: Limit some rights of use for the provision of Smart Grid and the remainder on a service and technology neutral basis.**
  - The available rights of use would be divided into two parts (Part A and Part B). Part A would comprise 2 × 3 MHz with rights of use limited to Network Utility Operators for provision of Smart Grid (as described in Option 2). Part B would comprise the remaining 2 × 2.5 MHz which all eligible bidders could compete for and it would be made available on a service and technology neutral basis (as described in Option 1).

- If no applications are received for Part A (2 × 3 MHz) then the full 2 × 2.5 MHz would be awarded on a service and technology neutral basis (as described in Option 1).

3.3 ComReg, having assessed the three identified options against the objectives, principles, and duties relevant to its spectrum management function, formed the preliminary view that Option 3 is the Preferred Option. It is the Preferred Option for a number of reasons:

- It provides an essential spectrum input for a Smart Grid where no alternative frequencies are available to Network Utility Operators;
- There is likely a key requirement for Smart Grid as evidenced by various national and international policy targets to reduce carbon emissions and make energy systems more secure and sustainable;
- A service and technology neutral award could result in the assignment of rights of use to other uses thus foreclosing those rights of use for the provision of Smart Grid; and
- The proposed restriction would only relate to 2 × 3 MHz of the available rights of use, necessary to efficiently operate a Smart Grid. The remaining spectrum would be made available on a service and technology neutral basis.

Relevant developments since Document 18/92

3.4 As noted in Chapter 2, ComReg proposes to reduce the amount of spectrum in this award from 410 – 415.5 MHz / 420 – 425.5 MHz to 410 – 414 MHz / 420 – 424 MHz. This revised draft RIA reflects this development.

3.3 Views of respondents on draft Assignment RIA

3.5 ComReg received eight responses[25] to the draft RIA and assesses them under the following headings:

- Definition of Smart Grid;
- Likely requirement for Smart Grid;
- Availability of alternative spectrum for Smart Grid;
- Technical and requirements for Smart Grid;
- Limiting rights of use for Smart Grid; and

[25] The 450 MHz Alliance; EirGrid, ESBN, Huawei, JRC, NIE Networks, Nokia, WPD.

- Provision of access to Smart Grid spectrum.

Definition of Smart Grid

3.6 In Document 18/92, and for the purpose of the award, ComReg defined Smart Grid as "a term used for advanced delivery systems for utility services (electricity, gas and water) from sources of generation and production to key elements in the grid networks and includes all supervisory and control necessary for their effective management."

3.7 ESBN and EirGrid agree with ComReg's definition and ComReg is not currently aware of any other information as would warrant its amendment. ComReg thus remains of the view that the definition of Smart Grid in this draft RIA is appropriate.

Likely requirement for Smart Grid

3.8 ComReg expressed the preliminary view that Smart Grids are likely to be required to meet various national and international policy goals and are likely to be viable services in the time period up to 2040 (that is, a 15 - 20 year licence duration).

3.9 ESBN supports ComReg's analysis on Ireland's need for a Smart Grid to meet international and Irish energy policies and objectives. ComReg is not currently aware of any other information as warrant an amendment to its view. ComReg thus remains of the preliminary view that a Smart Grid is a viable service proposition.

Availability of alternative spectrum for Smart Grid

3.10 ComReg expressed the preliminary view that no alternative unassigned frequencies would enable the provision of a Smart Grid in Ireland:

- ESBN, NIE Networks and 450 MHz Alliance agree with ComReg's view.
- NIE Networks submits that a lack of alternative spectrum for Smart Grid in Ireland means spectrum prices risk being artificially inflated by competition for monopoly rents, absent the assignment of rights of use on a service specific basis for Smart Grid use; and
- Huawei supports ComReg's analysis that the 400 MHz band should be made available for the provision of electronic[26] broadband communications (for example, Smart Grids).

[26] For the avoidance of doubt, bidders for Part A refers to electricity, gas and/or water through a utility network. Part A is not limited to any particular Network Utility Operators and is being made available for all Network Utility Operators as defined in the draft RIA.

3.11 ComReg is not aware of any other information which would warrant an amendment to its preliminary view that there are no alternative unassigned frequencies or technologies that would enable the provision of Smart Grid in Ireland.

Technical requirements for Smart Grid

3.12 To determine if other solutions are likely to be available, absent a Smart Grid network in Ireland, the draft RIA assessed the technical requirements for a Smart Grid including how much spectrum would be required to support those requirements.

3.13 EirGrid, ESBN and JRC agree with ComReg's assessment of the technical requirements for Smart Grid:

- ESBN submits that the most likely technology for providing a Smart Grid is LTE;
- ESBN and JRC that the minimum spectrum for a Smart Grid is 2 × 3 MHz; and
- EirGrid also welcomes the proposal to allocate 2 × 3 MHz in the 400 MHz band for Smart Grid.

3.14 ComReg is not currently aware of any other information as would warrant an amendment to its preliminary view and thus remains of the preliminary view that the assessment of technical requirements as in the draft RIA is appropriate.

Limiting certain rights of use for Smart Grid

3.15 ComReg was of the preliminary view that Option 3, to limit some rights of use for the provision of Smart Grid and award the remainder on a service and technology neutral basis, was its preferred option.

3.16 All eight submissions support Option 3 - limiting some rights of use for the provision of Smart Grid and assigning the remainder on a service and technology neutral basis:

- ESBN[27], EirGrid and JRC all agree that 2 × 3 MHz should be allocated for Smart Grid;
- NIE Networks supports the assignment of Part A rights of use on a service specific basis;

[27] This is not withstanding ESBN's preference for reserving all of the available spectrum to future proof Smart Grid network and maximise benefits.

- The 450 MHz Alliance and WPD agree with restricting Part A for Smart Grids and releasing Part B on a service and technology neutral basis;
- The 450 MHz Alliance and Huawei agree that a Network Utility Operator who wins spectrum in Part A can also bid for spectrum in Part B;
- WPD welcomes the proposal that any spectrum not taken up in the Part A award would be included in the Part B award; and
- Huawei does not consider it necessary to reserve part of the band for narrowband communications, as other parts of the UHF spectrum already provide sufficient capacity for those communication types.

3.17 ComReg notes the submissions supporting Option 3. In addition, and for the avoidance of doubt, Part B spectrum would not be reserved for narrowband communications but would be released on a service and technology neutral basis. ComReg is not currently aware of any other information as would warrant amending its preliminary view. Therefore, ComReg remains of the preliminary view that the approach provided for in the draft RIA remains appropriate.

Provision of access to a Smart Grid communications network

3.18 In the draft RIA, ComReg observed that a Network Utility Operator that won the 2 × 3 MHz of spectrum in Part A could find it difficult to justify denying a reasonable and necessary request by any other Network Utility Operator to access the Smart Grid and/or associated spectrum rights. That is because the winning Network Utility Operator would be subject to ex post competition law, where no alternative frequencies would be available for the provision of a Smart Grid.

3.19 ESBN expresses concern with ComReg's proposal to rely on ex post competition law as it considers that it could create the following difficulties for prospective bidders of Part A spectrum:

- the value of Part A spectrum would no longer be based on its sole value to the bidder;
- it would be difficult to scope the requirements of other potential bidders in advance of the bid; and
- there would be difficulties in roll-out coordination with other parties.

3.20 ESBN submits that any ex post competition analysis on access to a Smart Grid network should take into account the lack of information as to other Network Utility Operators' requirements and that any requests for access should not impact

negatively on the winning Network Utility Operator's Smart Grid deployment plans or cause service access issues for the winning Network Utility Operator.

3.21 ComReg's previous observations on the application of ex post competition law are unchanged though, for the sake of clarity, ComReg would note that all bidders, potential or actual, are subject to competition law and therefore all spectrum valuations, made by all bidders in the proposed award should be made on that understanding. ComReg is simply noting that any winning bidder would be subject to competition rules post award and those rules are appropriate for any situation in which a winning bidder denies a reasonable and necessary request for access made by another Network Utility Operator, where there are no alternative frequencies for provision of a Smart Grid.

3.22 An ex ante access obligation would require a detailed assessment in advance of the award, to determine how shared use of a Smart Grid might be best organised. An inappropriate access obligation could impair a Smart Grid's functionality. In particular, issues such as those described by ESBN would have to be determined pre-award, absent information on who the winning bidder would be or what type of Smart Grid would be required. Network Utility Operators may naturally reach a Smart Grid sharing arrangement and enforcing such an arrangement at the pre award stage, through some form of ex ante access obligation, is unnecessary and inappropriate as it could risk interfering with the proper functioning of the Smart Grid to required standards.

3.23 ComReg is currently not aware of any other information which would warrant an amendment to its preliminary view that ex post competition rules should be sufficient to deal with any situation in which a winning Network Utility Operator denied a reasonable and necessary request by any other Network Utility Operator for access to the Smart Grid and/or associated spectrum rights.

3.4 Updated Draft Assignment RIA

3.24 In 2005, ComReg auctioned three national licences for Wideband Digital Mobile Data Services ("WDMDS") in the ranges 410 – 414 MHz paired with 420 – 424 MHz and 872 – 876 MHz paired with 917 – 921 MHz[28]. No commercial services were successfully deployed in those frequency ranges and the rights of use expired on 31 December 2017.

[28] ComReg Document 05/80 – Information Memorandum: Process for the award of national licences for the provision of WDMDS – published 20 October 2005. Note: this document is not publicly available as it was only accessible through purchase. However, the majority of details in the Information Memorandum are covered at a high level in ComReg Document 05/79 – Information Notice.

3.25 In its Radio Spectrum Management Strategy Statement 2016 to 2018, ComReg observed that a number of potential uses for the 410 – 414 MHz / 420 – 424 MHz band required consideration and stated that it would consult on the future use of the band as part of its 2016 2018 work plan.[29]

3.26 In 2017, ComReg published Consultation 17/67[30] which noted that a RIA would form part of future consultations on the 400 MHz band depending on the measures proposed. This RIA now examines how rights of use in the 400 MHz band should be awarded. It concludes with an assessment of the Preferred Option against ComReg's statutory remit, including relevant functions, objectives and principles (see Annex 1).

RIA Framework

3.27 A RIA is an analysis of the likely effects of a proposed new regulation or regulatory change, and, indeed, of whether regulation is necessary at all. A RIA should help identify the most effective and least burdensome regulatory option and should seek to establish whether a proposed regulation or regulatory change is likely to achieve the desired objectives, having considered relevant alternatives and the impacts on stakeholders. In conducting a RIA, the aim is to ensure that all proposed measures are appropriate, effective, proportionate and justified.

Structure of a RIA

3.28 As set out in ComReg's RIA Guidelines[31], there are five steps in a RIA. These are:

- Step 1: Identify the policy issues and identify the objectives;
- Step 2: Identify and describe the regulatory options;
- Step 3: Determine the impacts on stakeholders;
- Step 4: Determine the impact on competition; and
- Step 5: Assess the impacts and choose the best option.

[29] ComReg Document 16/50 - Radio Spectrum Management Strategy 2016 to 2018 – Published 21 June 2016.
[30] ComReg Document 17/67 - Consultation on Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 31 July 2017.
[31] ComReg Document 07/56a – Guidelines on ComReg's approach to Regulatory Impact Assessment – Published 10 August 2007.

3.29 In the following sections ComReg identifies the relevant stakeholder groups, specific policy issues to be addressed, and relevant objectives (Step 1 of the RIA process).

3.30 This is followed by identification of policy issues and ComReg's consideration of same in accordance with Steps 2-5.

Policy Issues and Objectives (RIA Step 1)

3.31 Document 17/67 explored, at a high level, possible uses for the 400 MHz band and how it might be assigned. In response to concerns expressed by eir Group[32][33] ComReg noted in Response to Consultation 17/105[34] that the award of the band would respect the principles of service and technology neutrality. ComReg also noted that it would form a preliminary view on the matters discussed, in the next consultation phase and having considered responses together with other evidence, including expert advice obtained in the intervening period. In particular, ComReg stated that it would prepare a draft RIA on the assignment process for the 400 MHz band which would be informed by responses to Document 17/67.

3.32 In that regard, and in light of certain matters raised by respondents, ComReg commissioned Plum to analyse potential uses of the 400 MHz band as identified in Consultations 17/67 and 17/105, to identify any other possible uses, to assess how much spectrum may be needed for those uses, and to assess possible technical requirements. The Plum Report was published alongside Document 18/92[35]. An updated version of the Plum Report, taking account of responses to Document 18/92, is published alongside this document[36].

3.33 Among other things, Plum assessed four broad categories of potential uses for the 400 MHz band: Private/Professional Mobile Radio ("PMR"); Public Protection and Disaster Relief ("PPDR"); Smart Meters; and Smart Grids. See Table 4.3 of the Plum Report. For each identified use, Plum assessed a number of factors including:

a) the applicable technology(s) and future availability;

[32] Eircom Limited (trading as "eir" and "open eir") and Meteor Mobile Communications Limited ("MMC") (collectively referred to as "eir Group").
[33] ComReg Document 17/105s – Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 8 December 2017.
[34] ComReg Document 17/105 – Response to Consultation on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 8 December 2017.
[35] ComReg Document 18/92b Plum Consulting London LLP - Potential use of the 400 MHz band in Ireland Published October 2018.
[36] ComReg Document 19/23a Plum Consulting London LLP – Potential use of the 400 MHz band in Ireland Published March 2019.

b) the minimum spectrum block requirements; and

c) the availability of alternative frequency bands and/or solutions.

3.34 The assessments under bullets (a) and (b) are relevant to the Award Design and are addressed in Chapter 4.

3.35 In relation to (c), Plum concludes that PMR has alternative frequencies and or solutions available that can be used to deliver those services. For instance, a significant number of alternative bands are available for PMR[37], and TETRA Enhanced Data Services ("TEDS")[38], and Smart Meters[39]. However, Plum outlines that there are no alternative spectrum rights of use sufficient to provide for Smart Grid. In particular, sub 1 GHz spectrum is required to connect to sub-stations, pumping stations, and alternative energy sources and, to achieve necessary geographic coverage over remote rural locations.

3.36 The only alternative suitable spectrum for Smart Grid is the 450 – 470 MHz band, currently assigned for and used extensively by PMR (Business Radio). However it is unsuitable because the 2 × 3 MHz of contiguous spectrum required for Smart Grid use, as identified by Plum, is not available. See Figure 1 below.

[37] For example, 440 – 450 MHz for land mobile, 455 – 456 MHz for PMR, digital land mobile civil, 456 – 469 and 460 – 470 MHz or land mobile for Government service, commercial and local authorities, and 459 – 460 MHz for land mobile. PMR / PAMR already supported in licensed bands.

[38] For example, 380 – 385 paired with 390 – 395 MHz for the emergency services, and 385 – 389.9 paired with 395 – 399.9 MHz for a civil network. Current TETRA network 380 – 385 / 390 – 395 MHz.

[39] Smart Meters can be provided over licence exempt bands such as 868 MHz). Also, Smart Meters can be provided over MNO networks (for example, NB-IoT in LTE spectrum bands) and licence exempt bands such as 868 MHz. For example, ESB Networks has announced three successful tenders for the upgrade of the National electricity meter replacement programme. Three Ireland was selected to provide the ICT network.

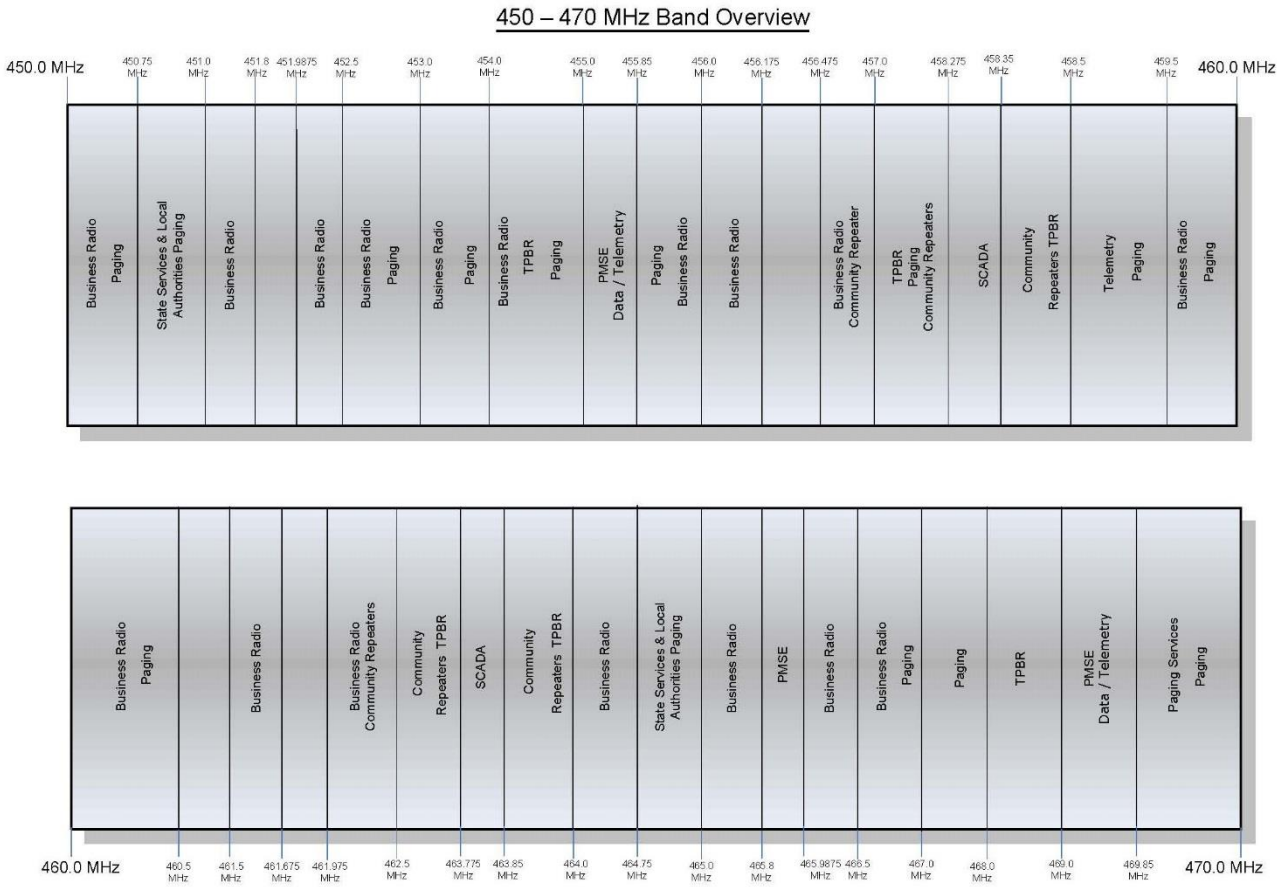

Figure 1. 450 – 470 MHz band overview

3.37 The 450 – 470 MHz band is used for many applications including Business Radio, Paging, Third Party Business Radio, Data/Telemetry, PMSE and Community Repeaters. Business Radio currently uses most of the band – there are currently about 600 individual frequency assignments. Plum also notes that Smart Grid networks, covering large and often rural areas, necessitates spectrum around 400 MHz and use of other bands would not be optimal.

3.38 Plum sees little demand for the 400 MHz band for other uses identified as there is enough available spectrum elsewhere to meet demand. For example, Plum notes that most use cases already have access to spectrum and, as regards PPDR, ComReg has provided for its possible future use in part of the 400 MHz band by reducing the amount of spectrum in Part B of the proposed award. There are also alternative solutions emerging for such use cases such as provision of PPDR[40] and Smart Metering over MNO networks[41].

3.39 ComReg agrees with Plum (whose views are unchanged having considered responses to Document 18/92) and is of the preliminary view that no suitable alternative spectrum is available for Smart Grid use. This view is consistent with responses to Documents 17/67[42] and 18/92[43] that suitable alternative spectrum is not available for wideband utility networks or Smart Grids[44].

3.40 The lack of suitable alternative spectrum for Smart Grid raises two important policy considerations that require ComReg's consideration.

1. Is there a likely requirement for Smart Grids in Ireland?

2. Are there alternative solutions that could deliver a Smart Grid(s)?

[40] In particular, the 700 MHz EC Decision gives Member States flexibility in terms of the potential uses of the 700 MHz band including the 700 MHz Duplex Gap and guard bands, including for PPDR. To date, no national policy decision has been taken in relation to the specific use of the 700 MHz band including the 700 MHz Duplex Gap and guard bands in Ireland and, in particular, in respect of PPDR. Moreover, in line with ECC Decision (16)02, as discussed in further detail in Chapter 2, ComReg is minded to make available 2 × 3 MHz of spectrum for the provision of BB-PPDR in the 400 MHz band by reducing the spectrum available in this award from 2 × 5.5 to 2 × 4 MHz.

[41] For example, O2 are providing connectivity for smart meters to over 23 million locations in the UK - https://www.o2.co.uk/business/iot/solutions/smartmeters

[42] In their submissions to Document 17/67, ESBN ("Electricity Supply Board Networks") and EUTC (European Utilities Telecommunications Union) agreed that alternative and suitable rights of use are not available for wideband utility networks and the provision of Smart Grid. These submissions are contained in Document 17/105s.

[43] NIE Networks ("Northern Ireland Electricity Networks"), ESBN and EirGrid agreed that alternative and suitable rights of use are not available for the provision of Smart Grid. These submissions are contained in Document 19/23s.

[44] ComReg Document 17/105s - Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published December 2017.

3.41 These policy considerations are assessed below. Prior to that assessment, it is helpful to provide information and a definition of Smart Grids in order to provide context to the remainder of this RIA.

What are Smart Grids?

3.42 Various definitions of a Smart Grid are in use. This response to consultation uses a definition provided by Plum which is based in part on the definition used by the International Telecommunications Union ("ITU")[45].

3.43 Plum defines Smart Grid as "a term used for advanced delivery systems for utility services (electricity, gas and water) from sources of generation and production to key elements in the grid networks and includes all supervisory and control necessary for their effective management"[46].

3.44 A Smart Grid enables two-way data flows between various parts of a utility network. At the core of the Smart Grid is the use of intelligent communication networks. This brings together the monitoring and control functions and enables analysis of various parts of the utility system; for example - power generation or transmission and distribution. Smart Grids have many more elements and sensors than legacy grids[47] and these are deployed at all levels of the grid such as power plants, substation equipment, generators and transformers. The sensors are used for data acquisition and information exchange between equipment and data centres. In order to handle the increased amount of data, a Smart Grid requires reliable and resilient infrastructure that provides secure real-time communications[48].

3.45 Existing utility distribution systems are designed to deliver resources uniformly, regardless of variations in demand at different times and places. These systems lack the intelligence to optimise delivery in response to demand leading to more inefficient delivery and use. A Smart Grid uses more data and better data analysis through better communication systems to optimise delivery in response to demand,

[45] The International Telecommunications Union ("ITU") defines Smart Grid as follows: "Smart Grid is a term used for advanced delivery system for utility services (electricity, gas and water) from sources of generation and production to consumption points, and includes all the related management and back office systems, together with integrated modern digital information technologies." Smart Grid Utility Management Systems, Report ITU-R SM.2351-2 06/17.
[46] As noted by Plum this definition does not include Smart Metering which is a use case considered separately in its report and has alternative frequencies and solutions available.
[47] The legacy grid communication systems are mainly used for data acquisition from limited number of sensors that are located in the main transmission and distribution points, limited number of control signals transmission and faults detection.
[48] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.

improving cost-effectiveness of grid infrastructure investments and increasing the reliability of the distribution system for end users.

1. Is there a likely requirement for Smart Grids in Ireland?

3.46 ComReg considers it necessary to assess whether Smart Grids are a viable service proposition likely to require spectrum rights of use in the period up to 2040 (15 - 20 year licence)[49]. Below are ComReg's preliminary views as to whether there is demand for spectrum for the provision of Smart Grids, noting that any actual demand can ultimately only be determined through the process of interested parties seeking to obtain spectrum for Smart Grids and being assigned same.

3.47 Smart Grids are a key component of government efforts to meet the demand for energy in a cost effective and secure way while also reducing the environmental impact (including carbon emissions)[50]. A Smart Grid, using new technology, could result in substantial reductions in energy use and carbon emissions and could make renewable energy and efficiency programs more affordable and accessible.

3.48 Greater integration of renewable energies into electricity and gas grids is key to lowering the environmental impact and meeting climate change targets:

- The ITU has outlined how Smart Grids can help to mitigate climate change by building more controllable and efficient energy systems[51]; and
- The UN has outlined that climate change requires development of Smart Grids founded on communications networks that can deliver centralised real time monitoring and control, eventually across the entire power distribution domain[52].

3.49 A number of international and national studies estimate the carbon reductions from using Smart Grids:

- the Electrical Power Research Institute ("EPRI") has estimated that Smart Grid enabled electrical distribution could reduce electrical energy consumption by 5% to 10% and carbon dioxide emissions by 13% to 25%[53];

[49] See Section 5.7 (Licence Duration).
[50] Transition to a Low Carbon and Climate Resilient Society – National Strategic Outcome 8 of the National Development Plan 2018 – 2027. https://www.gov.ie/pdf/?file=https://s3-eu-west-1.amazonaws.com/govieassets/831/130718120306-5569359-NDP%20strategy%202018-2027_WEB.pdf#page=76
[51] https://news.itu.int/energy-efficiency-fight-climate-change-vital-role-icts/
[52] United Nations Economic Commission For Europe, Electricity Systems Development – A Focus on Smart Grids, August 2015.
[53] Smart Grid Utility Management Systems, Report ITU-R SM.2351-2, 06/17.

- a smart electrical power grid could decrease annual electric energy use and utility sector carbon emissions by at least 12% by 2030[54]; and
- the Sustainable Energy Authority of Ireland estimates that by 2050, Smart Grids will see an accumulated reduction in energy related CO_2 emissions of 250 million tonnes[55] [56].

3.50 The European Commission also encourages use of Smart Grids for more efficient energy generation and consumption. The Electricity Directive states:[57]

- *"Member States should encourage the modernisation of distribution networks, such as through the introduction of* ***smart grids****, which should be built in such a way that encourages decentralised generation and energy efficiency*"[58]
- "*In order to promote energy efficiency, Member States or, where a Member State has so provided, the regulatory authority shall strongly recommend that electricity undertakings optimise the use of electricity, for example by providing energy management services, developing innovative pricing formulas, or introducing intelligent metering systems or* ***smart grids****, where appropriate*"[59] [60] [Emphasis added]

3.51 The European Commission's policy framework for climate and energy from 2020 to 2030 proposes new targets and measures to make the EU's economy and energy system more competitive, secure and sustainable. It includes targets for reducing greenhouse gas emissions and increasing use of renewable energies noting that "*the EU and Member States will need to develop further their policy frameworks to facilitate the transformation of energy infrastructure with more cross-border interconnections, storage potential and* ***smart grids*** *to manage demand to*

[54] The Smart Grid: An Estimation of the Energy and CO_2 Benefits, Department of Energy's Pacific Northwest National Laboratory.
[55] https://www.seai.ie/resources/publications/Smartgrid-Roadmap.pdf
[56] The Effort Sharing Regulation (ESR), was published by the European Commission in July 2016. The ESR proposal suggests a 39% GHG (Greenhouse Gas) reduction target for Ireland, based on GDP per capita, for the period 2021 to 2030.
[57] Note that references to the Electricity Directive are made to indicate demand or a requirement for Smart Grid rather than ComReg being subject to any specific requirements under those Directives.
[58] Recital 24 – Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2008.
[59] Article 3(11) – Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2008.
[60] The development of technology to deliver more efficient management of networks is more commonly known as Smart Grids. The new systems will improve efficiency, reliability, flexibility and accessibility and are the key next steps in the evolution of the internal market in energy Interpretative Note on Directive 2009/72/EC Concerning Common Rules for the Internal Market in Electricity and Directive 2009/73/EC concerning Common Rules for the Internal Market in Natural Gas.

ensure a secure energy supply in a system with higher shares of variable renewable energy"[61] [Emphasis added]

3.52 In December 2018, the Minister for Communications, Climate Action and the Environment, Richard Bruton T.D. submitted to the European Commission the first draft of Ireland's National Energy and Climate Plan (NECP) one of the key provisions of the proposed Governance of the Energy Union Regulation. The NECP sets out how Ireland will reduce carbon emissions and increase renewable energy up to 2030. The NECP includes trajectories for renewable energy, energy efficiency, and national emissions and measures to achieve these trajectories[62]. In relation to Smart Grids:

- Smart technologies and grids are one of the NECP's key objectives in achieving a fully integrated energy market;
- Smart Grids are one of a number of key measures required to increase the flexibility of the existing energy system with regard to renewable energy production and the NECP includes a case study of pilot programme launched by ESBN as an example of the benefits of Smart Grids;
- Smart Grids are one of the key electricity and gas transmission infrastructure projects needed for the NECP to meet its objectives;
- The NECP supports improved and increased gas and electrical infrastructure, through efficient and effective projects and wide implementation of Smart Grid technology; and
- A new grid development strategy to support the NECP is suggested as is infrastructure to link high penetration of renewables in the South and West of Ireland to high demand regions in the East.

3.53 Such requirements are also broadly in line with other State policies to encourage the provision of Smart Grid and other related technologies:

- The government's 2015 Energy White Paper, '*Ireland's Transition to a Low Carbon Energy Future 2015-2030*' sets out a framework to guide Irish energy policy in the period up to 2030 by, among other things, moving to lower emissions fuels significantly increasing renewable generation and implementing smart and interconnected energy systems[63];

[61] European Commission, 'A policy framework for climate and energy in the period from 2020 to 2030, (COM(2014) 15 final), January 2014.
[62] https://www.oireachtas.ie/en/debates/question/2018-05-30/198/
[63] https://www.dccae.gov.ie/documents/Energy%20White%20Paper%20-%20Dec%202015.pdf

- The Project Ireland 2040 National Planning Framework[64] promotes a transition to a low carbon energy future which requires decisions around developing and deploying new technologies for areas such as wind, **smart grids**, electric vehicles, buildings, ocean energy and bio energy. It also commits to roll-out of the National Smart Grid Plan enabling new connections, grid balancing, energy development and micro grid development.;

- The Department of Communications, Climate Action and Environment National Mitigation Plan observes that smart operation of the power system at both transmission and distribution level and energy efficiency will enable maximisation of the existing grid[65];

- The National Development Plan 2018 – 2027 foresees the piloting of 'climate-smart countryside' projects to establish the feasibility of the home and farm becoming net exporters of electricity through the adaptation of smart metering, **smart grids** and small-scale renewable technologies, for example, solar, heat pumps and wind; and

- The Sustainable Energy Authority of Ireland "Smart Grid" Roadmap to 2050[66] notes that Smart Grid can maximise our use of indigenous low carbon renewable energy resources which is central to ensuring Ireland meets its long term target of a secure and low carbon future. [Emphasis added]

3.54 At least one Network Utility Operator (ESBN) has publicly expressed an interest in acquiring 400 MHz spectrum to support the provision of a Smart Grid[67]. As to other utilities, the requirement for Information and Communications Technology ("ICT") in the water distribution network is documented by the ITU[68]. Sensors placed throughout the water distribution network are needed to save water. Such systems manage end-to-end distribution from reservoirs to pumping stations to smart pipes,

[64] Project Ireland 2040 - National Planning Framework – 2018.
[65] Department of Communications, Climate Action and Environment - National Mitigation Plan – July 2017.
[66] Sustainable Energy Ireland, Smart Grid 2050.
[67] ComReg Document 17/105s - Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – Published 8 December 2017 and ComReg Document 19/23s – Non-Confidential Submissions to ComReg Document 18/92 on the Proposed Release of the 410 – 414 / 420 – 424 MHz sub-band – Published March 2019
[68] https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000100003PDFE.pdf

allowing water utilities to identify leaks in real time and reduce the approximately 50% of water that, in developed countries, is lost through leaks[69].

3.55 Expert Group 4 of the EU Commission task force for Smart Grids examines Smart Grid aspects related to gas[70]. It has stated that Smart Gas Grids will support the ability of gas to play a major ongoing role in the energy mix while meeting carbon and renewable energy targets (targets outlined by the European Commission and discussed earlier). It has also stated that Smart Gas Grids empower end-users to optimise their energy use and allows them to participate actively in the energy market. A gas Smart Grid also enables injection of non-conventional gases, such as Biomethane which is CO_2 neutral, into the network, reducing the carbon intensity of the Gas Grid.

3.56 Finally, ComReg notes that other EU Member States are also addressing spectrum demand for Smart Grids:

- Germany has initiated a process to operate critical infrastructures (including Smart Grids) nationwide on a technology neutral basis[71]. BNetzA, the German regulator, considers the 450 MHz range suitable for applications for such critical infrastructures.

- The Polish Office of Electronic Communications ("UKE") recently assigned 450 MHz spectrum rights of use to PGE Systemy S.A., part of Poland's largest energy company, to provide voice and data communications in its transmission and distribution networks for gas, liquid fuels and electricity[72].

3.57 ComReg remains of the preliminary view that a Smart Grid is likely to be required to meet various national and international policy goals and is likely to be a viable service proposition in the period up to 2040 (15 - 20 year licence).

2. Are there alternative solutions that can deliver a Smart Grid(s)?

3.58 To ensure the Preferred Option is proportionate, it is necessary to assess whether a Smart Grid in Ireland could be provided without 400 MHz spectrum. ComReg must determine if there are viable alternatives. ComReg does this by first assessing the technical requirements for Smart Grid and then assessing how much spectrum is needed to support those requirements.

[69] https://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000100003PDFE.pdf
[70] https://ec.europa.eu/energy/sites/ener/files/documents/2010-2011.zip
[71] https://www.bundesnetzagentur.de/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/Firmennetze/450MHz/450MHz-node.html
[72] https://bip.uke.gov.pl/konsultacje-i-wyniki-konsultacji/komunikat-ws-przetargu-na-rezerwacje-czestotliwosci-zzakresow-452-5-457-5-mhz-oraz-462-5-467-5-mhz,378.html

(i) What are the technical requirements of Smart Grids?

3.59 Plum identifies several requirements for effective Smart Grids:

- low to medium data rates typically 9.6 Kbit/s to around 64 Kbit/s and up to multiple Mbit/s if video is required to monitor key installations;
- grid networks are expected to be deployed for a significant time (for example, 10 to 20 years);
- low jitter and synchronous requirements;
- enhanced resilience – for example this requires battery power back-up which far exceeds that provided over MNO networks;
- instant and guaranteed channel access;
- extensive geographic coverage (including less populated areas) to provide 100% coverage of the utility network;
- stringent latency requirements; and
- high levels of security[73].

3.60 Further, ComReg observes that in September 2017, the CEPT working group FM 54[74] agreed to draft some elements for a further revision of ITU-R Report SM.2351-2[75] to include PMR/PAMR technologies already in use. In May 2018, WGFM approved this proposed revision as a CEPT contribution to ITU-R Working Party 1A[76]. This contribution (referred to as the "CEPT contribution") was submitted by the United Kingdom on behalf of WGFM/CEPT. The Plum Report is largely in line with the updated "CEPT contribution". In particular, the CEPT contribution notes that while recent developments in commercial telecommunications networks facilitate carriage of critical communications, mission critical utilities still have several uniquely demanding requirements:[77]

[73] Network security, confidentiality, data and user privacy, network integrity and availability.
[74] https://cept.org/ecc/groups/ecc/wg-fm/fm-54/client/introduction/
[75] ITU-R Report SM.2351-2 on Smart Grid utility management.
[76] ITU Working Party 1A developed a preliminary draft revision of ITU- R SM.2351-2 during its recent meeting (Geneva, 4-12 June 2018). The draft will be further discussed at the next meeting of Working Party 1A (planned on 28 May to 5 June 2019). An ITU TIES account is required to access the draft report, however, the contribution from FM 54 may be accessed on the FM 54 website without restriction.
[77] https://www.cept.org/Documents/fm-54/43494/fm54-18-25_reporting-from-wgfm91-may-2018-incl-relevant-annexes

- Utility telecommunications growth comes from increasing the geographic coverage of the monitoring networks, numbers of connection points, and speed of response, rather than necessarily increased data rates;
- Geographic coverage availability requirements (for example, up to 99.999% for power line protection and 99.9% for scanning telemetry systems) within the defined service area including, in some cases, remote and unpopulated areas[78];
- Enhanced resilience to enable networks to operate in the absence of main electric power for an extended period, which may extend from a few minutes to 72 hours, and even beyond;
- Network hardened to ensure resilience against severe weather, including high winds, flooding, snow, icing, extreme temperatures, and electromagnetic disturbances such as lightning strikes;
- System reliability needs to be designed to meet exact technical requirements rather than for economic gain;
- Separate, independent and diverse redundant routing. Note: when the primary route is interrupted, it is essential that the diverse route works immediately and correctly. This is especially true when instant access to radio spectrum is required;
- Access to suitable allocated spectrum is preferred so that expansions and enhancements to the grid control network may be planned with confidence and incorporated speedily;
- Utilities need high levels of security for their telecoms networks, and infrastructure sites, not only in terms of integrity to prevent malicious disruption of utility operations; but also guaranteed access where denial of service occurs either from network congestion or malicious intent, denying the utility visibility of its network;
- Telecom signal latency and asymmetry requirements in the electricity industry are linked to voltage / power levels, requiring latencies as low as 6 ms with associated asymmetry of less than 300 µs if protection systems are to function correctly. These requirements emerge from the need to compare

[78]For example, power lines traverse remote regions where there is little population. Renewable energy and water resources are also often in remote locations. These remote and unpopulated areas may not attract commercial telecom operator services. The CEPT contribution note that "*The coverage of the commercial 3GPP networks is targeted to population centres and cannot in general be relied on in isolated non-populated areas across which utility supplies must frequently be carried and controlled*."

'in cycle' values across an electricity network in real time where the duration of a half-cycle is needed to maintain stability and accurately identify fault; and

- Whereas commercial networks are inherently download-centric, utility networks are upload-centric with a small number of control rooms remotely monitoring large geographic areas.

3.61 With regard to the above outline of requirements unique to mission critical utilities, ComReg notes that any potential alternative solutions, networks or frequencies would need to provide for each of the requirements outlined by Plum and CEPT. In particular, these requirements largely arise from the need for a Smart Grid to react effectively to changes in the conditions of generation and transmission, and that access to a Smart Grid should not be compromised[79]. If there is a need to shut these down due to conditions such as overload, full coverage across all connected elements is paramount and delays of milliseconds can be serious, hence network availability, reliability, resilience and security is essential. In the case of water supply there can be similar requirements to monitor key points in the water network such as the flow of water in major pipe lines or water levels in areas prone to flooding where it may be necessary to open or close various valves and dams to alleviate such risks[80].

(ii) How much spectrum is required to support the Smart Grid?

3.62 Plum is of the view that Smart Grid requires 2 × 3 MHz of contiguous spectrum. This is primarily based on the expectation that LTE technology will be required to deliver the technical requirements as set out above and that equipment for LTE in the 410 – 430 MHz band will be in FDD mode and use a minimum bandwidth of 3 MHz (that is, a total of 2 × 3 MHz).

3.63 Similarly, ETSI, also recommends that the shortfalls in bandwidth required for Smart Grid would be overcome if an allocation of spectrum, for example, 2 × 3 MHz in the 400 MHz band, for Utility Operations systems were to be made available[81]. Further, ETSI recommends that in an ideal scenario, a harmonised tuning range could be found across Europe, in the 450 MHz to 470 MHz band. However, where this is not possible, 2 × 3 MHz anywhere within the 400 MHz band (380 MHz to 470 MHz) will be acceptable. Further, ETSI note that ultimately, the need for real-

[79] Smart Grids typically contain multiple network devices, such as transformers, and switches each of which each could be vulnerable to network interference.
[80] Document 19/23a, Plum Report, 'Potential use of the 400 MHz band in Ireland' 2018, p12.
[81] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', November 2016. ETSI TR 103 401 V1.1.1 (2016-11).

time video, and other high speed data services, will only become clear as Smart Grids are rolled out. This would indicate that video and the need for additional spectrum to support use of same is not presently a central requirement for Smart Grids[82] [83].

3.64 In light of the views of Plum and ETSI, ComReg remains of the preliminary view that 2 × 3 MHz of contiguous spectrum in the 400 MHz band is required to provide a Smart Grid in Ireland.

Are viable alternatives available to support Smart Grid?

3.65 ComReg is of the preliminary view that there are two possible alternatives for providing a Smart Grid - (a) existing telemetry systems or (b) existing mobile networks. ComReg assesses each possible alternative against the technical requirements set out by Plum and CEPT.

(a) Existing telemetry systems

3.66 Plum notes that utility networks have historically been monitored using telemetry systems, to provide necessary command and control of a centralised grid network. Telemetry systems gather data from a limited number of sensors located at main transmission and distribution points. This provides for a limited number of control signals and fault detections[84] [85].

3.67 However Plum notes that utility networks are changing to new distributive models, requiring a new level of control, and this cannot be met using legacy technology and available spectrum. In particular, existing telemetry systems cannot support the bandwidth requirements for Smart Grids as recommended by ETSI and Plum. For example, ESBN's existing telemetry assignments in the 450 – 470 MHz band consist of 2 × 300 kHz[86] (two blocks, each comprising 12.5 kHz channels). That is ten times less spectrum than the 2 × 3 MHz recommended by Plum and ETSI.

3.68 Further, the shift from fossil fuel to renewable energies requires more points in the network because renewables, like wind, tend to be generated across many small generation points, often in remote areas, whereas a small number of large

[82] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', ETSI TR 103 401 V1.1.1 (2016-11).
[83] ETSI, 'Critical Infrastructure Utility Operations requirements for Smart Grid systems, other radio systems, and future radio spectrum access arrangements below 1,5 GHz', January 2019. ETSI TR 103 492 V1.1.1 (2019-01).
[84] Smart Grid an optimal solution to economic and environmental benefits. International Journal of Electrical Electronics & Computer Science Engineering Volume 4, Issue 4 (August, 2017).
[85] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.
[86] https://www.comreg.ie/industry/radio-spectrum/licensing/search-licence-type/telemetry/

generators use fossil fuels. The number of remote rural links is thus predicted to increase by between ten-fold and twelve-fold. Telemetry systems are unlikely to have enough bandwidth or spectrum to support an increase of such magnitude [87] [88].

3.69 ComReg therefore remains of the preliminary view, shared by Plum, that current telemetry systems are unlikely to be suitable for the provision of Smart Grids, up to 2040.

(b) Mobile Networks

3.70 A number of technical requirements listed above, from CEPT and Plum, could be provided by mobile networks to support certain Smart Grid applications. These include:

- low to medium data rates - typically 9.6 Kbit/s to around 64 Kbit/s and up to multiple Mbit/s if video is required to monitor key installations; and
- grid network deployed for 10 – 20 years.

3.71 Mobile networks offer high rates of data transfer and implement security algorithms[89]. However they do not appear to satisfy most of the technical requirements for utility networks, as listed by Plum and CEPT and including, in particular, mission critical communications[90]. ETSI[91] has noted that public mobile networks would need appropriate resilience and power backup measures before they could be deemed suitable for utility networks. CEPT is of the view[92] that commercial 3GPP systems[93] are unlikely to be appropriate for Smart Grids

[87] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', ETSI TR 103 401 V1.1.1 (2016-11).
[88] ECC Report 292, Current Use, Future Opportunities and Guidance to Administrations for the 400 MHz PMR/PAMR frequencies.
[89] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.
[90] CEPT define mission critical utilities as transmission/distribution monitoring and control systems which need very rapid dynamic interactivity and extremely high reliability and security capable of operating for many days without power in harsh environments but with far fewer points of interactivity and again with relatively small data volumes.
[91] ETSI TR 103 401 Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements Note 3.
[92] CEPT contribution on Report ITU-R SM2351-2 - approved WGFM#91 - 14-18 May 2018 - https://cept.org/Documents/fm-54/41892/temp1_draft-revised-cept-contribution-for-report-sm-2351-2
[93] 3rd Generation Partnership Project (3GPP) is a collaborative project caters to a large majority of the telecommunications networks in the world. It is the standard body behind UMTS (Universal Mobile Telecommunications System), which is the 3G upgrade of GSM. The 3GPP technologies from these groups are constantly evolving through Generations of commercial cellular / mobile systems (see table below).

because they are less suited to utilities' mission critical control systems, where rapid and dynamic interactivity is required.

3.72 Mobile networks are unlikely to provide sufficient geographic coverage, resilience, reliability or latency and they would not be Smart Grid dedicated networks[94]. As noted by Plum, if there is a need to shut down network elements (for example, transformers) due to conditions such as overload, delays of milliseconds can be serious, hence network availability, reliability and resilience are essential[95]. ETSI further notes that it is essential that utility systems are self-managed so as to maintain and ensure coverage, latency and power backup[96]. ComReg's preliminary are as follows:

- Geographic Coverage (99.999%) – mobile networks provide population coverage in the high 90% range but geographic coverage is typically lower and more remote areas with low population densities - where renewable energy sources like wind farms are typically located – tend not to be covered or at least are not covered to the required extent. Commercial 3GPP networks are targeted to cover population centres. In general, they cannot be expected to serve isolated low populated or unpopulated areas across which utility supplies must frequently be carried and controlled[97];

- Resilience – While mobile networks are typically very resilient, service interruptions do occur as a result of extreme weather. All mobile operators reported network failures to ComReg during Storm Emma and Ophelia and mobile operators have made consumers aware of such issues. For example, Eir[98] and Vodafone[99] have experienced service interruptions during extreme weather. Smart Grid networks must be resilient to short term link breaks and power outages, not typical in commercial networks where, for example, base stations are not usually provided with multi-day battery backed up power facilities[100];

Since the completion of the first LTE and the Evolved Packet Core specifications, 3GPP has become the focal point for mobile systems beyond 3G.

[94] Baimel, D, 2016, Smart Grid Communication Technologies, Journal of Power and Energy Engineering, 2016, 4, 1-8.

[95] For example, ESB noted that "*Smart Grid requires almost instantaneous communications with certain applications, extremely high availability of telecommunications channel, and coverage from designated base station as well as robust cybersecurity*". ComReg Document 17/105s.

[96] ETSI TR 103 401 Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements.

[97] CEPT updates to ITU - 'Smart grid utility management systems' Report, p21.

[98] https://www.rte.ie/news/business/2018/0302/944570-eir-reporting-service-interruptions-due-to-weather/

[99] http://www.thejournal.ie/vodafone-storm-1316479-Feb2014/

[100] CEPT updates to ITU - 'Smart grid utility management systems' Report, p21.

- Reliability – Reliability can generally be measured in terms of frequency and duration of network outages, the number of disturbances due to poor power quality, and the extent to which widespread blackouts have been eliminated. While mobile networks have proven very reliable they do fail on occasion, for various reasons. For example, Eir[101], Three[102] and Vodafone[103] have all experienced network failures unrelated to extreme weather. The potential for network interruptions is recognised in licence conditions - licensees are subject to the minimum "Availability of the Network" Standard[104]; and

- Latency – Latency requirements for Smart Grids vary but are at a maximum of 10 ms to maintain stability but can be as low as 1 ms in the control of electricity sub-stations[105]. As noted by Plum, existing mobile networks currently are unable to meet these requirements, with 4G networks having minimum latencies of around 30 ms.

3.73 Plum is of the view that while certain aspects of a Smart Grid could be supported on a mobile network, there is strong rationale for a dedicated network because:

- Mobile networks may not be able to meet the availability and reliability requirements - in particular they may fail when the mains power fails which is precisely when Smart Grid networks are most needed;

- Mobile networks may not have coverage in areas where Smart Grid elements such as remote sub-stations and wind farms are located and operators may have little incentive to provide such coverage;

- Despite new concepts such as network slicing, mobile networks may have insufficient capacity or there may not be a clear business model to give the appropriate prioritisation to Smart Grid control messages; and

[101] https://www.rte.ie/news/2015/0902/725168-eircom-fault/
[102] http://www.thejournal.ie/mobile-phone-networks-are-having-problems-2032568-Apr2015/
[103] http://www.thejournal.ie/vodafone-network-down-4124400-Jul2018/
[104] The Licensee shall ensure that network unavailability is less than 35 minutes (based on the weighting factors set out License) per six month period.
[105] The JRC in the UK has indicated that for some of the critical applications, particularly with transformers, 0.25 the cycle time (that is, 5ms) might be typical.

- The benefits of using commercial networks are smaller for Smart Grids than public safety[106] as there is little need for handsets which benefit substantially from commercial economies of scale.

3.74 These views are consistent with those of EirGird and at least one Network Utility Operator (ESBN) who both consider that a public mobile network may not be appropriate for the provision of Smart Grid[107].

3.75 In light of the above, ComReg remains of the preliminary view that:

a) there are no alternative unassigned frequencies to provide Smart Grid in Ireland;

b) there are no alternative technologies to provide Smart Grid in Ireland; and

c) use of existing mobile networks would not be suitable to provide for the likely requirements of Smart Grid as described by Plum and CEPT.

Overall policy issue

3.76 ComReg remains of the preliminary view that the primary policy issue to consider in assigning rights of use for 400 MHz spectrum is whether such rights should be assigned on a service neutral or service specific basis (that is, for Smart Grid use).

Objectives

3.77 This RIA assesses the impact of the proposed measure(s) on stakeholders, including consumers, and on competition. This should identify the most appropriate and effective means to assign the 400 MHz spectrum in an objective, transparent, and non-discriminatory manner while promoting the interests of end-users and the economic development of the electronic communications sector and the State.

3.78 ComReg seeks to design and conduct the process for assigning new rights of use in the 400 MHz band in accordance with its statutory remit in managing spectrum. That remit, in summary, is to encourage the efficient use and ensure the effective management of spectrum, to promote competition in the electronic communications sector, to contribute to the development of the internal market, and to promote the interests of users within the Community. Please see Annex 1 for a more detailed overview.

[106] In the UK, emergency services have opted to move to mobile using EE's LTE network and US public safety organisations are following a similar approach – Document 19/23a Plum Report - Potential use of the 400 MHz band in Ireland.
[107] ComReg Document 19/23s – Non-Confidential Submissions to ComReg Document 18/92 on the Proposed Release of the 410 – 414/ 420 – 424 MHz sub-band – Published March 2019.

3.79 ComReg's goal, ultimately, is to choose the regulatory measure(s) which are most likely to maximise the benefits for consumers in terms of price, choice, and quality of products and services.

3.80 The remainder of this chapter contains the "**Assignment Process RIA**" – this addresses the primary policy issue and the statutory objectives outlined above.

Identify and describe the regulatory options (Step 2)

3.81 As discussed in Chapter 2, ComReg proposes to keep open the possibility that 2 × 3 MHz in the 414 – 417 MHz / 424 – 427 MHz range may be required for BB-PPDR in future. Therefore, rights of use for 2 × 4 MHz (410 – 414 MHz / 420 – 424 MHz) would be made available in this award, rather than the previously proposed 2 × 5.5 MHz.

3.82 In light of the preceding discussion, and taking into consideration information provided in submissions in response to Document 17/67 and Document 18/92, ComReg considers that the following three regulatory options are available to it.

Option 1 – Assign all rights of use to the 400 MHz band on a service and technology neutral basis.

3.83 Under Option 1 the rights of use would be assigned on a service and technology neutral basis, allowing all bidders to compete for the same spectrum regardless of the intended use of those rights of use.

Option 2 – Limit all rights of use to the 400 MHz band for the provision of Smart Grid.

3.84 Under Option 2 all rights of use (2 × 4 MHz) to the 400 MHz band would be limited to the provision of Smart Grid as defined by Plum[108]. The only valid bidders would be those designated or licensed to operate a utility network (electricity, gas and water) in Ireland.

3.85 Bidders would require a licence issued by the Commission for Regulation of Utilities ("CRU") to distribute electricity, gas and/or water through a utility network. The current network licence holders are: ESB Networks (electricity distribution network operator and owner), EirGrid (electricity transmission network operator), and Gas Networks Ireland[109] (gas network owner and operator)[110].

3.86 The definition of a "Network Utility Operator" that ComReg proposes to use for the purpose of this award is:

[108] See para 3.43 of this document.
[109] Gas Networks Ireland is a subsidiary of Ervia. Ervia is a commercial semi-state company with responsibility for the delivery of gas and water infrastructure and services in Ireland.
[110] https://www.cru.ie/professional/energy/energy-networks/

- **in the electricity sector-**
  A person that has been granted a licence by the Commission for Regulation of Utilities under section 14 of the Electricity Regulation Act 1999, as amended:

  - *to discharge the functions of the transmission system owner;*
  - *to discharge the functions of the transmission system operator;*
  - *to discharge the functions of Distribution System Owner;*
  - *to discharge the functions of the distribution system operator.*

- **In the gas sector-**
  The company or a subsidiary of the company, the functions of which are laid out in section 8 of the Gas Act 1976 and in section 11 of the Gas (Interim) (Regulation) Act 2002; and

- **In the water sector-**
  The private company limited by shares formed by virtue of section 4 of the Water Services Act 2013 as amended.

3.87 Alternatively, Option 2 could proceed in the same manner as Option 1. If no applications are received then a full service and technology neutral award would be held for the entire 2 × 4 MHz.

Option 3 – Limit some rights of use for the provision of Smart Grid and the remainder on a service and technology neutral basis.

3.88 Under Option 3, the available rights of use would be divided into two parts (Part A and Part B). Part A would be comprised of 2 × 3 MHz whose rights of use would be limited to Network Utility Operators as described in Option 2.

3.89 Part B would comprise the remaining 2 × 1 MHz whose rights of use would be available on a service and technology neutral basis as described under Option 1.

3.90 Alternatively, Option 3 could proceed in the same manner as Option 1. If no applications are received for Part A (2 × 3 MHz) then a full service and technology neutral award would be held for the full 2 × 4 MHz as would be the case under Option 1.

Identification of stakeholders

3.91 Step 3 assesses the likely impact of the proposed regulatory measures on stakeholders. Hence a necessary precursor is to identify such stakeholders who, in this RIA, fall into two main groups:

i. Consumers (Impact on consumers is considered separately below); and

ii. Industry stakeholders.

3.92 There are a number of key industry stakeholders in relation to the matters considered in this chapter. These are:

- Network Utility Operators (that is, in the Electricity, Gas and Water sectors);
- Mobile Network Operators ("MNOs"); and
- Other Service Operators (for example, providers of PMR, PPDR and TETRA/TEDS[111], Narrowband Internet of Things ("NB-IoT") etc.).

Impact on stakeholders (Step 3)

3.93 It is recognised that, to the extent that a stakeholder has submitted a proposal in response to Document 17/67 or Document 18/92, they are likely to prefer the option that most closely reflects that proposal. Otherwise, stakeholders are likely to prefer an option which would offer the greatest amount of contestable spectrum (so as to provide the greatest chance of obtaining spectrum rights).

Network Utility Operators

3.94 ComReg notes the views of ESBN that a minimum of 2 × 3 MHz is necessary to provide for the provision of Smart Grid. In its submission to Document 18/92, ESBN notes its preference for Option 2, reserving all available spectrum for Smart Grid. ESBN notes that reserving all available spectrum could serve to future proof a Smart Grid network. As noted in the Plum report, applications such as video surveillance of key installations may be introduced in the future requiring access to the full spectrum available. Option 2 would allow a Network Utility Operator to obtain access to additional rights of use to support such uses that may arise in the future.

3.95 While ESBN has a preference for Option 2, it observed that Option 3 is most likely to meet ComReg's objectives. ESBN outlined a strong preference for Option 3 over Option 1, as Option 3 would still reserve a sufficient portion of spectrum (2 × 3 MHz) for Smart Grid. EirGrid also welcomed the proposal to allocate 2 × 3 MHz of spectrum in the 400 MHz band specifically for Smart Grid services, which indicates support for Option 2 or Option 3.

3.96 From the point of view of a Network Utility Operator, Option 2 has an advantage over Option 3 in that it reserves all available spectrum for Smart Grid. However, Option 3 may provide Network Utility Operators a degree of choice not available

[111] See Section 3 of the Plum Report - ComReg Document 19/23a.

under Option 2. Under both Option 2 and Option 3, a Network Utility Operator would have the ability to bid on rights of use in the remaining 2 × 1 MHz. Under Option 2, this additional spectrum would need to be used for Smart Grid. However, under Option 3, Network Utility Operators may also use the remaining 2 × 1 MHz for alternative uses, such as Smart Metering or PMR type services, if they so wish. This may be preferred by certain Network Utility Operators who wish to be assigned rights of use for the provision of Smart Grid (2 × 3 MHz) and other alternative uses such as Smart Metering.

3.97 Option 1 is the least preferred option for Network Utility Operators. Under Option 1 there is no certainty that such a provider would be assigned its preferred quantum of spectrum necessary for the provision of Smart Grid. Under Option 1, and in light of the findings of the Plum Report, there is a risk that Network Utility Operators could be denied an essential input to the provision of Smart Grid for which no alternative frequencies are available. Such operators would have to operate their networks using existing telemetry systems or over mobile networks, which, as previously noted, is not conducive to the effective operation of a Smart Grid and in particular Mission Critical activities.

MNOs

3.98 MNOs are likely to prefer Option 1 over Options 2 and 3 as all available spectrum is contestable and would not restrict potential bidders from competing for all available spectrum. While mobile services are unlikely to be provided as a result of the assignment of 400 MHz rights of use, MNO's nonetheless may be interested in those rights of use to complement existing rights of use currently providing NB-IoT type services, noting that the Plum Report outlined that alternative uses of spectrum may be suitable for NB-IoT.

3.99 There are already multiple general-purpose IoT networks in Ireland including NB-IoT and Sigfox[112] as well as some LoRa deployments[113]. In that regard, MNOs have adopted new networks for specific uses such as Low Power Wide Area Networks ("LPWAN") specifically to support NB-IoT devices. Vodafone activated an NB-IoT network in August 2017[114]. Such technologies are also available for deployment in licence-exempt spectrum, meaning that end-users can deploy their own IoT network.

[112] For example, VT have deployed a Sigfox network and claim this can be used for Smart Metering. VT is the exclusive operator of the SIGFOX network in Ireland.
[113] https://www.semtech.com/company/press/Semtech-LoRa-Technology-to-Enable-Irelands-Nationwide-IoT-Network
[114] http://www.vodafone.com/business/news-and-insights/press-release/vodafone-is-first-to-announce-nb-iot-launch-markets

3.100 MNOs would likely prefer Option 3 over Option 2 as this provides an opportunity for the assignment of some 400 MHz rights of use. However, for an MNO only 2 × 1 MHz would be available in Part B under Option 3 which is less than the minimum bandwidth required for LTE use (1.4 MHz is minimum LTE bandwidth). MNOs may also be indifferent between Options 2 and 3, given that LTE equipment for the 410 – 430 MHz will likely be FDD and use a minimum bandwidth of 3 MHz (that is, a total of 2 × 3 MHz)[115]. ComReg retains its preliminary view that MNOs would likely prefer Option 1 but notes that no submissions were received from MNOs in response to Document 18/92.

Other Operators/Users

3.101 Other operators (PMR uses, PPDR and Smart Metering) would likely prefer Option 1 over Option 2 as all available spectrum is contestable and would not restrict certain potential bidders from competing for all available spectrum. However, such operators may also prefer Option 3 over Option 1 because 2 × 1 MHz is available on a service and technology neutral basis and other potential competing operators such as MNOs may be less likely to compete for that portion of the band given the lack of a 2 × 3 or 2 × 1.4 MHz block (while the minimum bandwidth for LTE is 1.4 MHz, there is little or no equipment available for that bandwidth in any of the LTE bands. As a result, the expectation is the minimum bandwidth will be 3 MHz. In any case, 2 × 1 MHz is less than the minimum bandwidth required for LTE) [116]. Therefore, ComReg is of the preliminary view that other operators/users would prefer either Options 2 or 3 but notes that no submissions were received from other operators/users.

Impact on competition (Step 4)

3.102 Plum is of the view that it is very unlikely that MNOs would be interested in deploying a general-purpose network in the 400 MHz band. While the 400 MHz band is low in frequency and has good propagation characteristics suitable for coverage, there are no mobile handsets compatible with the 400 MHz band and coverage gains can only be realised if efficient antennas can be deployed on terminal devices[117]. Therefore, the assignment of 400 MHz rights does not impact the provision of existing or future mobile services. As a result, under all options, competition in downstream mobile markets would not likely be affected.

[115] See Section 4 of the Plum Report – ComReg Document 19/23s.
[116] Plum Report – ComReg Document 19/23a, p26.
[117] At 400MHz the optimal passive half-wave dipole antenna is around 35cm this is larger than most mobile handsets so if the band were used for mobile the reduced antenna size would likely nullify the propagation gains over frequencies such as 800MHz.

3.103 Under Option 1, there is a risk that rights of use could be assigned to bidders other than a Network Utility Operator. Under these circumstances, one of two scenarios is likely to arise:

a) The winning bidder would use the spectrum rights of use for uses other than Smart Grid thereby foreclosing spectrum rights of use for the provision of Smart Grid; or

b) The winning bidder would use the spectrum rights of use to provide Network Utility Operators with access to a communications network to enable them manage their Smart Grids.

3.104 In relation to (a), Network Utility Operator(s) would have no alternative frequencies or solutions suitable to satisfy the technical requirements as described above. Network Utility Operators would have to rely on other sub-optimal alternatives such as existing telemetry systems or mobile networks. Indeed, by foreclosing rights of use to Network Utility Operators for the provision of Smart Grid, MNOs may strategically or inadvertently compel Network Utility Operators to use mobile networks as a sub-optimal alternative in order to, at a minimum, improve on existing telemetry systems. As previously discussed, these alternatives would seem unlikely to provide for an effective Smart Grid solution and the benefits of same (increased efficiencies, reduced cost, reduced CO_2 emissions)[118] would not be realised to the same extent. In effect, under this scenario, Smart Grid as set out above could be significantly impaired with the existing grid unable to realise many of these benefits[119].

3.105 In relation to (b), a winning bidder may be able to offer access to a communications network to enable a Smart Grid using the 400 MHz band and potentially other rights of use (for example, the 800 and 900 MHz bands). Alternatively, rights of use could be leased or traded to the Network Utility Operator to operate a communications network for the Smart Grid in its own right. However, this would likely lead to a negative impact on competition as rights of use to an essential input would be invested in a single provider (only one block of 2 × 3 MHz is available) who would not be utilising the Smart Grid but rather providing network access or rights of use to a Network Utility Operator.

3.106 In effect, such an entity could become the sole provider of spectrum rights of use for the provision of access to a Smart Grid communications network. As noted by DotEcon, this would distort any auction, as there would effectively be competition

[118] See Impact on Consumers below.
[119] Xi Fang et al. 2012 Smart Grid – The new and Improved Power Grid: A Survey – IEEE Communications Surveys & Tutorials.

to secure the position of sole provider and spectrum prices could be artificially inflated by competition for monopoly rents. DotEcon also notes that such an outcome would be contrary to the objective of ensuring an efficient assignment and use of the radio spectrum. Further, the provision of access to this communications network using the 400 MHz band rights of use would likely be at a rate above the cost incurred by that entity during the Award Process. By extension, this would also be above the value expressed by the Network Utility Operators during the award process. In effect, a Network Utility Operator would likely have to pay a premium above the market clearing rate determined by the Award Process, potentially eroding any efficiency gains that may be accrued from the provision of a Smart Grid in the first instance.

3.107 For similar reasons, such an approach is also not recommended by ETSI in the provision of Smart Grid who notes that "Ideally, the 400 MHz UHF/VHF spectrum for the Utility Operation Networks (UON) will be self-owned/self-managed so as to ensure that the required resilience, quality of service (QoS), etc., are maintained and, especially, the cost of operation is kept similar to existing costs. Some utility operations may consider allowing a third-party to supply the necessary communications so long as the spectrum remains under the control of the utility."[120] [Emphasis added].

3.108 Alternatively, under Option 2, 2 × 4 MHz rights of use would be limited to Smart Grid use. Each Network Utility Operator would have the opportunity to be assigned rights of use for the provision of Smart Grid whose use could not be foreclosed and spectrum rights of use would not be a barrier to the provision of Smart Grid, compared to Option 1. However, under Option 2, 2 × 4 MHz would likely be assigned to a Network Utility Operator for Smart Grid when 2 × 3 may have been sufficient and the remaining 2 × 1 MHz would be assigned to Smart Grid as a result of the restriction rather than a requirement of same. While alternative spectrum is available for other uses (for example, PMR), an unreasonable restriction of an additional 2 × 1 MHz for Smart Grid could deny other uses additional spectrum that would likely improve competition in those markets.

3.109 Under Option 3, 2 × 3 MHz rights of use would be limited to Smart Grid in line with the amount of spectrum necessary for the efficient operation of a Smart Grid. Each Network Utility Operator would have the opportunity to be assigned rights of use for the provision of Smart Grid whose use could not be foreclosed and spectrum rights of use would not be a barrier to the provision of Smart Grid compared to Option 1. Finally, under Option 3, as noted by DotEcon, any winning bidder of the 2 × 3 MHz portion could find it difficult to justify denying any remaining Network

[120] ETSI, 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', ETSI TR 103 401 V1.1.1 (2016-11).

Utility Operators a reasonable and necessary request to access the Smart Grid and/or associated spectrum rights because the winning bidder would be subject to ex-post competition law obligations, noting that there are currently no alternative frequencies available for the provision of Smart Grid.

3.110 Therefore, ComReg remains of the preliminary view that Option 3 provides for the best opportunity to promote competition for the following reasons:

- It would prevent foreclosure of an essential input for Smart Grids by providing Network Utility Operators with an opportunity to be assigned the amount of spectrum rights of use necessary to efficiently operate a Smart Grid;
- It would release the remaining spectrum rights of use (2 × 1 MHz) on a service and technology neutral basis allowing other uses access to additional spectrum notwithstanding the availability of suitable alternatives in other bands;
- The possibility of a subsequent ex-post competition complaint by an alternative Network Utility Operator against the winning bidder should provide a sufficient restraint on the winning bidder denying reasonable access.
- It would likely prevent any Network Utility Operator from leveraging its position as sole licensee of an essential input as the winning bidder would be subject to ex-post competition law obligations;
- It would avoid outcomes where spectrum goes unsold despite efficient demand existing for that spectrum (that is, the auction would be sequenced such that demand for Smart Grid would be assessed first); and
- The award would promote incentives for bidders not to engage in strategic or collusive behaviour.

3.111 Therefore, and for the reasons stated above, Option 3 would, in ComReg's view, better promote competition.

Impact on consumers (Step 5)

3.112 ComReg considers that consumers would prefer the regulatory option which does not impact its existing use of mobile services and has the greatest potential to promote efficient energy technologies while increasing consumer welfare, thereby maximising the long term benefits to consumers in terms of price and quality in the provision of mobile and non-mobile services. Consumers are also likely to prefer options which can avoid or reduce disruptions to the services they currently use.

3.113 As noted in the 'Impact on competition' section above, 400 MHz rights of use are not suitable for the provision of mobile services. Therefore, for all options there is no consumer impact in the provision of mobile services. As a result, consumers are likely to be concerned about the provision of services resulting from the use cases considered suitable in the Plum Report (that is, PMR, PPDR, Smart Metering and Smart Grid) and the related end-uses provided by those networks (for example, energy and other utilities). Further, the provision of 2 × 1 MHz on a service and technology neutral basis provides rights of use for other uses identified by Plum noting that such uses also have other alternative spectrum rights of use.

3.114 In relation to Option 1, consumers may be indifferent about the assignment of rights of use to a particular user given that the provision of mobile services are unlikely to be affected. However, under Option 1, and given the multiple likely uses of the band, there is a possibility that the assignment of rights of use for the provision of one type of use could exclude the provision of other use types. In particular, the possibility for deployment of a Smart Grid network in Ireland would be entirely removed if more than 2 × 1 MHz were assigned to users for the provision of other services (such as PMR or NB-IoT). This situation would not arise for any other use type since, as noted by Plum, all other potential uses (that is, PMR, PPDR and Smart Metering) have alternative frequencies on which to operate or alternative solutions to provide for those services. Smart Grid is the only use case that does not have suitable alternative frequencies or solutions.

3.115 In that regard, it is worth considering what consumer benefits would arise from the provision of Smart Grid which could be denied under Option 1. ComReg assesses the benefits of a Smart Grid for the electricity network below noting that similar benefits are available for other utility providers. In that regard, consumer benefits from Smart Grid use can be broadly divided into three areas:

a) Reduced losses and inconvenience to consumers from power outages and power quality issues. For example, there was a total of 35,859[121] power outages occurred across the country in 2015[122];

b) Downward pressure on energy prices (gas and electricity) through improved operating efficiencies arising from use of Smart Grid; and

c) Increased use of renewable energies and reduced carbon emissions.

3.116 In relation to (a), Smart Grid systems are designed to detect power quality issues and loss of power, enabling system operators to rapidly diagnose system problems,

[121] This excludes outages due to storms, outages that lasted less than 3 minutes and those caused by problems in the transmission system.
[122] Latest ESB Performance Report - 2015.

preventing outages from occurring and more rapidly restore service when they occur. For example:

- Demand response systems can reduce the stress on system assets during peak conditions, reducing their probability of failure[123] [124];
- Sensors and intelligent controls provide operators with increased awareness of the network allowing early detection of failing equipment[125] allowing predictive condition-based maintenance[126]; and
- Smart Grid can quickly isolate system problems and location of outages, reducing outage duration and restore itself after a blackout[127], thereby limiting the number of customers affected[128].

3.117 In relation to (b) 'operating efficiencies' from Smart Grids can occur in a number of ways including:

- Reduced use of inefficient generation to meet system peaks. Usually the most costly and inefficient generation occurs during peak periods[129]. Demand for electricity is not constant and the cost to meet these different demands varies. This requires a buffer of excess power in the existing grid. This causes higher emissions, higher costs and lower efficiency[130], ultimately impacting on consumers.
- Improved efficiency removes or reduces the need for capacity expansion or upgrades and the associated costs of same[131].
- Reduced transmission congestion costs[132] through the use of Smart Grid technologies can translate into significant savings.

3.118 In relation to (c), consumers are also likely to prefer options that promote increased use of renewable energy, particularly where such options do not require actions by consumer's themselves[133]. For example, 7 in 10 residential electricity customers

[123] Momoh, J, 2012, Smart Grid Fundamentals of Design and analysis, p23.
[124] US Department of Energy, Understanding the Benefits of the Smart Grid, 2010.
[125] US Department of Energy, Understanding the Benefits of the Smart Grid, 2010.
[126] Bangalore, P & Tjernberg, L (2016) Condition Monitoring and Asset Management in the Smart Grid.
[127] Xiao, Y, Communications and Networking in a Smart Grid, p5.
[128] Borlase, S, 2017, Smart Grids: Infrastructure, Technology, and Solutions, p406.
[129] Smart Grid Handbook, 3 Volume Set, Volume 1, p16.
[130] Ramana, V & Manoj, S, 2017, Smart Grid an optimal solution to economic and environmental benefits. International Journal of Electrical Electronics & Computer Science Engineering Volume 4, Issue 4 (August, 2017).
[131] Smart Grid Handbook, 3 Volume Set, Volume 1, p16.
[132] Transmission congestion costs arise from the fact that, when transmission lines represent a bottleneck, it is not possible to generate electricity from the cheapest sources.
[133] In that regard, it is ComReg's understanding that much of the benefits of a Smart Grid relate to the transmission network and can be obtained absent consumer action on Smart Meters.

believe it important that energy is produced from renewable resources[134] [135]. Further, 88% of Irish consumers agree that fighting climate change and using energy more efficiently can boost the economy and jobs[136].

3.119 In that regard, Smart Grid systems are needed in order to intelligently manage renewable energy such as solar and wind. Intelligence in sub-stations will enable control and data acquisition systems to more effectively manage power supply and demand in grid segments that contain renewable energy sources. Smart Grid technologies enable high levels of renewables mainly by increasing grid flexibility and facilitating the increased use of variable renewable generation technologies. Further, in the medium to long term, the provision of Smart Grid systems provides the opportunity for certain consumers to sell consumer-produced renewables back to the grid.

3.120 Operating efficiencies and a more intelligent grid network leads to a more reliable grid, reducing power outages and keeping downward pressure on electricity prices. Further, these benefits are obtained while also increasing access to renewable energies and reducing carbon emissions. Consumers are therefore likely to prefer the assignment of radio spectrum that promotes such efficiencies.

3.121 In light of the above, ComReg remains of the preliminary view that consumers are unlikely to prefer Option 1 as the benefits of Smart Grid outlined above may not arise. Option 2 would likely be preferred to Option 1 as this provides Network Utility Operators with the opportunity to obtain spectrum rights of use in the provision of a Smart Grid. However, the assignment of 2 × 4 MHz would likely be in excess of the spectrum requirements of Smart Grid and the remaining 2 × 1 MHz may be better served for other alternative uses as outlined in the Plum Report. In that regard, Option 3 best provides for the provision of the Smart Grid while also ensuring other uses are also provided with 400 MHz rights of use where required.

3.122 Therefore, ComReg remains of the preliminary view that consumers are likely to prefer Option 3.

Preferred Option (Step 5)

3.123 The above assessment considers the likely impact of all valid regulatory options from the perspective of industry stakeholders and considering the likely impacts of all options on competition and consumers. In summary, ComReg considers that

[134] CRU Annual Survey of Residential and SME Customers in the Gas and Electricity Markets in Ireland, December 2017.
[135] In particular, this would appear to arise that Smart Grid can deliver certain benefits absent full engagement of smart meters. Much of the gains from Smart Grid in terms increased access to renewable energies are independent from Smart Meters which certain consumers remain unconvinced.
[136] Special Eurobarometer 459, Climate Change, September 2017.

MNOs and to a lesser extent other potential users would likely prefer Option 1 in which all rights of use are assigned on a service and technology neutral basis. Alternatively, Network Utility Operators are likely to prefer Option 2. Network Utility Operators could potentially prefer Option 3, if they wish to be assigned additional rights of use for the provision of Smart Grid (2 × 3 MHz) and other alternative uses, such as Smart Metering. ComReg considers that while Option 1 and Option 2 might be in the best interests of particular stakeholders, neither is likely to be in the best interests of competition and consumers.

3.124 Option 3, in this case, appears to be the best means to promote competition for spectrum usage rights and, in turn, promote competition in the related markets. Further, consumers are likely to prefer Option 3 as it provides a range of benefits across different potential uses of the radio spectrum. This approach allows an essential input in the provision of Smart Grid to be provided for where there are no alternative frequencies available to Network Utility Operators. DotEcon also recommends that it is likely to be efficient for at least part of the band (2 × 3 MHz) to be used for Smart Grid given that there is no alternative spectrum available to support such a use. Therefore, for the reasons set out in this draft RIA, ComReg is of the preliminary view that Option 3, to limit some rights of use (2 × 3 MHz) for the provision of Smart Grid and award the remainder on a service and technology neutral basis, is its preferred option[137].

3.125 In forming this view, ComReg is aware that a key principle to the management of radio frequencies under the Regulatory Framework is service and technology-neutrality[138]. This principle is reflected in ComReg's obligations under the Framework Regulations[139], the RSPP Decision[140] and the 2002 Act, as amended[141]. Despite this overarching principle, restrictions may be imposed on the types of services and/or technologies that may be provided or deployed in a specific band, though any such restrictions must be justified, proportionate, transparent, and non-discriminatory in order to fulfil certain relevant objectives, including to safeguard the efficient use of spectrum[142] and when general interest objectives are at stake[143].

[137] ComReg is also of the preliminary view that the new rights of use should be assigned by auction. Chapter 4 considers different auction formats and identifies a "Simple Clock Auction" (SCA) as preferable in the assignment of all rights of use.
[138] Recitals 32 and 34 of the 2009 Amending Directive.
[139] Regulations 16(1)(a), 17(2) and 17(4) of the Framework Regulations.
[140] Articles 2(1)(e), 2(2)(a), 3(f) and 6(3) of the RSPP Decision.
[141] Section 12(6) of 2002 Act, as amended.
[142] Regulation 17(5) of Framework Regulations; Articles 2(1)(e) of the RSPP Decision; Recital 38 of the 2009 Amending Directive; and Recitals 34 and 35 of the 2009 Amending Directive.
[143] Recital 34 of the 2009 Amending Directive.

3.126 ComReg considers its 'Preferred Option' is justified and proportionate for the reasons set out in the RIA above, and in summary include:

- There is likely a key requirement for Smart Grid as evidenced by the various national and international policy targets to reduce carbon emissions and make the energy system more secure and sustainable, all of which include the provision of Smart Grids (see paras 3.46 – 3.57);

- Suitable and sufficient alternative spectrum rights of use are not readily available in other bands. In that regard, ComReg notes that:

    - There are no alternative radio frequencies available for the use of Smart Grid. The 450 – 470 MHz band is the only other sub 1 GHz spectrum that is suitable for the provision of Smart Grid and is currently assigned for PMR (Business Radio) and is therefore unavailable (see paras 3.31 - 3.40);

    - Alternative technical solutions such as existing telemetry systems and mobile networks are not effective or sufficient for the provision of Smart Grid and do not cater for the technical requirements of a Smart Grid as determined by Plum and CEPT (see paras 3.58 – 3.76);

    - ComReg's expert advisors Plum is of the view that there is no other suitable spectrum available in the medium term to meet the critical communications needs of Smart Grids compared with the situation for the other identified uses; and

    - The likely technologies that have been considered by Plum are likely to be varied for the different use cases (PMR, NB-IoT, LTE and TETRA) warranting a technology neutral approach.

- A service and technology neutral award could result in the assignment of rights of use to other uses foreclosing spectrum rights of use for the provision of Smart Grid;

- It would better ensure the efficient use of the radio spectrum by preventing speculative acquisition of 400 MHz rights of use in order to deny a Network Utility Operators those rights of use;

- The proposed restriction would only relate to the spectrum rights of use necessary to efficiently operate a Smart Grid (that is, 2 × 3 MHz). The remaining 2 × 1 MHz would be made available on a service and technology neutral basis (see paras 3.62 – 3.64 and 3.81 – 3.90);

- The proposed restriction is being applied such that if there are no applications for the 2 × 3 MHz portion from applicable Network Utility Operators, the full 2 × 4MHz would be released on a service and technology neutral basis (see paras 3.81 – 3.90);
- ComReg has taken account of issues raised by responses to Document 17/105 by commissioning Plum to assess potential uses of the 400 MHz and the availability of alternative frequencies for same. Further Plum has provide a further report on responses received to Document 18/92;
- The views of DotEcon that this band is the only opportunity in the foreseeable future to establish a wireless Smart Grid network in Ireland; and
- There does not appear to be any less onerous means to address the likely requirement for spectrum rights of use in the provision of Smart Grid and to address the risk that those rights of use may not be assigned to a Network Utility Operator in a service and technology neutral award.

3.5 Assessment of preferred option against ComReg's statutory functions, objectives and duties

3.127 This draft RIA identifies and considers a number of options potentially available to ComReg, within the context of the RIA analytical framework as set out in ComReg's RIA Guidelines (impact on industry stakeholders, the impact on competition and the impact on consumers). This draft RIA also analyses the extent to which those various options would facilitate ComReg to meet its statutory remit in managing the 400 MHz band. This includes, in particular, analysing the extent to which the various options would promote competition and ensure that there is no distortion or restriction of competition in the electronic communications sector, whilst also encouraging efficient investment in infrastructure, promoting innovation, and ensuring the efficient use and effective management of the 400 MHz band.

3.128 In this section, ComReg assesses the Preferred Option against the statutory provisions relating to spectrum management (see Annex 1). Those provisions are not exhaustively set out herein. In summary, ComReg's statutory function is to manage the national radio spectrum resource and its objectives, in doing so, are to promote competition, to contribute to the development of the internal market, to promote the interests of users within the Community, and to ensure the efficient use and effective management of spectrum. ComReg is also required to take measures towards the achievement of its objectives but must also have regard to certain regulatory principles. Specifically, its measures must be justified, transparent, non-discriminatory, and proportionate.

Promotion of Competition

3.129 One of ComReg's statutory objectives, set out in section 12 of the 2002 Act, as amended, is to promote competition by, amongst other things:

- ensuring that users derive maximum benefit in terms of choice, price and quality;
- ensuring that there is no distortion or restriction of competition in the electronic communications sector;
- encouraging efficient use and ensuring effective management of radio frequencies; and
- ensuring that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality.

3.130 Other statutory provisions also require ComReg to promote and safeguard competition in the electronic communications sector:

- Regulation 16(2) of the Framework Regulations requires ComReg to apply objective, transparent, non-discriminatory and proportionate regulatory principles by safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure based competition;
- Regulation 9(11) of the Authorisation Regulations requires ComReg to ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies; and
- Article 4 of Directive 2002/77/EC (Competition Directive) requires ComReg to refrain from granting exclusive or special rights of use of radio frequencies for the provision of electronic communications services;

3.131 ComReg remains of the preliminary view that the Preferred Option would best safeguard and promote competition. In particular, it should maximise competition by preventing the foreclosure of an essential input to the provision of Smart Grid (that is, 400 MHz rights of use). In identifying the Preferred Option, ComReg applied objective, transparent, non-discriminatory and proportionate criteria and principles.

3.132 ComReg also considers that the alternative options would not achieve its objectives concerning competition to the same extent as the Preferred Option. In particular, Option 1 could lead to the foreclosure of an essential input to the provision of Smart Grid and Option 2 goes beyond what is necessary to prevent the said foreclosure.

Contributing to the development of the Internal Market

3.133 ComReg considers the following factors to be particularly relevant to its statutory objective to contribute to the development of the Internal Market, in the context of this award process:

- The Preferred Option should best support the establishment and development of trans-European networks and the interoperability of pan-European services, in particular by facilitating, or at the very least by not distorting or restricting, entry into the Irish mobile market by undertakings from other EU Member States; and
- In selecting the Preferred Option, and in order to ensure the development of consistent regulatory practice and the consistent application of EU law, ComReg has had due regard to the views of the European Commission, BEREC and other EU Member States.

Encouraging the establishment and development of trans-European networks and the interoperability of pan-European Services

3.134 ComReg notes the overlap between this objective and the objective to promote competition. Encouraging the establishment and development of trans-European networks requires that operators from other Member States, who seek to develop such networks, are given a fair and reasonable opportunity to obtain and/or use all requisite spectrum. ComReg considers that any regulatory measure which failed to encourage (or which actively discourages) the establishment and development of trans-European networks, would not meet the objective at issue.

3.135 ComReg, in this regard, considers that limiting rights of use to part of the 400 MHz band for Smart Grid best encourages the establishment and development of trans-European networks. The European Commission's Trans-European Networks for Energy TEN-E Regulation has identified Smart Grid deployment as one of 12 trans-European energy infrastructure priority corridors and areas. Smart Grids feature on the Commission's list of projects of common interest (PCIs). PCIs are key energy infrastructure projects seen as essential to completing the EU's internal energy market.

3.136 The Integrated Single Electricity Market (I-SEM) is a new wholesale electricity market arrangement for Ireland and Northern Ireland. The new market arrangements are designed to integrate the all-island electricity market with European electricity markets, enabling the free flow of energy across borders. The market is run by the Single Electricity Market Operator (SEMO), a joint venture

between EirGrid (electricity transmission operator)[144] and the System Operator for Northern Ireland (SONI). The new market arrangements are designed to integrate the all-island electricity market with European electricity markets, making optimal use of cross-border transmission assets[145].

Promoting the development of consistent regulatory practice and the consistent application of EU Law

3.137 ComReg continues to cooperate with other National Regulatory Authorities ("NRAs") and to closely monitor developments in other Member States, to ensure that its regulatory practice and implementation of the Common Regulatory Framework is generally consistent with comparable jurisdictions.

3.138 For example, ComReg has had regard to international developments in the use of the radio spectrum for the provision of Smart Grid, including the policy goals of the European Commission and technical standards as described by CEPT, ETSI and the ITU.

3.139 ComReg will continue to note relevant international developments including future updates to ITU-R SM.2351-2, as identified in the ITU and ETSI respective work plan.

Promote the interest of the users within the Community

3.140 The likely impact of the Preferred Option and of the other identified option on users, generally and in the context of ComReg's objective to promote competition, has been considered earlier in this draft RIA and is not considered in any further detail in this section.

3.141 ComReg also observes that most of the measures set out in section 12(2) (c) of the 2002 Act, as amended, aimed at promoting the interests of users, relate to consumer protection more than to spectrum management. In that regard, ComReg has identified the likely consumer benefits arising from the Preferred Option.

Efficient use and effective management of spectrum

3.142 Section 10 of the 2002 Act, as amended, requires ComReg to manage spectrum in accordance with any Ministerial Policy Direction No. 11 of 21 February 2003, issued under section 13 of the 2002 Act, as amended. Policy Direction No.11 requires ComReg to ensure that, in managing spectrum, it takes account of the interests of all users of spectrum, including commercial and non-commercial users.

[144] EirGrid Group is the independent Transmission System Operator (TSO) in Ireland and Northern Ireland, through EirGrid and SONI, respectively.
[145] EirGrid - Quick Guide to the Integrated Single Electricity Market.

Also, in pursuing its objective to promote competition ComReg must take all reasonable measures to encourage efficient use and ensure effective management of spectrum.

3.143 Further, section 12(3) of the 2002 Act, as amended, also requires that all measures by ComReg, including any measure related to managing spectrum, be proportionate, and regulation 9(11) of the Authorisation Regulations requires ComReg to ensure that spectrum is used efficiently and effectively having regard to section 12(2)(a) of the 2002 Act, as amended, and regulations 16(1) and 17(1) of the Framework Regulations.

3.144 In relation to Policy Direction No.11, this draft RIA seeks to take into account the interests of all current and potential users of the 400 MHz band, commercial and non-commercial. ComReg commissioned Plum to review all potential uses of the band in order to best inform ComReg's decision making on same. ComReg is of the view that the Preferred Option would best safeguard and promote those interests. Further, ComReg's expert economic advisors DotEcon also notes that it is likely to be efficient for at least part of the band to be used for Smart Grid and that an outcome which prevented this could be contrary to ComReg's objectives to ensure the efficient assignment and use of the radio spectrum.

3.145 Based on this draft RIA, ComReg remains of the preliminary view that the Preferred Option would best encourage the efficient use of the 400 MHz band and, in particular, the portion of the 400 MHz band in which new rights of use would be assigned. There is likely to be a continued reliance on a portion of the 400 MHz band for Smart Grid into the future. If demand does not arise, a full service and technology neutral award would be conducted. Assignment of new 400 MHz rights of use for Smart Grid should provide certainty that a portion of the 400 MHz band would be available for Smart Grid use for at least 15 years, at which point demand for the band and its potential uses can be considered afresh.

3.146 The Preferred Option also promotes effective management of the radio spectrum because there are no alternative frequencies available to provide for a Smart Grid.

3.147 ComReg therefore remains of the preliminary view that the Preferred Option best accords with its statutory objectives in managing the 400 MHz band and that by pursuing any of the alternative options, ComReg would likely fail to meet some or all of its relevant statutory objectives.

Regulatory principles

3.148 Under regulation 16(2) of the Framework Regulations, ComReg must, in pursuit of its objectives under regulation 16(1) and section 12 of the 2002 Act, as amended,

apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things:

- promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods;
- 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, whilst ensuring that competition in the market and the principles of non-discrimination are preserved; and
- taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within a Member State.

Regulatory Predictability

3.149 ComReg generally has regard to the requirement for predictability in managing spectrum though this requirement must always be weighed against all relevant factors, some of which may necessitate measures which are less predictable or which are not predictable. ComReg has had regard to the requirement for predictability in its consideration of how best to reassign the 400 MHz band, as illustrated below.

3.150 ComReg considers that regulatory predictability in relation to spectrum is best promoted by having an open, transparent, and non-discriminatory process for assigning new spectrum rights of use. In that regard, where ComReg is of the view that rights of use should be limited to a certain service or technology such restrictions must be justified, proportionate, transparent, and non-discriminatory in order to fulfil certain relevant objectives. ComReg sets out in detail the reasons for limiting rights of use to a particular service for 400 MHz rights of use in the draft RIA. This approach is similar to that taken in the recent 26 GHz Spectrum Award in 2018 where a service restriction also applied and detailed justification for that restriction was provided[146].

3.151 ComReg notes that the Preferred Option would ensure that the future assignment of rights of use in the 400 MHz band at issue would be known as soon as is possible. This should result in utmost transparency and predictability, in terms of interested parties being aware of the availability of 400 MHz rights of use in the

[146]ComReg Document 18/53 – Results of the 26 GHz Spectrum Award 2018 – Published 19 June 2018.

future. ComReg, in Section 4.8 of this document, has also set out its views that any unsold lots would not be assigned for a reasonable period after the award process has ended.

3.152 ComReg remains of the preliminary view that the alternative options, would be unlikely to promote regulatory predictability as important use cases in the future that are clearly established (for example, Smart Grid in 400 MHz and National Fixed Links in 26 GHz) and have no viable alternative frequencies may be foreclosed.

3.153 In addition, ComReg remains of the preliminary view that the Preferred Option:

- should no demand from Network Utility Operators for spectrum rights of use for the provision of Smart Grid arise, all remaining rights of use should be made available on a service and technology neutral basis;
- has been justified based on the available evidence and views of Plum, CEPT, ETSI and the ITU; and
- remain technology neutral in line with the Plum report which identified a number of technologies that could be used to deliver a variety of use cases.

3.154 In light of the above, ComReg remains of the preliminary view that the Preferred Option, an auction, should best accord with the regulatory principle of promoting regulatory predictability.

Promoting efficient investment and innovation in New and Enhanced Infrastructures

3.155 ComReg remains of the preliminary view that the Preferred Option is consistent with this regulatory principle in that it should:

- facilitate a competitive release of a portion of the 400 MHz band for Smart Grid at the earliest possible opportunity, thus ensuring that the winners of the new 400 MHz rights of use are appropriately incentivised to invest in new technologies and infrastructures;
- provide clarity as to whether demand for spectrum rights of use in the provision of Smart Grid exists in practice, and allows other services access to other spectrum rights of use (2 × 1 MHz) or additional rights of use (2 × 4 MHz) if demand for spectrum does not exist; and
- allows Network Utility Operators access to spectrum rights of use that are necessary in order to efficiently role out a Smart Grid, noting that

investment in alternative solutions would lead to less efficient and less innovative outcomes.

General guiding principles (in terms of spectrum management, licence conditions and setting of licence fees)

3.156 ComReg is required to be objective, transparent, non-discriminatory, and proportionate in the exercise of its statutory functions under the Common Regulatory Framework.

3.157 In relation to spectrum management and use, ComReg notes that:

- Regulation 11(2) of the Authorisation Regulations requires ComReg to grants rights of use for radio frequencies on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate; and
- Regulation 16(2) of the Framework Regulations requires ComReg to apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things, ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services.

3.158 ComReg at all times seeks to take account of and act in accordance with the above guiding principles of Irish and EU law.

ComReg, having had regard to the applicable statutory provisions, its draft RIA and other analyses, the advice of its external consultants, and all other relevant material, remains of the preliminary view that the Preferred Option would be an objectively justified, transparent, proportionate and non-discriminatory regulatory measure by which to assign new rights of use in the 400 MHz band for a minimum of 15 years duration and for the purposes of deploying Smart Grid and/or other uses as determined by winning bidders.

Chapter 4

4 Spectrum Award Details

4.1 Introduction

4.1 In this chapter, ComReg firstly summarises the proposals made in Document 18/92 that relate to:

- Auction or Administrative award;
- Sequencing of Part A and Part B of the award process;
- The Preferred Auction format;
- Packaging of available spectrum;
- Frequency Specific vs Frequency Generic Lots;
- Competition caps;
- Unsold lots; and
- Fees.

4.2 Secondly, it sets out the main points made by respondents in relation to matters discussed therein and ComReg's response to each.

4.2 Auction or Administrative Award

Summary of ComReg's view in Document 18/92

4.3 ComReg's preliminary view was that an auction would be appropriate for determining the assignment of Part A and Part B spectrum for the following reasons:

- For Part A, ComReg noted that an auction format was necessary in order to determine which Network Utility Operator and which technologies are best placed to provide for Smart Grid; and
- For Part B, ComReg noted that it had relatively little information about which of the different potential uses and technologies would yield the most efficient outcome that ensures the most efficient use. Therefore, ComReg considered that an auction format would offer a better solution for determining the optimal allocation than relying on the very limited information available to make a judgment itself and award the spectrum administratively.

Views of Respondents

4.4 ESBN submitted that in the absence of an administrative assignment (its preferred position), it supports ComReg's proposal to release this spectrum via an auction.

ComReg's Assessment and Position

4.5 ComReg notes ESBN's submission supporting the proposed assignment by auction. ComReg is not aware of any other information which would warrant an amendment to its preliminary view.

4.6 Therefore, ComReg remains of the preliminary view that the assignment mechanism for Part A and Part B should be an auction.

4.3 Sequencing of Part A and Part B of the award process

Summary of ComReg's view in Document 18/92

4.7 ComReg proposed to award Part A and Part B using two sequential auctions:

- The first auction would allow qualified bidders (that is, Network Utility Operators) to bid for Part A (2 × 3 MHz); and
- The second auction would allow all eligible bidders (including Network Utility Operators) to bid for the remaining Part B spectrum. Should Part A go unsold in the first auction, all of the available spectrum would be made available for the second auction.

Views of Respondents

4.8 Three respondents (JRC, ESBN and 450 MHz Alliance) support the proposed sequential award process. ESBN submits that this approach facilitates the requirements of a Smart Grid operator while providing flexibility for a Smart Grid operator and/or any other interested users to compete for remaining spectrum.

ComReg's Assessment and Position

4.9 ComReg notes the submissions supporting the proposed sequencing of the award process. ComReg is not aware of any other information which would warrant an amendment to its preliminary view.

4.10 Therefore, ComReg remains of the preliminary view that Part A and Part B would be awarded using two sequential auctions.

4.4 The preferred auction format

Summary of ComReg's view in Document 18/92

4.11 In Document 18/92, ComReg considered a number of potential auction formats for assigning 400 MHz spectrum rights of use, including:

- Simultaneous Multiple-Round Ascending (SMRA) auction;
- Simple Clock Auction (SCA);
- Combinatorial Clock Auction (CCA);
- Sealed Bid Combinatorial Auction (SBCA); and
- Combinatorial Multi-Round Auction (CMRA).

4.12 ComReg identified a number of risks[147] associated with this award process and assessed the extent to which each auction format would best mitigate those risks while also ensuring that new rights of use in the 400 MHz band would be assigned efficiently.

4.13 ComReg was of the preliminary view that a Simple Clock Auction (SCA) with exit bids[148] and combinatorial closing rule[149] would be best suited to address the stated risks for the following reasons:

- a SCA allows bidders to make mutually exclusive package bids for spectrum, and bidders can express valuations for various combinations of lots removing aggregation risks that would likely arise in Part B;
- the open auction format of SCA allows bidders to update their bids in light of information received through the bids submitted by other bidders reducing the risk of common value uncertainty, and the possibility to 'bid back' also helps to mitigate the risk of an inefficient outcome due to bidder error;
- the use of exit bids and combinatorial closing rule reduces the risk of inefficient unsold lots in Part B (the risk does not arise for Part A) and any residual risks are mitigated by the availability of alternative spectrum for users bidding in Part B; and

[147] Such as aggregations risks, common value uncertainty, inefficiently unsold lots, fragmentation risks and award complexity.
[148] Exit bids - bidders specify a price (between the preceding and current round price) at which the bidder would be prepared the buy the lots it no longer demands at the current round price.
[149] Combinatorial closing rule – auction only closes when the value maximising combination of bids includes a bid from all bidders who were active in the last round.

- compared to other viable alternatives (CCA or CMRA) it is the least complex award to implement, with the advantage of being relatively simple for bidders to understand and participate in.

Views of Respondents

4.14 Four of the respondents (JRC, ESBN[150], 450 MHz Alliance and WPD) support the proposed SCA format.

4.15 JRC and the 450 MHz Alliance submit that the proposed award format minimises complexity and creates clarity for potential bidders.

4.16 While ESBN agrees with the proposed SCA auction format, it suggests pricing based on opportunity costs rather than actual bids should be used. ESBN notes that ComReg has not proposed the implementation of a second price 'opportunity cost' rule in this spectrum release, which differs from recent ComReg award processes, where a successful bidder pays the corresponding opportunity cost of the spectrum. ESBN submits that opportunity cost based pricing achieves ComReg's objective in spectrum awards, whilst also ensuring that a successful Bidder does not overpay for the spectrum won.

ComReg's Assessment and Position

4.17 ComReg notes the submissions supporting the proposed SCA format with exit bids and a closing combinatorial rule.

4.18 With regard to ESBN's specific suggestion that pricing should be based on an opportunity cost which was used in previous awards[151], DotEcon recommends retaining the proposed pricing rules as described in Document 18/92. In particular:

- The use of this pricing approach is not the result of a deviation from ComReg's previous awards. Rather, it is the result of a different award format which should still result in final prices that are in line with opportunity cost as bidders only need to bid just enough to outbid other bidders[152]. DotEcon further notes that:
  - In Part A where only one lot is available there is little difference between the price with the proposed rules and in an alternative format applying opportunity cost;

[150] In absence of ESB's preferred position of administrative assignment.
[151] SBCA for the 26 GHz award, and CCA for both the 3.6 GHz and MBSA awards.
[152] This is because bidders bid for the item in successive rounds until the round price exceeds the second highest bidder's valuation, at which point the auction ends. The winner then pays the prevailing round price (or its exit bid). The closer the winning bid is to the second highest bidder's valuation, the closer it approximates opportunity cost.

- In Part B where multiple items are available it may make a minor difference where bidders have strong complementarities across lots, however prices are still increasing incrementally and bidders will only pay the amount necessary to clear excess demand (rather than at their full valuation);
- The winning bid amounts in a SCA are established through incrementing prices round by round in order to find a market clearing level. Winners are therefore not necessarily (and will be unlikely to) be required to pay their full valuation for the lots they win, but will pay only up to the level required to beat competing demand; and
- The SBCA and CCA each have a sealed bid component whereby bidders bid the *maximum* price they are willing to pay for lots they are interested in. An efficient outcome (in particular where the lot structure is complex) requires bidders to submit bids for many different packages in line with their valuations, and use of an opportunity cost rule helps to provide incentives for bidders to do so. These issues are not relevant for this particular award, where the lot structure is simple and there is no sealed bid component to the proposed auction format.

4.19 ComReg agrees with the views of DotEcon. Under the proposed auction format, an opportunity cost pricing rule is unlikely to make material difference to the prices paid by bidders, but would introduce complexity (both for implementation of the auction and for bidders to understand) that is unlikely to be justified by the potential benefits.

4.20 In Document 18/92, ComReg assessed the SCA with exit bids and combinatorial closing rule relative to other candidate formats that use an opportunity cost pricing mechanism (that is, the CCA and the SBCA). ComReg noted that the efficiency gains were unlikely to be sufficient to justify their use for an award where the benefits of simple rules for bidders is likely to be important. Furthermore, the SBCA was considered to be inappropriate due to the potential for a sealed bid process to expose bidders to the risks associated with common value uncertainty and/or bidding errors that cannot be recovered from.

4.21 In light of the above discussion, ComReg remains of the preliminary view that a SCA and the associated ‘pay as bid’ pricing mechanism remains appropriate for the proposed award process.

4.5 Packaging of available spectrum

Summary of ComReg's view in Document 18/92

4.22 ComReg was of the preliminary view that the spectrum would be offered in 2 parts:

- Part A would be offered as a 2 × 3 MHz lot for a Smart Grid; and
- Part B would be offered in lot sizes of 2 × 100 kHz as this would likely best accommodate all types of users and technologies of the band. This lot size also allows maximum flexibility to potential users who can aggregate the smaller lots to satisfy larger requirements.

Views of Respondents

4.23 There were seven respondents (JRC, WPD, ESBN, EirGrid, 450 MHz Alliance, Huawei, and Nokia) that provided comments on the proposals on packaging

- JRC and WPD support the proposed lot size of 2 × 100 kHz for Part B spectrum;
- ESBN, EirGrid and the 450 MHz Alliance agree with the proposed lot sizes of one 2 × 3 MHz for Smart Grid (Part A) and 2 × 100 kHz (Part B); and
- Huawei suggests that Part B should have a lot size of 2 × 200 kHz or above.
- Nokia agrees that 2 × 3 MHz is appropriate for Smart Grid but that the available spectrum should be portioned as follows:
    - 2 × 3 MHz (LTE) for Utility designation;
    - 2 × 1.4 MHz (LTE); and
    - 2 × 1.1 MHz for narrow band designation.

ComReg's Assessment and Position

4.24 ComReg notes the submissions supporting the proposed packaging arrangement.

4.25 In relation to Huawei's suggestion that Part B should have a lot size of 2 × 200 kHz, DotEcon notes that:

- bidders are able to bid for any number of the 2 × 100 kHz Part B lots available;
- the proposed auction format supports package bidding, so a bidder will never win a subset of the lots it bid for at a particular price; and

- if a bidder is only interested in bandwidths of 2 × 200 kHz, it can choose to bid for only even number of lots.

4.26 Lot sizes of 2 × 100 kHz in Part B would best accommodate all types of users and technologies since the auction design can provide for smaller lots to be aggregated to satisfy larger bandwidth requirements. ComReg's approach in previous awards has been to include lot sizes that best accommodate all types of users and technologies. As noted in Document 18/92 offering spectrum in blocks that can be aggregated to satisfy larger demand profiles provides bidders with greater flexibility to make bids on its preferred amount of spectrum. Any bidder only interested in 2 × 200 kHz or multiples of same can choses packages that fits that preference.

4.27 Plum (in Document 18/92b) recommended a minimum block size of 2 × 100 kHz, and this bandwidth would support up to sixteen 6.25 kHz channels where PMR technology is deployed. Using larger lot sizes would limit the flexibility that bidders have in expressing demand for precise quantities above any minimum requirement, and could lead to an inefficient distribution of the spectrum between bidders for example, if one user were assigned more bandwidth than it required when the excess could be more efficiently used by another. Furthermore, larger lots might preclude some users from participating in the auction if they only need (and value) a small amount of spectrum; for example, a bidder that requires only 2 × 100 kHz may not be able to participate if it would have to pay for an additional 2 × 100 kHz (if using 2 × 200 kHz lots) that it has no value for.

4.28 In relation to Nokia's submission, ComReg notes that the reduced amount of Part B spectrum means the proposal by Nokia is no longer viable.

4.29 Therefore, ComReg remains of the preliminary view that spectrum rights of use in Part B should be offered using lot sizes of 2 × 100 kHz.

4.6 Frequency Specific vs Frequency Generic Lots

Summary of ComReg's view in Document 18/92

4.30 ComReg was of the preliminary view that:

- Part A should be made available as a single frequency specific lot. This would be at the lower end of the available spectrum from 410 – 413 MHz / 420 – 423 MHz, to avoid the risk of interference with existing services at the upper end of the band;
- Part B lots should be made available (initially) on a frequency generic basis; and

- If there is no demand for Part A, all of the available spectrum would be made available as 2 × 100 kHz frequency generic lots in the Part B auction on a frequency generic basis.

Assignment Stage

4.31 ComReg proposed that the frequency specific Part A only requires one stage of bidding, where the winning bidder is assigned rights to the reserved lower part of the spectrum (410 – 413 MHz / 420 – 423 MHz). This would be undertaken using ComReg's proposed SCA with exit bids and combinatorial closing rule.

4.32 ComReg proposed a two stage bidding process for frequency generic Part B as below:

1. The primary stage would be undertaken using the proposed SCA with exit bids and combinatorial closing rule. This determines the number of lots won by successful bidders without reference to the frequency location of the lots.
2. A follow-up assignment stage would assign specific frequencies to each winner of Part B lots using a random assignment process (determined algorithmically), subject to:
   - All winning bidders being guaranteed a continuous block of spectrum; and
   - Any Part B spectrum won by the winner of Part A would be automatically assigned next to the Part A frequencies.

Views of Respondents

4.33 JRC and WPD support the proposed lot arrangements (that is, Part A frequency specific, Part B frequency generic).

4.34 ESBN agrees with the proposal to reserve spectrum for Smart Grid at the lower end of the available spectrum band and the use of a software tool for selection in Part B[153], whilst ensuring contiguity of spectrum assignments.

4.35 Huawei suggests:

I. that Part A and Part B should be allocated as contiguous as possible; and

II. For Network Utility Operators to have a higher priority than MNOs to get spectrum in Part B, on the basis that, given the small bandwidth, it does not provide much value for consumers of Mobile Broadband services.

[153] On the basis that there is likely to be no material value difference between spectrum locations.

ComReg's Assessment and Position

4.36 ComReg notes the submissions supporting the proposed lot arrangements.

4.37 With regard to ESBN's and Huawei's suggestions on the contiguous assignment of Part A and Part B, Document 18/92 noted that Part B spectrum won by the winner of Part A would be automatically assigned next to the Part A frequencies.

4.38 ComReg notes Huawei's suggestion that Network Utility Operators should have a higher priority than MNOs. In response, ComReg notes that it is required to grant rights of use for radio frequencies on the basis of selection criteria which are objective, transparent, non-discriminatory and proportionate. In that regard, the draft RIA sets out in detail why setting aside 2 × 3 MHz for the provision of Smart Grid (that only Network Utility Operators have access to) satisfied those criteria, among other things. In particular, ComReg also set out why 2 × 3 MHz is sufficient to deploy mission critical Smart Grid services[154]. Furthermore, in satisfying its objectives ComReg noted that the proposed restriction would only relate to the spectrum rights of use necessary to efficiently operate a Smart Grid (that is, 2 × 3 MHz). The remaining rights of use would be made available on a service and technology neutral basis. A qualifying Network Utility Operator can compete for additional spectrum in Part B should it require more spectrum for the provision of other services including Smart Grid.

4.39 Therefore, ComReg remains of the preliminary view that:

- Part A would be made available on a frequency specific basis as one lot. This would be positioned at the lower spectrum end of the band, 410 – 413 MHz / 420 – 423 MHz, to avoid the risk of interference with existing services at the upper end;
- Part B would be made available on a frequency generic basis as 10, 2 × 100 kHz lots;
- If there is no demand for Part A, all 40 lots of available spectrum would be made available on a frequency generic basis; and
- A follow-up assignment stage would assign specific frequencies to each winner of Part B lots using a random assignment process (determined algorithmically) and subject to certain criteria described above.

[154] ComReg Document 18/92b Plum Consulting LLP 'Plum Consulting on the Potential use of the 400 MHz band in Ireland', ETSI TR 103 401 (2016-11) 'Smart Grid Systems and Other Radio Systems suitable for Utility Operations, and their long-term spectrum requirements', and ETSI TR 103 492 V1.1.1 (2019-01) "Critical Infrastructure Utility Operations requirements for Smart Grid systems, other radio systems, and future radio spectrum access arrangements below 1,5 GHz".

4.7 Competition Caps

Summary of ComReg's view in Document 18/92

4.40 ComReg was of the preliminary view that a competition cap was not necessary for this award for a number of reasons:

- It could prevent a Network Utility Operator from being assigned the necessary spectrum to efficiently operate a Smart Grid;
- It would better allow bidders to obtain sufficiently large contiguous blocks of spectrum to meet likely requirements and would not unduly restrict the range of demand that could be expressed in the proposed auction;
- It would better ensure the efficient use of spectrum by minimising the potential for lots to be stranded and therefore unused; and
- There are alternative frequencies for other potential use cases if certain bidders were unsuccessful in this award as a result of a small number of users obtaining large amounts of the band.
- The proposed award is unlikely to have any impact on downstream competition. The assignment of 400 MHz rights does not impact the provision of existing and future mobile services and other potential services have alternative frequencies and or solutions available that can be used to deliver those services.

Views of Respondents

4.41 JRC, WPD and ESBN support ComReg's proposal not to apply a competition cap.

ComReg Assessment and Position

4.42 ComReg notes the submissions supporting its proposal not to apply a competition cap. ComReg is not aware of any other information which would warrant an amendment to its preliminary view. Therefore, ComReg remains of the view that a competition cap is not necessary for this award.

4.8 Unsold lots

Summary of ComReg's view in Document 18/92

4.43 ComReg was of the preliminary view that it should retain its discretion regarding how it might treat any unsold spectrum lots, depending on the factual

circumstances arising from the award process, save that it intends that unsold lots would not be assigned for a reasonable period after the process has ended.

Views of Respondents

4.44 Two of the respondents (JRC and ESBN) provided views on the treatment of unsold lots:

- JRC propose locating any unsold spectrum in Part B adjacent to the Part A spectrum to offer the potential for the unsold spectrum to be used for Smart Grid purposes; and
- ESBN recommends any unsold lots are located between Part A and any winner(s) of Part B on the basis that this would reduce potential interference issues between Smart Grid users and potential narrowband applications (that is, to effectively form a guard band between different users and networks between Part A and Part B users).

ComReg's Assessment and Position

4.45 In Document 18/92, ComReg proposed that specific frequencies could be assigned by ComReg through a random selection process (most likely determined algorithmically), subject to:

- All winning bidders being guaranteed a contiguous block of spectrum; and
- Any Part B spectrum won by the winner of Part A would be automatically assigned next to the Part A frequencies.

4.46 As previously noted, ComReg has reduced the spectrum available in Part B in order to provide for the possibility that BB-PPDR may be assigned spectrum in the 400 MHz band at some point in the future. In that regard, ComReg is of the preliminary view that any unsold lots should be located on a contiguous basis in the upper range (414 MHz / 424 MHz) of Part B in order to maximise the future availability of spectrum for BB-PPDR, or to create greater interference protection between a potential BB-PPDR requirement and other uses assigned in Part B.

4.47 In relation to ESBNs view that any unsold lots should be placed adjacent to Part A (to separate Smart Grid use from any other use assigned in Part B), ComReg notes that its views on interference protection (Block Edge Masks) are already set out in Chapter 5 and these are sufficient to provide adequate protections.

4.48 Therefore, ComReg remains of the preliminary view that it should retain its discretion regarding how it might treat any unsold spectrum lots but envisages that any unsold lots would be located at the top of Part B.

4.9 Fees

Summary of ComReg's view in Document 18/92

4.49 ComReg was of the preliminary view that a minimum price should be set for both Part A and Part B:

- In relation to Part B, minimum prices would promote an efficient outcome by reducing incentives for gaming behaviour aimed at restricting competition in the award. It would also discourage frivolous bidding by ensuring that only bids above a certain level would be considered eligible by ComReg; and
- In relation to Part A, minimum prices would prevent the potential winner of Part A from gaining an unfair advantage in competing for additional rights of use in Part B[155].

4.50 ComReg determined that the minimum price would comprise an upfront Spectrum Access Fee (SAF) which would be payable as part of the award process, together with the sum of annual Spectrum Usage Fees (SUFs) which would be paid periodically over the licence duration. The minimum price for all spectrum rights of use (that is, Part A and Part B) would be split on a 40/60 SAF/SUF basis.

4.51 Further, ComReg noted that a number of factors should inform the setting of the minimum price, including:

- The minimum price should not be set so high as to choke off demand of potential users;
- The minimum SAF should be set high enough to discourage participation by frivolous bidders in Part B;
- The minimum price should allow for SUFs to be set at a level that provides at least some incentives for winning bidders to return spectrum rights of use to ComReg if left unused; and
- The minimum price (per MHz) should not be different for Part A and Part B.

4.52 ComReg proposed the following level of minimum prices:

[155] The risk of frivolous bidding for Part A is reduced as ComReg has only Network Utility Operators would be eligible to bid for its spectrum. As there is only one 2 × 3 MHz lot available, there is little incentive for bidders to collude to keep prices low, since only one winner is possible.

- For Part A, a minimum price of €590,000[156] which comprises an upfront minimum SAF of €240,000 and an annual SUF of €39,000, subject to annual indexation by CPI.
- For Part B, a minimum price of €19,600[157] for a 2 × 100 kHz lot which comprises an upfront minimum SAF of €8,000 per 2 × 100 kHz lot and an annual SUF of €1,300 per lot, subject to annual indexation by CPI.

Views of Respondents

4.53 Two respondents (JRC and WPD) agree with ComReg's proposal on minimum prices.

4.54 ESBN agrees with the use of a minimum price and the SAF and SUF on a 40/60 basis. However, it is of the view that a discount rate of 4.95%[158] instead of 8.63% should be used for determining the SUFs for spectrum assigned to a Network Utility Operator.

ComReg's Assessment and Position

4.55 ComReg notes the submissions supporting the proposed minimum prices.

4.56 In relation to ESBNs suggestion that a discount rate of 4.95% would be more appropriate, DotEcon notes that there are a number of different potential users for Part B spectrum and each could have a different cost of capital. These SUFs must be known to all potential bidders prior to the award in order to consider an appropriate valuation of the award spectrum. In that regard, DotEcon notes that using a cost of capital similar to that of a commercial mobile operator to determine SUFs is reasonable as although this would not be how the spectrum would likely be used, it would represent a potential alternative use. In any event, differences between individual discount rates and the discount rate used for determining SUFs should not have any material impact on the ability of different users to compete in the award.

4.57 ComReg agrees with the views of DotEcon and notes that the use of operator specific discount rates would, in a perfect world, be preferable to calculate the discounted SUFs. However while such information may be available for certain regulated entities (for example, Network Utility Operators) it is not available for all bidders (since not all bidders are known). ComReg has therefore used the nominal discount rate that corresponds to mobile in order to provide all bidders (known and unknown) with certainty over the real value of future SUFs which can then be

[156] Discounted at a rate of 8.63%.
[157] Discounted at a rate of 8.63%.
[158] Weighted Average Cost of Capital as calculated by CRU for investments in Network Infrastructure.

reflected in individual operator's valuations/bids. This also provides better incentives to use the spectrum more efficiently given potential alternative users.

4.58 Therefore, ComReg remains of the preliminary view that a discount rate for Part A and Part B remains of 8.63% is appropriate. As such, ComReg's view on the level of minimum prices remains unchanged as set out below:

- For Part A, there should be a minimum price of €590,000. This comprises an upfront minimum SAF of €240,000 and an annual SUF of €39,000 subject to annual indexation by CPI; and
- For Part B, there should be a minimum price of €19,600 for a 2 × 100 kHz lot. This comprises an upfront minimum SAF of €8,000 per 2 × 100 kHz lot and an annual SUF of €1,300 per lot subject to annual indexation by CPI.

Chapter 5

5 Licence Conditions

5.1 Introduction

5.1 In Document 18/92, ComReg consulted on a number of licence conditions including:

- National Licences;
- Channel Bandwidth;
- Mode of Operation;
- Interference Mitigation;
- Roll-out obligations / usage conditions;
- Licence Duration;
- Memorandum of Understanding;
- Third Party Use; and
- Other issues raised.

5.2 This chapter further sets out ComReg's views on the above issues, taking into account the views of respondents.

5.2 National Licences

Summary of ComReg's view in Document 18/92

5.3 In Document 18/92, ComReg observed that national licences would likely provide greater flexibility for the potential uses identified for this band.

Views of Respondents

5.4 ComReg received 4 responses regarding national licences – from JRC, WPD, ESBN and EirGrid.

5.5 All the above respondent's agreed that the 400 MHz band should be made available on a national basis.

ComReg's Assessment and Position

5.6 As set out in Document 18/92, national licences would likely provide greater flexibility for the potential uses identified for this band, and it would also likely ensure the most efficient use of the band.

5.7 Based on the views of respondents and for the reasons set out in document 18/92, ComReg maintains its view to make both Part A and Part B spectrum available on a national basis.

5.3 Channel Bandwidth

Summary of ComReg's view in Document 18/92

5.8 In Document 18/92, ComReg maintained its view that licensees should have the flexibility to use whatever bandwidth their choice of technology requires, noting that potential bidders may be required to aggregate spectrum to satisfy their spectrum needs. ComReg also stated that potential licensees must operate within their spectrum holdings and comply with any interference mitigation as set out by ComReg.

Views of Respondents

5.9 ComReg received 2 submissions on the topic of Channel Bandwidth. JRC and WPD support ComReg's approach to not define channel bandwidth and in doing so allow parties to aggregate spectrum to support their individual system needs.

ComReg's Assessment and Position

5.10 ComReg maintains its view not to specify a specific channel bandwidth noting that potential bidders may be required to aggregate enough spectrum to satisfy their spectrum needs. For the avoidance of doubt, potential licensees must operate within their spectrum holdings and comply with any licence conditions and interference mitigation as set out by ComReg in Section 5.5 of this Document.

5.4 Mode of Operation

Summary of ComReg's view in Document 18/92

5.11 In Document 18/92, ComReg maintained its view to award this spectrum for FDD[159] operation only. In arriving at this view, ComReg noted:

- ECC Decision (19)02 which provides the Least Restrictive Technical Conditions for LTE FDD systems;
- the Plum report which advises that FDD appears to be the most appropriate solution as it would likely align with equipment availability, and with the use of this and neighbouring bands in Ireland and other countries. Plum further advises that the spectrum should be made available for FDD, noting that the likely technology to provide Smart Grids will be LTE; and
- as LTE will be the likely technology for the provision of Smart Grids, allowing a mixture of FDD and TDD[160] in the band could result in the need for guard bands and restricted blocks. ComReg noted that given the limited amount of spectrum available, any such restriction should be avoided, if at all possible.

Views of Respondents

5.12 ComReg received 8 responses regarding the proposed mode of operation. In general, respondents were of the view that a flexible approach should be introduced, allowing a licensee to choose whether it deploys FDD or TDD technology.

5.13 Two respondents, the 450 MHz Alliance and Nokia, were in favour of restricting the mode of operation to FDD only.

5.14 The 450 MHz Alliance states that the current equipment availability for TDD in this band is somewhat proprietary and that in the longer term it appears that global markets will evolve towards FDD variants of 400 MHz products as these offer greater alignment with the largest number of countries and the direction of 3GPP in the sub-1GHz bands, citing a 3GPP work item for standardisation of FDD LTE in the 410 – 430 MHz band. Nokia also refer to the 3GPP alignment and states that FDD fosters a worldwide eco system of vendors.

5.15 JRC, WPD, ESBN, NIE Networks and Huawei ask ComReg to consider a flexible approach whereby the winning bidder may decide which technology it deploys.

[159] Frequency Division Duplex.
[160] Time Division Duplex.

5.16 JRC and WPD expressed concern that a restriction of this spectrum to FDD operation only at this stage would potentially foreclose on the flexibility of use for the band and prevent the industry from being able to exploit future technology developments. JRC and WPD both claim that FDD may be in conflict with the characteristics of traffic in a Smart Grid network as it is likely to be asymmetric – with uplink channels used more heavily than downlink channels.

5.17 The concerns of JRC and WPD above are echoed by EirGrid. EirGrid contends, for similar reasons outlined above, that TDD may result in greater spectral efficiency when compared to FDD.

5.18 ESBN requests ComReg to consider a flexible approach with regards to deploying FDD or TDD technology, and expresses some concern that by limiting the mode of operation to FDD there is a risk that a sub-optimum solution is used by a Smart Grid operator, or that no network is deployed due to the limitation. ESBN further notes that there is FDD and TDD equipment available in the band. ESBN asks ComReg to clarify that in the event where a single entity acquires all of the available spectrum, it can choose to deploy either FDD or TDD technology as interference issues with other users would not exist. Further, ESBN encourages ComReg to consider options that can overcome potential FDD/TDD issues such as coordination guidelines, guard bands etc.

5.19 Huawei is of the opinion that ComReg should give users the flexibility to deploy either FDD or TDD equipment provided that existing users are given the same level of protection. Huawei also highlights the asymmetry of traffic in a Smart Grid network and is therefore of the opinion that TDD would be a better solution.

5.20 NIE Networks are of the view that it may be too early to specify a mode of operation and that ComReg should not propose a particular mode of operation until Network Utility Operators show a preference. NIE Networks contend that several technology trials are being carried out at present which may facilitate ComReg in making a more informed decision at a later date.

ComReg's Assessment

5.21 Firstly, ComReg notes ECC Decision (19)02 gives the Least Restrictive Technical Conditions for LTE FDD systems only, and that there is a 3GPP work item[161] to develop a standard for FDD equipment in the 410 – 430 MHz band.

5.22 ComReg observes that many submissions received in relation to this issue are in favour of a flexible approach, whereby the winning bidder can decide which technology (FDD or TDD) it can deploy. Further, ComReg observes that the 450

[161] https://portal.3gpp.org/ngppapp/TdocList.aspx?meetingId=18670

MHz Alliance and Nokia agree with ComReg's proposal to award this spectrum for FDD operation only.

5.23 Plum considers this issue in its assessment of responses, noting that allowing a mixture of FDD and TDD in the band would likely require guard bands and reduce the amount of spectrum available. Further, Plum states that if TDD is adopted in Part A, then potential licence holders within the remaining spectrum in the 410 – 430 MHz band would need to adopt the same UL/DL ratio to avoid base station to base station interference. As Plum notes, additional measures may be required to handle interference scenarios if a technology neutral approach is adopted.

5.24 ComReg considers that this could negatively impact both users of Smart Grid and future BB-PPDR services as ECC Decision (16)02 describes an FDD configuration for BB-PPDR services operating in the 400 MHz band.

5.25 Plum's view therefore is that FDD should be retained for both Part A and Part B spectrum.

5.26 ESBN submits that FDD may result in a sub-optimal Smart Grid deployment, or indeed no network deployment at all. ComReg however notes that in its submission, ESBN outlines that it is still considering whether FDD or TDD is the optimum mode of operation for Smart Grid. ComReg is aware that equipment is currently available in this band that utilises FDD technology, notwithstanding the 3GPP work item to develop a standard for FDD equipment in the 410 – 430 MHz band.

5.27 ComReg does not agree with JRC and WPD's concern that a restriction of this spectrum to FDD technology would prevent the industry from being able to exploit future technology developments. As mentioned above, ComReg is aware of a 3GPP work item to develop a standard for FDD equipment in the 410 – 430 MHz band, indicating that FDD will likely be the technology of choice in this band for the foreseeable future.

ComReg's Position

5.28 Considering the above, and the advice of its expert consultants Plum, ComReg maintains its view that this spectrum should be made available for FDD operation only.

5.5 Interference Mitigation

Block Edge Masks

Summary of ComReg's views in Document 18/92

5.29 ComReg, in Document 18/92, proposed two Block Edge Masks ("BEM") for channel bandwidths up to 200 kHz, and another for bandwidths between 1.25 MHz – 5 MHz (together the "Proposed BEMs"). The proposed BEMs were recommended by Plum and are based on the then draft ECC Decision (19)02 – a strong indication that compliant equipment is available, or will be available in the near term. ComReg also stated that it is satisfied that the proposed BEM would provide sufficient protection to any adjacent licensees within the 2 × 5.5 MHz band, and also sufficiently protect current adjacent users of Trunked Systems.

Views of Respondents

5.30 ComReg received 5 responses regarding the proposed BEMs.

5.31 There is a general concern among respondents that the Proposed BEMs may be too restrictive. WPD and Nokia opine that the BEM proposals require further analysis.

5.32 Nokia considers that 0.5 MHz of the band could be considered for both narrowband and block edge separation of services as the channel bandwidths for 3GPP LTE standards is for of 1.4 MHz, 3 MHz and 5 MHz.

5.33 ESBN, Huawei and JRC advise ComReg to adopt the normal 3GPP LTE out-of-band emissions mask. JRC is of the opinion that the Proposed BEMs would likely result in higher equipment costs and have a negative impact on equipment availability. JRC notes the observation of Plum that there will be little interference between LTE and Private Business Radio if the normal out-of-band emission masks are used for LTE.

5.34 Huawei states that the BEMs in draft ECC Decision (19)02 are unnecessarily stringent and would impose significant cost on Base Station equipment. Huawei refers to ECC Report 283 which concludes that interference to other bands is unlikely in most scenarios, with the main issues of compatibility coming from the requirement to protect Radio Astronomy (406.1 – 410 MHz) and Radiolocation (430 – 440 MHz), 2 services which Huawei observes are not present in Ireland.

5.35 ESBN notes that ECC Report 240 and ECC Report 283 are based on 3GPP standards for out-of-band emission levels and that these emission levels were found to provide compatibility with other services in most cases.

5.36 ESBN submit that a Network Utility Operator who is successful in acquiring Part A spectrum should have the option to purchase additional contiguous spectrum to be used as a guard band to protect against interference. ESBN requests ComReg to outline a method for communication in interference scenarios between a Smart Grid operator and other licensees.

5.37 The 450 MHz Alliance submits that it may be necessary that one or two of the lowest 100 kHz allocations in Part B spectrum are held by the winner of Part A spectrum in order to prevent interference between users of Part A and Part B spectrum.

ComReg's Assessment

5.38 ComReg notes the general view amongst licensees that the proposed Wideband BEM (for channel bandwidths between 1.25 MHz and 5 MHz) should be less stringent and therefore requires re-visiting.

5.39 Regarding submissions made on the requirement for guard bands, as stated in Document 18/92, ComReg encourages all interested parties to internalise guard bands and to acquire sufficient spectrum to satisfy their requirements. This may require an interested party to purchase spectrum adjacent to their spectrum holding in order to reduce any interference concerns it may have.

5.40 ComReg is aware that a number of responses[162] to the consultation on the draft ECC Decision (19)02 raised similar concerns regarding the proposed Wideband BEM. Following consideration of the concerns raised and the justifications offered, the Wideband BEM values in the finalised ECC Decision (19)02 have been changed.

5.41 In its report, Plum advises ComReg to adopt the modified Wideband BEM in ECC Decision (19)02. Although the modified Wideband BEM has changed from previous drafts of ECC Decision (19)02, Plum is of the view that it should be used as:

- it is based on detailed sharing analysis scenarios involving a range of services presented in ECC Report 283; and
- it is the agreed least restrictive sharing criteria developed within FM 54 and adopted by the ECC in March 2019.

5.42 Therefore, ComReg's proposal to adopt the modified Wideband BEM from ECC Decision (19)02, would likely address the concerns of respondents. With the BEMs originating from a ECC Decision, it is a good indicator that compliant equipment will be available in the near term.

[162] https://www.cept.org/Documents/fm-54/48243/temp-10_dec-19-02-comment-resolution-table

5.43 ComReg notes that there were no comments made on the proposed BEM for systems utilising a bandwidth up to 200 kHz.

ComReg's Position

5.44 ComReg propose to adopt the BEMs from ECC Decision (19)02 as proposed by Plum:

- an unchanged BEM for technologies utilising bandwidths up to 200 kHz; and
- an updated Wideband BEM for systems utilising bandwidths from 1.25 MHz up to 3 MHz.

5.45 Interested parties may view the proposed BEMs in Annex 2 of this document.

Protection of Radio Astronomy

Summary of ComReg's views in Document 18/92

5.46 In Document 18/92, ComReg noted that the 406.1 – 410 MHz frequency band is allocated to the Radio Astronomy service in both the ITU and European Common Allocation Tables, and that footnote 5.149 of the Radio Regulations and ITU Recommendation RA. 769-2 recommend that administrations take all practicable steps to protect the Radio Astronomy service from harmful interference.

5.47 In its report, Document 18/92b, Plum states that it is likely that future use of the Radio Astronomy band can be accommodated through careful site selection and coordination with the licensee.

5.48 To this end, ComReg proposed to make it a condition of the licence that any potential future licensee must coordinate with any potential Radio Astronomy users so as to minimise harmful interference.

Views of Respondents

5.49 ComReg received 2 responses to this proposal from JRC and WPD, both of whom support a licence condition to protect Radio Astronomy.

ComReg's Assessment and Position

5.50 ComReg notes the support of JRC and WPD to protect any potential use of the Radio Astronomy band 406.1 – 410 MHz.

5.51 ComReg maintains its view that any potential licensee of the 400 MHz band will be required to coordinate with any potential user of Radio Astronomy in order to protect the Radio Astronomy service from harmful levels of interference.

EIRP Limit

Summary of ComReg's views in Document 18/92

5.52 ComReg maintained its proposal, as set out in Document 17/67, to limit EIRP to 50 W. ComReg observed that the BEM, as recommended by Plum, is based upon a maximum EIRP of 54 dBm. Given Plums view that the ECC has taken all possible precautions to prevent undue interference, ComReg considered that an EIRP limit of 50 W would likely facilitate better coordination between adjacent licensees.

5.53 ComReg reminded licensees that a limit of 50 W is an upper limit and that the minimum EIRP required to maintain the network should be used at all times. ComReg further stated that licensees must also take into consideration potential future obligations to protect the Radio Astronomy service, adjacent licensees, and any potential cross border MOU's.

Views of Respondents

5.54 Five respondents provided views on ComReg's proposed EIRP limit.

5.55 JRC and WPD endorse a maximum EIRP of 50 W and acknowledge that this is an upper limit where the minimum EIRP to maintain a network be established and deployed in order to minimise interference to adjacent licensees and any potential users of the Radio Astronomy service.

5.56 EirGrid considers an EIRP limit of 50 W to be reasonable as this will allow for the deployment of a national network utilising a reasonable number of sites while taking into account interference concerns with the United Kingdom.

5.57 ESBN maintains its view from its response to Document 17/67 that a 50 W EIRP limit is appropriate. The 450 MHz Alliance suggest that the EIRP limit will need to be reflected in any adjustments to the Memorandum of Understanding with the United Kingdom.

5.58 ESBN and Huawei both submit that ComReg should allow for a higher User Equipment ("UE") power limit than the 23 dBm specified in the Proposed BEMs. Both ESBN and Huawei note that draft ECC Decision (19)02 mentions fixed terminals in rural areas as an example of a deployment scenario in which a higher UE equipment EIRP may be permitted. ESBN encourages ComReg to increase the UE EIRP limit to 30 dBm to allow the design and build of an optimised network, in the process reducing the cost of network deployment.

ComReg's Assessment

5.59 ComReg notes the support for a maximum EIRP limit of 50 W and agrees with respondents that this will allow deployment of a national network while using fewer sites, and will likely facilitate better coordination between licensees.

5.60 Some respondents requested an increase of the proposed UE maximum mean in block power. The UE maximum mean in block power was based on then draft ECC Decision (19)02. Following public consultation of draft ECC Decision (19)02 a limit of 23 dBm has been maintained. In its report, Plum consider that the UE maximum mean in block power could be increased to 31 dBm, and that this condition was included in earlier drafts of ECC Decision (19)02.

5.61 Increasing the UE maximum mean in block power to 31 dBm would allow potential licensees to deploy more robust networks. However, in any case, 31 dBm is a limit and any potential licensees must use the minimum power required to maintain a network.

ComReg's Position

5.62 ComReg maintains its view that an EIRP limit of 50 W is appropriate.

5.63 ComReg proposes to increase the UE maximum mean in block power to 31 dBm. This would allow for the deployment of fixed terminal stations in rural areas provided that protection of other services, networks and applications is not compromised. Vice-versa, the maximum mean in block power of UEs for the protection of other services may be limited on a cell-by-cell basis.

5.64 ComReg is also of the view that licensees must take into consideration potential future obligations to protect the Radio Astronomy service, adjacent licensees, and any potential cross border MOU's.

5.65 The proposed power limits above represent a maximum, any potential licensees must use the minimum power required in order to maintain a network.

5.6 Roll-out obligations / usage conditions

Summary of ComReg's views in Document 18/92

5.66 In Document 18/92, ComReg noted that roll-out obligations and usage conditions are useful as they can ensure efficient and timely use of the radio spectrum.

5.67 ComReg noted that with the segmentation of spectrum into Part A for the provision of Smart Grid and the potential suite of users in Part B, a 'one size fits all' approach is unlikely to satisfy all potential users. ComReg considered that 2 separate roll-out conditions are required for Part A and Part B spectrum.

5.68 For Part B spectrum, ComReg considered a reasonable roll-out condition of no less than 10 base stations in each of the areas[163] shown in figure 2 below within the first 3 years.

[163] Area 1, coloured Orange (Carlow, Dublin, Kildare, Kilkenny, Laois, Longford, Louth, Meath, Offaly, Westmeath, Wexford, and Wicklow), Area 2 coloured Blue (Clare, Cork, Kerry, Limerick, Tipperary, and Waterford), Area 3 coloured Green (Cavan, Donegal, Galway, Leitrim, Mayo, Monaghan, Roscommon, and Sligo).

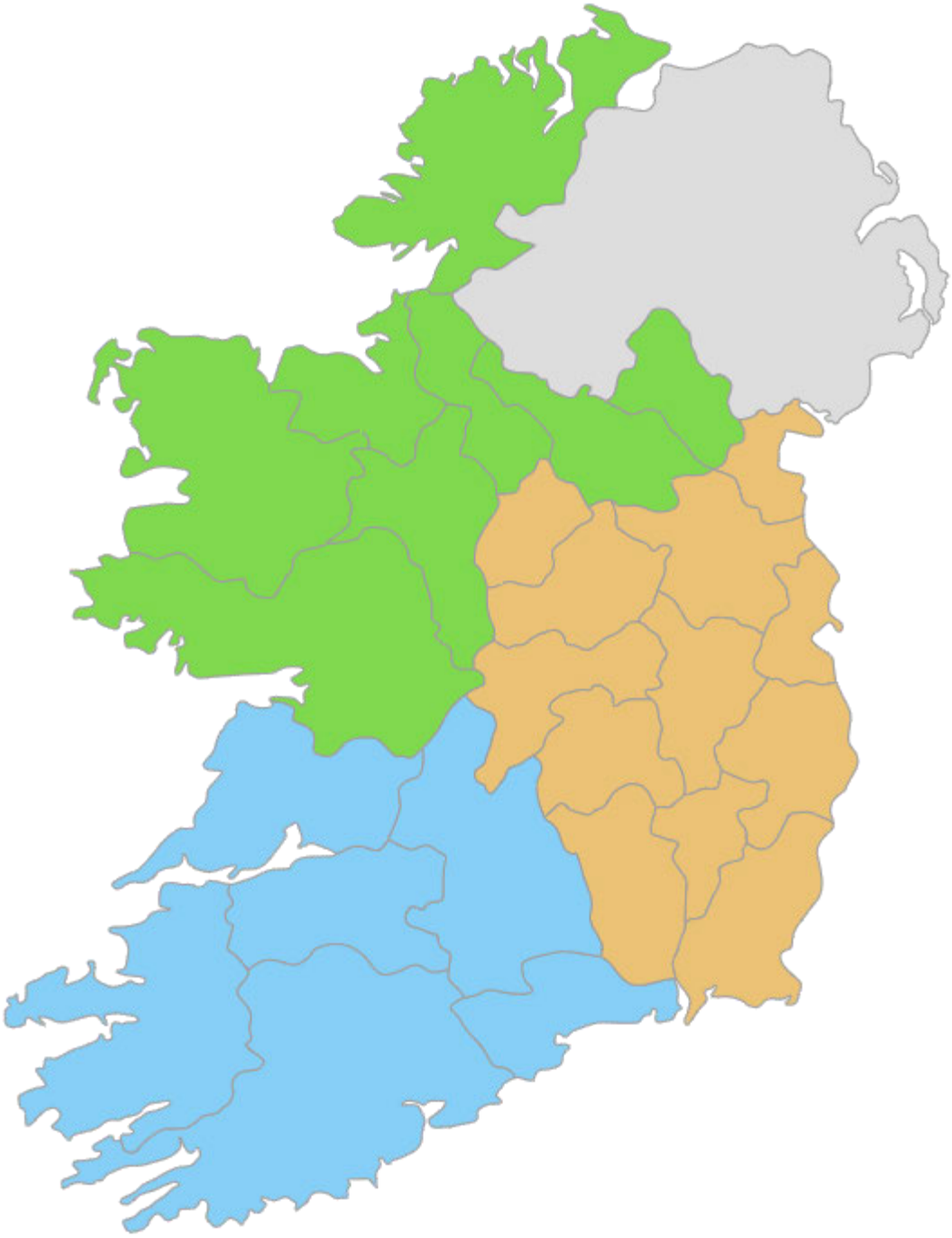

Figure 2. Coverage Areas for Part B spectrum

5.69 With regard to Part A spectrum, ComReg referred to Annex 4, Figure 10 of draft ECC Report 292 which shows that in the UK at least 89% of high voltage sub-stations will require communications by 2031 as part of the UKs Smart Grid

deployment. The report outlines that these percentages are expected to be representative of the requirements in most member states.

5.70 Considering the above, for Part A spectrum ComReg proposed a reasonable roll-out obligation is for a Network Utility Operator to provide communications to 50% of its utility network within 3 years of the commencement date of the licence. As these licences will not expire until 2034 at the earliest, a Network Utility Operator would be able to fully provide for communications capabilities in its utility network by the indicated date of 2031 in para 5.69 above.

5.71 ComReg also stated that, for the avoidance of doubt, Smart Metering[164] [165] is not considered part of a Smart Grid and so any roll-out obligation may not be based on, or include, any references to Smart Meter deployment.

Measurement of roll-out obligation

5.72 ComReg, in Document 18/92, proposed that the obligation for Part B would be assessed after a 3 year period to ensure compliance. The licensee would be required to register the locations of apparatus (both base stations and associated numbers of connected devices) on each anniversary of licence commencement for ComReg's records and assessment of the usage of spectrum. On the third anniversary of the licence, using the compliance report the Licensee shall notify the Commission whether or not it has met the relevant rollout obligation.

5.73 For Part A spectrum, ComReg proposed that an interested party must submit details of its utility network (for example, the number and locations of wireless telegraphy equipment deployed to cover the Smart Grid network) with its application to participate in any award that may take place. ComReg also proposed to make it a condition of the licence that licensees must submit an annual report on each anniversary of licence commencement demonstrating compliance with its roll-out obligation. Licensees would also be required to include, on an annual basis, the locations where wireless telegraphy apparatus operating in Part A spectrum has been deployed – allowing ComReg to continually assess a licensee's progress against its roll-out obligation.

Views of Respondents

5.74 ComReg received 6 submissions regarding roll-out and how it might be measured. ESBN, NIE Networks, JRC and WPD submit that due to the cycle of funding within the energy sector, ComReg's roll-out proposal may not be appropriate.

[164] Smart Meters are considered to be the devices located at premises that record energy, water and gas usage and provide two-way electronic communication between consumers and the grid.
[165] ComReg note that ESBN has begun rolling out Smart Meters to every dwelling in Ireland and it is due to be completed in 2024.

5.75 Respondents submit that Network Utility Operators are bound by funding rules as set out by the Commission for Regulation of Utilities, Water and Energy ("the CRU"). Price reviews are conducted by the CRU every 5 years to grant approval for an agreed spend for the proceeding 5 years. The next Price Review period is scheduled for 2021. ESBN submits that this funding schedule could make it difficult for ESBN to meet the proposed roll-out conditions. ESBN is of the view that ComReg should treat licensees as new entrants, as in ComReg's 2012 MBSA Award, and extend the proposed roll-out condition to 7 years provided the licence duration is also extended. In that award, for a new entrant Mobile Network Operator the obligation to achieve 70% population coverage was to be met within 7 years, as opposed to 3 years for an existing Mobile Network Operator.

5.76 ESBN and JRC highlight the onerous OJEC procurement rules that could potentially be a barrier for a Network Utility Operator in meeting the proposed roll-out conditions. ESBN submits that these procurement rules are time intensive and can only begin once the auction results are known.

5.77 NIE Networks, JRC and WPD submit that ComReg should consider an outcome based approach to roll-out. In particular, JRC and WPD encourage ComReg to liaise with the CRU to define roll-out as, for example, a reduction in CO_2 emissions, increasing network efficiency and enhancing the utilisation of renewables.

5.78 EirGrid submits that ComReg's proposal for Part A roll-out is too stringent and that a longer period for roll-out is required. EirGrid contends that in its experience roll-out in remote locations takes considerably longer than it would for a commercial network. EirGrid points out that the revenue streams for Smart Grid would be very low when compared to commercial operators and that the telecommunications network would follow the development of a Smart Grid, resulting in an uneven spread of development.

5.79 The 450 MHz Alliance considers the period of time to satisfy the initial roll-out should be extended by 2 years as this would allow sufficient time for a procurement process to be carried out.

5.80 Regarding the proposed roll-out condition for Part B spectrum, JRC and WPD view the proposed roll-out condition as less onerous than that for Part A and suggest aligning roll-out obligations to specific outcomes in terms of the services that may be delivered rather than some level of infrastructure deployment.

5.81 ESBN asks ComReg to clarify what roll-out conditions would apply should one entity win both Part A and Part B spectrum. ESBN assumes that one condition as contained in Part A spectrum would cover the entire licence.

ComReg's Assessment

5.82 ComReg notes the views of respondents regarding the proposed roll-out conditions. ComReg's assessment of respondents views for Part A spectrum and Part B spectrum are dealt with separately below.

Part A roll out condition

Outcome Based Roll-out Conditions

5.83 As noted above, ComReg has a favourable view on roll-out obligations as they can ensure efficient and timely use of the radio spectrum. With regard to submissions suggesting roll-out be based on an outcome approach, such as a reduction of CO_2 emissions, increase of network efficiency and enhancement in the utilisation of renewables, ComReg does not consider these approaches to be a viable method in ensuring the efficient use of the radio spectrum as many such outcomes may be achievable without the introduction of wireless technology, for example through better operating procedures, consequently, there may not be suitable indicators as to whether spectrum is being used efficiently.

5.84 ComReg has the statutory function under section 12(1)(b) of the Communications Regulation Act 2002, as amended, to ensure the efficient management of the radio frequency spectrum. Under Regulation 10(1) of the Authorisation Regulations, where ComReg attaches conditions to rights of use for radio frequencies, it may only attach such conditions as are listed in Part B of the Schedule to the Authorisation Regulations[166]. ComReg must act within its statutory functions and powers at all times. To apply roll-out obligations such as in relation to reducing CO_2 emissions would go beyond the "efficient management of the radio frequency spectrum" function and would therefore go beyond ComReg's powers.

[166] 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.
2. Effective and efficient use of frequencies in conformity with the Framework Directive and Framework Regulations.
3. Technical and operational conditions necessary for the avoidance of harmful interference and for the limitation of exposure of the general public to electromagnetic fields, where such conditions are different from those included in the general authorisation.
4. Maximum duration in conformity with Regulation 9, subject to any changes in the national frequency plan.
5. Transfer of rights at the initiative of the rights holder and conditions of such transfer in conformity with the Framework Directive.
6. Usage fees in accordance with Regulation 19.
7. Any commitments which the undertaking obtaining the usage right has made in the course of a competitive or comparative selection procedure.
8. Obligations under relevant international agreements relating to the use of frequencies.
9. Obligations specific to an experimental use of radio frequencies.

Furthermore, a condition relating to "reducing CO_2 emissions" or suchlike is not contained in Part B of the Schedule to the Authorisation Regulations.

Time period to comply with Roll-out Condition

5.85 As submitted by ESBN, the 2012 MBSA[167] award allowed a new entrant MNO 7 years to meet the 70% population roll-out obligation, as opposed to 3 years for an existing MNO[168]. However, noting this extended roll-out time of 7 years, in the 2012 MBSA ComReg also set an interim obligation of 35% population coverage within 3 years.

5.86 It is important to point out the differences between this award and the 2012 MBSA award. The spectrum acquired by Winning Bidders in the 2012 MBSA award was to provide electronic communication services for the benefit of end users, whereas the spectrum in this proposed award process is to improve a Network Utility Operator's own utility network for use by that Network Utility Operator.

5.87 However, were ComReg to allow a time period similar to the MBSA process for this award, it would better coincide with price reviews and give licensees time to comply with OJEC procurement rules.

5.88 ComReg appreciates that there is a process within the utilities sector for funding, with the next review scheduled for 2021. ComReg also notes that all users (private and public) of spectrum have individual funding requirements which they must address themselves. ComReg's primary concern is the efficient use of the radio spectrum.

5.89 Considering the above, ComReg is minded to increase the roll-out obligation time period as specified in Document 18/92 to 7 years. In ComReg's view, this would allow licensees sufficient time to meet the proposed roll-out obligation, while also ensuring spectrum efficiency.

5.90 For the avoidance of doubt, any roll-out obligation set by ComReg must be met using only the 400 MHz band spectrum awarded and no other spectrum shall be considered when measuring compliance with any roll-out obligation.

Part B Roll-out Condition

5.91 In the case where a Network Utility Operator wins spectrum in both Part A and Part B, then the roll-out condition for Part A would apply where the entity is using Part B spectrum for the provision of Smart Grid. If Part B spectrum is not being used for the provision of Smart Grid, then the roll-out condition for Part B spectrum, as proposed in Document 18/92, would apply.

[167] https://www.comreg.ie/industry/radio-spectrum/spectrum-awards/multi-band-spectrum-award-2012/
[168] ComReg notes that in practice there were no new entrants and so this aspect of the roll-out obligation was not acted upon.

5.92 Some respondents are of the view that the roll-out condition proposed for Part B spectrum is less onerous than that proposed for Part A. Respondents therefore suggest ComReg should introduce an outcome based approach that is aligned with the types of services that may be delivered in Part B spectrum. ComReg does not consider the use of outcome based roll-out obligations for reasons set out in paragraphs 5.83 and 5.84 of this document. Further, as stated in Document 18/92, it is difficult to specify a 'one size fits all' roll-out obligation due to the number of possible potential uses for Part B spectrum.

5.93 The proposed roll-out condition for Part B represents, in ComReg's view, efficient use of the radio spectrum while also allowing different technology[169] and service types to be deployed. ComReg notes that there were no other suggestions as to how the proposed roll-out condition may be altered.

ComReg's Position

5.94 Based on the above, ComReg proposes to:

- increase the roll-out condition for Part A to 7 years; and
- maintain its proposed roll-out condition for Part B spectrum as set out in Document 18/92.

5.95 ComReg maintains its view that the roll-out obligation for Part B would be assessed after a 3 year period to ensure compliance, provided the licensee is not using the spectrum for Smart Grid services. The licensee would be required to register the locations of apparatus (both base stations and numbers of connected devices) on each anniversary of licence commencement for ComReg's records and assessment of the usage of spectrum.

5.96 For Part A spectrum, ComReg maintains its view that an interested party would be required to submit details of its utility network (for example, the number and locations of wireless telegraphy equipment deployed to cover the Smart Grid network) with its application to participate in any award that may take place. In the case of an electric utility network, a roll-out obligation may take the form of an obligation to provide communications to at least 50% of high voltage substations[170]. ComReg also maintains its view that licensees would submit an annual report on each anniversary of licence commencement demonstrating progress made with its roll-out obligation. On the seventh anniversary of the licence, using the compliance report the Licensee would notify the Commission as to whether or not it has met the relevant rollout obligation. Licensees would also be required to register, on an annual basis, the locations where wireless telegraphy apparatus operating in Part

[169] For the avoidance of doubt, any technology deployed must utilise an FDD mode of operation.
[170] This requirement is based on draft ECC Report 292 as described in para 5.69.

A spectrum have been deployed – allowing ComReg to annually monitor a licensee's progress against its roll-out obligation.

5.7 Licence Duration

Summary of ComReg's view in Document 18/92

5.97 In Document 18/92, ComReg outlined its reasons for granting rights of use for a fixed duration and proposed a 15 year licence duration.

5.98 Plum observed that the potential uses identified are for services and networks that would require a long lifetime and recommended a licence duration of no less than 15 years.

5.99 ComReg noted and agreed with Plums recommendation as the potential uses identified require a long lifetime to ensure that a licensee can have time to design and deploy a network, as well as see a return on their investment. Further, ComReg did not consider a 15 year licence duration to be an unduly long period and was in line with respondent's views in ComReg Document 17/105s.

Views of Respondents

5.100 ComReg received 7 submissions regarding licence duration.

5.101 Overall, respondents viewed the proposed licence duration of 15 years to be too short. Respondents generally expressed the view that a greater licence duration is required in order to better align with the investment period as set out by the Commission for Regulation of Utilities, and the operational lifetime of the utility assets.

5.102 The Commission for Regulation of Utilities carry out price reviews every 5 years to grant approval for an agreed spend for the proceeding 5 years. The next price review period will begin in 2021.

5.103 EirGrid submits that due to the nature of the telecommunications network services, revenue streams would be orders of magnitude smaller than for commercial mobile operators, so any investment can only be justified in its view over a much longer period than would normally be considered appropriate. EirGrid propose a licence duration of 25 – 30 years.

5.104 The 450 MHz Alliance proposes a licence duration of 20 – 25 years. It submits that there will only be 12 years of 'useful' service as the network will take 3 – 5 years to design, implement and integrate. The 450 MHz Alliance further suggests that there should be a clear indication at the start of the award process outlining the method by which an extension to the licence duration would be granted. According to the

450 MHz Alliance, this is essential so that a Smart Grid operator would not be deterred from investment in the network.

5.105 ESBN submits that:

- the benefits of Smart Grid need to be realised in its view over a longer period to justify investment, and that a user needs to factor in the life time of the asset which, in this case, have long physical lifetimes[171]; and
- the proposed 15 year licence duration, in its view, is too short and would create investment issues for Network Utility Operators who do not have the same funds available to them as Mobile Network Operators. Therefore a roll-out may take many years to allow for cost benefits to be accrued which enables for additional investment.

5.106 ESBN proposes a licence of indefinite duration, or a minimum of 25 years as this would, in its view, allow investment certainty and better use of the spectrum.

5.107 Huawei proposes a licence duration of at least 20 years to align with the 'usual' investment period for electricity utility companies. In addition, Huawei submits that there is a high likelihood that users of this spectrum would continue to operations beyond the initial licence duration. Huawei also requests that ComReg provides clarity on the licence renewal process for this band.

5.108 NIE Networks proposes a licence duration upwards of 20 years, as a 15 year duration is not sufficient time in its view for a licensee to be in operation to begin delivering benefits to electricity customers.

5.109 JRC and WPD both propose a 25 year and 20 year licence duration respectively as this would in their view better align to with the long term planning horizons adopted by Network Utility Operators and the operational life of the utility assets.

ComReg's Assessment

5.110 In Document 18/92, ComReg stated that it favours granting rights of use for spectrum for a fixed duration as, amongst other things, this approach:

- promotes competition between undertakings and the efficient use of spectrum and it should contribute to the development of the internal market;
- be wholly compatible with the Common Regulatory Framework;

[171] 50 years for an overhead line, 55 years is the technical minimum life of a Substation (including associated switchgear, protection relays etc.), over 80 years for underground cabling, and 40 years for transformers.

- allows licensees sufficient time to make a return on their investments, in line with the expected life-cycles of any technologies deployed;
- provides enough flexibility to deal with any international harmonisation of a spectrum band, for example at EU-level, as may occur after fixed-term licences in that band have been granted;
- ensures that there are no long-term barriers to a co-ordinated approach to the bands (particularly important where a co-ordinated approach is necessary to introduce new services); and
- ensures that there can be a co-ordinated approach to bringing about the desired change but without creating perverse incentives for incumbents to hold out in order to gain more rents.

In its report to ComReg, DotEcon considers that indefinite licences are not the best approach - technology advancements and changing spectrum requirements mean that it may be appropriate for ComReg to periodically assess frequency assignments in order to ensure long term efficiency.

5.111 ComReg's proposal for a licence duration of 15 years facilitates the periodic coordination and potential realignment of the band as and when required while, at the same time, reducing the potential for licensees to resist changes in the coordination of such bands for strategic reasons. Such strategic behaviour could have serious consequences for consumer welfare, for example in terms of delays to the deployment of new services. ComReg also note that a 15 year licence duration is consistent with the views of Plum who recommend a minimum licence duration of 15 years.

5.112 The lifetime of the physical utility assets are cited as a reason for increased licence duration. However, these utility assets and do not necessarily represent the lifetime of the radio network infrastructure. The lifetime of the radio infrastructure is likely to be much shorter due to technical changes, as pointed out by DotEcon. DotEcon considers that where a Network Utility Operator chooses to invest in its own spectrum licence, it should take into account both the changing requirements and other potential means of delivering connectivity that might become available.

5.113 ComReg notes that based on the 5 year price review in the energy sector a licence duration of 15 years would allow for 3 price reviews to take place for Smart Grid providers.

5.114 The issue of licence renewal has been considered by DotEcon, noting that ComReg has established a clear approach through its spectrum awards to date and that incumbent holders of expiring licenses can expect licences to be re-awarded in a timely manner in advance of expiry. This allows existing licensees a

fair opportunity to compete for new licences, while also giving interested parties a chance to show their value for the spectrum.

5.115 ComReg considers this approach appropriate, for example due to industry demand, ComReg awarded 26 GHz national licences in 2018, which allowed:

- existing licensees to compete for new licences that could be aligned with their existing assignment;
- existing licensees an appropriate time to transition; and
- provided the potential for any new entrants to compete.

ComReg's Position

5.116 In light of the above, ComReg proposes to award 400 MHz rights of use for a duration of 15 years. These rights of use would then expire on the fifteenth anniversary of licence commencement.

5.8 Memorandum of Understanding

Summary of ComReg's views in Document 18/92

5.117 In its report to ComReg, Document 18/92b, Plum advised ComReg to re-examine the MOU that is currently in place for the 410 – 414 MHz / 420 – 424 MHz sub-band as technologies or potential uses that require bandwidths of greater than 25 kHz may experience a greater risk of interference from the narrowband networks present in the UK. Plum recommended that systems using a channel spacing of greater than 25 kHz (with LTE expected to be deployed for the provision of Smart Grids) should be accounted for using CEPT Recommendation 25/08[172] and the Harmonised Calculation Method Agreement.

5.118 ComReg agreed that the current MOU should be re-examined to account for the likely use of wideband technologies, and the increase in spectrum to 410 – 415.5 MHz / 420 – 425.5 MHz. ComReg stated that it would engage Ofcom, the UK National Regulatory Authority, to re-examine the current MOU.

Views of Respondents

5.119 ComReg received 6 submissions regarding the proposed revision of the MOU.

[172] https://www.ecodocdb.dk/download/063e7311-fba7/TR2508.pdf

5.120 JRC and WPD support ComReg's proposal to re-examine the current MOU, noting that this is an important aspect in ensuring the spectrum can be utilised in Ireland as early as possible after the award process.

5.121 NIE Networks note the importance of re-examining the MOU. NIE Networks refer to the Integrated Single Electricity Market (I-SEM) which is a new wholesale electricity market arrangement for Ireland and Northern Ireland. These new market arrangements are designed to integrate the all-island (both Northern Ireland and the Republic of Ireland) Smart Grid telecommunications infrastructure and ensure that the electricity grid can be met to meet the challenges arising from transitioning to a low carbon economy.

5.122 The 450 MHz Alliance submits that if ESBN was to be successfully awarded Part A spectrum, then it must be prudent to consider a solution for the whole of Ireland which could also serve Northern Ireland Electricity, as well as other Utilities. The 450 MHz Alliance observes that the above scenario would have implications for any new MOU.

5.123 Nokia observes that dialogue with JRC and Ofcom could be warranted to align the band with the UK.

5.124 ESBN agrees that it is appropriate to revisit the existing MOU as, in its opinion, it is not fit for purpose given the existing proposals and increase in spectrum. ESBN encourages ComReg to engage with Ofcom soonest as the contents of the MOU may impact network configuration and location of base stations for any potential licensee, as well as an interested bidder's valuation in the spectrum. ESBN further encourages ComReg to consult on the proposed new MOU.

ComReg's Assessment

5.125 ComReg agrees that the MOU is in need of update but reminds interested parties that it is only able to licence users of the radio spectrum within the Republic of Ireland. Any licensee would need to liaise with Ofcom regarding their spectrum needs in Northern Ireland.

5.126 ComReg also note Plum's recommendation to revisit the MOU to take account of possible changes in current or planned use of the band in the UK.

ComReg's Position

5.127 ComReg will engage Ofcom to define a new MOU and will publish details of the MOU once finalised.

5.9 Third Party use

Summary of ComReg's views in Document 18/92

5.128 ComReg maintained its view that for spectrum in Part B, Third Party use would mirror the Third Party Business Radio licensing scheme by allowing licensees to provide services to third parties throughout the country without the need for individual licensing for specific geographic sites or by each third party user.

Views of respondents

5.129 JRC and WPD support ComReg's proposal to allow third party use in Part B of the band in keeping with the existing arrangements for Third Party Business Radio.

5.130 EirGrid is also supportive of ComReg's proposal and points out that EirGrid currently avails of telecommunications services from licensed providers and envisages being an end-user of the new services which would enable Smart Grid.

ComReg's Assessment

5.131 ComReg notes the support from respondents to ComReg's proposal regarding third party use.

5.132 ComReg has proposed a structure similar to that of the Third Party Business Radio licencing scheme. ComReg proposes:

- the Licensee is the entity that partook in the proposed 400 MHz spectrum award and is responsible for ensuring that it complies with the conditions contained in the licensing regulations and schedules, ensure payment of fees, and compliance with any relevant international agreements relating to the use of apparatus or the frequencies assigned; and
- the Licensee would be responsible for submission of an annual report on spectrum usage within 31 days of each anniversary of the commencement of the licence.

5.133 ComReg would like to reiterate that, for the avoidance of doubt, any third party use would only be permitted in Part B spectrum. Where a Network Utility Operator wins both Part A and Part B spectrum, third party services may only be offered in Part B spectrum.

ComReg's Position

5.134 ComReg will permit third party use in Part B spectrum.

5.10 Other Issues Raised

Primary users within the 400 MHz Band

5.135 ESBN is of the opinion that as there is no other spectrum available for Smart Grid, and with other potential uses having alternate spectrum available, then Part A Smart Grid users should be given primacy over other potential users of Part B spectrum.

ComReg's Assessment and Position

5.136 ComReg does not agree with ESBNs above submission. ComReg has stated, in Document 18/92, that BEMs and coordination between licensees is necessary. The spectrum is being auctioned on a primary basis and so Part A users and Part B users will be treated as primary users.

Chapter 6

6 Draft Decision Instrument

Draft Decision Instrument

Introduction

The draft Decision Instrument (D.I.) below reflects ComReg's preliminary views as of the date of publication of this Response to Consultation and Draft Decision on the proposed 400 MHz Spectrum Award 2019 (Document 19/23). For ease of reading the draft D.I. reads as if it is a finalised document. However it is a draft document throughout and is subject to further consultation and consideration by ComReg. No final decisions have yet been made by ComReg as to the content and effect of any final D.I., as may be put into effect, for the purpose of granting new rights of use for radio frequencies in the portion of the 400 MHz band at issue.

Therefore, and for example, though the draft D.I. describes and refers to the "400 MHz Band Licence Regulations 2019" and "Information Memorandum" as if these were both finalised documents, as of the date of publication of this document they are both draft documents. Further, if this draft D.I. should become a final D.I., whether in whole or in part, ComReg may make such amendments to the text of any final D.I as it considers necessary and without further consultation, where such amendments are editorial only and do not affect the substance of the final D.I., as to its meaning, purpose, or effect.

1. Definitions and Interpretations

In this Decision Instrument, save where the context otherwise admits or requires:

"400 MHz Band" means the part of the radio frequency spectrum consisting of the 410 – 414 MHz / 420 – 424 MHz sub-band;

"**400 MHz Band Part A**" means the part of the radio frequency spectrum consisting of the 410 – 413 MHz / 420 – 423 MHz sub-band;

"**400 MHz Band Part B**" means the part of the radio frequency spectrum consisting of the 413 – 414 MHz / 423 – 424 MHz sub-band;

"**400 MHz Band Licence**" or "**Licence**" means a licence granted by ComReg pursuant to section 5 of the Wireless Telegraphy Act 1926 (as amended) and the

400 MHz Band Licence Regulations 2019, of the type set out in Schedule 1 to the 400 MHz Band Licence Regulations 2019;

"**400 MHz Band Part A Licence**" means a licence granted by ComReg pursuant to section 5 of the Wireless Telegraphy Act 1926 (as amended) and the 400 MHz Band Licence Regulations 2019 for the part of the radio frequency spectrum consisting of the 410 – 413 MHz / 420 – 423 MHz sub-band;

"**400 MHz Band Part B Licence**" means a licence granted by ComReg pursuant to section 5 of the Wireless Telegraphy Act 1926 (as amended) and the 400 MHz Band Licence Regulations 2019 for the part of the radio frequency spectrum consisting of the 413 – 414 MHz / 423 – 424 MHz sub-band;

"**400 MHz Band Licence Regulations 2019**" means the Wireless Telegraphy (400 MHz Band Licences) Regulations, 2019 (S.I. XX/2019) made by ComReg pursuant to section 6 of the Wireless Telegraphy Act 1926 with the consent of the Minister under section 37 of the Communications Regulation Act 2002, as amended, a draft form of which is set out in the Information Memorandum;

"**Authorisation Regulations**" means the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations, 2011 (S.I. No. 335 of 2011);

"**Award Spectrum**" means the portion of the means the part of the radio frequency spectrum consisting of the 410 – 414 MHz / 420 – 424 MHz sub-band; the available rights of use of which will be divided into two parts (Part A and Part B): Part A is comprised of 2 × 3 MHz whose rights of use would be limited to Network Utility Operators as set out in the Information Memorandum; and Part B is comprised of the remaining 2 × 1 MHz whose rights of use would be available as set out in the Information Memorandum; and which will be awarded by means of two sequential auctions;

"**Communications Regulation Act 2002**" means the Communications Regulation Act, 2002, (No. 20 of 2002), as amended;

"**ComReg**" means the Commission for Communications Regulation, established under section 6 of the Communications Regulation Act 2002;

"**Framework Regulations**" means the European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011, (S.I. No. 333 of 2011);

"**Information Memorandum**" means Document XX/XX, published by ComReg on [XX] 20XX;

"**Licensee**" means an undertaking to whom a 400 MHz Band Licence has been granted;

"**Minister**" means the Minister for Communications, Climate Action and Environment;

"**Network Utility Operator**" means:

(1) *A person that has been granted a licence by the Commission for Regulation of Utilities under section 14 of the Electricity Regulation Act 1999, as amended:*
- *to discharge the functions of the transmission system owner;*
- *to discharge the functions of the transmission system operator;*
- *to discharge the functions of Distribution System Owner;*
- *to discharge the functions of the distribution system operator;*

(2) *The company or a subsidiary of the company, the functions of which are laid out in section 8 of the Gas Act 1976 and in section 11 of the Gas (Interim) (Regulation) Act 2002; and*

(3) *The private company limited by shares formed by virtue of section 4 of the Water Services Act 2013 as amended.*

"**RIA**" means Regulatory Impact Assessment;

"**Smart Grid**" means advanced delivery systems for utility services (electricity, gas and water) from sources of generation and production to key elements in the grid networks and includes all supervisory and control necessary for their effective management. For the avoidance of doubt, this definition does not mean merely the use of smart metering, which consists of devices located at premises that record energy, water and gas usage and provide two-way electronic communication between consumers and the grid.;

"**Wireless Telegraphy Act 1926**" means the Wireless Telegraphy Act, 1926 (No. 45 of 1926), as amended.

2. Decision-Making Considerations

In arriving at its decisions as set out in this Decision Instrument, ComReg has had regard to:

(i). the contents of, and the materials and reasoning referred to in, as well as the materials provided by respondents in connection with, the below-listed ComReg documents:

a. Consultation on Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz sub-band – ComReg Document 17/67;
b. Response to Consultation on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz Sub-band – ComReg Document 17/105;

c. Non-Confidential Submissions to ComReg Document 17/67 on the Proposed Release of the 410 – 415.5 / 420 – 425.5 MHz Sub-band – ComReg Document 17/105s;
d. Further Consultation on the release of the 410 – 415.5 / 420 – 425.5 MHz Sub-band– ComReg Document 18/92;
e. DotEcon Limited - Award of licences for the use of radio frequencies in the 400 MHz band - ComReg Document 18/92a;
f. Plum Consulting London LLP - Potential use of the 400 MHz band in Ireland - ComReg Document 18/92b;

(ii). the consultants' reports commissioned by ComReg and the advice obtained by ComReg in relation to the subject matter of the documents and materials listed at (i) above; and

(iii). the powers, functions, objectives and duties of ComReg, including, without limitation, those under and by virtue of:

a. the Communications Regulation Act 2002, as amended, and, in particular, sections 10, 12 and 13 thereof;

b. the Framework Regulations, and, in particular, Regulations 13, 16 and 17 thereof;

c. the Authorisation Regulations, and, in particular, Regulations 9, 10, 11, 12, 15, 16, 17, 18(1) and 19 thereof;

d. the Wireless Telegraphy Act, 1926 and, in particular, sections 5 and 6 thereof; and

e. applicable Policy Directions made by the Minister under section 13 of the Communications Regulation Act 2002.

In arriving at its decisions as set out in this Decision Instrument, ComReg has:

(i). given all interested parties the opportunity to express their views and to make submissions in accordance with Regulation 11 of the Authorisation Regulations and Regulation 12 of the Framework Regulations; and

(ii). evaluated the matters to be decided, in accordance with ComReg's RIA Guidelines (ComReg Document 07/56a) and the RIA Guidelines issued by the Department of An Taoiseach in June, 2009, as set out in the various chapters of Document [-] and their supporting annexes.

3. Decisions

ComReg has made the following decisions –

- ComReg will proceed with the release of the Award Spectrum using the auction format and in accordance with the procedures and rules as detailed in the Information Memorandum and will grant new 400 MHz Band Licences which shall come into operation on [- 2019] or as close to that date as possible.

- The available rights of use of the Award Spectrum will be divided into two parts (400 MHz Band Part A and 400 MHz Band Part B): 400 MHz Band Part A is comprised of 2 × 3 MHz (410 – 413 MHz / 420 – 423 MHz) whose rights of use would be limited to Network Utility Operators as set out in the Regulations, and the Information Memorandum; and 400 MHz Band Part B is comprised of the remaining 2 × 1 MHz (413 – 414 MHz / 423 – 424 MHz) whose rights of use would be available as set out in the Information Memorandum.

- For the purpose of granting new 400 MHz Band Licences, and subject to obtaining the required consent of the Minister in accordance with section 37 of the Communications Regulation Act 2002, as amended, ComReg will make regulations under section 5 of the Wireless Telegraphy Act 1926, to be titled the 400 MHz Band Licence Regulations 2019 and which shall prescribe, amongst other things –

    a. the form of such Licences;
    b. the period during which such Licences shall continue in force;
    c. the manner in which, the terms on which, and the period or periods for which such Licences may be renewed;
    d. the circumstances in which or the terms under which such Licences are granted;
    e. the circumstances and manner in which such Licences may be suspended or revoked;
    f. the terms and conditions to be observed by the holders of such Licences and subject to which such Licences are deemed to be granted;
    g. the fees to be paid on the application, grant or renewal of such Licences or classes of such Licences, subject to such exceptions as the appropriate authority may prescribe, and the time and manner at and in which such fees are to be paid; and
    h. matters which such Licences do not entitle or authorise the holder to do.

- ComReg will attach certain conditions to the rights of use for radio frequencies that form the Award Spectrum, as generally described in Chapter 5 of this Document and as shall be particularised in each 400 MHz Band Licence.

- All 400 MHz Band Licences will be of fifteen years duration such that they will commence concurrently on [-], or on such later date as ComReg may specify, and they will all expire concurrently on [-] or on the fifteenth anniversary of such later commencement date as may apply and all rights of use for radio frequencies

assigned under such Licences shall commence and expire on the same dates as such Licences.

- 400 MHz Band Part A Licences will permit Licensees who are Network Utility Operators to keep, possess, install, maintain, work and use apparatus for the provision of Smart Grids as defined in the Information Memorandum, on a national basis.

- 400 MHz Band Part B Licences will permit Licensees to keep, possess, install, maintain, work and use apparatus for the provision of radio communications, on a national basis.

- 400 MHz Band Licences will permit Licensees to keep, possess, install, maintain, work and use equipment that utilises "Frequency Division Duplexing" technology only[173], and, in particular and for avoidance of doubt, Licences will not permit Licensees to keep, possess, install, maintain, work or use any form of equipment that utilises "Time Division Duplexing" technology[174].

- All undertakings who may be granted 400 MHz Band Licences shall be selected by their participation in an open and competitive selection procedure, specifically two sequential auctions, using a "Simple Clock Auction", the format, processes, and rules of which auctions are particularised in the Information Memorandum.

- The granting of a 400 MHz Band Licence, to any undertaking who successfully participates in the auction and wins some quantum of the Award Spectrum, shall be conditional upon all such undertakings paying the applicable fees for such Licences (as determined by the auction conducted in accordance with the IM) and complying with the terms and conditions subject to which such Licences shall be deemed to be granted.

4. Statutory Powers Not Affected

Nothing in this Decision Instrument shall operate to limit ComReg in the exercise of its discretions or powers, or in the performance of its functions or duties, or in the attainment of any of its objectives under any laws applicable to ComReg from time to time.

COMMISSIONER

[173] "Frequency Division Duplexing (FDD)" is a method for establishing a full-duplex communications link that uses two different radio frequencies for transmitter and receiver operation. The transmit direction and receive direction frequencies are separated by a defined frequency offset.
[174] "Time Division Duplexing (TDD)" is a method for emulating full-duplex communication over a half-duplex communication link. The transmitter and receiver both use the same frequency but transmit and receive traffic is switched in time.

THE COMMISSION FOR COMMUNICATIONS REGULATION

THE XX DAY OF XX 2019

Chapter 7

7 Next Steps and Submitting Comments

7.1 All input and comments are welcome. However, it would make the task of analysing responses easier if comments were referenced to the relevant section / paragraph number in each chapter and annex in this document.

7.2 Please also set out your reasoning and all supporting information for any views expressed so that ComReg can make a full assessment of your input.

7.3 The consultation period will run until 12:00 on Monday 15 April 2019 during which time ComReg welcomes written comments on any of the issues raised in this paper.

7.4 Responses must be submitted in written form and sent to the below email address for the attention of Mr. Patrick Bolton, and clearly marked – Submissions to ComReg Document 19/23:

Email: marketframeworkconsult@comreg.ie

7.5 ComReg requests that electronic submissions be submitted in an unprotected format so that they can be redacted (if required) and included in the ComReg submissions document for electronic publication.

7.6 ComReg appreciates that respondents may wish to provide confidential information if their comments are to be meaningful. In order to promote openness and transparency, ComReg will publish all respondents' submissions to this consultation as well as all substantive correspondence on matters relating to this document, subject to the provisions of ComReg's guidelines on the treatment of confidential information. In that regard, **respondents are requested to provide both a confidential and non-confidential versions of their submission to the consultation, providing supporting reasoning as to why they consider material to be confidential**. Alternatively, respondents are requested to place confidential material in a separate annex to their response, again providing supporting reasoning in that annex as to why such material is confidential.

7.1 Next Steps

7.7 When it has concluded its review of all submissions received and other relevant material, ComReg's intention would be to first publish a draft Regulation with a draft Information Memorandum and a response to consultation and Final Decision as appropriate.

Annex: 1 Legal Basis

A 1.1 The Communications Regulation Acts 2002-2017[175] (the "2002 Act"), the Common Regulatory Framework (including the Framework and Authorisation Directives[176] as transposed into Irish law by the corresponding Framework and Authorisation Regulations[177]), and the Wireless Telegraphy Acts 1926 to 2009[178] set out, amongst other things, powers, functions, duties and objectives of ComReg that are relevant to the management of the radio frequency spectrum in Ireland and to this preliminary consultation.

A 1.2 Apart from licencing and making regulations in relation to licences, ComReg's functions include the management of Ireland's radio frequency spectrum in accordance with ministerial Policy Directions under Section 13 of the 2002 Act, having regard to its objectives under Section 12 of the 2002 Act, Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive. ComReg is to carry out its functions effectively, and in a manner serving to ensure that the allocation and assignment of radio frequencies is based on objective, transparent, non-discriminatory and proportionate criteria.

[175] The Communications Regulation Act 2002, the Communications Regulation (Amendment) Act 2007, the Communications Regulation (Premium Rate Services and Electronic Communications Infrastructure) Act 2010, the Communications Regulation (Postal Services) Act 2011, the Communications Regulation (Postal Services) (Amendment) Act 2015, and the Communications Regulation (Postal Services) (Amendment) Act 2017.

[176] Directive No. 2002/21/EC of the European Parliament and of the Council of 7 March 2002 (as amended by Regulation (EC) No. 717/2007 of 27 June 2007, Regulation (EC) No. 544/2009 of 18 June 2009 and Directive 2009/140/EC of the European Parliament and Council of 25 November 2009) (the "Framework Directive") and Directive No. 2002/20/EC of the European Parliament and of the Council of 7 March 2002 (as amended by Directive 2009/140/EC) (the "Authorisation Directive")

[177] The European Communities (Electronic Communications Networks and Services) (Framework) Regulations 2011 (S.I. No. 333 of 2011) and the European Communities (Electronic Communications Networks and Services) (Authorisation) Regulations 2011 (S.I. No. 335 of 2011) respectively.

[178] The Wireless Telegraphy Acts 1926 to 1988 and Sections 181 (1) to (7) and (9) and Section 182 of the Broadcasting Act 2009.

A 1.3 This annex is intended as a general guide as to ComReg's role in this area, and not as a definitive or exhaustive legal exposition of that role. Further, this annex restricts itself to consideration of those powers, functions, duties and objectives of ComReg that appear most relevant to the matters at hand and generally excludes those not considered relevant (for example, in relation to postal services, premium rate services or market analysis). For the avoidance of doubt, however, the inclusion of particular material in this Annex does not necessarily mean that ComReg considers same to be of specific relevance to the matters at hand.

A 1.4 All references in this annex to enactments are to the enactment as amended at the date hereof, unless the context otherwise requires.

Primary Objectives and Regulatory Principles under the 2002 Act and Common Regulatory Framework

A 1.5 ComReg's primary objective in carrying out its statutory functions in the context of electronic communications are to:

- Promote competition[179]
- contribute to the development of the internal market[180]
- promote the interests of users within the Community[181];
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act;[182] and
- unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological

[179] Section 12 (1)(a)(i) of the 2002 Act.
[180] Section 12 (1)(a)(ii) of the 2002 Act.
[181] Section 12(1)(a)(iii) of the 2002 Act.
[182] Section 12(1)(b) of the 2002 Act. Whilst this objective would appear to be a separate and distinct objective in the 2002 Act, it is noted that, for the purposes of ComReg's activities in relation to electronic communications networks and services ("ECN" and "ECS"), Article 8 of the Framework Directive identifies "*encouraging efficient use and ensuring the effective management of radio frequencies (and numbering resources*)" as a sub-objective of the broader objective of the promotion of competition.

neutrality in complying with the requirements of the Specific regulations[183] in particular those designed to ensure effective competition[184]

Promotion of Competition

A 1.6 Section 12(2)(a) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at the promotion of competition, including:

- Ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- ensuring that there is no distortion or restriction of competition in the electronic communications sector; and
- encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.

A 1.7 In so far as the promotion of competition is concerned, Regulation 16(1)(b) of the Framework Regulations also requires ComReg to:

- Ensure that elderly users and users with special social needs derive maximum benefit in terms of choice, price and quality, and
- ensure that, in the transmission of content, there is no distortion or restriction of competition in the electronic communications sector.

A 1.8 Regulation 9(11) of the Authorisation Regulations also provides that ComReg must ensure that radio frequencies are efficiently and effectively used having regard to Section 12(2)(a) of the 2002 Act and Regulations 16(1) and 17(1) of the Framework Regulations. Regulation 9(11) further provides that ComReg must ensure that competition is not distorted by any transfer or accumulation of rights of use for radio frequencies, and, for this purpose, ComReg may take appropriate measures such as mandating the sale or the lease of rights of use for radio frequencies.

[183] The 'Specific Regulations' comprise collectively the Framework Regulations, the Authorisation Regulations, the European Communities (Electronic Communications Networks and Services) (Access) Regulations 2011 (S.I. No. 334 of 2011), the European Communities (Electronic Communications Networks and Services) (Universal Service and Users' Rights) Regulations 2011 (S.I. 337 of 2011) and the European Communities (Electronic Communications Networks and Services) (Privacy and Electronic Communications) Regulations 2011 (S.I. No. 336 of 2011).

[184] Regulation 16(1)(a) of the Framework Regulations.

Contributing to the Development of the Internal Market

A 1.9 Section 12(2)(b) of the 2002 Act requires ComReg to take all reasonable measures which are aimed at contributing to the development of the internal market, including:

- Removing remaining obstacles to the provision of electronic communications networks, electronic communications services and associated facilities at Community level;
- encouraging the establishment and development of trans-European networks and the interoperability of transnational services and end-to-end connectivity; and
- 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.

A 1.10 In so far as contributing to the development of the internal market is concerned, Regulation 16(1) (c) of the Framework Regulations also requires ComReg to co-operate with the Body of European Regulators for Electronic Communications (BEREC) in a transparent manner to ensure the development of consistent regulatory practice and the consistent application of EU law in the field of electronic communications.

Promotion of Interests of Users

A 1.11 Section 12(2)(c) of the 2002 Act requires ComReg, when exercising its functions in relation to the provision of electronic communications networks and services, to take all reasonable measures which are aimed at the promotion of the interests of users within the Community, including:

- Ensuring that all users have access to a universal service;
- 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;
- contributing to ensuring a high level of protection of personal data and privacy;

- promoting the provision of clear information, in particular requiring transparency of tariffs and conditions for using publicly available electronic communications services
- encouraging access to the internet at reasonable cost to users;
- addressing the needs of specific social groups, in particular disabled users; and
- ensuring that the integrity and security of public communications networks are maintained.

A 1.12 In so far as promotion of the interests of users within the EU is concerned, Regulation 16(1)(d) of the Framework Regulations also requires ComReg to:

- Address the the needs of specific social groups, in particular, elderly users and users with special social needs, and
- promote the ability of end-users to access and distribute information or use applications and services of their choice.

Regulatory Principles

A 1.13 In pursuit of its objectives under Regulation 16(1) of the Framework Regulations and Section 12 of the 2002 Act, ComReg must apply objective, transparent, non-discriminatory and proportionate regulatory principles by, amongst other things:

- Promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate review periods;
- ensuring that, in similar circumstances, there is no discrimination in the treatment of undertakings providing electronic communications networks and services;
- safeguarding competition to the benefit of consumers and promoting, where appropriate, infrastructure-based competition;
- 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;

- taking due account of the variety of conditions relating to competition and consumers that exist in the various geographic areas within the State; and
- imposing ex-ante regulatory obligations only where there is no effective and sustainable competition and relaxing or lifting such obligations as soon as that condition is fulfilled.

BEREC

A 1.14 Under Regulation 16(1)(3) of the Framework Regulations, ComReg must:

- Having regard to its objectives under Section 12 of the 2002 Act and its functions under the Specific Regulations, actively support the goals of BEREC of promoting greater regulatory co-ordination and coherence; and
- take the utmost account of opinions and common positions adopted by BEREC when adopting decisions for the national market.

Other obligations under the 2002 Act

A 1.15 In carrying out its functions, ComReg is required amongst other things, to:

- Seek to ensure that any measures taken by it are proportionate having regard to the objectives set out in Section 12 of the 2002 Act[185];

- 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[186]; and

- take the utmost account of the desirability that the exercise of its functions aimed at achieving its radio frequency management objectives does not result in discrimination in favour of or against particular types of technology for the provision of ECS.[187]

[185] Section 12(3) of the 2002 Act.
[186] Section 12(5) of the 2002 Act.
[187] Section 12(6) of the 2002 Act.

Policy Directions

A 1.16 Section 12(4) of the 2002 Act provides that, in carrying out its functions, ComReg must have appropriate regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to the Commission, in relation to the economic and social development of the State. Section 13(1) of the 2002 Act requires ComReg to comply with any policy direction given to ComReg by the Minister for Communications, Energy and Natural Resources ("the Minister") as he or she considers appropriate, in the interests of the proper and effective regulation of the electronic communications market, the management of the radio frequency spectrum in the State and the formulation of policy applicable to such proper and effective regulation and management, to be followed by ComReg in the exercise of its functions. Section 10(1)(b) of the 2002 Act also requires ComReg, in managing the radio frequency spectrum, to do so in accordance with a direction of the Minister under Section 13 of the 2002 Act, while Section 12(1)(b) requires ComReg to ensure the efficient management and use of the radio frequency spectrum in accordance with a direction under Section 13.

Policy Direction No.4 on Industry Sustainability

A 1.17 ComReg shall ensure that in making regulatory decisions in relation to the electronic communications market, it takes account of the state of the industry and in particular the industry's position in the business cycle and the impact of such decisions on the sustainability of the business of undertakings affected.

Policy Direction No.5 on Regulation where necessary

A 1.18 Where ComReg has discretion as to whether to impose regulatory obligations, it shall, before deciding to impose such regulatory obligations on undertakings, examine whether the objectives of such regulatory obligations would be better achieved by forbearance from imposition of such obligations and reliance instead on market forces.

Policy Direction No.6 on Regulatory Impact Assessment

A 1.19 ComReg, before deciding to impose regulatory obligations on undertakings in the market for electronic communications or for the purposes of the management and use of the radio frequency spectrum or for the purposes of the regulation of the postal sector, shall conduct a Regulatory Impact Assessment in accordance with European and International best practice and otherwise in accordance with measures that may be adopted under the Government's Better Regulation programme.

Policy Direction No.7 on Consistency with other Member States

A 1.20 ComReg shall ensure that, where market circumstances are equivalent, the regulatory obligations imposed on undertakings in the electronic communications market in Ireland should be equivalent to those imposed on undertakings in equivalent positions in other Member States of the European Community.

Policy Direction No.11 on Management of the Radio Frequency Spectrum

A 1.21 ComReg shall ensure that, in its management of the radio frequency spectrum, it takes account of the interests of all users of the radio frequency spectrum.

General Policy Direction No.1 on Competition

A 1.22 ComReg shall focus on the promotion of competition as a key objective. Where necessary, ComReg shall implement remedies which counteract or remove barriers to market entry and shall support entry by new players to the market and entry into new sectors by existing players. ComReg shall have a particular focus on:

- Market share of new entrants
- ensuring that the applicable margin attributable to a product at the wholesale level is sufficient to promote and sustain competition;
- price level to the end user;
- competition in the fixed and mobile markets;
- the potential of alternative technology delivery platforms to support competition.

Other relevant obligations under the Framework and Authorisation Regulations

Framework Regulations

A 1.23 Regulation 17 of the Framework Regulations governs the management of radio frequencies for electronic communications services. Regulation 17(1) requires that ComReg, subject to any directions issued by the Minister pursuant to Section 13 of the 2002 Act and having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 of the Framework Regulations and the provisions of Article 8a of the Framework Directive, ensure:

- The effective management of radio frequencies for electronic communications services;
- that spectrum allocation 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
- ensure that harmonisation of the use of radio frequency spectrum across the EU 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 Decision No. 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the EU.

A 1.24 Regulation 17(2) provides that, unless otherwise provided in Regulation 17(3), ComReg must ensure that all types of technology used for electronic communications services may be used in the radio frequency bands that are declared available for electronic communications services in the Radio Frequency Plan published under Section 35 of the 2002 Act in accordance with EU law.

A 1.25 Regulation 17(3) provides that, notwithstanding Regulation 17(2), ComReg may, through licence conditions or otherwise, provide for proportionate and non-discriminatory restrictions to the types of radio network or wireless access technology used for electronic communications services where this is necessary to:

- Avoid harmful interference;

- protect public health against electromagnetic fields,
- ensure technical quality of service,
- ensure maximisation of radio frequency sharing,
- safeguard the efficient use of spectrum, or
- ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in accordance with Regulation 17(6).

A 1.26 Regulation 17(4) requires that, unless otherwise provided in Regulation 17(5), ComReg must ensure that all types of electronic communications services may be provided in the radio frequency bands, declared available for electronic communications services in the Radio Frequency Plan published under Section 35 of the Act of 2002 in accordance with EU law.

A 1.27 Regulation 17(5) provides that, notwithstanding Regulation 17(4), ComReg may provide for proportionate and non-discriminatory restrictions to the types of electronic communications services to be provided, including where necessary, to fulfil a requirement under the International Telecommunication Union Radio Regulations ("ITU-RR").

A 1.28 Regulation 17(6) requires that measures that require an electronic communications service to be provided in a specific band available for electronic communications services must be justified in order to ensure the fulfilment of a general interest objective as defined by or on behalf of the Government or a Minister of the Government in conformity with EU law such as, but not limited to:

- Safety of life
- the promotion of social, regional or territorial cohesion,
- the avoidance of inefficient use of radio frequencies, or
- the promotion of cultural and linguistic diversity and media pluralism, for example, by the provision of radio and television broadcasting services.

A 1.29 Regulation 17(7) provides that ComReg may only prohibit the provision of any other electronic communications service in a specific radio spectrum frequency band where such a prohibition is justified by the need to protect safety of life services. ComReg may, on an exceptional basis, extend such a measure in order to fulfil other general interest objectives as defined by or on behalf of the Government or a Minister of the Government.

A 1.30 Regulation 17(8) provides that ComReg must, in accordance with Regulation 18, regularly review the necessity of the restrictions referred to in Regulations 17(3) and 17(5) and must make the results of such reviews publicly available.

A 1.31 Regulation 17(9) provides that Regulations 17(2) to (7) only apply to spectrum allocated to be used for electronic communications services, general authorisations issued and individual rights of use for radio frequencies granted after the 1 July 2011. Spectrum allocations, general authorisations and individual rights of use which already existed on the 1 July 2011 Framework Regulations are subject to Regulation 18.

A 1.32 Regulation 17(10) provides that ComReg may, having regard to its objectives under Section 12 of the 2002 Act and Regulation 16 and its functions under the Specific Regulations, lay down rules in order to prevent spectrum hoarding, in particular by setting out strict deadlines for the effective exploitation of the rights of use by the holder of rights and by withdrawing the rights of use in cases of non-compliance with the deadlines. Any rules laid down under this Regulation must be applied in a proportionate, non-discriminatory and transparent manner.

A 1.33 Regulation 17(11) requires ComReg to, in the fulfilment of its obligations under that Regulation, respect relevant international agreements, including the ITU Radio Regulations and any public policy considerations brought to its attention by the Minister.

Authorisation Regulations

Decision to limit rights of use for radio frequencies

A 1.34 Regulation 9(2) of the Authorisation Regulations provides that ComReg 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:

- it is necessary to avoid harmful interference,
- it is necessary to ensure technical quality of service,
- it is necessary to safeguard the efficient use of spectrum, or
- 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 EU law.

A 1.35 Regulation 9(10) of the Authorisation Regulations provides that ComReg must 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.

A 1.36 Regulation 9(7) also provides that:

- Where individual rights of use for radio frequencies are granted for a period of 10 years or more and such rights may not be transferred or leased between undertakings in accordance with Regulation 19 of the Framework Regulations, ComReg must ensure that criteria set out in Regulation 9(2) apply for the duration of the rights of use, in particular upon a justified request from the holder of the right.

- Where ComReg determines that the criteria referred to in Regulation 9(2) are no longer applicable to a right of use for radio frequencies, ComReg must, after a reasonable period and having notified the holder of the individual rights of use, change the individual rights of use into a general authorisation or must ensure that the individual rights of use are made transferable or leasable between undertakings in accordance with Regulation 19 of the Framework Regulations.

Publication of procedures

A 1.37 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.

Duration of rights of use for radio frequencies

A 1.38 Regulation 9(6) of the Authorisation Regulations provides that rights of use for radio frequencies must be in force for such period as ComReg considers appropriate having regard to the network or service concerned in view of the objective pursued taking due account of the need to allow for an appropriate period for investment amortisation.

Conditions attached to rights of use for radio frequencies

A 1.39 Regulation 9(5) of the Authorisation Regulations provides that, when granting rights of use for radio frequencies, ComReg must, having regard to the provisions of Regulations 17 and 19 of the Framework Regulations, specify whether such rights may be transferred by the holder of the rights and under what conditions such a transfer may take place.

A 1.40 Regulation 10(1) of the Authorisation Regulations provides that, notwithstanding Section 5 of the Wireless Telegraphy Act,1926, but subject to any regulations under Section 6 of that Act, ComReg may only attach those conditions listed in Part B of the Schedule to the Authorisation Regulations. Part B lists the following conditions which may be attached to rights of use:

- 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.
- Effective and efficient use of frequencies in conformity with the Framework Directive and Framework Regulations.
- Technical and operational conditions necessary for the avoidance of harmful interference and for the limitation of exposure of the general public to electromagnetic fields, where such conditions are different from those included in the general authorisation.
- Maximum duration in conformity with Regulation 9, subject to any changes in the national frequency plan.
- Transfer of rights at the initiative of the rights holder and conditions of such transfer in conformity with the Framework Directive.
- Usage fees in accordance with Regulation 19
- Any commitments which the undertaking obtaining the usage right has made in the course of a competitive or comparative selection procedure.
- Obligations under relevant international agreements relating to the use of frequencies.
- Obligations specific to an experimental use of radio frequencies.

A 1.41 Regulation 10(02) also requires that any attachment of conditions under Regulation 10(1) to rights of use for radio frequencies must be non-discriminatory, proportionate and transparent and in accordance with Regulation 17 of the Framework Regulations.

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

A 1.42 Regulation 11(1) of the Authorisation Regulations provides that, where ComReg considers that the number of rights of use to be granted for radio frequencies should be limited it must, without prejudice to Sections 13 and 37 of the 2002 Act:

- Give due weight to the need to maximise benefits for users and to facilitate the development of competition, and
- Give all interested parties, including users and consumers, the opportunity to express their views in accordance with Regulation 12 of the Framework Regulations.

A 1.43 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 1.44 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 1.45 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 1.46 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.

Amendments of rights and obligations

A 1.47 Regulation 15 of the Authorisation Regulations permits ComReg to amend rights and conditions concerning rights of use, provided that any such amendments may only be made in objectively justified cases and in a proportionate manner, following the process set down in Regulation 15(4).

Other Relevant Provisions

Wireless Telegraphy Act, 1926 (the "1926 Act")

A 1.48 Under Section 5(1) of the 1926 Act, ComReg may, subject to that Act, and on payment of the prescribed fees (if any), grant to any person a licence to keep and have possession of apparatus for wireless telegraphy in any specified place in the State.

A 1.49 Section 5(2) provides that, such a licence shall be in such form, continue in force for such period and be subject to such conditions and restrictions (including conditions as to suspension and revocation) as may be prescribed in regard to it by regulations made by ComReg under Section 6.

A 1.50 Section 5(3) also provides that, where it appears appropriate to ComReg, it may, in the interests of the efficient and orderly use of wireless telegraphy, limit the number of licences for any particular class or classes of apparatus for wireless telegraphy granted under Section 5.

A 1.51 Section 6 provides that ComReg may make regulations prescribing in relation to all licences granted by it under Section 5, or any particular class or classes of such licences, all or any of the following matters:

- The form of such licences
- The period during which such licences continue in force,
- The manner in which, the terms on which, and the period or periods for which such licences may be renewed,
- The circumstances in which or the terms under which such licences are granted,
- The circumstances and manner in which such licences may be suspended or revoked by ComReg,

- The terms and conditions to be observed by the holders of such licences and subject to which such licences are deemed to be granted,

- The fees to be paid on the application, grant or renewal of such licences or classes of such licences, subject to such exceptions as ComReg may prescribe, and the time and manner at and in which such fees are to be paid, and

- Matters which such licences do not entitle or authorise the holder to do.

A 1.52 Section 6(2) provides that Regulations made by ComReg under Regulation 6 may authorise and provide for the granting of a licence under Section 5 subject to special terms, conditions, and restrictions to persons who satisfy it that they require the licences solely for the purpose of conducting experiments in wireless telegraphy.

Article 4 of Directive 2002/77/EC (Competition Directive)

A 1.53 Article 4 of the Competition Directive provides that:

"Without prejudice to specific criteria *and procedures adopted by Member States to grant rights of use of radio frequencies to providers of radio or television broadcast content services with a view to pursuing general interest objectives in conformity with Community law:*

- Member states shall not grant exclusive or special rights of use of radio frequencies for the provision of electronic communications services.

- The assignment of radio frequencies for electronic communication services shall be based on objective, transparent, non-discriminatory and proportionate criteria."

EECC and other relevant standards

A 1.54 The project team has taken account, where relevant, of:

- provisions of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code including, for instance, provisions relating to spectrum rights of use, whilst noting that this Directive has yet to be transposed in this jurisdiction;

- reports by the International Telecommunication Union ("ITU"), including Report ITU-R SM.2351 (Smart grid utility management systems), Working Document towards a preliminary draft revision of Report ITU-R SM.2351-2, 28 June 2018;

- standards of the European Telecommunications Standards Institute ("ETSI"), including ETSI TR 103 528: "SmartM2M; Landscape for open source and standards for cloud native software applicable for a Virtualized IoT service layer" and ETSI TR 103 527: "SmartM2M; Virtualized IoT Architectures with Cloud Back-ends".

Annex: 2 Proposed BEMs

A) Base station transmitter mask for systems operating with a channel bandwidth of 1.4 MHz and greater[188].

Channel width	Delta Fc (MHz) from centre frequency	Out-of-band emissions (transmitter output power)	Measurement bandwidth
1.4 MHz	0.7 to 2.1	-1 dBm -10/1.4 * (Delta F_c – 0.7) dB	100 kHz
	2.1 to 3.5	-11 dBm	100 kHz
	3.5 to 9.95	-16 dBm	100 kHz
3 MHz	1.5 to 4.5	-5 dBm -10/3* (Delta F_c – 1.5) dB	100 kHz
	4.5 to 7.5	-15 dBm	100 kHz
	7.5 to 9.995	-16 dBm	100 kHz
5 MHz	2.5 to 7.5	-7 dBm -7/5* (Delta F_c – 2.5) dB	100 kHz
	7.5 to 9.95	-14 dBm	100 kHz

Note 1: for the maximum mean out-of-block e.i.r.p. the antenna gain and cable losses of the land mobile system have to be considered.

Note 2: additional out-of-band emission reduction may be necessary for the protection of other land mobile systems in the adjacent bands (see ECC Report 283). For the protection of the uplink frequencies of land mobile systems within 410-420 MHz, a maximum mean out-of-block e.i.r.p. of -43 dBm/100 kHz may be needed.

Note 3: additional 40 dB of out-of-block emission reduction may be needed for the protection of radiolocation services).

[188] Although 5 MHz is listed, licensees are reminded that the maximum channel available in this award process is 2 × 4 MHz.

Table A1. BS frequency range of out-of-block emissions (1.4 MHz, 3 MHz and 5 MHz channel bandwidth)

Frequency offset from centre frequency (MHz)	Channel width 1.25 MHz	Measurement bandwidth
±0.885-1.98	-17 dBm	30 kHz
±1.98-4	-22 dBm	30 kHz

Table A2: BS frequency range of out-of-block emissions (1.25 MHz channel width)

B) User Equipment for systems operating with a channel bandwidth of 1.4 MHz and greater.

Parameter	Value
Channel bandwidth	1.25, 1.4, 3 or 5 MHz
Maximum mean in-block power	31 dBm
Note: Licensees should use the minimum power required to deploy their network. If interference should occur then licensees may be required to lower their in-block UE transmitter power as necessary to provide protection of other services, networks and applications.	

Table A3: UE transmitter characteristics

Frequency offset from channel edge (MHz)	Channel width			Measurement bandwidth
	1.4 MHz	3 MHz	5 MHz	
±0-1	-10 dBm	-13 dBm	-15 dBm	30 kHz
±1-2.5	-10 dBm	-10 dBm	-10 dBm	1 MHz
±2.5-2.8	-25 dBm	-10 dBm	-10 dBm	1 MHz
±2.8-5		-10 dBm	-10 dBm	1 MHz
±5-6		-25 dBm	-13 dBm	1 MHz

±6-10			-25 dBm	1 MHz

Table A4: UE maximum unwanted emission levels (1.4 MHz, 3 MHz and 5 MHz channel width)

Frequency offset from channel edge (MHz)	Channel width 1.25 MHz	Measurement bandwidth
±0.885-1.98	-24 dBm	30 kHz
±1.98-4	-44 dBm	30 kHz

Table A5: UE maximum unwanted emission levels (1.25 MHz channel bandwidth)

C) Technical requirements for systems utilising a bandwidth of 6.25 kHz to 200 kHz.

The technical requirements for land mobile systems with channel bandwidths of between 6.25 kHz and 200 kHz are defined in Annex 1 of the ECC Decision and specify:

Wanted channel effective radiated power: 40 dBm for user equipment and 53 dBm for base station equipment

Adjacent and alternate adjacent channel power: Power in upper and lower channels, as well as in the lower and upper alternate adjacent channels, shall not exceed a value of 60 dBc below the transmitter power level without the need to be below the -36 dBm e.r.p.

Unwanted emissions in the spurious domain: During operation shall not exceed -36 dBm for frequencies up to 1 GHz and -30 dBm for frequencies above 1 GHz. During standby shall not exceed -57 dBm for frequencies up to 1 GHz and -47 dBm for frequencies above 1 GHz.

Annex: 3 Band Plan

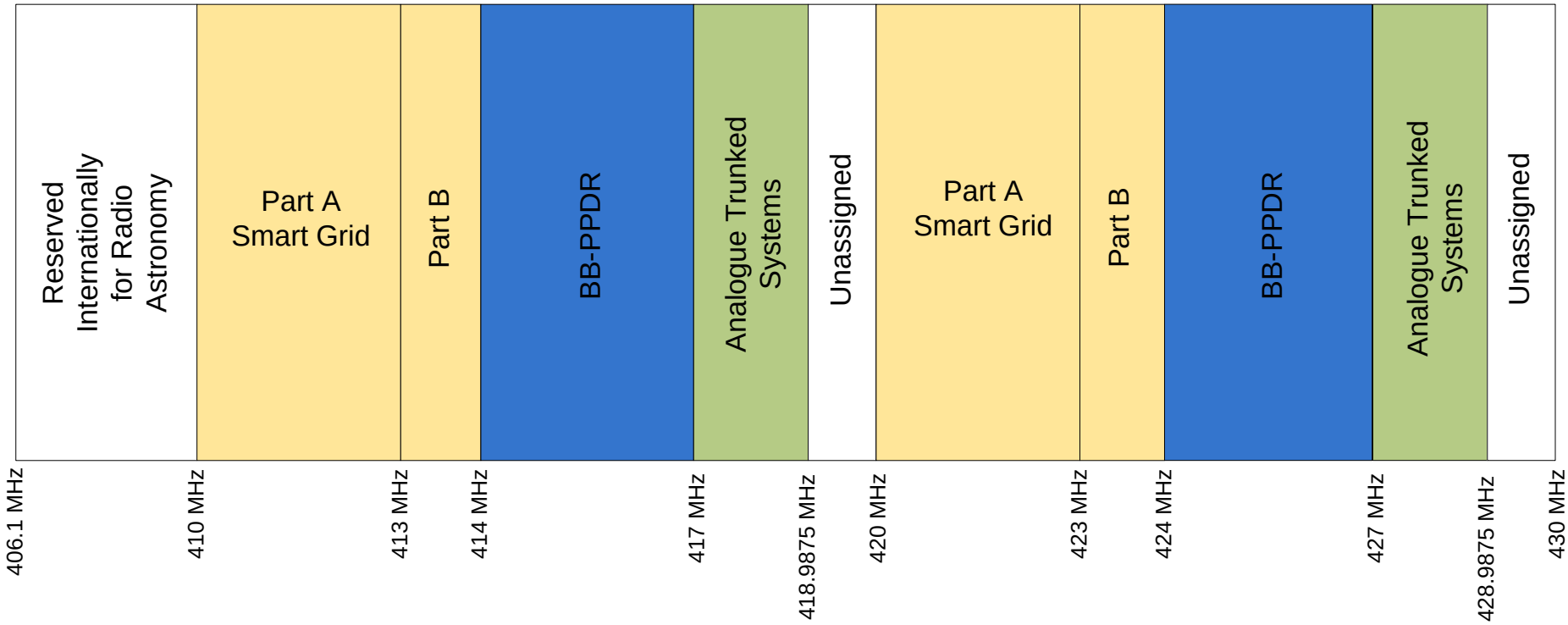

Figure A1. Proposed Band Plan