Commission for
Communications Regulation

Radio Spectrum Management Strategy 2016 to 2018

Response to Consultation on ComReg's radio spectrum management strategy

Reference: ComReg 16/49
Date: 21/06/2016

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation
Abbey Court Irish Life Centre Lower Abbey Street Dublin 1 Ireland
Telephone +353 1 804 9600 Fax +353 1 804 9680 Email info@comreg.ie Web www.comreg.ie

Contents

Chapter 1

1 Introduction

1.1 In December 2015, the Commission for Communications Regulation ('ComReg') issued a consultation on its draft radio spectrum management strategy for the period 2016 to 2018 ('Consultation 15/131')[1]. Among other things, Consultation 15/131 set out ComReg's draft radio spectrum work plan for this period and its current thinking of several topical spectrum management issues.

1.2 Fourteen interested parties responded to Consultation 15/131. Having considered these responses, and other relevant information, this response to consultation document sets out ComReg's assessment of, and views in relation to, the matters raised.

1.3 ComReg's finalised radio spectrum management strategy for the period 2016 to 2018 (ComReg Document 16/50) is published alongside this response to consultation.

Respondents to Consultation 15/131

1.4 The interested parties who responded to Consultation 15/131 are:

- the Broadcasting Authority of Ireland ('BAI')
- BT Communications Ireland Ltd. ('BT')
- Eircom Ltd. and Meteor Mobile Communications Ltd. ('eir Group')
- Electricity Supply Board Networks ('ESBN')
- Inmarsat Ventures Limited ('Inmarsat')
- the Irish Radio Transmitters Society ('IRTS')
- Motorola Solutions Ireland Ltd. ('Motorola')
- Raidió Teilifís Éireann and 2RN ('RTÉ & 2RN')
- Sensus ('Sensus')
- Sigma Wireless Communications Ltd. ('Sigma Wireless')
- Silver Spring Networks ('Silver Spring')
- Smart Connect[2] ('Smart Connect')

[1] http://www.comreg.ie/_fileupload/publications/ComReg15131.pdf

[2] Smart Connect is a partnership between Sigma Wireless, Tetra Ireland and Sensus

- Three Ireland ('Three')
- Vodafone Ireland Ltd. ('Vodafone')

1.5 Non-confidential versions of all responses received are published by ComReg in Document 15/131s.[3]

Structure of this document

1.6 This document is structured as follows:

- **Chapter 2**: considers issues related to matters discussed in chapters 3, 4 and 5 in Consultation 15/131, namely:
    - spectrum management in Ireland;
    - significant developments in radio spectrum use since 2011; and
    - the demand for radio spectrum.
- **Chapter 3**: considers issues related to chapter 6 of Consultation 15/131, namely ComReg's draft radio spectrum work plan for the period 2016 to 2018; and
- **Chapter 4**: considers issues related to chapter 7 of Consultation 15/131, namely ComReg's current thinking on topical spectrum management issues.

[3] http://www.comreg.ie/_fileupload/publications/ComReg15131s.pdf

Chapter 2

2 Spectrum management, significant developments and demand for radio spectrum

2.1 Chapter 3 of Consultation 15/131 discussed the management of radio spectrum in Ireland, including matters such as the importance of radio spectrum, and an overview of spectrum policy and management in Ireland including ComReg's spectrum management activities.

2.2 Chapter 4 of Consultation 15/131 reflected upon a number of significant developments in radio spectrum use in the Irish market since the previous spectrum management strategy statement was finalised in 2011.

2.3 Chapter 5 of Consultation 15/131 discussed the potential radio spectrum demand of specific radiocommunication service categories, including mobile, nomadic and fixed wireless broadband services, broadcasting services, and short range devices including the Internet of Things ('IoT') etc.

2.4 Submissions received in relation to the matters discussed in chapters 3, 4 and 5 of Consultation 15/131 are considered below.

2.1 Spectrum Management in Ireland

2.1.1 The importance of radio spectrum

Summary of Consultation 15/131

2.5 Section 3.1 of Consultation 15/131 considered the economic contribution of radio spectrum to Irish Gross Domestic Product ('GDP'). ComReg's analysis conservatively suggests that the direct contribution of radio spectrum continues to increase and, based on the most recent data available (2013), this contribution was over €4.2 billion, or approximately 2.4% of GDP. In addition, circa 28,000 people were employed through the use of radio spectrum.

Views of respondents

2.6 Four respondents (ESBN, RTÉ & 2RN, Three and Vodafone) commented upon the importance of the economic contribution of radio spectrum. All four

respondents consider that radio spectrum is a valuable national resource that underpins many economic, social and communications activities.

2.7 In addition, RTÉ & 2RN submits that ComReg omits referencing the contribution of public service broadcasting in its analysis which, in in their view, suggests that ComReg's recognition of the unique requirements and use of spectrum for public service broadcasting has diminished compared to the previous spectrum management statement.

2.8 Vodafone generally agrees with ComReg's calculations of the economic contribution of radio spectrum. Three observes that the calculations do not include "extraneous benefits" derived from spectrum, such as the ability to attract multinational investors and skilled employees given the availability of mobile communications services. In addition, Three believes that any loss of competitiveness in this respect would have a significantly negative impact on the wider competitiveness of the economy and that this could be over and above the €4.2bn (for 2013) as calculated by ComReg.

ComReg's assessment

2.9 ComReg notes the agreement among respondents that radio spectrum is an important natural resource that provides a significant economic contribution to Ireland. In Consultation 15/131, ComReg acknowledged the conservative nature of its estimate of the economic contribution calculations and outlined the reasons for this. ComReg accepts that an input / output model across the whole economy or the inclusion of additional factors, such as social benefits, would likely increase the overall estimate. Notwithstanding issues about the precise final estimate, what is clear is that the radio spectrum plays an important and significant role in Ireland's economy.

2.10 In relation to the submission of RTÉ & 2RN, ComReg notes that its methodology for calculating the economic contribution of radio spectrum is broadly consistent with the methodology used in its previous spectrum management statements. In that regard, ComReg observes that the economic contribution of companies in the broadcasting sector was included in ComReg's calculations[4].

2.11 Finally, given the availability of more recent financial records and data from the national accounts, ComReg has updated its calculations for 2014 (see Figure 1 below). ComReg estimates that for 2014:

- the economic contribution of radio spectrum to GDP increased to circa €4.7 billion, or approximately 2.5% of GDP; and

[4] See paragraph A.161 of Consultation 15/131

- the number employed in activities that utilise radio spectrum increased to almost 29,000.

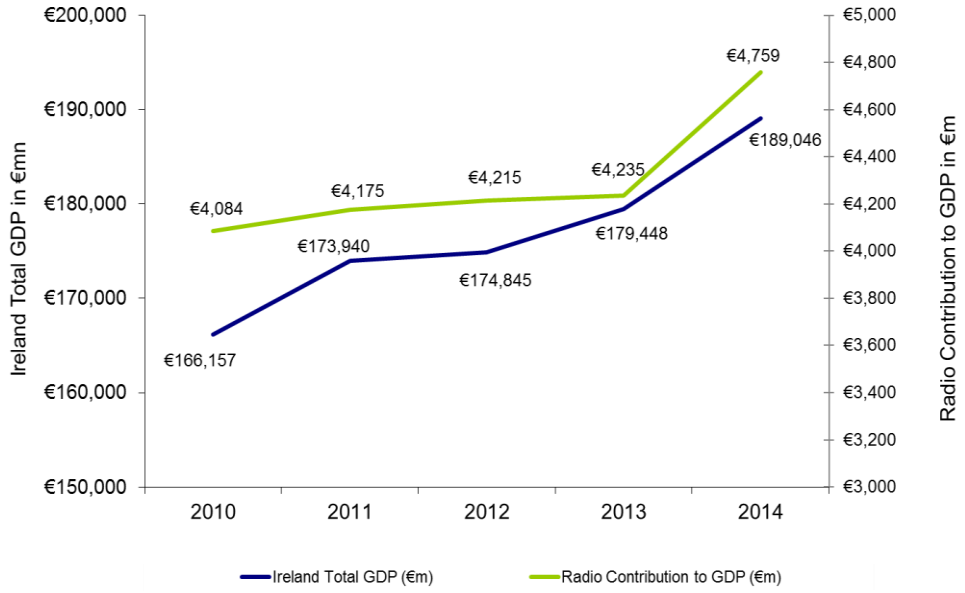

Figure 1: Contribution of Radio Spectrum to GDP: 2010 to 2014

2.1.2 Spectrum monitoring, compliance and enforcement

Summary of Consultation 15/131

2.12 In section 3.3.3 of Consultation 15/131, ComReg outlined its role in relation to spectrum monitoring, compliance and enforcement and, among other things, noted the increasing number of radio interference investigation cases.

Views of respondents

2.13 Two interested parties (the IRTS and Three) responded on these matters.

2.14 In summary, Three:

- considers that there is a growing workload for ComReg in spectrum monitoring, enforcement and compliance;
- submits that there are many possible reasons for the recent increase in interference cases[5] and believes that this trend is likely to continue;

[5] Three indicates possible reasons such as larger network deployment, the use of more advanced technology that is more sensitive to interference, and the ready availability equipment which is not intended for use in the Irish market.

- believes that this area of ComReg's remit must be adequately resourced given that:
    - in most cases, interference directly affects customer services; and
    - licensees depend on ComReg to eliminate sources of interference to their services; and
- believes that it would be useful for ComReg to provide feedback when cases have been closed as this would help operators to recognise future sources of interference and speed up the process of interference elimination.

2.15 In summary, the IRTS:

- submits that the amateur service continues to experience problems due to the general increase in electromagnetic noise;
- considers this increase is due to a number of sources including increasing broadband noise levels from domestic apparatus (e.g. computers, microprocessors, etc.) and fixed installations such as lifts (elevators), solar PV panels, wind turbines etc;
- while welcoming ComReg's heightened market surveillance, remains concerned that ComReg, subject to resources, will need to increase product testing in the coming years, given the ever increasing number of radio related devices entering the marketplace;
- considers that market surveillance for EMC compliance should not only be focussed solely on radio related devices but also on electrical and electronic equipment entering the marketplace which radiate (albeit unintentionally) electromagnetic emissions;
- wishes to have regular engagement with ComReg staff who are responsible for resolving harmful interference affecting ComReg licensees, in order to resolve EMC issues in a timely manner;
- expressed concerned at the lack of consultation when directives of the European Union are transposed into Irish Law because, in its view, it is important in its view to ensure that the Essential Requirements of Directives designed to protect telecommunications are adequately reflected in national legislation which impacts the sector; and
- hopes that this matter can be rectified prior to the laying of new statutory instruments addressing the new EMC and RED Directives (2014/30/EU and 2014/53/EU respectively) before the Dáil and Seanad.

ComReg's assessment

2.16 ComReg firstly notes and agrees with respondents' views as to the importance of its role in terms of interference investigation and proactive compliance activities. At the same time, ComReg observes that it has limited resources and, accordingly, is required to appropriately prioritise its workload.

2.17 In relation to the views expressed by the IRTS, ComReg would respond as follows:

- ComReg confirms that its market surveillance activities are not focussed solely on radio products. Indeed, during the period since the last spectrum strategy in excess of 65,000 non-compliant *non*-radio devices have been removed from service due to ComReg intervention;
- ComReg notes that no evidence was provided by the IRTS to support its assertion that the noise floor is increasing and, further, ComReg observes that its monitoring activities do not indicate a significant increase in the noise floor on the whole;
- in relation to the concern expressed regarding the lack of consultation when transposing EU Directives into Irish law, ComReg observes that the responsibility for transposing such directives into Irish law rests with the DCENR and not ComReg; and
- in relation to suggestions that that ComReg provide regular briefings or updates on its Spectrum Compliance matters, ComReg recalls that all cases investigated by the Spectrum Compliance Unit have the potential to come before the courts. Accordingly, ComReg is limited in its ability to discuss any such matters. That said, ComReg does routinely make available information that it can appropriately do so to relevant parties.

2.1.3 Test and Trial Ireland

Summary of Consultation 15/131

2.18 In section 3.3.4 of Consultation 15/131, ComReg outlined the benefits of its Test and Trial Ireland programme and in section 6.2.1 of Consultation 15/131 set out its work plan proposal to continue *"promoting Test and Trial Ireland and the benefits of using Ireland as a location to test or trial wireless products and services in a real world environment."*

Views of respondents

2.19 In summary, ESBN, Sensus, and Three responded on these matters as follows:

- Three supports ComReg's proposal to promote Test and Trial Ireland;
- Sensus agrees that Ireland is an excellent location for testing and trialling radio solutions and notes that it has already participated in several technology trials in Ireland and is monitoring further opportunities; and
- ESBN states that it holds a trial licence for spectrum at 410 MHz to demonstrate how radio equipment operating in the 410 MHz range could be capable of remotely communicating from electrical devices back to a base station. ESBN submits that ComReg should be cognisant of the outcome of such trials when deciding the appropriate time to release spectrum.

ComReg's assessment

2.20 Noting the activities and achievements in terms of innovation in radio spectrum use by clients of Test and Trial Ireland, ComReg will continue its support in this important area.

2.21 In relation to ESBN's submission, ComReg would again note that there are many relevant considerations for ComReg when determining its spectrum management priorities.[6] While successful trialling is clearly a welcome outcome for clients availing of Test and Trial Ireland, ComReg reminds interested parties that Test and Trial Ireland is specifically designed for the non-commercial testing and trialling of wireless products and services.

2.2 Significant spectrum management developments since 2011

2.22 In chapter 4 of Consultation 15/131, ComReg reflected upon a number of significant developments in radio spectrum use in the Irish market since the previous spectrum management strategy statement was finalised in 2011. Such developments included:

- the switchover from analogue to Digital Terrestrial Television ('DTT') which was completed in October 2012;
- the successful assignment of all the long term spectrum rights of use in the 800 MHz, 900 MHz and 1800 MHz bands on foot of ComReg's 2012 Multi-band Spectrum Award ('MBSA') process;
- the acquisition of Telefónica Ireland Limited ('Telefónica') by Hutchison 3G UK Holdings Limited (Hutchison) which was notified to the European

[6] For example, see section 6.1.1 of Consultation 15/131.

Commission ('EC') in 2013 and conditionally approved by the EC on 28 May 2014;

- judicial review proceedings brought by Vodafone in connection with the above proposed acquisition; and
- proposals by ComReg to release up to a further 740 MHz of spectrum rights in a number of harmonised radio spectrum bands (i.e. 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and/or 3.6 GHz) suitable for mobile, nomadic and fixed wireless broadband.

2.23 Submissions received in relation to such significant developments are considered below.

2.2.1 The 2012 Multi-Band Spectrum Award (MBSA)

Summary of Consultation 15/131

2.24 In section 4.1.1 of Consultation 15/131, ComReg discussed its 2012 MBSA process and provided some observations and insights on same. Among other things, ComReg noted that this award process resulted in the assignment of all long term rights of use in the relevant spectrum bands and that the award outcome was welcomed by the winning bidders.

View of respondents

2.25 Vodafone and Three provided responses on this matter, which are grouped and addressed in the context of:

- award timing;
- complexity and specific MBSA award considerations; and
- future awards.

Award timing

2.26 In summary, Vodafone:

- observes that the MBSA consultation process extended over a long time period and identifies the following two factors in support of its view:
  - changes in the design of auction process which is claimed to have caused considerable delay; and
  - a view that the process was slowed by the complexity inherent in trying to solve for issues in multiple bands;

- considers the award timing delayed the assignment of 800MHz spectrum and liberalisation of the 900MHz band as well as the delivery of new services in these bands to customers;
- suggests that the rapid roll-out and take-up of new services in these bands post-auction illustrates that there was pent-up demand for these services;
- considers that if the MBSA had happened earlier the roll-out of services would have happened more quickly; and
- considers that the auction should have happened in advance of expiry of existing licences, where such licences existed.

2.27 Three submits that it can take several years to complete the process of consultation, decision and award of spectrum (noting that the MBSA required a duration of 4 years). Three considers that this process might accelerate for future awards or less complicated awards.

Complexity and specific MBSA award considerations

2.28 In summary, Vodafone:

- considers that the auction design was too complex and an alternative simpler auction could have achieved the aims of the award earlier;
- identifies several factors which it believes contributed to the MBSA being complex[7]; and
- suggests that there were too many possible packages so bidders needed to speculate too much on values of different packages.

Outlook on future awards

2.29 In summary, Vodafone submits that:

- not all lessons learned from the MBSA would be relevant to future auctions of additional spectrum;
- future auctions should be simpler and consistent in design;
- the consultation process should be more straightforward and be held in a timely manner; and
- ComReg should also keep to a more standard design should it be minded to do another combinatorial clock auction ('CCA').

[7] Including: *the use of two time-slots; the bidder-specific "liberalized" lots; the mechanisms of "relaxed" bids and "chain" bids; the intersection of "relative" caps and "final round" caps, leading to cycles of caps in some cases; and the unduly complex assignment stage (owing to the two slots).*

2.30 Three submits that, while the process might accelerate a little for future awards, ComReg needs to allow significant time to complete the various activities in preparation for an auction and that the process must begin early enough to allow re-licensing of spectrum before existing licences expire.

ComReg's assessment

Award timing

2.31 In response to Vodafone's submissions, ComReg considers that the time taken did not go beyond what was reasonably necessary to appropriately achieve/discharge its statutory objectives and duties particularly given:

- the complex set of particular circumstances of that award (see following section);
- that circumstances (including those outside of ComReg's control) also evolved during the course of the consultation process[8];
- its obligation to appropriately consult upon its proposed measures[9], including new measures in response to changing circumstances and the need to carefully and thoroughly consider views received from interested parties on foot of such consultation[10]; and
- that the bands involved were of critical importance for the future development of the sector.[11]

[8] Interested parties will recall, among other things, that:

- ComReg proposed the inclusion of the 800 MHz band when it became apparent that digital switch over from analogue TV would free the 800 MHz band for other purposes in the lifetime of the award (e.g Consultation 10/71);
- ComReg proposed the inclusion of the 1800 MHz band on foot of developments in the equipment ecosystem (for consumers and operators) for this band (e.g Consultation 10/105); and
- the significant benefits of awarding these bands simultaneously, noting that multi-band spectrum awards have become quite prevalent in Europe.

[9] See the following ComReg web-page for links to the consultations and associated documents for the MBSA: http://www.comreg.ie/radio_spectrum/consultations_and_associated_documents.713.1096.html .

[10] Interested parties may also recall that:

- extensions were sought by respondents to the response deadlines to six of the key consultations on the award design and process (for periods of between 2 and 7 weeks);
- ComReg, in every case, acceded to these requests, albeit not always allowing for the period sought by parties; and
- while collectively these requests added several months to the overall process, ComReg was happy to facilitate interested parties in providing fulsome responses.

[11] Recalling that the MBSA involved the issue of rights of use of a duration of 15+ years, ComReg observes that undue haste in award design and implementation could well have entailed an

2.32 Clearly, future spectrum awards may not involve such a complex and specific set of issues to be considered and appropriately addressed.

Complexity and specific MBSA award considerations

2.33 By way of background, ComReg firstly refers interested parties to Annex 8 of Document 15/140 which presents a detailed analysis of the issue of award/auction complexity. In summary, ComReg:

- observes that three types of complexity exist (mechanical, computational and bidding);
- notes that a trade-off exists between the mechanical simplicity of an award/auction and the ability of bidders to ensure that their valuations deliver the optimum outcome. For auctions with simple mechanics, such simplicity often comes at the cost of increasing the complexity of bidding decisions and the risks faced by bidders, in turn lead to risks of inefficient outcomes;
- observes that it is appropriate to consider the issues pertaining to each particular award in order to deliver the correct balance between the various types of complexity. Broadly speaking, ComReg considers that there will often be an interest in ensuring that the decisions bidders need to take within an award can be kept simple, even if this might require more complex rules;
- will take all reasonable steps to assist bidders in developing an understanding of award/auction rules (such as through the running of workshops, seminars and mock auctions prior to an award), particular where ComReg considers a particular award to involve material mechanical complexity; and
- notes that computational complexity falls entirely on the auctioneer and is not a relevant consideration for bidders. That said, to the extent that this might affect the ability of bidders to simulate auctions for training and testing purposes, ComReg would typically expect to make tools available to facilitate that process (such as access to software implementing any auction algorithms).

2.34 Vodafone's more specific concerns in relation to complexity are grouped and addressed as follows.

1. Relative caps;
2. Final caps;
3. Relaxed Primary Bid;

unacceptable level of risk of inefficient award outcomes to the long-term detriment of consumers and/or legal challenge to the award outcome resulting in delays to consumer benefits.

4. Chain Bid;
5. Number of packages; and
6. Time slices and early liberalisation.

2.35 ComReg firstly notes that each of the rules referred to by Vodafone was implemented to, among other things, provide bidders with significant additional flexibility during the MBSA bidding process. The absence of some or all of the aforementioned matters from the MBSA could have compromised the efficiency of the award, suppressed competition and resulted in an outcome significantly different to the one which winning bidders, including Vodafone, expressed satisfaction with.[12]

2.36 In order to aid Vodafone and other interested parties, ComReg briefly provides a general description on each of the MBSA rules identified by Vodafone and identifies, at a high level, the primary rationale or each.[13]

1. Relative cap

2.37 The relative cap limited the amount that could be bid on packages in cases where a bidder was no longer eligible to bid for in the final primary round. It was intended to provide incentives for straightforward bidding and to ensure that bidders could not hide their true demand in the primary bid rounds only to reveal it in the supplementary bids round. ComReg also recalls that, in its response to Consultation 10/71, Vodafone welcomed the relative cap activity rule as part of the then proposed CCA.[14]

2. Final cap

2.38 The final price cap applied to supplementary bids for any package other than a bidder's final primary package. Therefore, a bidder was able to secure its final primary package provided it made a sufficiently high supplementary bid since the final price cap restricted the bids that could be made by others. In this way, the final price cap mitigated the uncertainty about the package a bidder was able to secure.

[12] See, for example: http://www.vodafone.ie/aboutus/media/press/show/BAU018835.shtml .

[13] ComReg notes that the definitive description of the following rules are set out in the relevant MBSA consultation documents and final MBSA information memorandum, as relevant.

[14] "…*We [Vodafone] believe that the use of a CCA format as proposed when combined with the relative cap activity rule described by DotEcon (which ensures the ability of an existing 900 MHz licensee to rebid in a supplementary bids round to secure at least the minimum amount of spectrum required for continued provision of existing GSM services) must therefore be retained in any final decision if the concerns around risks of service disruption are to be effectively addressed*." [emphasis added], see http://www.comreg.ie/_fileupload/publications/ComReg10103R.pdf]

3. Relaxed Primary Bids

2.39 The use of relaxed primary bids allowed greater flexibility for bidders to bid on their most preferred packages in each round. A relaxed rule allowed a bidder to switch where the relative prices of different lot categories changed across primary bid rounds. This rule facilitated a bidder who wished to switch from bidding on package A to a smaller package B because package A had become relatively too expensive, to return to bidding on package A if it subsequently became cheaper relative to package B.

2.40 Whilst this added a degree of complexity to the rules, it provided significant additional flexibility for bidders. Under a simple eligibility points-based activity rule, a bidder would not have been able to bid on a preferred package with more eligibility points than it held in a particular round. Therefore, a decision to switch to a package with fewer eligibility points would have required a bidder to decide that it would never wish to bid for a higher eligibility package in later rounds regardless if any subsequent change in relative prices made it preferable for that bidder to do so. This would have added significant bidding complexity to the bidders in the auction. This limitation of a simple eligibility points-based activity rule was addressed by a relaxed primary bids rule.

4. Chain Bids

2.41 Making a relaxed primary bid might have required a bidder to submit additional bids in order to raise the relative cap that applied to the package subject to the relaxed primary bid. These so called chain bids ensured that the bidder was able to submit the relaxed primary bid at round prices without breaching the cap.

5. Number of packages

2.42 In relation to Vodafone's claim that there were "*too many possible packages and operators needed to speculate too much on values of different packages*", ComReg notes that the only parties capable of determining a preferred package in the MBSA auction was the bidder itself. To facilitate this, ComReg provided for the maximum number of packages consistent with the computational demands of determining the winners and prices within a reasonable time. In this way, any commercially viable package was likely provided for. This ensured maximum choice for bidders. It did not, however, require a bidder to bid on all possible packages, only its preferred packages. The valuation attached to each preferred package was solely at the discretion of each individual bidder. The multi-round clock stage of the auction, combined with the final price cap rule, allowed bidders to form an assessment of packages they might potentially be able win in the auction, drastically reducing the set of packages needing to be considered.

6. Time slices and early liberalisation

2.43 The award process usefully provided an existing GSM licensee the option of bidding for party-specific lots which, if won, resulted in the liberalisation of some or all of the spectrum rights of use in its existing GSM licence/s. This meant that such a winning bidder could use, for example, 3G or 4G technologies in the former GSM-only band if it so wished. This was an important and forward-oriented feature of the award design which, ComReg recalls, was availed of (including by Vodafone). This approach also addressed complications arising from the different expiry dates of existing licences in the 900MHz and 1800MHz bands.

2.44 ComReg recalls that while Vodafone favoured a single time slice for the 800 MHz band, it also supported ComReg's proposal for a two time slice approach to the 1800 MHz band (with 900 MHz)[15].

2.45 In summary, the rules used in the MBSA intended to promote an efficient award outcome by, among other things:

- providing bidders, which required spectrum rights for the purpose of "business continuity", with a degree of certainty that such spectrum rights could be secured provided that sufficiently high bids were made;
- providing flexibility for bidders to switch to their preferred package of spectrum in line with previously stated preferences;
- preventing a bidder from hiding demand during the primary bid rounds and only revealing its preferences in later rounds to the disadvantage of other bidders;
- minimising incentives for non-straightforward bidding behaviour; and
- promoting price discovery to allow bidders make use of the information revealed in the open rounds.

Outlook on future awards

2.46 As ComReg identified in section 7.1 of Consultation 15/131, the use and specifics of an auction by which to award spectrum rights of use for ECS will be determined on a case-by-case basis having regard to the particular facts and circumstances

[15] In its response to ComReg's draft Decision on the 2012 MBSA (in Document 11/60) Vodafone set out that *"…the adoption of our proposed alternative approach [Vodafone's —modified auction approach] at this late stage no longer appears to be feasible given the requirement to complete an award process without additional delay. In these circumstances ComReg's currently proposed auction format, including its approach to use of temporal lots, is an appropriate approach to implement despite its considerable complexity…"* [emphasis added, see Document 12/25 and the discussion on time slices at chapter 4 therein].

arising.[16] Given this, ComReg clearly recognises that the specifics of the MBSA design may not be particularly relevant or applicable for future awards. At the same time, ComReg observes that the MBSA has provided an invaluable "tool-kit", including highly innovative and effective measures such as the use of time-slices and the early liberalisation option, by which to seek to address similar issues arising in future awards.

2.47 In relation to Vodafone's suggestion that a simpler and more standard award design should be selected in the future, ComReg does not believe it is possible (or indeed appropriate) to commit to implementing a standardised award design for future awards. In particular, ComReg observes that Vodafone's suggestion entails real risks of:

- not fully considering and implementing the most appropriate award for the particular facts and circumstances arising; and
- inefficient award outcomes to the long-term detriment of consumers and/or legal challenge to the award outcome resulting in delays to consumer benefits.

2.48 As is its practice, ComReg agrees that, where practicable, future award designs should be consulted upon and finalised significantly in advance of licence expiry. This can promote the efficient use of the radio spectrum by, among other things, clarifying the future of new rights of use to radio spectrum before the expiry of existing rights. At the same time, it is incumbent upon ComReg to take into account all the relevant facts and circumstances of a proposed spectrum award (such as relevant international developments), noting that the time required to complete an award process may be subject to factors outside its control. For example:

- harmonisation measures being developed, but which have yet to be adopted, and which are relevant to the spectrum band/s in question;
- changes to accommodate national or international policy developments in radio spectrum use (e.g developments in relation to ASO in the MBSA process); and
- technological developments such as the availability of operator and consumer equipment for the spectrum band/s in question.

2.49 In addition, ComReg observes that trade-offs may be necessary between the speed of finalising an award and accommodating features reasonably required

[16] See, for example, paragraph 7.14 of Consultation 15/131 where ComReg states: *"…there are different auction formats available and that the most appropriate format will be the one which best addresses the specific circumstances that arise*."

for an efficient award outcome and subsequent efficient use of spectrum. For example, sometimes it may be preferable to delay the award of rights in one or more bands to accommodate additional band/s that may be sufficiently close substitutes or complements within a common award process (again recalling the benefits of award such spectrum bands together).

2.2.2 Post-acquisition developments of Telefonica's acquisition by Hutchison

Summary of Consultation 15/131

2.50 In section 4.1.4 of Consultation 15/131, ComReg discussed the acquisition of Telefonica by Hutchison ("the Merger"), including the commitments associated with the Merger ("the Commitments").

2.51 In section 4.1.5 of Consultation 15/131, ComReg discussed the judicial review proceedings instituted by Vodafone in relation to the exercise by ComReg of its spectrum management powers in the context of the Merger (JR 2014/595/JR).

Views of respondents

2.52 Vodafone set out views on these matters as follows:

i. observing that the Commitments included discussion of possible future use of spectrum by the MVNOs (provided for in the Commitments), Vodafone states that ComReg has not made clear what mechanisms may be used to implement these possible changes;

ii. whilst noting that footnote 56 of Consultation 15/131[17] mentions that specific *ex-ante* measures have been put in place to ensure on-going efficient use of spectrum, Vodafone states that it does not know what

[17] Footnote 56 of Consultation 15/131 stated:

"In particular, ComReg assessed the Merger from a spectrum management perspective and continues to monitor spectrum use in Ireland (including as it may be affected by the acquisition) in accordance with its relevant statutory functions, duties and obligations. In summary:

- *ComReg has put in place a regulatory regime to ensure and incentivise efficient spectrum use. In particular ComReg, via the spectrum licensing regime, put in place various specific ex-ante measures to ensure on-going efficient use of spectrum in the relevant bands and in particular coverage and roll-out obligations and the payment of upfront spectrum access fees and ongoing spectrum usage fees;*
- *ComReg continues to monitor and supervise compliance by all of the MNOs with the conditions attached to their respective licences, including those identified above;*
- *ComReg continues to monitor and supervise compliance by all of the MNOs with the provisions of the Regulatory Framework; and ComReg regularly meets with the MNOs to discuss relevant matters such as market trends, deployment of new technologies, coverage levels etc."*

actions ComReg intends to take to monitor and review the effects of the Merger and future change arising from the Commitments made in the Merger process; and

iii. Vodafone states that it remains concerned that there is significant imbalance in spectrum assignments that no planned round of assignments could address in its view.[18]

ComReg's assessment

2.53 ComReg has considered Vodafone's submissions and responds as follows.

2.54 In relation to **point (i)**, ComReg:

- recalls its view on this issue as set out in Information Notice 15/56 (and which was extracted in section 4.1.5 of Consultation 15/131)[19]; and
- considers that this remains an appropriate and reasonable position to take, noting that no persuasive material has been put forward by interested parties (or is otherwise before it) to objectively justify any deviation from same.

2.55 In relation to **point (ii)**, ComReg:

- firstly reiterates that it continues to monitor spectrum use in Ireland (including as it may be affected by the Merger) in accordance with its relevant statutory functions, duties and obligations;
- recalls that it has put in place a regulatory regime to ensure and incentivise efficient spectrum use. In particular, various specific *ex-ante* measures to ensure on-going efficient use of spectrum in the relevant bands (in particular, coverage and roll-out obligations and the payment of upfront spectrum access fees and ongoing spectrum usage fees); and
- in that regard, notes that it continues to monitor and supervise compliance by all of the MNOs with the conditions attached to their respective licences, including the *ex-ante* measures identified above. In that regard, ComReg would refer to, among other things:

[18] In addition Vodafone notes that trading does not happen often in practice and it is of the view that it is unlikely that this can provide a remedy for unbalanced spectrum assignments.

[19] In Information Notice 15/56 ComReg relevantly stated:

"ComReg also takes this opportunity to confirm that…administrative matters concerning the spectrum divestment aspect of the Commitments will be addressed by ComReg at the appropriate time (e.g. if and when the commitment to divest spectrum is likely to be exercised) and will depend on what is proposed by the relevant parties in accordance with the terms of the Commitments. These matters cannot be addressed until this time".

- its drive testing exercise which it carried out in mid-2015, details of which are available in ComReg Document 15/142R1[20] and, in this regard, ComReg's finding that *"All networks measured were found to be compliant with the licence conditions in force."* (para 10);
- its drive testing exercise which it carried out in winter 2015, details of which are available in ComReg Document 16/27[21], and in this regard, ComReg's finding that *"To date all networks measured were found to be compliant with the licence conditions in force."* (para 10)*;*
- the fact that Liberalised Use Licensees are up-to-date for their respective spectrum usage fees; and
- that it continues to regularly meet with the MNOs to discuss relevant matters such as market trends, deployment of new technologies, coverage levels etc.

2.56 In relation to **point (iii)**, ComReg recalls that the spectrum imbalance to which Vodafone refers arose as a result of the Merger and the European Commission specifically considered that issue and found that it was unlikely to have anticompetitive effects.[22]

2.2.3 Claimed "gap" in spectrum management strategy

Summary of Consultation 15/131

2.57 In chapter 4 of Consultation 15/131, ComReg discussed a number of significant spectrum-related developments which occurred in the Irish Market since the publication of its previous spectrum management strategy.[23]

[20] http://www.comreg.ie/_fileupload/publications/ComReg1542R1.pdf

[21] http://www.comreg.ie/_fileupload/publications/ComReg1627.pdf

[22] The Full Decision considered the issue of "Spectrum imbalance after the merger" at section 7.6.2.2 (page 163). In particular the following comments of the European Commission are noted:

> "(687) *In submissions to the Commission, […] has argued that the spectrum asymmetry resulting from the merger would give the merged entity an insurmountable advantage, especially for LTE services. [..] has made similar submission to the Commission and argues that the merged entity's spectrum advantage would make other MNOs unable to constrain the merged entity. (688) The Commission considers that the change in spectrum holdings resulting from the merger is unlikely to have anticompetitive effects. The merger will not reduce the spectrum holdings of Eircom and Vodafone and, hence, it will not have any impact on the network quality and speed offered by Eircom and Vodafone. The fact that, after the merger, there will be a spectrum asymmetry is not, as such, anticompetitive. In this respect, the Commission points out that, at present, each of Vodafone and Eircom have more spectrum than Three. This has not, however, prevented Three from competing effectively in the Irish retail market.".*

[23] Including: the conclusion of its 2012 MBSA process; the acquisition of Telefonica by Hutchison; the related judicial review proceedings brought by Vodafone; and ComReg's work to progress the further

Views of respondents

2.58 Three made various submissions in relation to the time between the publication of its previous spectrum management strategy and Consultation 15/131, including that:

- the previous strategy (Document 11/89) is two years out of date;
- while the previous spectrum management strategy anticipated events that would occur further ahead than the two year time period covered in ComReg Document 11/89, and that the period since 2011 has been an eventful one with several significant tasks completed and lessons learned, Three submits that "*ComReg should be careful to avoid gaps of policy continuity";*[24] and
- ComReg should ensure that no such gap is allowed to emerge, even if that means publishing a brief update to state that "everything is on track" and no further change is necessary.

ComReg's assessment

2.59 ComReg does not consider Three's submissions to be particularly persuasive for reasons including that:

- in addition to providing an outlook on the key radio spectrum priorities as part of its strategy statement for the Electronic Communications (Document 14/75) [25], ComReg set out a forward looking 3 to 5 year outlook in Document 11/89[26];

spectrum release in line with its key priorities on radio spectrum as set out in its strategy statement on the Electronic Communications (Document 14/75).

[24] In this regard, Three notes that:

- industry does not sit still and ComReg is facing an equally challenging set of tasks during the forthcoming strategy period;
- radio spectrum is an important natural resource the provides a significant contribution to the economy; and
- Section 31 of the Communications Regulation Act requires that a statement is published every two years.

[25] As part of a number of Strategic Priorities set out in Document 14/75, and in particular to facilitate innovation, investment and the internal market ComReg set out the following relevant actions:

- Finalise a strategy for the UHF Band (470 - 790 MHz);
- Release additional spectrum for wireless broadband
- Test and Trial Ireland: Promote Ireland's (wireless) Research and Development Agenda

[26] *"…It is clear that the demand for spectrum will continue to increase beyond the timeframe of this Strategy Statement and that ComReg must continue to ensure spectrum is an enabler and not a constraint on service provision. In this context ComReg is mindful of emerging trends and developments that will have a longer term impact on spectrum management strategy. Although it is unlikely that all of these trends will have a significant impact over the lifetime of this strategy statement, it is nevertheless important to highlight these issues now, at a high level, to raise*

- ComReg maintains and updates and its action plan of activities (including radio spectrum activities) on its website;
- they appear to assume that ComReg did not take into account and act upon relevant national and international developments in the intervening period. In that regard, ComReg recalls, among other things, its activities concerning the future of the UHF band[27]; and
- ComReg was clearly focused on delivering the outcomes identified in the previous strategy (e.g. the conclusion of the MBSA and associated matters[28]), progressing its day-to-day operational activities[29] and addressing unforeseen circumstances (including those identified in Consultation 15/131)[30].

2.60 In light of the above, ComReg is satisfied that supported the continuance of its radio spectrum strategy activities in a stable and predictable fashion and, further, pro-actively responded to relevant developments in the intervening period, albeit absent an updated dedicated statement concerning radio spectrum. At the same time, it recognises that an update with regard to its radio spectrum strategy might provide the wireless community with even greater clarity, a factor that ComReg will bear in mind going forward if similar circumstances emerge.

2.3 Demand for spectrum

2.61 In chapter 5 of Consultation 15/131, ComReg discussed the potential radio spectrum demand of specific radiocommunication service categories, including the mobile, nomadic and fixed wireless broadband service, the broadcasting service, and short range devices including the Internet of Things ('IoT').

2.3.1 Spectrum for broadcasting

Summary of Consultation 15/131

2.62 In chapter 3 of Consultation 15/131, ComReg indicated that the Department of Communications, Energy and National Resources ('DCENR') is responsible for the development of national broadcasting policy and associated use, while

awareness and stimulate debate amongst interested parties. …" [Chapter 7 of ComReg Document 11/89]

[27] For example, see ComReg Documents 14/13, 14/85 and 15/62.

[28] Including transition activities in Time Slice 1 and 2, the grant of interim 1800 MHz rights of use to Telefonica and addressing Three's request for an amendment to its Liberalised Use Licence.

[29] Such as continuing to administer licences sought by wireless users in Ireland (including over 17,000 individual licences per year in 2014 and 2015),

[30] For example, the acquisition of Telefónica by Hutchison and the related judicial review proceedings brought by Vodafone.

ComReg's mandate and role relates to spectrum management as set out in relevant legislation.

2.63 In chapter 5 of Consultation 15/131, ComReg discussed the potential demand for spectrum from the broadcasting radiocommunication service. Among other things, ComReg observed that while consumers are increasingly using other platforms as a way of consuming broadcasting services, the demand for broadcasting services via radio spectrum has remained strong over the last number of years and is likely to remain so in the short-to-medium term future.

Views of respondents

2.64 One respondent (RTÉ & 2RN) commented on these matters. In summary, RTÉ & 2RN:

- submits that public service broadcasting is in danger of being unable to develop without having access to enough high quality spectrum (noting that Saorview is now received by 43% of TV households across Ireland);
- submits that continued access to high quality UHF spectrum is required to ensure the free-to-air DTT service continues to be strong, appealing, relevant and competitive;
- believes that limiting access to the UHF spectrum will cause disruption and additional cost to both users and broadcasters and devalue the DTT service as a primary free-to-air television service for Ireland and its ability to compete with other television delivery services;
- seeks greater regulatory certainty and reassurance to support the long-term future of public service broadcasting in Ireland from ComReg[31], given the decisions recently taken at WRC-15 in relation to the UHF band[32];
- notes that DCENR's policy in regard to national broadcasting policy and its associated spectrum use had not changed since ComReg's earlier Spectrum Management Strategy Statement 2008 – 2010;
- considers that, under certain circumstances (for example what they consider to be services of significant social importance such as public service

[31] In their view, the UHF band will be required for terrestrial television until at least 2030. In support of this view it draws a comparison with the UK where the NRA, Ofcom, has an expectation that the UK will require the UHF spectrum for DTT until at least 2030.

[32] In relation to section 3.3.1.1 of the Consultation 15/131, RTÉ & 2RN express their gratitude for ComReg's contribution at the recent WRC-15. In their view, ComReg, together with DCENR, contributed to supporting the future of the broadcasting service in the UHF band under WRC-15 Agenda Item 1.1, ensuring regulatory certainty for the use of UHF band by the broadcasting service up to 2030.

broadcasting), the effective management of spectrum includes considering more than just technical efficiency;

- considers that eMBMS, a technology for the delivery of mobile TV, is not as efficient in delivering high quality mobile video as other technologies, such as DVB-T2; and
- highlights that DVB-T2 has been a mandatory requirement of the Saorview receiver since January 2013.

ComReg's assessment

2.65 In respect of spectrum and access to spectrum for broadcasting services, ComReg remains guided by national broadcasting policy as expressed by the Broadcasting Act 2009, and ComReg's functions, objectives and duties under national and European legislation (the latter relevantly including the RSPP Decision and EC decisions).[33]

2.66 In relation In relation to spectrum and access to spectrum for the DTT service in Ireland, ComReg would respond as follows.

2.67 As a consequence of a decision[34] taken at WRC-12 to allocate the band 694 – 790 MHz ('the 700 MHz band') on a co-primary basis with the mobile service, ComReg, together with representatives of 2RN and the Broadcasting Authority of Ireland, has been leading a team to re-plan the spectrum used by DTT in the UHF band. The intention is to relocate the DTT service below the 700 MHz band while maintaining the spectrum access requirements of the DTT service as set out in the Broadcasting Act 2009. This work is very advanced, with negotiations on a new spectrum plan to accommodate the DTT service below the 700 MHz band due to be completed shortly.[35]

2.68 In respect of a decision taken to co-allocate the mobile service with the broadcasting service in the 700 MHz band at WRC-15, ComReg recalls that it commissioned a cost benefit analysis ('CBA') on a repurposing of the 700 MHz band[36]. A number of stakeholders were engaged in preparing the CBA, namely

[33] For example, ComReg observes the proposal for a Decision of the European Parliament and of the Council on the use of the 470-790 MHz frequency band in the Union, COM(2016) 43 final http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2016%3A43%3AFIN

[34] Resolution 232 (WRC-12)

[35] In respect of the future relocation of the DTT service below the 700 MHz band, significantly prior to the expiry of RTÉ's DTT licence, ComReg will be ready to accommodate RTÉ's requests in relation to access to the UHF spectrum below the 700 MHz band for the DTT service. Further to this, ComReg recognises that such a move by the DTT service out of the 700 MHz band requires RTÉ and/or 2RN to incur additional costs that would not be incurred in the normal course of events, and such costs require consideration in the context of an appropriate compensation mechanism.

[36] A cost benefit analysis of the change in use of the 700 MHz radio frequency band in Ireland, 15/62a

DCENR, RTÉ, 2RN, the MNOs, and PMSE service providers. Having considered the conclusions of the CBA, ComReg recognised that repurposing would require that the incumbent DTT and PMSE service providers be migrated from the 700 MHz band. The costs likely to be incurred by the incumbents, and in particular by 2RN, were identified by ComReg as a matter that requires engagement among relevant stakeholders.

2.69 ComReg notes that the future use of the 470 – 790MHz band within the EU is currently being considered in European discussions. In particular, in the context of an EC proposal that the 470 -790 MHz band would be made available for the terrestrial provision of broadcasting services until at least 2030.[37]

2.70 ComReg is grateful to RTÉ & 2RN for drawing attention to the updated technical specification for Saorview, which includes DVB-T2 as a mandatory requirement as part of the minimum specification for the Saorview receiver. In relation to RTÉ & 2RN's comment on eMBMS, ComReg was simply noting the developments of mobile technology and their ability to deliver mobile video, rather than making a comparison to that of broadcast technologies, such as DVB-T2.

2.71 Finally, ComReg notes RTÉ & 2RN's agreement that effective spectrum management requires flexibility, as discussed in section 3.2.2 of Consultation 15/131, and their comments in relation to technical efficiency as discussed in Document 08/50, where it states that "*Technical efficiencies may have to be compromised in order to safeguard the provision of certain public services such as safety, defence and public broadcasting services*".

2.3.2 Mobile data usage and the 700 MHz band Cost Benefit Analysis (CBA)

Summary of Consultation 15/131

2.72 At paragraphs 4.22 and 4.56 of Consultation 15/131, ComReg noted the 700 MHz Cost Benefit Analysis report by Frontier Economics[38] which estimated:

[37] The proposed text of Article 4 states *"Member States shall ensure availability at least until 2030 of the 470-694 MHz frequency band for the terrestrial provision of broadcasting services, including free television and for use by wireless audio PMSE equipment, based on national needs. Member States shall ensure that any other use of the 470-694 MHz frequency band on their territory is compatible with the national broadcasting needs in the relevant Member State and does not cause harmful interference to, nor claim protection from, the terrestrial provision of broadcasting services in a neighbouring Member State. Such use shall be without prejudice to obligations resulting from international agreements, such as cross-border frequency coordination agreements."* http://www.consilium.europa.eu/en/meetings/tte/2016/05/26/

[38] ComReg Documents 15/62, 15/62a and 15/62b

- that user demand for mobile data will increase 33 times between 2015 and 2035; and
- a positive NPV of €91m in a change in use to mobile.

2.73 In addition, paragraphs 4.19 to 4.21 discussed historic mobile data usage in Ireland noting that data usage on mobile networks has increased by almost 500% since 2011.

Views of respondents

2.74 Three respondents (RTÉ & 2RN, Three and Vodafone) submitted views regarding mobile data usage, with RTÉ & 2RN also providing comments on the 700 MHz CBA report.

2.75 In relation to mobile data usage, both Three and Vodafone support the mobile data usage information presented in Consultation 15/131 while RTÉ & 2RN query the mobile data projections in the 700 MHz CBA.

2.76 Three and Vodafone submit that ComReg should make more spectrum available to meet demand (evidenced by mobile data usage) as follows:

- Three notes that the demand for mobile data is growing inexorably and it believes that real network traffic growth would be greater than that forecast by Frontier Economics even in their "High Growth" scenario. In this regard, Three notes ComReg's market data and observes that its own network experience indicates a growth rate of [CONFIDENTIAL]% per annum. While noting that some of this demand can be met by increases in advances in technology and the densification of networks, Three believes that these measures would not be sufficient to keep pace with expected growth and, therefore, suggests that more spectrum is needed in the medium term; and
- Vodafone believes that the anticipated demand for mobile services necessitates the assignment of more spectrum and that ComReg should plan for spectrum assignments to meet this demand.

2.77 RTÉ & 2RN query certain aspects of the CBA such as the assumptions and conclusions in the report[39] including by stating *"…in particular we believe that the potential costs to TV viewers have been underestimated and that the assumptions based on UK research/experience may not be directly applicable to local conditions in Ireland…".* In addition, RTÉ & 2RN sets out an alternative perspective of the consumption of data in Irish households using the Saorview

[39] Points made by RTÉ&2RN cover four areas, the definitive version of these is set out in its submission including on; demand forecasts used by Frontier Economics' analysis; the analysis of costs and benefits to mobile users and suppliers contained in the CBA; the analysis of costs to users and suppliers of broadcasting services in the CBA; and the PMSE analysis in the CBA.

network in comparison to the mobile demand reported in Figure 6 of Consultation 15/131. In that aspect, RTÉ & 2RN claims that *"…with 2 DTT multiplexes on-air (with a total of 48 Mbit/s), over 18,000 million GB of data per year is currently delivered to Saorview households during their 3.5 hours viewing per day".*

2.78 RTÉ & 2RN also state *"…that all efforts are made to minimise damage to the Saorview platform during this transition, and we suggest that additional effort be given to the preparations and support of the migration."* and *"… when considering new alternative PMSE bands, ComReg should expect a lengthy lead time before new equipment designed for the new bands are sufficiently mature for critical live PMSE use".*

Frontier Economics assessment of 700 MHz band CBA comments

2.79 Frontier Economics considered RTÉ & 2RN's views and sets out its response in a supplemental report (published alongside this document as ComReg Document 16/49a). In summary, Frontier Economics does not find any cause to alter the conclusions of its CBA report (Documents 15/62a and 15/62b).[40]

ComReg's assessment

2.80 First, ComReg continues to observe significant increases in mobile data usage with data volumes increasing by 75% in the calendar year 2015 to 123,286 terabytes[41], which would support the claims of increasing mobile data usage in Ireland.

2.81 In relation to views that more spectrum should be made available to support increasing demand for mobile data usage, ComReg notes that the work plan items for mobile, nomadic and fixed wireless broadband services, as discussed in chapter 3, include the progression of award proposals for a number of possible radio spectrum bands[42].

2.82 In relation to RTÉ & 2RN's submission concerning the CBA, ComReg considers Frontier Economics' assessment of RTÉ & 2RN's submission to be reasonable for a number of reasons including:

[40] Among other things, Frontier Economics state: *"We have considered the submission from RTÉ & 2RN in relation to the CBA for repurposing 700MHz spectrum. The objective of the CBA is to assess the economic costs and benefits of repurposing 700 MHz spectrum from DTT and PMSE use to wireless mobile broadband use. We consider that the assumptions and results of the CBA analysis remain valid, and that there is no cause to change the conclusions of the report."*

[41] Based on ComReg's quarterly report data.

[42] See also ComReg Document 14/101 on proposed award of new rights of use to radio spectrum in the 2.6 GHz band with other bands.

- the fact that even where TV equivalent data consumption may be higher than mobile data consumption, this does not imply that the utility derived from broadcasting is higher than mobile;
- there remains a considerable degree of uncertainty in the forecasts of mobile data use. ComReg agrees with Frontier Economics that there are unknown factors which could create upside or downside risks, or both. Recent evidence of growth in mobile data demand in Ireland suggests the assumptions used by Frontier Economics may, if anything, prove conservative. For example total demand for mobile data grew by 75% in 2015 compared to 2014, which is faster than the growth rate assumed in the first year of the CBA in all three low, medium and high demand scenarios (58%, 65% and 70% respectively); and
- alternatives, such as increasing mobile network density, would add significant costs compared to a strategy of repurposing the 700 MHz band.

2.83 In relation to the claim that *"…costs to TV viewers have been underestimated and that the assumptions based on UK research/experience may not be directly applicable to local conditions in Ireland…"* ComReg notes that as there is currently no reliable Irish data available on this matter Frontier Economics was required to make certain assumptions as outlined in Document 15/62a and, further, that this resulted in a range of potential costs for TV viewers being identified in the CBA[43]. ComReg considers this to be a reasonable approach for estimating a range of potential DTT consumer costs.

2.84 In relation to the view that ComReg should expect a lengthy lead time before new PMSE equipment designed for the new bands is sufficiently mature for live PMSE use, ComReg notes Frontier Economics' assessment that some PMSE equipment already uses spectrum outside the 700 MHz band and, therefore, a long lead time is unlikely to be necessary. ComReg further notes that the future of the 700 MHz band has been the subject of considerable public debate[44], which should facilitate industry stakeholders, including PMSE, in making timely decisions in preparation for the expected future use of the 700 MHz band.

2.3.3 Spectrum for mobile, nomadic and fixed broadband

Summary of Consultation 15/131

2.85 ComReg observed that harmonisation measures have recently been adopted by the CEPT and EC to identify and make available more harmonised radio

[43] See paragraph 5.57 of Document 15/62a where a range of €0.4m to €3.4m is discussed.

[44] For example the Lamy report published in August 2014 https://ec.europa.eu/digital-single-market/en/news/report-results-work-high-level-group-future-use-uhf-band

spectrum for mobile, nomadic and fixed wireless broadband services. ComReg noted that should it continue its current spectrum proposals a further 740 MHz of harmonised spectrum could be released in a number of spectrum bands (i.e. the 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz bands).

View of respondents

2.86 A number of respondents commented on specific aspects of ComReg's draft work plan for mobile, nomadic and fixed wireless broadband services (see chapter 3 of this document). Two respondents (Three and Vodafone) also provided general comments on this matter.

2.87 Three believes that more spectrum will be needed in the medium term and supports ComReg's work to repurpose the 700 MHz band, in particular, and the plans to award spectrum from among the 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz bands.

2.88 Vodafone submits that:

- Ireland must have spectrum assignments in line with other European countries and should, therefore, align with European norms both on the allocation and importantly on the assignment of spectrum;
- based on information which it compiled on current spectrum assignments in Member States where Vodafone operates (see Figure 2 below), there is a disparity between the spectrum assignments in Ireland and elsewhere;
- this disparity drives additional cost in network build and, further, a lag between assignments in other European countries and Ireland is now evident in relation to the 2.6 GHz band (where the assignment of this band has been completed in every major European market that Vodafone operates in except Ireland);

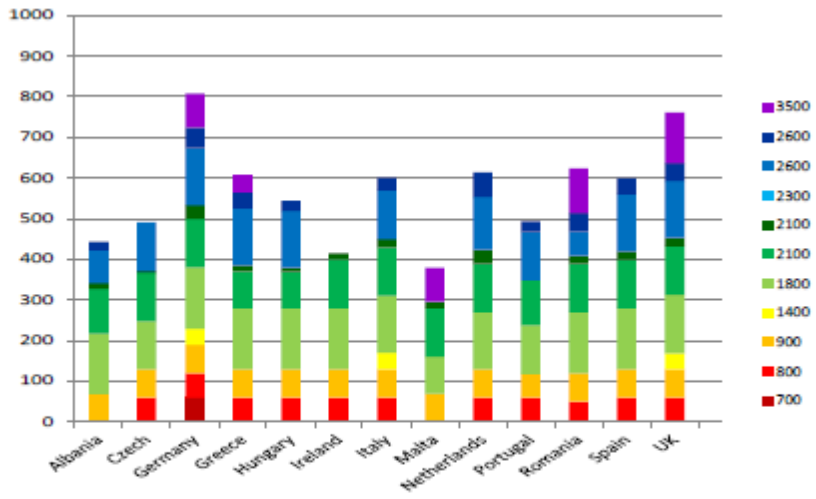

Figure 2: Vodafone's information - current spectrum assignments in EU markets where Vodafone operates

- a digital single market for Europe will bring benefits for Irish customers, and this requires moving towards a consistent policy environment for spectrum across EC countries; and
- aligning the timing of the assignment process with European norms would have major advantages for Irish customers as the same terminal devices are generally available in all EU countries.

ComReg's assessment

2.89 Noting the increasing demand for mobile data services, the ongoing harmonisation activities in specific spectrum bands, and the availability of these harmonised spectrum bands in Ireland, ComReg agrees that more spectrum should be released in the medium term to support the provision of mobile, nomadic and fixed wireless broadband services. In this regard, ComReg's action plan for the period 2016 to 2018, as discussed in chapter 3 below, includes progressing the release of a further 740 MHz of harmonised spectrum in the 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz bands.

2.90 In relation to Vodafone's suggestion that there is a disparity in the spectrum assignment in Ireland compared to the other EU markets where Vodafone Group operates, ComReg observes that:

- Vodafone's information for Ireland only considers spectrum assignments to the mobile network operators and disregards spectrum assignments in the 2.6 GHz band (MMDS licences) and 3.6 GHz bands (FWALA licences), both

of which comply with relevant EC harmonisation decisions.[45] Including these spectrum assignments corrects the total amount of harmonised spectrum in Ireland by raising the quantum by circa 500 MHz; and

- the EC digital scoreboard for 2015[46] (see Figure 3 below) reports Ireland as having assigned for wireless broadband over 75% of the spectrum in the EU harmonised bands[47] which, further, puts Ireland above the EU average.

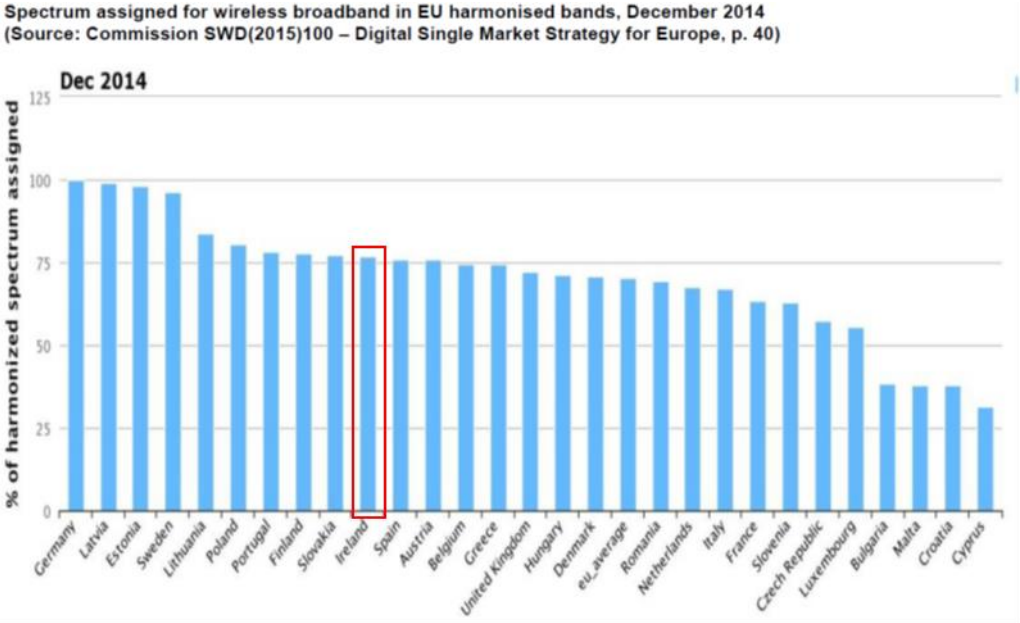

Figure 3: Spectrum assigned to wireless broadband in EU.

2.91 In relation to Vodafone's suggestion for moving towards a consistent policy environment for spectrum across EC countries and aligning the timing of the assignment process with European norms as the same terminal devices are generally available in all EU countries, ComReg:

- agrees that the timing for the release of spectrum for ECS in the EU is important and, in this regard, ComReg supports the current process of harmonisation of the timing of same;
- considers that the existing Regulatory Framework ("Framework") has served Irish and European citizens and businesses well including by: enabling the appropriate management of spectrum at a national level against a backdrop

[45] Decision 2008/477/EC (the 2.6 GHz band), Decision 2008/411/EC (the 3.6 GHz band), Decision 243/2012/EU (The RSPP Decision that includes both the 2.6 GHz and 3.6 GHz bands) and Decision 2014/276/EU (the 3.6 GHz band)

[46] The EC report on the implementation of the EU regulatory framework for electronic communication for 2015 https://ec.europa.eu/digital-single-market/en/download-scoreboard-reports

[47] While Ireland's spectrum assignment for MMDS licences in the 2.6 GHz band complies with the relevant EC Decisions, ComReg observes that the EC report does not include this spectrum assignment, presumably as this is not a spectrum assignment for wireless broadband.

of suitable European harmonisation, and ensuring greater consumer protection and choice; and

- would highlight that it is also important to set reasonable and realistic timeframes for the release of spectrum having due regard for the tasks that some Member States may have in migrating existing services from spectrum bands that are marked for release. In relation to the 2.6 GHz band, ComReg notes that existing services enabled under the MMDS licences only recently ceased on 18 April 2016.

2.92 In addition, ComReg notes and shares the view of BEREC's collective response to the EC's review of the Framework on this issue[48] as relevantly extracted (emphasis added) below.

- *"BEREC agrees that the timing for the release of spectrum for ECS in the EU is important and the current processs* [sic] *of harmonisation of the timing has been proved valuable for the market and the end users. And we note that the Commission already has the power to harmonise the release of spectrum for ECS within certain timelines, and to enforce those decisions. Regarding the timing for release it is also a matter of setting reasonable time schedules and enforcing them.*
- *The Commission granted derogations to all countries which did not meet the deadline for release of the 800 MHz band, in recognition of the difficulties they faced in resolving interference issues, particularly those Member States sharing a border with non-EU countries. In any event, under the current regulatory Framework, 4G coverage rose significantly, from 59.1% in 2013 to 79.4% in 2014.*
- *Against this background, greater "coordination" of the criteria and procedural elements of national assignments (including coverage requirements, timing and conditions of renewals) tend to look more like solutions in search of a problem. Furthermore, not only would greater "coordination" not be efficient in improving the roll out of high-speed mobile broadband networks, but it would also seriously risk hindering such roll-out, potentially creating more restrictive award processes, undermining innovative solutions, and slowing all of Europe down to the speed of the slowest, or at the very least, the average.*
- *It is important that national spectrum authorities are able to design their spectrum awards and licence conditions to reflect the situation in and meet the needs of their Member State. The common EU objective of connectivity*

[48] See BoR (15) 206 http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/5577-berec-opinion-on-the-review-of-the-eu-electronic-communications-regulatory-framework

will best be met by ensuring each Member State can move as quickly as it can, and manage its spectrum as efficiently as it can.

- *It is important not to lose sight of the fact that the vast majority of coordination of spectrum use occurs at the global and regional levels, through the ITU (where spectrum is allocated to different uses, and cross-border interference is addressed) and the CEPT (where detailed technical rules to ensure maximally efficient spectrum use across the greater European landmass beyond the EU are developed). Neither organisation produces decisions on the use of spectrum which bind its members. And the speed to market of new wireless services depends more on the development of (globally defined) common standards for equipment (and the interoperability of equipment and networks) than it does on the coordinated availability of spectrum.*
- *In any event, it should be borne in mind that Articles 8a to 9b of the Framework Directive and Articles 5 to 8 of the Authorisation Directive already harmonise important aspects of the spectrum managed in Member States. This framework guarantees important EU-wide principles of regulation aimed at ensuring the efficient use of this scarce resource at national level, including technology and service neutrality, the principle of general assignments, the removal of obstacles to spectrum trading, and the ability of holders of rights to use frequencies to transfer or lease those rights In addition, Article 4(3) of the Radio Spectrum Decision (676/2002/EC) already empowers the Commission to issue binding decisions for "technical implementing measures with a view to ensuring harmonised conditions for the availability and efficient use of radio spectrum", including the harmonisation of frequency bands to be used for ECS."*

2.3.4 Spectrum for smart grid and smart metering

Summary of Consultation 15/131

2.93 In section 5.1.4 of Consultation 15/131, ComReg noted that the Europe 2020 growth strategy is increasing the demand for specific services such as wireless broadband and smart metering. ComReg also noted that smart metering solutions can be provided by various solutions and spectrum bands, including SRDs in the 870-876 MHz, 915-921 MHz and 410-414 MHz/420-424 MHz bands (paragraphs 5.55 and Table 3 in Annex 3),

Views of respondents

2.94 Six respondents (BT, ESBN, Motorola, Sigma Wireless, Sensus and Smart Connect) provided submissions concerning the potential benefits of spectrum being made available for new intelligent/smart services and devices; advanced

smart metering communications (both smart metering and smart grid), and other professional voice and data platforms (such as Tetra and DMR)[49].

2.95 In relation to the spectrum demands for smart grid and smart metering, all six respondents suggested various benefits of spectrum or technologies that provide long range communications (e.g. in terms of reducing costs), with the 410-430 MHz band specifically mentioned by ESBN, Motorola, Sigma Wireless, Sensus and Smart Connect. ComReg's consideration of the 410-430 MHz band is set out in section 3.3.7 below.

2.96 ESBN additionally submits that dedicated radio spectrum best serves the needs of smart grid and claims that sharing on telecommunications networks with millions of unsecured and unencrypted public mobile devices would create vulnerabilities for utility companies on such shared networks.[50] In this regard, ESBN cites the following examples to support its view:

- two examples of dedicated spectrum being used for the provision of smart grid and smart metering services;[51] and
- one example where dedicated spectrum is made available for all utilities to use as required, provided that the spectrum is used to meet electric utility operational requirements subject to approval by the regulator.[52]

ComReg's assessment and position

2.97 ComReg notes that radio spectrum can be a valuable resource in terms of monitoring and managing key national infrastructure. ComReg also notes the distinction between smart grid and smart metering, with licence-exempt spectrum potentially being suitable for the latter but less so for the former. There are a number of spectrum bands that could possibly be useful for smart grid infrastructure; indeed some respondents identified spectrum for which they

[49] For example, ESBN sets out the benefits of smart grid as being, amongst other things, optimising efficiency and energy management on its network, helping Ireland achieve ambitious renewable energy targets by the integration of additional renewable energy onto its network, and lowering carbon emissions.

[50] ESBN submits that smart grid requires, amongst other things, instantaneous communications, coverage from designated base stations and robust cyber security. Further at page 11 of its submission the ESBN sets out some of the specific benefits to ESBN of deploying its own smart grid such as real-time monitoring, data mining, post incident fault analysis, improved situational awareness amongst others.

[51] ESBN observes that: in the Netherlands, Alliander is using spectrum in the 450 MHz range with the CDMA technology; and in the UK, Arqiva, in conjunction with equipment supplier Sensus, is using spectrum in the 412-414 MHz paired with 422-424 MHz to deliver smart metering to 10 million gas and electricity users.

[52] ESBN observes that in Canada, Hydro One, Manitoba Hydro and BC Hydro, among others, as using spectrum within the 1800 – 1830 MHz band.

appear to have a preference, namely the 410-430 MHz band. ComReg's consideration of the 410-430 MHz band is discussed in section 3.3.7 below.

2.3.5 The Internet of Things ('IoT')

Summary of Consultation 15/131

2.98 At paragraphs 5.57 and 5.48 of Consultation 15/131, ComReg noted that the RSPG and CEPT have both identified the spectrum management considerations of IoT as a key item of their respective work plans in terms of developing a strategy for its requirements and ensuring that developments are adequately accommodated.

Views of respondents

2.99 Three respondents (BT, Silver Spring and Three) provided comments in relation to this matter

2.100 BT considers that IoT is about small data transactions from vast numbers of devices and is a growth area. It notes that the radio spectrum requirements for some IoT devices may be fundamentally different depending on whether they have short range requirements or longer ones as part of a meshed network. BT further considers that SRDs and IoT should be able to operate within the WiFi bands but notes that some "always-on" or "nearly-always-on" SRDs could limit WiFi for broadband access capacity. Accordingly, BT supports a timely and progressive approach towards making additional and appropriate or harmonised (or both) radio spectrum available for SRDs and IoT.

2.101 Silver Springs welcomes ComReg's proposals to release the bands 870-876 MHz and 915-921 MHz according to the conditions of CEPT Rec 70-03. It submits that exploiting radio sharing opportunities by SRD usage is an important way to maximise the benefit of radio spectrum use and to allow a multitude of applications and service providers to operate. It notes that there are various IoT technologies available and that standardisation and harmonisation is important, particularly to manufacturers of equipment supporting radios. It further notes that various standardised IoT technologies are currently available.

2.102 Three suggests that one consistent trend to emerge over the past number of years, and in all CEPT countries, is growing demand for spectrum access. It submits that this demand can come from existing or entirely new applications, such as IoT, or both. In relation to IoT, Three agrees with ComReg's position that it is too early to know how IoT could impact on spectrum policy and that IoT is an item that ComReg should keep under review.

ComReg's assessment

2.103 ComReg agrees that IoT may be facilitated via various technologies and that both short and long range use cases may arise in the future. ComReg will continue to monitor IoT developments and appropriately facilitate the radio spectrum requirements for IoT as required.

2.4 Other Issues

2.4.1 Non-Ionizing Radiation

Views of respondents

2.104 One respondent (RTÉ & 2RN) believes that non-ionizing radiation (NIR) should be mentioned in the spectrum management strategy as this an important aspect of spectrum use and management in which ComReg has a role. In this regard, it notes that Ireland must transpose Directive 2013/35/EU this year.[53]

ComReg's assessment

2.105 By way of background, ComReg recalls that, as a radiation protection matter, NIR lies outside the scope of ComReg's spectrum management strategy (which is primarily aimed at ComReg's obligation and objective of the effective and efficient management and use of the radio spectrum). ComReg nevertheless recognises that NIR emissions from transmitter sites remain a matter of interest for the public and that it is important to ensure that human exposure to NIR is within safe limits.

2.106 ComReg also notes that, since 2003, it has had in place a programme of NIR emissions measurement in order to assess compliance on the part of transmitter operators with the ICNIRP limits for general public exposure to NIR. Compliance with those limits is a condition of Wireless Telegraphy Licences and/or General Authorisations issued by ComReg. Currently, ComReg commissions surveys of NIR emissions from 80 transmitter sites[54] each year, the results of which are published on ComReg's website.

2.107 It should be noted that work on the transposition of the Directive 2013/35/EU relating to occupational exposure to NIR is not a matter for ComReg or within ComReg's expertise as this directive relates to health and safety at work.

[53] Directive 2013/35/EU of the European Parliament and of the Council of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields).

[54] Mobile phone and wireless broadband base stations, TV transmitters etc.

ComReg understands that work on transposition of this directive into Irish law is currently being undertaken by the Department of Jobs, Enterprise & Innovation.

2.4.2 Ireland's National Broadband Plan (NBP)

Summary of Consultation 15/131

2.108 In paragraph 5.18 of Consultation 15/131, ComReg noted that the delivery of NBP may result in improved backhaul connectivity which could assist the development of wireless networks.

Views of Respondents

2.109 One respondent, Three, believes that while microwave links will play an increasingly important role in providing backhaul in the medium term, it does consider it sufficient to meet the requirement for low-cost, high-capacity backhaul for small cells by using microwave. Instead, it believes that ubiquitous access to fibre-based transmission will be required.

2.110 Three agrees that the NBP has the potential to remove bottlenecks to backhaul in many locations and could facilitate significant improvements in mobile and nomadic services. However, it observes that this is only possible if the NBP can be used to provide backhaul services.

ComReg's assessment

2.111 By way of background, ComReg observes that the potential for NBP infrastructure to be used for backhaul services is a matter for the DCENR and, further, notes that this issue is addressed in section 8.3.3 of the December 2015 "Broadband strategy for Ireland" report[55], which states:

> *"Barring an unacceptable distortion to existing competition, our view is that NBP-Co should be allowed to provide, in addition to high speed broadband, other wholesale services that can be supported by the network. These may include, for instance, the following:*
>
> - *Wholesale Leased lines*
> - *Wholesale Voice services*
> - *Wholesale Multicast services*
> - *Mobile backhaul services*

[55] Broadband Strategy for Ireland, December 2015, http://www.dcenr.gov.ie/communications/SiteCollectionDocuments/Broadband/Updated%20Expert%20reports/PwC%20Broadband%20Strategy%20for%20Ireland%20December%202015.pdf

- *Ancillary products such as machine-to-machine applications like smart energy metering or security alarms."*

Chapter 3

3 Radio spectrum work plan for 2016 to 2018

3.1 In chapter 6 of Consultation 15/131, ComReg outlined its draft spectrum management work plan for 2016 to 2018 for specific radiocommunication services whilst observing the need for appropriate prioritisation of same.

3.1 Appropriate prioritisation of spectrum work activities

Summary of Consultation 15/131

3.2 In section 6.1 of Consultation 15/131, ComReg noted that its spectrum workload is driven by a wide range of factors[56] and, while it strives to meet the spectrum demands of all users, inevitably this is not possible given, among other things, often multiple competing demands for the same spectrum resource and practical considerations, such as resourcing.

3.3 To manage its workload in a pragmatic manner, ComReg outlined a number of relevant considerations that affected its prioritisation. Among other things, ComReg observed that spectrum bands which are subject to harmonisation measures are generally the ones which will deliver the most benefits to end-users, given factors such as increased economies of scale and equipment availability.

Views of respondents

3.4 Four respondents (ESBN, Silver Spring, Three, Vodafone) submitted comments on matters relating to the appropriate prioritisation of spectrum work activities.

3.5 In relation to ComReg's resources, Three and Vodafone submit that given the important contribution that radio spectrum brings to the economy, ComReg's actions in relation to the timely progress of spectrum projects should not be resource limited. In addition:

- Three considers that ComReg needs to ensure that it can run multiple projects in parallel so as to avoid a situation where some issues must "wait in line" and are delayed; and

[56] Amongst other things, this considered the expiry of existing licences over the next six years (i.e. up to 2021), the potential for additional spectrum bands to be released, and other developments.

- Vodafone considers that given the importance of this spectrum[57] to the provision of services to customers, a lack of resources in ComReg should not be a factor in deciding the timing of auctions.

3.6 On the benefits of harmonised spectrum bands:

- Three submits that harmonised bands are important, as standardised equipment is generally available. It believes that the absence of standardised equipment can be a barrier to successful use of spectrum as Ireland is too small of a market for most mass market vendors to produce customised equipment. In that regard, Three references the WDMDS licences issued by ComReg in 2005 which, in its view, failed to launch entirely or had no market impact;
- Vodafone also agrees that international harmonisation is important and that it brings significant consumer benefit. Vodafone believes that European alignment is very important for the availability of network and terminal equipment for end-users thereby facilitating the faster and cheaper delivery of services to end-users.
- Silver Spring further agrees that the release of harmonised spectrum is of particular importance to any national regulator as this increases the likely benefits and usage of the spectrum. For instance, manufacturers are better able to take advantage of economies of scale and develop products that can operate and, if necessary, interoperate across borders;
- Whilst agreeing with ComReg's preference for activities in relation to harmonised bands, Three also considers this should not be an absolute rule as there can always be cases where local circumstances require a local solution (e.g. the use of the 2.6GHz band for MMDS, which fulfilled a market and social need for several years);
- As discussed earlier in section 2.3.3, Vodafone also submits that Ireland should align its spectrum assignments, as well as allocations, with other EU countries in a timely manner; and
- ESBN believes that dismissing the release of non-harmonised bands in non-commercial deployments is not appropriate.

3.7 In addition to the considerations listed by ComReg in Consultation 15/131, Vodafone suggests the following additional considerations, observing that the

[57] Vodafone did not specify which spectrum it is referring to. However noting that Vodafone's subsequent paragraph refers to the 2.6 GHz band, ComReg presumes that Vodafone is referring to the 2.6 GHz band in this instance.

aim must be to have a timetable of activity driven by the need to satisfy customer demand which is not limited by resources:

- the need to make forward-looking assessments of spectrum needs, taking into account available forecasts for demand;
- timeliness of spectrum assignment having regard to European norms; and
- the generation of simple auction design which it claims would facilitate more straightforward consultation and more timely assignment.

ComReg's assessment

3.8 In relation to the comments suggesting that the timely progress of spectrum projects should not be subject to resource constraints, ComReg observes that, similar to many other organisations, has finite staff resources. In addition, the specialist expertise to manage and execute spectrum projects can be difficult to secure and maintain.

3.9 Interested parties will also appreciate that it is not possible to have a timetable of activity driven by the need to satisfy the demands of each individual spectrum user. As discussed in paragraph 6.3 of Consultation 15/131, and among other things, the demand from two of more individual spectrum users can differ and potentially be in conflict.

3.10 Given these practical considerations, and the spectrum-specific considerations as outlined in paragraph 6.5 of Consultation 15/131, an appropriate prioritisation of spectrum projects is carried out by ComReg to appropriately and pragmatically meet the needs of a diverse range of actual and potential spectrum users (noting that the proposed spectrum work plan for 2016 to 2018 is an example of this prioritisation process). In addition, ComReg observes that its work plan may change over time as the radio spectrum environment is international and dynamic with new developments emerging constantly.

3.11 In relation to the benefits of harmonised spectrum bands, ComReg agrees that spectrum bands subject to harmonised measures are generally the ones that deliver the most benefits for the reasons identified by respondents. ComReg also confirms that the requirement for harmonisation is not an absolute rule as there may be local circumstances which support the release of non-harmonised spectrum. In this regard, ComReg notes that the spectrum prioritisation considerations discussed in Consultation 15/131 are non-exhaustive.

3.12 In relation to Vodafone' suggestion to make forward-looking assessments which take available forecasts for demand into account, ComReg notes that it assesses demand for spectrum using a number of approaches including:

- its Spectrum Management Strategy consultation - which allows ComReg to conduct a strategic review of work plan items for spectrum bands in order to identify appropriate priorities;
- public consultations on the potential award of band(s) – which allow ComReg to gather and consider relevant information;[58] and
- having regard to international developments and ComReg's participation in international fora (such as the RSPG).

3.13 In relation to Vodafone's suggestion regarding the timeliness of assignment having regard to European norms, ComReg:

- agrees that the timing for the release of spectrum for ECS in the EU is important and in this regard ComReg supports the current process of harmonisation of the timing of same; and
- again notes that there is no significant disparity between the amount of spectrum assigned in Ireland compared to other EU member states (see section 2.3.3 above).

3.14 Finally, the matter of appropriate award design is discussed in section 4.1.

3.2 ComReg's spectrum management function

Summary of Consultation 15/131

3.15 In section 6.2.1 of Consultation 15/131, ComReg out its work plan proposals for its spectrum management function, including its licensing and compliance activities.

Views of respondents

3.16 Four respondents commented on matters relating to ComReg's proposed actions for its spectrum management function (noting that comments received concerning ComReg's Test and Trial Ireland programme are considered at section 2.1.3 above).

[58] Interested parties will recall that a determination of whether to include certain band(s) in an award process will typically include a consideration factors including: availability of spectrum; degree of harmonisation; technical constraints on the use of the spectrum; third party assessments of spectrum use (e.g. RSPG Opinions); type of potential use/users; assessment of existing demand internationally; and prorogation characteristics.

ComReg consultations also typically assess other factors which could influence demand such as equipment availability, spectrum packaging, licence duration, licence conditions, award format, caps and fees. Further, a Regulatory Impact Assessment (RIA) is typically conducted assessing whether a certain band or bands should be included in a particular award; and how best to assign the rights of use in the relevant band(s).

3.17 RTÉ & 2RN submits that it would be appropriate for ComReg to *"reference the protection of existing users of spectrum when considering actions to encourage the efficient use of spectrum"*.

ComReg's assessment and position

3.18 ComReg notes that the consideration of spectrum rights of existing spectrum users forms part of ComReg's spectrum management function, particularly in relation to the protection of existing users from harmful interference. ComReg observes that this activity forms part of proposed spectrum enforcement and compliance work plan actions as set out in bullets (v) and (vi) of paragraph 6.12 of Consultation 15/131.

3.3 Mobile, nomadic and fixed wireless broadband services

3.19 In section 6.2.2 of Consultation 15/131, ComReg set out its work plan proposals for mobile, nomadic and fixed wireless broadband services. Responses received to each of these specific proposals are discussed below.

3.3.1 The 3.6 GHz band

Summary of Consultation 15/131

3.20 ComReg identified its relevant work plan proposal as being to "*complete the assignment process for the 3.6 GHz band significantly in advance of the expiry of existing FWALA licences on 31 July 2017*".

Views of respondents

3.21 Two respondents (Three and Vodafone) commented as follows:

- Three agrees with ComReg's work plan proposal, acknowledges that ComReg accepted industry views that the 3.6GHz band should be separated from the proposed second multiband auction, and agrees that ComReg is following the right course in relation to the award of the remaining bands;
- while welcoming the progress on advancing an auction for the 3.6 GHz band, Vodafone requests that:
    - any auction in 2016 take the opportunity to auction a number of bands and not just the 3.6 GHz band; and
    - in relation to the 2.6 GHz band, the award of this band could be included with the 3.6 GHz band award process, or run in parallel with this process.

Updated information on ComReg's 3.6 GHz band award proposals

3.22 Following the publication of Consultation 15/131, ComReg published its response to consultation and draft decision on the 3.6 GHz band (Document 15/140).

3.23 In setting out its draft decisions on the 3.6 GHz band, ComReg took account of the material submitted by interested parties to previous consultations related to the 3.6 GHz band, as well as other relevant information including the advice provided by consultants engaged by ComReg in relation to that process.[59]

ComReg's assessment and position

3.24 ComReg notes and welcomes the positive responses regarding timely progressing of its 3.6 GHz band award proposals.

3.25 In relation to Vodafone's suggestions, ComReg observes that:

- Vodafone's suggestion was considered as "Option 3" in the revised draft 'Spectrum for Award' regulatory impact assessment ('RIA') (as set out in section 3.2 and Annex 5.1 and 5.2 of Document 15/140); and
- the preferred option identified by ComReg in Document 15/140 is the award of the 3.6 GHz band alone ("Option 2"). Among other things, ComReg noted that *"[a]ll thirteen respondents who submitted a view on the matter expressed support for the release of the 3.6 GHz band alone in a separate award process"* (paragraph 3.9).

3.26 Noting the above, ComReg remains of the view that its work plan proposals for the 3.6 GHz band as discussed in Consultation 15/131 remain appropriate.[60]

3.3.2 The availability of the 700 MHz band

Summary of Consultation 15/131

3.27 ComReg identified its work plan proposal as being to *"actively engage with relevant stakeholders to progress the repurposing of the 700 MHz band so as to obtain clarity on its timing availability".*

[59] ComReg Documents 15/40a, 15/40b, 15/40c, 15/40d.

[60] This view is without prejudice to the ongoing consultation process for the 3.6 GHz band award which has yet to be finalised.

3.28 ComReg also noted that preparations are ongoing to facilitate a repurposing of the 700 MHz band, including progressing an internationally-coordinated spectrum plan for DTT below the 700 MHz band.

Views of respondents

3.29 In summary, respondents' views on this proposal (from RTÉ & 2RN, Three and Vodafone) are as follows:

- observing that the 700 MHz band is important for the wide area coverage of data services and given Ireland's lower population density, Vodafone welcomes ComReg's 700 MHz band activities and believes that the use of this band will be more important for mobile services in Ireland than in other European countries;
- at the same time, Vodafone expresses concern that the assignment of 700 MHz is proceeding in other European countries while the timescale for this step in Ireland remains vague and believes there is a further risk that Ireland will fall behind in delivery of service to customers;
- further, Vodafone proposes that ComReg should continue its work to reallocate the 700 MHz band, but considers that activity in other bands should not be held up while waiting for clarity on the timing availability of the 700 MHz band. In this regard Vodafone repeated its request (as discussed above in relation to the 3.6 GHz band);
- Three supports ComReg's work to repurpose the 700 MHz band in particular, but also ComReg's plans to award capacity spectrum from among the 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz bands. Three considers that commencement of this work should not have to wait until after the 3.6 GHz band process is complete;
- RTÉ & 2RN consider that a key issue in relation to the preparations for repurposing the 700MHz band is the issue of compensation for viewers and existing operators given that they are likely to experience little benefit from this costly and disruptive repurposing of spectrum; and
- in relation to the timing of a 700 MHz band release, RTÉ & 2RN believe that a significant period of time will be required to allow for the planning, raising of capital, procurement and rollout of infrastructure to enable a 700 MHz migration. RTÉ & 2RN observe that while footnote 119 of Consultation 15/131 refers to an announcement of ASO in 2010 prior to a 2012 completion date, the planning and roll-out of the DTT network began with the publication of the Broadcasting Amendment Act, 2007. Accordingly, a two-year period from announcement to migration is not, in its view, realistic for infrastructure projects of this scale.

Updated information

3.30 ComReg notes that the following developments in relation to the 700 MHz band subsequent to the publication of Consultation 15/131:

- on 2 February 2016, the EC submitted a proposal for a decision by the EU Council and Parliament on the 470-790 MHz band[61] that by 30 June 2020 Member States would be required to allow the use of the 700 MHz band for terrestrial systems capable of providing wireless broadband electronic communications services only under harmonised technical conditions set by the EC;
- on 11 March 2016, Ofcom published updated 700 MHz proposals[62] which included bringing forward the date at which the 700 MHz band would be available in the United Kingdom for ECS by up to 18 months - to a target of no later than Q2/2020;
- on 28 April 2016, a EC implementation decision on the harmonisation of the 700 MHz band for terrestrial systems capable of providing wireless broadband electronic communications services was adopted into law[63]; and
- on 29 April 2016, the administrations of Belgium, France, Germany, Ireland, Luxembourg, the Netherlands and the United Kingdom entered into a multilateral agreement relating to the DTT plan for the 470-694 MHz band, as facilitated by the Western European Digital Dividend Implementation Platform (WEDDIP) group.[64]

ComReg's assessment and position

3.31 ComReg agrees that the 700 MHz band is an important band for Ireland noting, in particular, Ireland's demographics and the benefits that this band can provide in relation to the provision of both wide-area and potentially deep indoor coverage. Noting these potential benefits, and the results of the 700 MHz Cost Benefit Analysis (CBA) as set out in ComReg Documents 15/62a and 15/62b, ComReg remains of the view that the 700 MHz band should be repurposed in Ireland. Further, ComReg notes that, since Consultation 15/131 was published, the EC (for all EU Member states) and Ofcom (specifically for the UK) have

[61] Decision of the European Parliament and of the Council on the use of the 470-790 MHz frequency band in the Union, {SWD(2016) 19 final}, {SWD(2016) 20 final}. https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-43-EN-F1-1.PDF

[62] http://stakeholders.ofcom.org.uk/binaries/consultations/maximising-benefits-700-MHz-clearance/summary/maximising-benefits-of-700MHz-clearance.pdf

[63] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016D0687&from=EN

[64] http://www.anfr.fr/fileadmin/mediatheque/documents/coordination/Accords_par_pays/WEDDIP_statement_700_MHz_band_release.pdf

proposed that the repurposing of the 700 MHz band should be completed by 2020.

3.32 To facilitate a timely repurposing, significant preparatory work has already been completed by ComReg, in collaboration with 2RN and the BAI, on a technical frequency plan to relocate DTT below the 700 MHz band and the international coordination of this with the UK and France. In that regard, ComReg notes:

- in April 2016 a DTT co-ordination agreement was signed with France[65];
- in relation to the UK it is ComReg's intention that:
    - the frequency plan for DTT below the 700 MHz band will be finalised and co-ordinated by July 2017; and
    - the frequency plan to enable the transition of DTT to below the 700 MHz band will be finalised and co-ordinated by Q4 2016.

3.33 The DTT frequency plan below the 700 MHz band allows relevant stakeholders to make practical arrangements (e.g. selecting equipment for purchase) for the repurposing of the 700 MHz band and to consider a repurposing date. While Ireland has yet to finalise these considerations, it is ComReg's understanding that Ireland's 700 MHz migration activities would occur in the time period 2019/2020 (i.e. a period of 3-4 years from now).

3.34 In relation to specific points raised by RTÉ & 2RN, ComReg:

- observes that issues such as planning, the raising of capital, and the procurement and rollout of infrastructure to enable a 700 MHz migration have all been raised in stakeholder discussions on a 700 MHz repurposing date; and
- agrees that a mechanism of compensation for the additional DTT costs directly attributable to a 700 MHz migration is an important issue to address at an early stage, as this can facilitate a timely 700 MHz band repurposing to the benefit of consumers and the economy overall.

3.35 In light of the above, ComReg considers that its 700 MHz work plan proposal remains appropriate, namely that it will "actively engage with relevant stakeholders to progress the repurposing of the 700 MHz band so as to obtain clarity on its timing availability."

3.3.3 Award proposals for the 700 MHz, 1.4 GHz, 2.3 GHz and 2.6

[65] http://www.anfr.fr/fileadmin/mediatheque/documents/coordination/Accords_par_pays/IRL-F_UHF_Agreement_20160428_signed.pdf

GHz bands

Summary of Consultation 15/131

3.36 ComReg identified its work plan proposal as being to *"further develop ComReg's award proposals in relation to the 700 MHz, 1.4 GHz, 2.3 GHz, and 2.6 GHz bands".*

3.37 ComReg also envisaged that proposals outlining the next steps for these bands would likely be provided from the second half of 2016 onwards.

Views of respondents

3.38 Two interested parties (Three and Vodafone) submitted comments on these matters being, in summary:

- Three supports ComReg's work plan proposal and believes that ComReg should continue with work to clarify its position on the timing for availability of the other bands (700 MHz, 1.4 GHz, 2.3 GHz and 2.6 GHz) in parallel with the work to award 3.6 GHz spectrum. In Three's view, commencement of this work should not have to wait until after the completion of the 3.6 GHz process;
- Vodafone proposes that ComReg accelerate the award process for the 2.6 GHz band, and that further auctions for the other bands discussed in 14/101 (700 MHz, 1.4 GHz, 2.3 GHz) can then take place at a later date;
- In relation to the 2.6 GHz band, Vodafone:
    - believes that the assignment of the 2.6 GHz band should have been completed in advance of the 18 April 2016 expiry date of the MMDS licences in this band;
    - suggests that it would be feasible and efficient to run an auction for the 2.6 GHz band this year, with the 2.6 GHz band being included in the award process for the 3.6 GHz band, or run in parallel with the 3.6 GHz band[66];
    - considers that it is an inefficient use of spectrum if the 2.6 GHz spectrum band remains unassigned when there is clear demand and submits that the benefits of holding an early award for the 2.6 GHz band outweigh the arguments for developing an auction with multiple spectrum bands;

[66] ComReg observes that this request is the same as that suggested by Vodafone for the 3.6 GHz band, where ComReg's assessment and positon is outlined.

- considers that there are now significant drivers to assign the 2.6 GHz band spectrum in as short a time as possible[67]; and
- observes that as well as supporting its customers with additional 4G capacity and speeds the 2.6GHz band would support: enhanced service at special events, better service at high footfall areas and outdoor hotspots.

ComReg's assessment and position

3.39 ComReg notes that both Three and Vodafone support ComReg's work plan proposal to progress the award proposals for these bands, albeit with Vodafone adding that the award of the 2.6 GHz band should be accelerated in advance of the other bands.

3.40 In relation to Vodafone's 2.6 GHz band proposals, ComReg observes that:

- its request for the 2.6 GHz band to be awarded as part of the 3.6 GHz band award process has been considered and addressed above in relation to the 3.6 GHz band; and
- Vodafone's request to accelerate the award of the 2.6 GHz band in advance of the other bands would need to be considered in combination with other relevant information to this matter. Such information would include re-consideration of the responses received to ComReg Document 14/101[68] and other relevant/updated information, such as updated information on each of the potential bands for award. ComReg envisages that further information outlining the next steps for these bands will likely to be provided by the first half of 2017.

3.41 In relation to Vodafone's comment that the award process for the 2.6 GHz band should have been completed in advance of the 18 April 2016 expiry date of the MMDS licences in this band, ComReg observes that:

- the potential release of the 2.6 GHz band was discussed in ComReg Document 14/101 published 30 September 2014, circa 1½ years in advance of the expiry date of the MMDS licences; and

[67] Vodafone submits that: customers' mobile devices now being sold have the capability to use this band; the assignment of this band has been completed in most European countries; and the previous licence for this band will expire in Q2 2016.

[68] Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands, http://www.comreg.ie/_fileupload/publications/ComReg14101.pdf

- responses to that consultation indicated broad support for the release of the 3.6 GHz band in a separate award process, and this resulted in the ComReg's proposals to accelerate the award process for the 3.6 GHz band.

3.42 In light of the above, ComReg considers that its work plan proposal remains appropriate, namely that it will *"further develop ComReg's award proposals in relation to the 700 MHz, 1.4 GHz, 2.3 GHz, and 2.6 GHz bands".*

3.3.4 Liberalising the paired 2 GHz band

Summary of Consultation 15/131

3.43 ComReg identified its work plan proposal as being to *"continue ComReg's consultation process on liberalising the paired 2 GHz band".*

3.44 On timing, ComReg noted that *"while a response to Consultation 14/65 on the 2 GHz band remains a work plan action, its timing needs to be considered in light of other work programme priorities and the likely timing of the existing licensee's need for liberalisation in this band."*

Views of respondents

3.45 Two interested parties (Eir Group and Three) submitted comments on these matters being, in summary:

- Eir Group and Three proposing that ComReg conclude its consultation process on this matter before 30 June 2017 and in H1 2016, respectively;
- Eir Group's observations that the liberalisation of the paired 2 GHz band:
    - is a natural and timely step in achieving the harmonisation of the use of the 3G bands, noting that the Czech Republic, Slovenia and Spain are examples of European countries that have taken this step;
    - would allow operators to leverage this spectrum in a future-proofed way noting that the ecosystem for the Internet of Things (IOT) family of services on mobile networks is evolving around LTE; and
    - would create opportunities for more innovative use of the radio spectrum, consistent with ComReg's objectives. Eir Group notes that significant innovation in both the RAN, device and service elements is coming from Asia and, further, that 2100 MHz is currently being used for LTE in Japan, Philippines and South Korea with more than 36% of all devices able to operate in the 2100 MHz band.
- Three's observations that the liberalisation of the paired 2 GHz band:

- is required by EC Decision (2012/688/EU) which obliges member states make available this band on a liberalised basis no later than 30th June 2014. While observing that ComReg issued a consultation calling for input on this matter (ComReg Document 14/65), Three notes that ComReg has not published the responses received to this consultation or a follow-up document; and
- facilitates investment decisions in advance of the 2022 licence expiry because the investment case for introducing new technology in the band becomes more difficult as licence expiry approaches.

ComReg's assessment and position

3.46 ComReg agrees with respondents that liberalising the paired 2 GHz band could bring benefits to consumers while allowing operators the flexibility to maximise spectrum efficiency.

3.47 ComReg also notes that within 3GPP the IoT ecosystem is evolving around LTE[69] and the continued growth in LTE device availability for the paired 2 GHz band[70].

3.48 At the same time, ComReg recalls that the relevant EC decision does not automatically mean that existing licences in the band will be liberalised. There are other factors that ComReg is obliged to consider including, for example, potential distortions to competition that might arise from the implementation of the decision.

3.49 ComReg also observes that there are a number of other countries within the EU where existing licences in the band are not liberalised[71]. ComReg further notes that, to date, only operators in the Czech Republic have started to deploy LTE equipment in this band.

3.50 Notwithstanding, ComReg sees benefits in aiming to conclude this process within the time period of the spectrum management strategy statement, recognising that a reasonable time period will be required to complete the consultation process.

3.51 Accordingly, ComReg considers it appropriate to revise its work plan proposal to clarify that it aims to conclude its consultation process on liberalising the paired 2 GHz band within the time period of this spectrum management strategy

[69] http://www.3gpp.org/news-events/3gpp-news/1607-iot

[70] http://gsacom.com. see, Report: Status of the LTE ecosystem, Aril 7 2016

[71] See the Regulation of the 2GHz band table from Cullen International, http://www.cullen-international.com/product/documents/CTTEEU20160063

statement. ComReg envisages that its further consultation on this matter would be issued by mid-2017.

3.3.5 Spectrum leasing

Summary of Consultation 15/131

3.52 ComReg identified its work plan proposal as being to *"set out a regulatory framework for the leasing of spectrum rights in the RSPP bands in advance of 31 July 2017".*

3.53 In addition, ComReg sought any preliminary views that interested parties might have on certain high level issues that may be associated with same.

Views of respondents

3.54 Four respondents (BT, Eir Group, Three and Vodafone) submitted views on this matter, with all four supporting spectrum leasing. In addition:

- BT notes that permitting spectrum trading can lead to market-based exchanges that increase the welfare not just of the trading parties but society generally;
- Vodafone observes that trading does not happen often in practice and is unlikely to provide a remedy for *"unbalanced spectrum assignments"*; and
- Eir Group submits that specific policy issues, such as those identified in footnote 117 of Consultation 15/131, are better addressed through dedicated consultation papers that allow the issues to be considered in a coherent and comprehensive manner, rather than in the draft spectrum management consultation. With regard to any forthcoming consultation on spectrum leasing, Eir Group considers that an over-arching objective should be that the leasing framework is established in accordance with the principles of the established spectrum trading framework, and operates consistently with the checks and balances of same.

ComReg's assessment and position

3.55 ComReg agrees that spectrum trading can increase the efficient use of spectrum noting, at the same time, that transfers or leases do not happen often in practice.

3.56 In relation to the comments of Eir Group on a spectrum leasing framework consultation, ComReg sees merit in an over-arching principle that any leasing framework would be established consistent with the principles and checks and balances of the existing Spectrum Transfer Framework.

3.57 Accordingly, ComReg's work plan item is to *"set out a regulatory framework for the leasing of spectrum rights in the RSPP bands in advance of 31 July 2017".* ComReg envisages issuing a consultation before the end of 2016.

3.3.6 Mobile retail consumer experience

Summary of Consultation 15/131

3.58 ComReg identified its work plan proposal as being to *"facilitate better understanding of the factors impacting on actual mobile consumer experience and take appropriate measures on foot of same".*

Views of respondents

3.59 Two interested parties (Eir Group and Vodafone) submitted views on this matter, being in summary:

- on the basis of its own consumer research and an analysis of the volume of consumer complaints escalated by ComReg to its customer care team, Eir Group considers that there has not been an appreciable decline in mobile customer satisfaction levels (at least in respect of its mobile service)[72];
- in light of this information, Eir Group believes that it is unclear that a work package focussed on mobile retail consumer experience issues is necessarily the best use of ComReg's scarce resources. However, it notes that there may be merit in such an exercise to the extent that it can bring an objective perspective to public debates. In addition, it agrees that the six factors identified on page 99 of Consultation 15/131 are relevant for consideration if ComReg proceeds with this work item; and
- Vodafone states that it continues to invest in network improvements and that, in parallel, it actively engages with the public in communicating these improvements through multiple channels. Overall, Vodafone states that it would be happy to discuss further with ComReg ways in which it can give the public a better understanding of factors that affect their experience.

[72] Eir Group also notes it is continually improving its network and references that in 2015 it added over 700 sites nationwide and that it plans to continue its network investment in 2016.

ComReg's assessment and position

3.60 First, ComReg observes a significant difference in the public perception of the mobile retail consumer experience[73] [74] and the views of the interested parties which responded on this issue.

3.61 It is clear that this is an issue of national importance in which ComReg has a part to play, as highlighted by the discussions in the following priority recently identified in the programme for Government:[75]

> *"Within 100 days, we will establish a mobile phone and broadband taskforce to provide immediate solutions to the broadband/phone coverage deficit, involving the Department of Communications, the Department of Environment, the Department of Transport, ComReg, the telecommunications industry and consumers, to investigate how to provide better services for consumers including better use of State assets."*

3.62 ComReg is, of course, happy to participate in the taskforce that is planned to explore this issue (in the context of its statutory functions, objectives and duties).

3.63 In relation to the six factors[76] which ComReg identified in Consultation 15/131 as playing a part in public perception around mobile network quality, ComReg welcomes Eir Group's view that these are relevant factors for consideration. ComReg also observes that there may also be other factors contributing to this perception such as:

- the difference between outdoor and indoor signal level, noting that this can often vary substantially and that this may deteriorate indoors (compared to outdoors) depending on the technology (2G or 3G) and the network operator[77]; and

[73] See debates in Joint Oireachtas Committee on Transport and Communications

- Electronic Communications Services: Commission for Communications Regulation - 27 January 2016; and
- Mobile Telephone Coverage and High Speed Broadband Availability: Discussion – 12 November 2014 and 8 October 2014.

[74] For example, see ComReg's Consumer Line Statistics for Q3 2015 (Document 15/122), Q4 2015 (Document 16/08) and Q1 2016 (Document 16/38, and in particular paragraphs 15 and 16).

[75] http://www.merrionstreet.ie/MerrionStreet/en/ImageLibrary/Programme_for_Partnership_Government.pdf

[76] See paragraph 7.94 of Consultation 15/131

[77] See paragraph 90, ComReg Document 16/31, published 4 May 2016.

- the post-acquisition activities of Three to integrate the networks of Hutchison and Teléfonica[78].

3.64 During the lifetime of this strategy ComReg intends to conduct further research into these factors and the various ways of appropriately addressing this matter, such as the 5 areas discussed in paragraph 7.95 of Consultation 15/131.

3.65 Noting the above, ComReg considers that its work plan item remains appropriate, namely, to facilitate better understanding of the factors impacting on actual mobile consumer experience and take appropriate measures on foot of same.

3.3.7 The 410-414 MHz / 420-424 MHz band

Summary of Consultation 15/131

3.66 In relation to the 410-414 MHz/ 420-424 MHz band, ComReg stated that it:

> *"is of the view that it should take no specific action(s) following the expiry the WDMDS licence using 400 MHz radio spectrum in 2015 (i.e. the licence currently held by Wirefree Communications). In this regard ComReg notes that this spectrum band forms part of the BB-PPDR harmonisation spectrum considerations."*

Views of respondents

3.67 Five respondents (ESBN, Motorola, Sensus, Sigma Wireless and Smart Connect) provided views on this matter.

3.68 ESBN states that it is investing in trials of equipment in this band and that it is confident that such trials will meet its objectives. It believes that innovation, investment, a low carbon electrical network and efficient management of spectrum can be ensured by ComReg consulting upon and releasing the 410 MHz spectrum speedily.

3.69 Motorola submits that ComReg should launch a formal allocation process for this spectrum band which it suggests could potentially transition from the traditional analogue to more spectrally-efficient DMR and TETRA platforms, as well as for the growing identification of new non-broadband technologies in service of the expanding IoT/M2M segment. Motorola also states that:

[78] See for example 'Coverage is getting worse, not better,' says Coleman – 19 May 2016, http://www.southernstar.ie/news/roundup/articles/2016/05/19/4119711-coverage-is-getting-worse-not-better-says-coleman/

- *"the meeting Jan 13-14 of the WG FM PT49 on BB-PPDR spectrum issues, decided not to consider the band 410 – 430 MHz for BB-PPDR in contrast to the COMREG observation at the time of writing its plan."*; and
- *"We therefore take the view, that this further amplifies the significance of the said 2 x 4 MHz allocation (410 – 414 MHz paired with 420 – 424 MHz) as subject for hosting future non-broadband type of services along with our further observed services requirements expressed herein."*

3.70 Sensus believes that ComReg should reconsider its preliminary view to take no specific action in relation to the 400 MHz band and that this matter should be a matter of urgency because there are known commercial opportunities for same. In that regard, Sensus suggests that the available spectrum in the 400 MHz band be broken into smaller allocations based on 12.5 kHz pairs with an initial 1 MHz allocation immediately available to address what it refers to as current needs.

3.71 Sigma Wireless and Smart Connect request that a consultation process should be carried out for this spectrum to assess potential interest immediately given the excellent propagation characteristics of same.

ComReg's assessment and position

3.72 ComReg notes the interest in this band and the various suggestions that it could be commercially or operationally beneficial to release spectrum rights of use for this band.

3.73 At the same time, ComReg notes that there are other potential uses for this band that will require attention and consideration. For example, ComReg observes that while the draft ECC decision on the harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems (ECC/DEC/16(02))[79] currently excludes the 410-430 MHz bands, it also states that *"studies are currently continuing and where agreed in ECC this could lead to a subsequent revision to this Decision accordingly."*

3.74 Noting the above, ComReg considers it appropriate to add a work plan item for this band, namely that ComReg will commence a consultation process on the future use of the 410 – 430 MHz band during the lifetime of this strategy statement.

3.75 ComReg currently envisages that this consultation would be issued by mid-2017.

[79] http://www.cept.org/files/1051/Tools%20and%20Services/Public%20Consultations/2016/Draft%20new%20ECCDec(16)02.docx

3.4 Broadcasting service

Summary of Consultation 15/131

3.76 Section 6.2.3 of Consultation 15/131 set out ComReg's draft work plan proposals for broadcasting services. Among other things, ComReg proposed to:

- *"In collaboration with the BAI and 2rn, finalise an internationally coordinated spectrum plan for DTT services in the UHF band below 694 MHz;*
- *Commence a review of the licence conditions for some or all broadcasting licences; and*
- *Monitor developments in relation to the broadcasting licences in the UHF, LF, VHF Band II, and VHF band III which are due to expire in 2019, and take actions as appropriate."*

3.77 In addition, ComReg observed that:

- *"the spectrum plan for DTT services in the UHF band below 694 MHz is well advanced and the planning group (involving ComReg, BAI and 2rn) aims to finalise same by Q2 2016;* and
- *the broadcasting licences for DTT, LW, FM and DAB licences all expire in 2019 and a review of the spectrum management considerations and licence conditions significantly in advance of licence expiry is appropriate."*

Views of respondents

3.78 Two respondents (BAI and RTÉ & 2RN) submitted views on these proposals.

3.79 RTÉ & 2RN submit that ComReg should continue to take its guidance from DCENR policy in relation to public service broadcasting.

3.80 The BAI observes that ComReg may commence its consideration of licences related to RTÉ's radio and television digital multiplexes during the proposed strategy period and, further, that part of this may include the consideration of current spectrum fees. In that regard, the BAI submits that:

- a fee structure should also consider such matters as the important cultural relevance of Irish broadcasting, broader national policy objectives, as well as mandatory legal provisions particularly applicable to the availability of free-to-air Irish broadcasting services via digital terrestrial multiplexes;
- concerning DTT, the setting of fees should take into consideration the significance of the resources required to re-engineer Ireland's DTT spectrum plan to accommodate other uses. In relation to the co-ordinated simultaneous

migration of the DTT services across the border with Northern Ireland, the BAI recognises the synergies and importance of this to freeing up spectrum. Transition plans to facilitate such a migration will need further development over the proposed lifetime of this strategy statement. The BAI is of the view that such public policy dimensions and associated cost contributions be addressed in ComReg's consideration of spectrum fees; and

- a number of its sound broadcasting contracts are due for consideration by its Contracts Award Committee, both imminently and over the period to 2018. The BAI notes that any ComReg decision regarding spectrum fees relevant these services will need to be reflected in the BAI's contract award process and would welcome early clarification on this matter.

3.81 In relation to fees BAI further submits that:

- social and other benefits of spectrum need to be taken into account when considering fees;
- a one fit or numeric based approach is not appropriate. Broadcasting services, in particular, require a different consideration given their unique cultural relevance, the broader policy, legislative and regulatory environment in which they operate and the manner by which spectrum is planned and subsequently licensed;
- spectrum fees, if any, should consider the nature, scale and geographic reach of the service. This consideration is not just limited to the type of service (e.g. community or national) but to other factors including the transmission infrastructure required to serve the entire area; and
- it would welcome the opportunity to further engage with ComReg in relation to this work area. [80]

ComReg's assessment and position

3.82 Where matters relate to the broadcasting service in Ireland, ComReg confirms that it appropriately takes into account DCENR policy in relation to same, in the context of its statutory functions, objectives and duties.

[80] The BAI submits that the following could be considered:

(i)the spectrum planning, co-ordination and WT licensing process that is currently used for analogue broadcasting, and

(ii) fees including consideration of a review of SI 392 of 2003 - The Communications Regulation Act (2002) Section 30 Amendment - Levy Order. In its current form, it may act as a disincentive to providing coverage in low population areas and therefore may act against the wider public interest.

3.83 In respect of broadcasting licences due to expire in the 2016 to 2018 time period, ComReg confirms these will form part of its considerations and that it will consult as appropriate.

3.84 ComReg notes the BAI's comments in respect of sound broadcasting contracts that will fall for its consideration in the lifetime of this strategy statement. ComReg also notes the BAI's views with regard to the setting of radio spectrum fees and associated considerations. ComReg acknowledges and appreciates the work of representatives of BAI and 2RN in the re-engineering of the DTT spectrum plan for Ireland. However, ComReg must consider all relevant matters, including relevant legislation and its statutory obligations when it considers the setting of appropriate licence conditions (including fees).

3.85 ComReg will engage as appropriate with the BAI and RTÉ in respect of licence conditions (including fees) for broadcasting services.

3.5 Point-to-Point Radio Links

Summary of Consultation 15/131

3.86 In section 6.2.4 of Consultation 15/131, ComReg set out its draft work plan proposals for point-to-point radio link services including proposing to, among other things:

- consider the use of national block licensing in the 26 GHz band in advance of its 2018 licence expiry and if warranted establish further national block licensing in the 42 GHz band"[81];
- consider adding additional bands to the radio link licensing regime where new ECC Recommendations have been developed (e.g. 55.78 – 57 GHz and 57 – 64 GHz);
- consider adding a number of bands in the range 5 – 30 MHz for HF fixed links to the radio link licensing list of bands;
- review congestion issues associated with the licensing of fixed links to congested and if there are any other areas and frequency bands that have or are reasonably likely to become congested; and
- consider appropriate changes to radio links licensing aspects to address relevant spectrum management issues (e.g. congestion).

[81] In relation *to* timing, ComReg indicated that it *"envisages that further information would be provided on same in early 2017".*

Views of respondents

3.87 Three respondents (ESBN, Three and Vodafone) submitted views on ComReg's proposals.

3.88 In relation to 26 GHz national block licences, both Three and Vodafone note their respective considerable numbers of existing links in this band[82] and request that ComReg prioritise its 26 GHz national block licensing actions to facilitate continuity of services. In relation to the latter:

- Three and Vodafone request that ComReg provide clarity on the future of this band at least 2 years in advance of licence expiry (i.e. by June 2016);
- Vodafone states that starting a process of consultation in early 2017, followed by an auction process in this band would not allow adequate time to re-configure the network if spectrum in this band is not re-assigned to it; and
- Three submits that if ComReg cannot clarify its position before the end of June 2016 (2 years from expiry), then ComReg should automatically grant a two year extension to existing licensees.

3.89 In relation to ComReg's proposal to consider releasing additional spectrum bands for radio links, Vodafone believes that this will be required given Ireland's high usage of radio links. [83] It also submits that further block allocation would be the most efficient way of assigning additional spectrum. In addition to 26 GHz national block licences discussed above, Vodafone states that:

- it would welcome a block assignment process in the 42 GHz band; and
- future deployment of small cells will be a driver for the 60 GHz band.

3.90 In relation to ComReg's consideration of congestion on radio links, Vodafone notes that due to high usage it is now impractical in its view to plan new radio links in the lower frequency bands in the Dublin area. Vodafone and ESNB comment upon ComReg's work plan proposals as follows:

- Vodafone proposes the allocation and assignment of alternative frequency bands as the best solution to resolving congestion because congestion charges can only be a useful tool of managing these bands if other frequency bands are available; and

[82] Vodafone indicated that it has 1,000 links, and Three indicated that it has over [CONFIDENTIAL] links using this band.

[83] Vodafone observes that radio links are used more extensively in Ireland for a number of reasons: Ireland's low availability of fibre; the use of widely spread base-station sites to serve areas of low population; and the use of short term contracts for site occupation.

- ESBN believes that congestion charges should only apply to new radio link licence applications because it could otherwise penalise applicants that have no other option but to use these bands.

3.91 ESBN also submits that it would:

- encourage ComReg to continue to facilitate wider channels to increase data rates of existing fixed links, i.e. 56 MHz and 122 MHz channels; and
- welcome further details from ComReg on how it plans to update licence fees to today's prices.

ComReg's assessment and position

3.92 ComReg notes the importance of the 26 GHz band and expects that all work will be carried out in good time in order to, among other things, facilitate continuity of services.

3.93 In relation to Three's proposal that ComReg should provide a two year extension if it cannot clarify its position by June 2016 (i.e two years before licence expiry), ComReg recalls that regulation 6 of S.I. 762 of 2007[84] clearly provides that:

> *"A licence shall commence on the date of its grant and expire ten years thereafter".*

3.94 Regarding timing, ComReg considers that starting a consultation process by end-2016 should allow sufficient time to complete an assignment process in 2017, and that this would be sufficient to address any 26 GHz spectrum availability issues that may arise.

3.95 In relation to adding 42 GHz spectrum band to any block assignment licensing, ComReg currently considers that, given its propagation characteristics, this spectrum may not be sufficiently substitutable for 26 GHz spectrum and assigning rights of use in both bands in the same award process might, therefore, not be justified. Additionally, ComReg notes the inclusion of the 42GHz band may have an adverse impact on the timescales of the 26 GHz consultation process.

3.96 ComReg further observes that of the 18 lots of 26 GHz spectrum that were made available in the auction in 2008 only 12 remain licensed. An award process for the 26 GHz band could therefore increase the total amount of licensed 26 GHz spectrum by 50%. In ComReg's view, this may well satisfy short-term demand thus reducing any need for releasing 42 GHz spectrum band at the same time.

[84] Wireless Telegraphy (National Point-to-point and Point-to-Multipoint Block Licences) Regulations 2007

ComReg further notes that the take up of the individual point-to-point radio link licences in the 42 GHz band has been very limited to date.

3.97 In light of the above, it is ComReg intention to proceed with a 26 GHz consultation process and to determine at a future date how best to assign rights of use in the 42 GHz band.

3.98 In relation to its proposal to consider adding additional bands to the radio link licensing regime where ECC recommendations are available (e.g. 55.78 – 57 GHz and 57 – 64 GHz), ComReg is aware of the likely future need for releasing the 60 GHz spectrum band for small-cell deployment. ComReg's intention is to include this band in its radio link licensing regime during the period of this strategy statement as was proposed in Consultation 15/131.

3.99 ComReg recognises that an ideal way to resolve congestion is by allocating and then assigning additional frequency bands. At the same time, ComReg observes that, except for the frequency bands identified in the draft spectrum strategy statement, it has made available all the frequency bands that are allocated to the fixed services where there is an ECC Recommendation in place. ComReg further observes that, following a survey of the fixed link bands in 2013, it opened both the 31 GHz and 42 GHz frequency bands following expression of interest from operators and there has been very limited take up of these bands for fixed link use to-date.

3.100 In order to resolve existing congestion issues in the 13 GHz, 15 GHz, 18 GHz and 23 GHz bands in certain geographic locations, ComReg notes that it may be necessary to make appropriate adjustments to current congestion charging pricing noting that any such proposals would be appropriately consulted upon. In light of the priority that ComReg considers ought to be afforded to other work items identified in this document, however, ComReg does not envisage that this issue will likely be addressed during this strategy period, and its work plan is adjusted accordingly.

3.101 In relation to ESBN's request that ComReg make channels available with higher bandwidths, it should be noted that ComReg is already facilitating wider channel use (i.e. 56 MHz, 112 MHz in multiple bands)[85]. ComReg notes, however, that certain frequencies can be congested in different geographical areas and securing wider channels may be not be possible because of this. ComReg also notes that the 42 GHz band, which is not widely utilised, facilitates channel

[85] See ComReg Document 09/89R1, Guidelines to Applicants for Radio Links Licences, http://www.comreg.ie/_fileupload/publications/ComReg0989R1.pdf

bandwidths of 56 MHz and 112 MHz and could be used to meet operators' needs for higher channel bandwidths.

3.102 In relation to how ComReg might update licence fees to reflect current day prices, ComReg has yet to formulate its plans on this issue but notes that any proposals would be subject to appropriate consultation.

3.103 No comments were received on ComReg's proposal to add a number of bands in the 5 – 30 MHz range for HF fixed links. Subject to the completion of other work items identified in this document, ComReg envisages that it will undertake this activity during this strategy period.

3.6 Satellite

Summary of Consultation 15/131

3.104 In section 6.2.5 of Consultation 15/131, ComReg set out its draft work plan proposals for the satellite service. Among other things, ComReg proposed to:

> *"monitor developments in relation to MSS noting that the consideration of CGC issue is contingent upon successful satellite launch by operators and other matters including compliance with rollout and coverage obligations as determined by the EC award."*

Views of Respondents

3.105 One respondent (Inmarsat) provided a response relating specifically to Mobile Satellite Service with Complementary Ground Component ("MSS with CGC").

3.106 Inmarsat requests that ComReg urgently finalise the outstanding element of Ireland's MSS 2 GHz regulatory framework, namely the establishment of a regulatory framework for the authorisation of CGC (in the bands 1980 to 2010 MHz and 2170 to 2200 MHz). Inmarsat further requests that this be included and completed in ComReg's work programme for 2016.[86]

3.107 In support of this request Inmarsat:

- believes that the legal framework for MSS[87] provides the selected operators, Inmarsat and Echostar Mobile Ltd. ("Echostar") with a legitimate expectation that Member States will provide full authorisation for an integrated MSS/CGC network in time to finalise the CGC roll-out for simultaneous commercial

[86] Elsewhere in its submission, Inmarsat requests ComReg to provide it with a MSS 2 GHz CGC authorisation within the next 2 to 3 months.

[87] Decision 2009/449/EC, Decision 636/2008/EC and Decision 2007/98/EC

availability of both elements of the integrated MSS/CGC network. In particular, Inmarsat notes that Article 8 of Decision 626/2008/EC obliges Member States to grant authorisation necessary for the provision of CGC of mobile satellite systems subject to the common conditions in Article 8(3);

- believes that Consultation 15/131 incorrectly asserts that the completion of the MSS CGC regulatory framework is contingent upon successful satellite launch and roll-out and coverage obligations. In particular, Inmarsat:
    - observes that the common conditions in Article 8(3) of Decision 626/2008/EC do not require a successful satellite launch or the completion of roll-out and coverage obligations in advance of the award of a CGC authorisation; and
    - highlights that a new roadmap for the delivery of services to end-users was put in place by all European authorities in 2014. It urges ComReg to recognise that all regulatory milestones incumbent on Inmarsat have been met and that Inmarsat is on-course to provide services to end users in compliance with its pan-European authorisation conditions; and
- states that it plans to commence roll-out of the ground element of its hybrid MSS/CGC network in 2016 and that the award of a CGC authorisation would facilitate the building of Inmarsat's CGC network in parallel with satellite construction.

3.108 In addition, Inmarsat:

- comments upon its engagement with ComReg and, among other things, suggests that ComReg had previously given *"[R]epeated assurance"* that:
    - Inmarsat's European Aviation Network (EAN) complies with the EU regulatory framework for MSS 2 GHz; and
    - the 2015/2016 work programme would include finalisation of the CGC framework;
- provides specific recommendations on the implementation of a CGC framework, including that it:
    - be based on service-neutrality that can accommodate Inmarsat's EAN;
    - introduce a CGC fee regime that is proportionate and consistent with service provision; and
    - introduce a CGC fee structure consistent with the approach being negotiated with a number of Member States.

ComReg's assessment

3.109 By way of background, ComReg notes that, pursuant to EC Decision 2009/449/EC, both Inmarsat and (then) Solaris Mobile Limited ("Solaris") were awarded harmonised radio frequency spectrum rights on a pan-European basis, under EC Decision 2007/98/EC, in order '*to facilitate the development of a competitive internal market for mobile satellite services (MSS) across the Community and to ensure gradual coverage in all Member States'.*

3.110 The radio frequency spectrum authorised in each Member State, including Ireland, is as follows:

- Inmarsat: from 1980 to 1995 MHz for Earth to space communications and from 2170 to 2185 MHz for space to Earth communications; and
- Solaris: from 1995 to 2010 MHz for Earth to space communications and from 2185 to 2200 MHz for space to Earth communications.

3.111 ComReg further notes that Echostar acquired Solaris in 2014[88].

3.112 In response to Inmarsat's first point, ComReg observes that there have been a number of significant recent developments in relation to MSS with CGC which indicate that it is now appropriate to include a work plan item to conclude the consultation process[89] on establishing a regulatory framework for CGC in Ireland, including:

- the progress made by both Inmarsat and Echostar towards their respective satellite launches[90];
- Inmarsat's identified plans to commence a roll-out of a CGC network in 2016; and
- the progress being made within ETSI in relation to the standardisation of various CGC elements[91].

3.113 On timing, ComReg would expect the next document in this consultation process to be issued in 2016 and ComReg aims to finalise a CGC regulatory framework in Ireland in 2017. In addition, ComReg observes that, should Inmarsat wish to progress CGC aspects in advance of the finalisation of a CGC framework in Ireland, it could apply for a licence for the testing and/or non-

[88] http://www.echostar.com/NewsEvents/PressReleases/PressRelease.aspx?prid=1002

[89] This consultation process was initiated with ComReg Document 09/96 http://www.comreg.ie/_fileupload/publications/ComReg0996.pdf

[90] Information available to ComReg via the EU COCOM MSS WG

[91] ETSI Standard Draft EN 301-473 and 302-574 parts 1, 2 and 3

commercial trialling of services using terrestrial radio frequencies, including MSS with CGC.

3.114 ComReg notes Inmarsat's specific recommendations on a CGC framework, which will be taken into account in the specific MSS with CGC consultation process.

3.7 Short range devices (including IoT)

Summary of Consultation 15/131

3.115 In section 6.2.6 of Consultation 15/131, ComReg set out its draft work plan proposals for the short range devices (including IoT). Among other things, ComReg proposed to:

- *"designate and make available the use of the bands 870-876 / 915 - 921 MHz for SRDs (see ECC Report 189) shortly after the expiry of the WDMDS licence using 900 MHz radio spectrum in December 2015 (i.e. the licence currently held by Digiweb);"* and
- *"Monitor, contribute to and promote Ireland's spectrum management position in relation to IoT."*

Views of respondents

3.116 Two respondents (Silver Springs and ESBN) provided responses in relation to ComReg's proposal.

3.117 Both ESBN and Silver Springs welcomed the proposal to designate and make available the 870 - 876 MHz and 915 - 921 MHz bands according to the conditions of CEPT Rec 70-03 shortly after the expiry of the WDMDS licence using 900 MHz radio spectrum in December 2015. In that regard, Silver Springs submits that exploiting radio sharing opportunities by SRD usage is an important way to maximise the benefit of radio spectrum use and an excellent way to allow a multitude of applications and service providers to operate.

3.118 Both respondents also believe that ComReg should allow the unlicensed use of Network Relay Points (NRPs) in these bands.

3.119 Three respondents (BT, Silver Springs and Three) provided comments in relation to the Internet of Things, which are considered by ComReg in section 2.3.5 above.

ComReg's assessment and position

3.120 First, ComReg notes that it updated its SRD document (02/71R10[92]) in May 2016 and will continue to do so, keeping up-to-date with ECC Recommendation 70-03.

3.121 ComReg is pleased to have now introduced the 870 – 876 MHz and 915 – 921 MHz bands for licence exempt use for SRDs, noting that utilising harmonised radio spectrum measures is an ideal approach for releasing spectrum rights of use.

3.122 ComReg will consider allowing the licence-exempted operation of NRPs and notes, in this regard, the approach which Ofcom has taken regarding the use of these devices. ComReg will also consider other Member States' approaches before implementing an appropriate authorisation system.

3.123 ComReg also clearly recognises the value of sub-1GHz frequencies, given their favourable propagation properties, including in the context of various prospective uses such as smart metering.

3.124 ComReg acknowledges that licence-exempt SRD operations represent a useful means by which to maximise spectrum benefit and will continue to keep abreast of the various technologies that can use licence-exempt spectrum (for example, LoRa, Sigfox, WiSun and other mesh network systems such as those used for smart metering).

3.8 Business radio services (including PPDR and PMSE)

Summary of Consultation 15/131

3.125 In section 6.2.8 of Consultation 15/131, ComReg set out its draft work plan proposals for the business radio services (including Public Protection and Disaster Relief (PPDR) and Programme Making and Special Events (PMSE)).

Views of respondents

3.126 Two respondents (ESBN and Sigma Wireless) submitted views on these proposals.

3.127 Sigma Wireless welcomes and looks forward to ComReg consulting on the business radio licensing regime to permit the use of national channels on a technology- and service-neutral basis. It also requests that ComReg consult on the Mobile Radio System Licence (Trunked Radio) licencing scheme. In that

[92] Document 02/71R10 http://www.comreg.ie/_fileupload/publications/ComReg0271_R10.pdf

regard, and noting the emergence of digital mobile radio (DMR) over the last number of years, Sigma Wireless states that it would like to see a situation where all DMR technologies (specifically Tier II and Tier III trunking) can be deployed across the 410 – 470 MHz bands and not be limited to specific technologies per frequency band (i.e. 385.0000 to 389.9875 MHz (Mobile transmit) paired with 395.0000 to 399.9875 MHz (Base transmit) for Digital Mobile Radio (Trunked) systems).

3.128 Sigma Wireless further considers that it would be technically feasible to deploy DRM technologies across the 410 – 470 MHz band and that this has been the case in in other jurisdictions across Europe.

3.129 ESBN notes that currently there is only the technology-specific TETRA 385 – 400MHz band available for PMR digital trunking and suggests that spectrum be made available in the 450 MHz range specifically for same.

ComReg's assessment and position

3.130 ComReg notes that it currently offers a specific range of frequencies for digital PMR trunking (which are identified in the Mobile Radio System Licence (Trunked Radio) licensing document (ComReg 07/57)).

3.131 ComReg is open to the suggestion that Tier II and Tier III trunking be permitted to be deployed across the 410 – 470 MHz frequency band. The limiting of specific technologies per frequency band i.e. 385.0000 MHz to 389.9875 MHz (Mobile transmit) paired with 395.0000 to 399.9875 MHz (Base transmit) for Digital Mobile Radio (Trunked) systems was first deployed as a measure to prevent the possibility of interference to existing services. However, prior to making any changes to the current licensing regime ComReg would first need to be satisfied that such a step would not increase the possibility of interference to existing services. As such, and subject to the availability of resources, ComReg is minded to carry out investigations on the possibility of deploying Tier II and Tier III DMR technologies across the 410 – 470 MHz frequency band, where the outcome of such studies could form a basis for any proposed changes to the existing Mobile Radio System licensing regime.

3.9 Radio amateur services

Summary of Consultation 15/131

3.132 In section 6.2.9 of Consultation 15/131, ComReg set out its draft work plan proposals for the radio amateur service. In particular, ComReg proposed to:

- consider a possible new allocation to the amateur service on a secondary basis in the band 5 351.5 - 5 366.5 kHz in line with the outcome of agenda item 1.4 of WRC-15; and
- consider additional spectrum allocations to the amateur services in the bands 30-49 MHz and 52-70.5 MHz to facilitate propagation beacons, digital amateur television repeaters and to align current allocations with those in the European Common Allocation.

Views of respondents

3.133 One respondent (IRTS) submitted views on ComReg's work plan proposals.

3.134 ComReg notes that Table 1 of the IRTS submission (at page 10) sets out current and future spectrum allocations sought by it and those identified as a high priority are noted below. In that regard, the IRTS:

- is pleased that active consideration will be given by ComReg to the release of the 5351.5-5366.5 kHz band as awarded at WRC-15;
- is grateful that the range 30-70.5 MHz already appears in the draft radio spectrum work plan for 2016 to 2018.
- remains of the view, which it expressed in 2011, that it like to see the band 50-52 MHz upgraded to national primary status;
- notes the decline of the business radio sector and the removal of low band VHF channels from third party business radio licensing. From this, the IRTS requests an extension to the lower limit of the 70 MHz band to 69.9 or 70 MHz with an upper limit of 70.5 MHz; and
- seeks the introduction of a novice licence given a stated decline in its membership and claims that a novice licence category has been introduced in other CEPT countries and that standards for such a licence are defined.

ComReg's assessment and position

3.135 ComReg firstly notes that a number of the bands identified by the IRTS do not align with existing allocations in ITU Region 1 and/or the European Common Allocations table. Accordingly, ComReg does not consider it appropriate to make a unilateral allocation to the Radio Amateur service in Ireland in the bands identified as 1, 2, 3, 5, 6 and 14, 15 in Table 1 of the IRTS submission.

3.136 Furthermore, ComReg notes that it already permits the use of spot frequencies in the 5250 - 5351.5 kHz band and that, to-date, there has only been a limited number of requests to use these frequencies. ComReg accordingly does not

consider there to be persuasive reasons to justify the release of further spot frequencies.

3.137 With regard to the 10100-10200 kHz band, ComReg notes that the suggested extension would not align with the European Common Allocations table and, as such, does not consider it appropriate to grant this request. Furthermore, ComReg recalls that a power increase in this band has been in place since January 2013 (see ComReg Document 09/45R1).

3.138 Noting that the harmonisation of the 52 – 54 MHz band with Region 2 is to be addressed as Agenda Item 1.1 of WRC-19, ComReg also does not consider it appropriate to make any decision on the future of this band prior to the outcome of WRC–19.

3.139 In relation to the present request by the IRTS to access the guard band 3400-3410 MHz (and its response to Document 14/101 on same issue), ComReg's position as stated in Document 15/70 is unchanged at this time.

3.140 With regard to the IRTS request to introduce a novice licence, ComReg recalls that a major overhaul of the Radio Amateur Examination syllabus was conducted in 2011. This overhaul followed on from the changes introduced in 2005 when the examination paper was changed to a multiple choice format. ComReg also observes that the current syllabus and exam structure is the minimum required to ensure that licensees have an adequate knowledge of:

- the rules pertaining to the use of the amateur radio spectrum;
- the procedures that must be followed; and
- basic technical knowledge to prevent interference to both amateur and other service in the spectrum utilised by the radio amateur service.

3.141 In light of the above, ComReg is not in a position to licence persons who cannot meet these minimum requirements.

3.142 In addition, ComReg notes that radio amateur services are currently allocated the 50 - 52 MHz band on a secondary basis in the European Common Frequency Allocations Table and, further, does not consider it appropriate to unilaterally change it to a primary allocation.

3.143 In light of the above, ComReg's work plan for radio amateur services is to make available the following bands:

- the 5351.5-5366.5 kHz band in line with the outcome of WRC-15;

- the 30 - 49 MHz and the 54 - 69.9 MHz and 69.9 – 70.125 MHz bands to facilitate propagation beacons, digital amateur television repeaters and to align current allocations with those in the European Common Allocation Table; and
- the 70.45 – 70.50 MHz band to align it with the European Common Allocation Table.

3.144 ComReg expects that these changes will come into effect during the lifetime of this strategy statement and will be reflected in an update to the radio amateur guidelines (Document 09/45R1) which ComReg expects to publish circa Q4/2016.

Chapter 4

4 Topical spectrum management issues

4.1 In chapter 7 of Consultation 15/131, ComReg outlined its current thinking on a number of topical spectrum management issues. Views received from interested parties on these issues are discussed below.

4.1 The use of auctions for awarding spectrum rights of use for ECS

Summary of Consultation 15/131

4.2 Section 7.1 of Consultation 15/131 discussed the use of auctions for awarding spectrum rights of use for ECS and set out ComReg's current thinking on same.

Views of respondents

4.3 Three respondents (BT, Three and Vodafone) provided comments on this matter.

4.4 Vodafone supports the use of auctions for assigning spectrum and notes that:

- open, simultaneous, multi-round auctions (whether SMRA or CCA) are the most efficient way to assign new spectrum;
- the use of a well-defined and relative standard auction is clearly the way to assign future spectrum;
- a separate assignment round was an effective process; and
- auction objectives should include the efficient use of spectrum and increasing access to mobile broadband services.

4.5 Vodafone also expressed concerns relating to use of auctions for awarding spectrum rights of use and, in particular, that:

- it supports the views of the GSM Association ('GSMA')[93] in relation to auction measures to promote new entrants/facilitate market entry and that sealed bid auctions are inefficient, can distort competition and are therefore inappropriate; and

[93] Submitted in response to the RSPG's consultation on its draft report on Efficient Awards and the Efficient Use of Spectrum . http://rspg-spectrum.eu/public-consultations/

- spectrum set-asides for possible new entrants may be discriminatory and inefficient.

4.6 Three submits that auctions can work well as an award mechanism and agrees with ComReg's view that it is not always the best method, and a case by case approach is appropriate for each award process. It notes, however, that ComReg needs to allow significant time to complete the various activities in preparation for an auction and that the process must begin early enough to allow re-licensing of spectrum before existing licences expire.

4.7 BT supports the use of auctions for awarding licences in bands where demand is expected to exceed supply because they are usually the best way to objectively identify the licence holder(s) who will make best use of the spectrum. BT also agrees that the best choice of auction design will depend on the individual circumstances. However, it is of the view that a combinational clock auction ('CCA') format can lead to excessive uncertainty (particularly in the supplementary bids round) and a lack of transparency.

ComReg's assessment and position

4.8 In relation to the role of auctions in promoting competition and new entry in particular ComReg observes that there are a number of potential mechanisms available by which to achieve such objectives including:

- spectrum competition caps (discussed in Section 4.5);
- spectrum reservations;
- asymmetric coverage obligations; and
- simultaneous/sequential award of spectrum.

4.9 ComReg further observes that the extent to which any of the above or any other measures are appropriate for a particular spectrum award in the context of ComReg's statutory functions, objectives and duties will, of course, depend on the particular facts and circumstances arising.[94] That being said, ComReg will continue to consider and take appropriate measures to promote competition, including new entry, where appropriate.

4.10 Similarly, ComReg considers that the appropriate award mechanism for a particular spectrum award will depend on the specifics of the award under consideration.

[94] ComReg recalls that in the MBSA process it considered the simultaneous award of multiple bands and asymmetric rollout timing obligations for coverage as appropriate measures to encourage new entry.

4.11 In relation to the GSMA's view on sealed-bid auctions as referenced by Vodafone, ComReg:

- observes that in its final report the RSPG does not conclude that such auctions are necessarily inefficient and instead correctly highlights that sealed-bid formats do not, by their nature, allow for price discovery and, further, may expose bidders to common value uncertainty in some circumstances[95];
- also recognises that a sealed-bid format may not be appropriate in certain circumstances (e.g where there is significant common value uncertainty);
- observes, at the same time, that such problems are not germane to all sealed-bid auctions. For example, second-price auctions of various forms may allow for strategically simple decisions by bidders and in some cases common value uncertainty may be a lesser concern[96];
- believes that sealed bid auctions should form part of the auction design "toolkit"; and
- expects that the use of sealed-bid formats for the assignment of spectrum will continue to be appropriate in certain circumstances.

4.12 In relation to BT's view that a CCA format lacks sufficient transparency and can lead to excessive uncertainty particularly in the supplementary bids round, ComReg is unclear as to the precise nature of BT's concerns. Notwithstanding, ComReg would make the following general observations:

- in a CCA, transparency is limited concerning other bidders' individual bidding behaviour during the primary bid rounds as a CCA typically only reveals information about *aggregate* demand. The latter provides for price discovery by allowing bidders to observe the level of *market* demand at different prices giving bidders information about realistic alternative packages. This may also assist bidders with budget constraints by providing relevant information about which packages they might have a realistic prospect of winning. Increasing transparency beyond the level provided for in the CCA used in the MBSA, for example, can increase the risk of gaming which could compromise an award, result in an inefficient assignment of spectrum, and could increase the risk of disputes about the outcome (in turn leading to potential delays to spectrum availability and the corresponding operator/consumer benefits);

[95] Document RSPG16-004 FINAL - RSPG Report on Efficient Awards and Efficient Use of Spectrum.

[96] ComReg recalls, for example, in the context of determining the appropriate award format for the unsold 1800 MHz lots, its view that common value uncertainty was likely to be limited due, among other things, to the relatively limited bandwidth available and the short duration of the licences.

- in relation to a supplementary bids round, the reason for such a mechanism is that bidders may not have bid for all the packages for which they have a valuation up to the end of the primary bids round. In addition, where a bidder has reduced its demand between rounds, the bid increments are such that it may not have been able to bid the entirety of its valuation across all packages. In such cases, a supplementary bids round gives such bidders a final opportunity to raise bids and express their full valuation across a range of packages. Information from the open stage can be used by a bidder to assess its chances of winning different packages, so that the bidder can focus its attention on supplementary bids for a reasonable number of packages; and
- in relation to BTs views on uncertainty in the supplementary bids round, a final price cap can help mitigate the uncertainty about the package a bidder may be able to secure at the conclusion of an award. Therefore, it is not clear whether BTs concerns are specific to any particular ComReg award or whether it is referring to awards conducted in other jurisdictions where a final cap rule may not have applied.

4.2 Spectrum trading/transfers

Summary of Consultation 15/131

4.13 Section 7.2 of Consultation 15/131 discussed spectrum trading/transfer and set out ComReg's current thinking on this matter.

Views of respondents

4.14 As noted in section 3.3.5, the introduction of a spectrum leasing framework was supported by three respondents (BT, Three and Vodafone). In addition, Vodafone submits that in countries where spectrum trading has been allowed, it is not generally used probably because there is constantly a spectrum shortage, and uncertain future supply.

ComReg's assessment and position

4.15 ComReg notes respondents' support for spectrum trading and concurs that spectrum trading does not occur often in practice. ComReg's view on spectrum leasing is outlined in section 3.3.5 above.

4.16 Having had regard to respondents' views, ComReg considers that its current thinking on this matter (as set out in paragraphs 7.22, 7.23 and 7.24 of Consultation 15/131) remains appropriate.

4.3 Appropriate duration for spectrum rights for ECS and

timing of assignment processes

Summary of Consultation 15/131

4.17 Section 7.3 of Consultation 15/131 discussed and set out ComReg's current thinking on the appropriate duration for spectrum rights for ECS and the timing of assignment processes.

Views of respondents

4.18 Three respondents (BT, Three and Vodafone) provided comments on this matter, being in summary:

i. BT's view that a licence should be (at the minimum) of sufficient duration to allow the necessary investment to be recovered on an economic basis and this should also recognise that there may be a delay between the issuing of the licence and the availability of suitable equipment for the band;

ii. BT's view that there are advantages (in some circumstances) to indefinite licences, particularly in a fully liberalised market where spectrum trading provides an incentive to maximise return on spectrum which is not being used in an economically efficient manner;

iii. Vodafone's submission that the RSPG is of the view that licence terms should be lengthened and consideration given to creating perpetual licences (as already exist in the UK) in order to promote ongoing investment and upgrades in mobile broadband networks and its support of same;

iv. Three's belief that the award of licences with a fixed duration is sub-optimal both for the licensees and for the State. In summary, the submissions provided by Three in support of its view include the following:

a) a growing disincentive for operators to maintain investment towards the latter stages of a licence, unless they have certainty regarding licence renewal;

b) this investment disincentive would not be mitigated by the threat of new entry, in practice, because new entrants do not have access to the relevant spectrum during this period of investment disincentive;

c) in practice, ComReg has been unable to deliver processes that re-licence spectrum sufficiently in advance of expiry (with reference to the expiry of GSM 900 licences in 2011 and 2.6GHz licences which expired in April this year, and noting that 26GHz link licences will expire within 2.5 years);

d) the alternative approach of "rolling licences"[97] as a means to alleviate the claimed investment disincentive, including Three's view that:

- *"rolling licences with a minimum [sic] would maximise valuations at auctions";* and
- rolling licences have been found to work in the UK and other countries and that ComReg should now commission an independent review of their effectiveness.

ComReg's assessment and position

4.19 ComReg recalls that it addressed this matter extensively in its response to consultation on the 2011-2013 radio spectrum management strategy (see, in particular, ComReg Document 11/88) and more recently in Consultation 15/131. ComReg does not propose to repeat the analysis in those documents and refers interested parties to same. Instead, ComReg sets out below its consideration of the responses received to this issue, including by reference to previous ComReg analysis as appropriate.

4.20 In relation to **point (i),** ComReg notes that the timing of equipment availability can be a relevant consideration and, further, observes that it has appropriately taken such matters into account in the development of its spectrum award proposals. See, for example, ComReg Document 15/74 - being a report by Plum Consulting commissioned by ComReg to inform its 3.6 GHz band award proposals.[98] See also ComReg Documents 10/71 and 10/105 regarding its proposal to include the 1800 MHz band in its multi-band spectrum award following developments in LTE equipment availability in this band.

4.21 In relation to **point (ii)**, ComReg is, of course, aware of the claimed benefits to incumbent spectrum rights holders of indefinite/perpetual durations of rights of use. ComReg reminds interested parties, however, that it is required to consider and evaluate such potential measures in the context of all its relevant statutory functions, objectives and duties (see further below).

[97] According to Three:

- these would have an initial minimum term, following which they would automatically be eligible for renewal on an on-going basis; and
- ComReg would be able to terminate the licences for spectrum management reasons by serving reasonable notice to the licensee.

[98] http://www.comreg.ie/_fileupload/publications/ComReg1574.pdf

4.22 In relation to **point (iii)**, ComReg observes that the RSPG, in its final report on Efficient Awards and Efficient Use of Spectrum (RSP16-004 FINAL)[99] does not, in fact, express the views claimed by Vodafone.[100]

4.23 In relation to Three's claims of reduced investment incentives for operators during the latter stages of a right of use with finite duration, ComReg firstly notes that it carefully considered such claims in Document 11/88 and found them to be overstated and to not accord with the likely economic incentives of incumbent operators.[101] In relation to Three's view about the threat of new entry, ComReg

---

[99] http://rspg-spectrum.eu/2016/03/39th-rspg-meeting-24-february-2016/

[100] In section 6.1 (entitled "Licence Duration") of its report the RSPG states:

> *"Licence duration is important in that it provides licensees with the certainty that they require in order to have confidence to invest in the development and deployment of their network, and needs to be carefully assessed when defining the licence duration. Several respondents to the consultation agreed that licenses need to be of sufficient duration to promote long term investment. In most Member States licences are awarded for a specific duration, usually around 15-20 years. While in some Member States this is a policy decision, in others, there are statutory requirements that limit the duration of usage.*
>
> *In a few cases, the licence duration is not specified and a revocation notice may be issued after a set period of time. For example, in the UK, Ofcom generally grants indefinite licences with a minimum period of notice for revocation (such as five years) for spectrum management reasons. In order to give the licensee certainty following the award that they will have at least a minimum period to recover their investment, Ofcom will offer assurances during the award that no such revocation notice will be issued for a certain period (e.g. not in the first 15 years).*
>
> *The nature of investment in mobile networks has evolved and changed over time as a result of the different characteristics of 2G, 3G and 4G networks. The RSPG considers it essential that licences are of sufficient duration, taking into account national circumstances, to provide legal certainty and the promotion of investment. Equally, however, care must be taken to ensure that spectrum is not sterilised; for example if the use for which the band has been harmonised does not materialise as expected, or changes over time or as a result of technical innovation or changes in consumer demand (such as 1900-1920MHz where rights have been granted 15 years ago)."* (emphasis added).

[101] Specifically, ComReg observed that:

- reducing investment may actually encourage outside firms to enter on the basis that the incumbent firms appear to believe that their substantial advantages of incumbency are not sufficient to allow them to outbid their likely competitors in an auction;
- moreover, incumbent firms are competing with each other on the retail market and any loss in network quality (arising from non-investment) could translate to worse outcomes on the retail market. Hence, they will be strongly motivated to maintain their network quality or risk losing valuable customers (and customer groups that value network quality highly);
- these factors may explain the considerable network investment by incumbent 900 MHz licensees in recent times. Indeed, and notwithstanding claims that such investment was made on the assumption that licences would be renewed or otherwise extended to prevent widespread disruption to consumers, ComReg notes NERA"s view that empirical evidence for decreasing investment in mobile networks as licence expiry approaches is ambiguous;
- with indefinite licences there would not be the same incentive to fear new entry and hence investment rates would likely fall, once a stable market equilibrium emerges; and

observes that it was referring primarily to the threat of potential entry by way of acquiring the relevant expiring spectrum rights of use that would be made available by ComReg through a competitive award of said rights. That is, the potential threat of new entry by way of participation in such an award may be a significant incentive for incumbent operators to not reduce investment in the lead up to same award (in addition to competition between incumbent firms in same period). ComReg additionally notes that its view on the important link between competition and investment accords with European Commissioner Vestager's comments on the same issue.[102]

4.24 In addition, ComReg observes that spectrum rights of finite duration (and a competitive process for the assignment of these expiring rights) are particularly beneficial in the context of the achievement of its other statutory objectives, including the promotion of competition [103], ensuring the efficient use of spectrum[104], and contributing to the development of the internal market.

- in relation to the view regarding the potential for spectrum to lie idle, ComReg notes that this can be addressed by considering, and where appropriate, consulting on decisions in relation to the future use of spectrum bands with fixed term licences significantly in advance of expiry of same.

[102] See Commissioner Vestager's speech of 2 October 2015 entitled "Competition in telecom markets" given at the 42nd Annual Conference on International Antitrust Law and Policy Fordham University: https://ec.europa.eu/commission/2014-2019/vestager/announcements/competition-telecom-markets_en where she stated, among other things:

> *"In competitive markets, companies have strong incentives to invest and innovate to offer superior products and win business from their competitors.*
>
> *Why should a company invest and innovate if there is no competitor to provide the impetus? I can still remember the days of national telecom monopolies in the EU: high prices, low service quality and less innovative products.*
>
> *…*
>
> *And we should not forget that consumers ultimately do not benefit from investment as such. It is the impact of investment on parameters of competition such as quality and price that leads to consumer benefit."*

[103] ComReg observes that a competitive re-assignment process for expiring rights of use furthers ComReg's objective to promote competition (in this case for both the acquisition of these rights and for downstream competition) by, firstly, providing opportunities for new entry and, secondly, the opportunity for incumbents to compete to acquire a different spectrum portfolio which may better suit their respective particular needs at that time. In that regard, ComReg notes that one could usefully explore the proposed implementation of the GSM Amendment Directive in the context of the 900 MHz band in the UK and note, amongst other things:

- that Thee in the UK, which did not have any 900 MHz spectrum rights, argued that the spectrum rights associated with the indefinite 900 MHz licences of Vodafone and O2 should be released via a full-band auction; and
- the various claims and arguments made by Vodafone and O2 against such a proposal.

[104] Such as by enabling:

- the assignment of these spectrum rights to persons who would *now* value them the most; and

4.25 In relation to **point (iv)(c),** ComReg observes that there can be very good reasons why a re-assignment process should take place later than the expiry of rights of use in a particular band. For example, in relation to the 900 MHz band example cited by Three, ComReg recalls, among other things, the subsequent developments in relation to the 800 MHz and 1800 MHz bands, and the benefits of awarding substitutable/complementary spectrum bands together, which supported the inclusion of these bands in its 900 MHz band award proposals. ComReg also recalls that its proposal to award these 3 bands together found considerable support from interested parties at the time. In addition, ComReg recalls that its approach of prioritising the award of rights in the 3.6 GHz band reflected, among other things, the views of interested parties received in response to Consultation 14/101. In relation to the 2.6 GHz band, ComReg also recalls the views of interested parties for the joint award of the 2.6 GHz band with some of the other bands discussed in Consultation 14/101 (e.g 700 MHz and 2.3 GHz). In relation to the 26 GHz band, ComReg refers to section 3.5 of this document.

4.26 In relation to Three's submissions regarding "rolling licences"**,** ComReg:

- recognises that "rolling licences" of the kind proposed by Three (or variants thereof) represent a potential means by which to address the issue of the appropriate duration of spectrum rights of use;
- remains of the view that the primary rationale put forward for this approach (i.e claimed reduced investment incentives) is not particularly persuasive. Indeed, ComReg recalls that a report from Three's consultant, Nera, which was submitted by Three as part of its response to Document 11/60 in the MBSA consultation process [105], recognises that empirical evidence for decreasing investment in mobile networks as licence expiry approaches is ambiguous;
- observes that proponents of this approach also do not address the issues of regulatory uncertainty, delays and potential litigation that may well be associated with a spectrum manager seeking to recover spectrum rights under this approach [106], nor the non-trivial issue of how to ensure that

- providing for an opportunity to recalibrate the conditions which may be attached to these spectrum rights (e.g spectrum fees, coverage, quality of service etc) to better reflect current market realities.

[105] See page 188 of Document 11/102, http://www.comreg.ie/_fileupload/publications/ComReg11102.pdf

[106] ComReg again recalls that in 2009, the UK spectrum regulator, Ofcom, issued a consultation titled the "Application of spectrum liberalisation and trading to the mobile sector – A further consultation" (See http://stakeholders.ofcom.org.uk/binaries/consultations/spectrumlib/summary/spectrumlib.pdf).

In this document, it was proposed that the current holders of the 900 MHz spectrum in the UK (Vodafone and O2) would each surrender a proportion of their respective 900 MHz spectrum holdings

spectrum fees attached to such licences remain at a level which ensures the optimal use of such spectrum rights;

- observes, in the context of its duty to have regard to international developments in ECS and the radio frequency spectrum and its objective of the development of consistent regulatory practice and the consistent application of Community law in this field, that the overwhelming majority of Member States award licences of a specific duration and usually around 15-20 years[107]. ComReg further observes that these Member States are likely to be aware of the approach adopted in the UK and the relative advantages and disadvantages of same;
- in this regard, recalls that spectrum rights of finite duration (and a competitive process for the assignment of these expiring rights) are particularly beneficial in the context of the achievement of ComReg's other statutory objectives (including as previously discussed); and
- reminds interested parties that, in relation to Three's reference to *"maximis[ing] valuations at auctions"*, regulation 19 of the Authorisation Regulations permits ComReg to impose spectrum fees for rights of use for ECS which reflect the need to ensure the optimal use of the radio frequency spectrum, where 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.

4.27 In light of the above, ComReg does not see merit in a review of the kind suggested by Three. That being said, ComReg will, of course, continue to have regard to relevant international developments in ECS and the radio frequency spectrum and take all reasonable measures which are aimed at contributing to the development of the internal market including contributing to the development of consistent regulatory practice and the consistent application of Community law in this field.

(2 x 2.5MHz out of a current total of 2 x 17.4MHz for each operator) to allow a third operator to have access to this particularly important spectrum.

Considerable comment and debate was received on this proposal. One operator, O2, took a case to the Competition Appeals Tribunal and, ultimately, the Secretary of State of the UK government issued a direction to Ofcom in relation to a number of matters relating to mobile spectrum. (See http://www.legislation.gov.uk/uksi/2010/3024/introduction/made)

Following this direction, in January 2011 Ofcom released a Regulatory Statement varying the licences in the 900 MHz and 1800 MHz bands to permit the use of these bands on a liberalised basis. Notably, no spectrum rights in the 900 MHz band were surrendered by Vodafone or O2 in this process.

[107] RPSG Final Report on Efficient Awards and Efficient Use of Spectrum. ComReg further observes that such durations are broadly similar to those adopted by ComReg (such as in its MBSA process) and those currently proposed (e.g Document 15/140).

4.4 The sharing of spectrum and collaboration between wireless operators

Summary of Consultation 15/131

4.28 Section 7.4 of Consultation 15/131 discussed the sharing of spectrum and collaboration between wireless operators and set out ComReg's current thinking on same.

Views of respondents

4.29 Four respondents, (BT, ESBN, Silver Spring and Vodafone) provided comments related to this matter.

4.30 Three respondents (BT, ESBN and Silver Spring) support the sharing of spectrum noting that it can increase the use of spectrum. Additional specific comments as summarised below:

- BT believes that the sharing of spectrum should not compromise the incumbent use and that Licensed Shared Access ('LSA'), as well as advances in technology, such as geolocation databases, are promising approaches;
- ESBN queries how a third party could access and utilise spectrum licensed to another party but not currently used in a given location. For instance, whether a licence would be required, how a licence could be requested, whether there would be spectrum fees, and how long could this spectrum be used for; and
- Silver Spring believes that spectrum for SRDs is an excellent way to allow a multitude of applications and service providers to have access spectrum as necessary in geographic locations around the country.

4.31 Two respondents (BT and Vodafone) commented on collaboration between wireless operators as follows:

- BT submits that collaboration between network operators to share elements of their network infrastructure provides a means to reduce costs, which can be passed onto customers, whilst maintaining a competitive marketplace; and
- Vodafone submits that operators will continue to explore different models of site and network/equipment sharing as a means of reducing costs, increasing the speed of rollout and improving services. Vodafone also submits that any agreements between operators on this sharing should be voluntary and not need regulatory intervention.

ComReg's assessment and position

4.32 ComReg agrees that in general terms the sharing of spectrum can improve the efficient use of spectrum subject to, among other things, the normal spectrum management and competition considerations.

4.33 In relation to the specific comments on spectrum sharing raised by BT and Silver Spring, ComReg:

- observes that a consideration of the incumbent use would form part of the technical in-band or adjacent-band compatibility assessments between services when considering the possibility of spectrum sharing. Further, such assessments could be carried out at a European level, via the work of CEPT or ETSI, and/or at a national level by ComReg[108];
- agrees that LSA and the use of geographic databases could provide further opportunities for spectrum sharing in the future, but notes that these advancements are relatively immature in terms of their development; and
- agrees that the framework for agreeing SRDs within Europe is a good example of the successful sharing of spectrum between difference services.

4.34 In relation to ESBN's queries on how a third party could access and utilise spectrum licensed to another party but not currently used in a given location, ComReg would firstly encourage such parties to explore all available market mechanisms including spectrum transfers and spectrum leasing. Where such mechanisms prove unsuccessful, a third party could request action from the appropriate regulatory and/or standardisation body in line with its remit. For example:

- for new services that could be made available at a regional level (e.g. new SRDs), the third party could make a request to the relevant working group of CEPT for technical compatibility studies to be carried out;
- where an existing licensee has a third-party access obligation it may be appropriate for the third party to request action from ComReg (e.g. the relevant 3G licence of Three which contains an MVNO access obligation[109]); and

[108] For example, a consideration of the existing uses of the 3.6 GHz band has been carried out in the 3.6 GHz band award process. See for example ComReg Document 15/73 on co-existence recommendations from Plum Consulting Ltd.

[109] See Schedule 5, Part 7 of http://www.comreg.ie/_fileupload/M3G1006.pdf

- a third party seeking access for a wireless test or trial of a limited duration could request ComReg to use its good offices with the existing licensee to facilitate such a request.

4.35 In relation to collaboration between wireless operators, ComReg notes Vodafone's view that wireless operators will continue to explore different models of site and network/equipment sharing for a variety of reasons such as reducing costs, increasing the speed of rollout, improving services etc. ComReg also notes Vodafone's suggestion that any collaboration agreements between operators should be voluntary and not need regulatory intervention. For its part, ComReg observes that the nature and extent of any potential regulatory issues will, of course, depend on the specifics of any proposed collaboration. Further, ComReg recalls its previous views, including that:

- it cannot have a firm view on spectrum rights sharing (or pooling) and network sharing other than that it would look more favourably on agreements that would not unduly restrict competition and would deliver demonstrable benefits that are shared with end-users; and
- interested parties should be in a position to identify for themselves the types of potential issues and concerns (e.g. competition) that could be raised by a proposed collaboration agreement.

4.5 Competition Caps on Spectrum

Summary of Consultation 15/131

4.36 Section 7.5 of Consultation 15/131 discussed competition caps and set out ComReg's current thinking on this matter.

Views of respondents

4.37 Two respondents (Three and Vodafone) submitted comments on competition caps.

4.38 Vodafone cites the GSMA's views and supports the application of reasonable caps, as long as they do not restrict operators from making reasonable trade-offs in the amount and mix of spectrum they require to operate efficient networks. In addition, future auctions, in Vodafone's view, should take account of total spectrum assigned to operators and also have regard to the technical capability of different bands in which such spectrum rights of use are held. Vodafone also submits that the extent to which bands are directly substitutable is an important consideration of caps.

4.39 Three generally supports ComReg's position in relation to competition caps as set out in Consultation 15/131 but submits that such caps can control auction outcomes and, if overly restrictive, can impair competition within the auction itself. Finally, Three believes there should be no blanket policy on whether to or how to apply caps.

ComReg's assessment and position

4.40 ComReg firstly notes respondents' general agreement with its position on competition caps as set out in Consultation 15/131.

4.41 In relation to the views expressed by Vodafone, ComReg recalls its objectives of ensuring the efficient management and use of the radio spectrum and promoting competition and, further, that a competition cap involves the imposition of some restriction on operators in terms of both the amount and mix of spectrum.

4.42 In terms of the amount of spectrum which ought to be subject to a competition cap, ComReg observes that the extent of any restriction typically involves an assessment of the extent to which allowing bidders the opportunity to obtain a sufficiently large amount of spectrum to meet their requirements may also result in excessively concentrated outcomes where downstream competition would likely be harmed.

4.43 In terms of the mix of spectrum, ComReg recognises that the level of substitutability and/or complementarity between spectrum bands can clearly be relevant factors and, further, that appropriate band-specific caps, multi-band caps and/or combinations thereof can be effective in addressing such issues.[110]

4.6 Spectrum fees

Summary of Consultation 15/131

4.44 In section 7.6 of Consultation 15/131, ComReg discussed spectrum fees and set out its current thinking on this matter.

Views of respondents

4.45 Four respondents (BT, BAI, Three and Vodafone) submitted views on this matter.

4.46 Three agrees that there is a requirement for annual fees that are material in the context of relevant usage in order to avoid spectrum hoarding. Three also

[110] For instance by ensuring that any bidder can obtain an appropriate aggregate amount of spectrum across all bands and a minimum amount of spectrum in certain bands while guarding against the risks of extreme asymmetric outcomes with the potential to harm competition.

welcomes setting the split between upfront and ongoing fees on a case by case basis.

4.47 Three also expresses a number of concerns with the current process for setting spectrum fees, which can be broadly grouped as follows:

- Three's view that any adjustment of annual spectrum fees should be by reference to the communications sub-index of the CPI or mobile markets revenue;
- Three's view that certain ComReg awards (26 GHz and 1800 MHz) involved minimum prices which 'choked-off' demand;
- Three's view that minimum prices should be set using benchmarking but at a level that is low but non-trivial and substantially below expected valuations;
- Three's view that speculative bidding is risky because such a bidder would need to outbid all existing legitimate bidders; and
- Three's view that ComReg should carry out a review of the fees that apply to all spectrum users in order to ensure users are not treated "unfairly".

4.48 BT submits that in an open and competitive market spectrum fees are an important element to ensure that spectrum licences are held and used in the most economically viable manner. BT also considers that fees should promote the efficient use of the spectrum, and should not be seen simply as a revenue raising mechanism. Finally, any ongoing spectrum usage fees should be transparent and predictable to enable licence holders to factor these into their business plans.

4.49 Vodafone suggests that there is a possible role for appropriate annual fees as an incentive to ensure on-going efficient use of licences that are perpetual or term-based but renewed on an administrative basis. Vodafone also submits that:

- fees should be at the minimum level to secure efficient use and should not be used as a revenue raising instrument;
- ComReg should adopt conservative reserve prices which, in its view, would support investment in infrastructure;
- ComReg should consider the consistent market pricing of spectrum across all users; and
- ComReg has tended to follow the "unfortunate practice" of setting auction reserve prices based on results of auctions in other countries.

4.50 In addition, Vodafone supports a number of views expressed by the GSMA in the latter's response to the RSPG Report of Efficient Awards and Efficient use of spectrum, including that:

- lower spectrum fees will result in lower input costs and enable greater sector investment, growing the digital economy, and associated benefits to the wider economy;
- focusing on maximising licence revenue can have unintended consequences; and
- reserve prices serve one purpose only being to establish the opportunity cost of the next best use.

ComReg's assessment and position

4.51 By way of background and as an overarching matter, ComReg again reminds interested parties that regulation 19 of the Authorisation Regulations permits ComReg to impose spectrum fees for rights of use for ECS which reflect the need to ensure the optimal use of the radio frequency spectrum, where 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.

Indexation of spectrum usage fees (SUFS)

4.52 In relation to the issue of an appropriate adjustment of annual spectrum fees and by way of background ComReg firstly recalls its view at paragraph 7.77 of Consultation 15/131 which states:

"[i]n order to ensure that the SUFs continue to incentivise the efficient use of spectrum over time, ComReg applied an indexation factor to update the fees to account for the general rate of inflation. [111] *Such indexation keeps the value of these usage fees constant in real terms and, as such, maintains proper incentives for firms to continually assess whether they should continue to hold particular spectrum usage rights. As the Consumer Price Index (CPI) is the generally accepted means of maintaining a figure constant in real value terms, this is the indexation metric used by ComReg."*

4.53 In relation to Three's specific views, ComReg observes:

- firstly, that both a SUF and the value which a bidder has for a particular spectrum right (reflected in the monetary value it attaches to that spectrum right) are set at particular point/s in time;

[111] For example the annual updating of SUFs for CPI is applied to the ESDR, 26 GHz national block , DTT, national telemetry, GSM-R and Liberalised Use Licences, and proposed for the 3.6 GHz band in Document 15/70.

- second, the value of money changes over time and the extent of these changes, particularly in the context of the typical duration of a right of use for ECS (e.g. 15 years), can affect the incentive for, and extent to which, spectrum rights holders continually assess whether they should continue to hold said rights;
- in light of the above, and in the context of ensuring/incentivising the continued optimal use of spectrum, a bidder having expressed a valuation for the spectrum at the time of an award, should be paying SUFs consistent with that valuation over the period of right of use; and
- further, the CPI is the official measure of inflation in Ireland and is, therefore, an appropriate and accessible benchmark for measuring changes to the value of money. In this regard, the Central Statistics Office notes that the CPI "*can also be used to update or determine the value of a sum of money from the past e.g. the equivalent value of £2,000 in 1951 to today's level.* In effect, the CPI shows the change in the value of money over time" (emphasis added)[112].

4.54 Given this context, ComReg:

- considers that Three's view that the "*aim is to provide an incentive that is constant to the licensee*" (emphasis added) is mistaken. Instead, ComReg observes that the appropriate aim is to provide an incentive that is *constant to the value expressed by the licensee when it was assigned the licence*;
- observes that that the communications sub-index of the CPI does not measure the general rate of inflation and, therefore, is less appropriate than the CPI as a reference by which to benchmark the value of money over time; and
- observes that mobile revenues also do not provide any indication about changes in the value of money over time and are, similarly, an unsuitable benchmark.

Minimum pricing methodology

4.55 Three suggests that minimum prices should be set by reference to a low but non-trivial methodology that is substantially below expected valuations. Three also appears to suggest that this non-trivial value, apparently sufficient to deter frivolous bidders, would be obtained by setting the reserve price at 10% of the benchmarked value.

4.56 Interested parties will be aware that ComReg has considered the issue of the appropriate minimum price methodology extensively in the specific context of the

[112] http://www.cso.ie/en/media/csoie/surveysandmethodologies/surveys/prices/documents/frequentlyaskedquestions16.pdf

2012 MBSA award and in several subsequent award proposal consultations[113]. In that regard, ComReg recalls its views that a low but non-trivial approach (irrespective of how it may be calculated) was unsuitable for setting minimum prices in those matters. ComReg further recalls, among other things, its view that such an approach could compromise the objective of achieving an efficient auction outcome (and the efficient use of the spectrum rights and optimal ultimate consumer outcomes and benefits) by distorting bidding behaviour in a number of ways such as by:

- creating incentives for collusion and other forms of gaming aimed at keeping prices at a low level and preventing them from reaching their actual market value;
- creating incentives for individual bidders to suppress demand in an auction (or strategic demand reduction) if the surplus acquired from winning a smaller number of lots at a low price would be greater than the lost opportunity to win more lots;
- incentivising prospective bidders to limit the field of bidders in an auction (e.g. pre-auction mergers, MVNO agreements etc.); and
- incentivising participation by speculative bidders who may gamble on the spectrum rights having greater value at a later date[114].

Benchmarking

4.57 By way of background, ComReg recalls that it has on more than one occasion set out and clarified its views on benchmarking and minimum prices in relation to specific awards, including that:

> *"The benchmarking estimate is used solely to determine a conservative estimate of the minimum price. It does not set out to predict the final price of the spectrum. This will be determined solely by the competitive interaction of bidders in the proposed award process."*[115]

> *"As noted in Document 14/101, ComReg's proposed approach to benchmarking does not set out to predict the final winning price but to derive a conservative estimate of the minimum price."*[116]

[113] Document 14/101 and Document 15/70.

[114] In response to Three, ComReg notes this is more likely in low participation scenarios and it may often be appropriate to take into account expectations on the value of spectrum, with a view to promoting an efficient assignment in the long run.

[115] Document 14/101, p114

[116] Document 15/70, p 126

"ComReg has repeatedly stated that benchmarking does not set out to predict the final winning price but simply derives a conservative estimate of the minimum price (a factor 3IHL should be familiar with given its previous participation in spectrum awards). In this way, the benchmarking approach minimises the risk of setting a minimum rice that chokes off efficient demand and the final price will be determined solely by the competitive interaction of bidders in the proposed award process even where such benchmarking is based on limited data points "[117]

4.58 Interested parties will also be aware that the benchmarking approach proposed/used in these matters has sought to estimate a minimum price that would be below final prices and, at the same time, sufficiently high to reduce incentives for distorted bidding behaviour such as those described above (e.g. gaming and speculative bidding). As noted above, benchmarking has not been used to estimate the final prices that should be paid by bidders in auctions and ComReg again recalls that it is the function of an auction, where it is required, to determine the actual market value of particular spectrum rights.

4.59 In relation to Three's concern that setting a reserve price too high would likely choke-off demand and prevent legitimate spectrum utilisation, ComReg observes that its approach to-date has been to select a minimum price that is sufficiently high to reduce incentives for distorted bidding behaviour but subject to the risk of choking-off demand being sufficiently low. In this way, the final price paid will continue to be determined by the competitive auction process, a position which both Three and Vodafone support.

4.60 Further, ComReg notes that Three's concerns are not supported by the outcome of the 2012 MBSA award, where similar concerns were expressed by interested parties. In particular, ComReg observes that the final prices in that award would indicate that the minimum prices adopted were set well below the value of the rights of use of spectrum that were sold.[118]

4.61 In relation to Three's reference to the 26 GHz award in 2006, ComReg firstly notes that the minimum prices derived for that award did *not* use benchmarking to set minimum prices. Therefore, the benchmarking approach could not have led to minimum prices being set at a level that choked-off demand. ComReg also recalls that minimum prices were set using a benchmarking approach in the

[117] Document 15/140, p132

[118] ComReg also recalls that all winning bidders, including Three, expressed satisfaction with the outcome of the MBSA. For instance, ComReg notes Three's claim that it "*had won a strong portfolio of spectrum at the lowest portfolio price of 51.14 million euros*". (emphasis added): http://press.three.ie/press_releases/913/

subsequent award in 2008[119] and that this award resulted in the assignment of 13 national channels to 5 different bidders.[120]

4.62 In relation to Three's reference to the 2013 award of unsold 1800 MHz lots in Time Slice 1, ComReg does not accept the claim that reserve prices choked-off the legitimate use of the relevant spectrum rights. In particular, and as previously noted by DotEcon prior to that award process, the fact that these lots remained unsold in the MBSA merely indicated that none of the bidders submitted a bid for a package that included these lots along with their winning package and, importantly, does not provide any information about the level of demand.[121] The extent to which bidders subsequently had demand for these same lots over a year later and with rights of use shorter than available under the MBSA is not known.

4.63 The above said, ComReg recognises that there is some level of uncertainty when setting minimum prices. In that regard, interested parties will recall that minimum prices have to-date typically been set conservatively in relation to the benchmarking estimates to mitigate the risk of setting excessively high prices that could choke-off demand. Further, where there is reason to believe that there is greater uncertainty about the value of particular spectrum rights to be awarded, ComReg observes that even more conservative prices can be adopted to appropriately address this issue. For example, and as Three will be aware, in Document 15/140 ComReg considered that there was sufficient uncertainty surrounding the value of the 3.6 GHz spectrum rights to justify proposing a lower minimum price for said rights than originally considered. ComReg notes Vodafone's support for the GSMA claim that *"reserve prices serve one purpose only, to establish the opportunity cost of the next best use, and therefore to ensure that if spectrum is sold it sells for a higher price than the value to next alternative users and if it remains unsold, it will still be of marginal value to that next best user, and be assigned to them"*.

4.64 In that regard, ComReg considers that this statement appears to be based on a misunderstanding of what opportunity cost is given that:

- reserve prices are not typically designed to establish the opportunity cost of the next best use;
- as Vodafone and Three observe, it is the function of an auction, and the interaction of bidders in same, to determine the opportunity cost of spectrum, not the reserve price;

[119] See Document 07/93R, p 10

[120] http://www.comreg.ie/_fileupload/publications/PR060608.pdf

[121] Document 13/103, p 4

- the opportunity cost of awarding spectrum means a winner would need to pay at least the amount that the highest value alternative user of the spectrum would be prepared to pay[122]; and
- unsold spectrum rights are typically not subsequently assigned to an undetermined "next best user".

Objective of spectrum fees

4.65 In relation to the concerns expressed by BT and Vodafone that spectrum fees should not be seen simply as a revenue raising mechanism, ComReg would again draw interested parties' attention to the provisions of regulation 19 of the Authorisation Regulations.

4.66 ComReg agrees with BT that any ongoing fees should be transparent and predictable so as to enable licence holders to factor these into their business plans.[123]

4.67 In relation to Vodafone's suggestion that consistent market pricing of spectrum should apply across all users and Three's request that ComReg carry out a review of the fees that apply to all spectrum users in order to ensure all users are treated "fairly", ComReg firstly observes that the appropriate spectrum fee to ensure the optimal use of a particular right of use will, clearly, depend on the specifics of that right of use, including for example:

- the nature of the service(s) provided using those rights;
- the market characteristics of the services provided using those rights;
- whether those rights relate to a spectrum band which has been harmonised;
- the extent to which alternative spectrum rights are available for the provision of the relevant services; and
- technological innovation across different bands.

4.68 In addition, ComReg observes that these respondents have not provided any evidence, and nor is ComReg aware of any credible material indicating, that different spectrum fees for different rights of use are either discriminatory (recalling that the factual position may well be materially different across different

[122] ComReg's observes that its 2012 MBSA award used a similar approach where each winning bid and, collectively, each and every group of winning bidders, were required to pay a sufficient amount so that there was no other bidder or group of bidders that would be prepared to pay more.

[123] For example, ComReg's observes that its practice to-date has been to publish the applicable spectrum usage fees prior to an award, which would remain the same over the duration of the licence save for any indexation of SUFs to account for the change in the value of money.

spectrum bands/classes of spectrum users) or likely to result in less than optimal use of the relevant spectrum rights.

4.69 In relation to Vodafone's claimed benefits of lower spectrum fees, ComReg observes that fees imposed reflective of the need to ensure the optimal use of the radio frequency spectrum should contribute to the efficient use of the relevant spectrum rights and, in so doing, also contribute to the achievement of the benefits referred to by Vodafone.

4.70 Finally, ComReg notes the views of a downward trend in price/Mbit resulting from consumers growing demand for data usage. In that regard, and recalling that it is for the auction and the interaction of bidders in same to determine the opportunity cost/market value of spectrum rights, ComReg observes that such matters are for bidders to consider and reflect in their bids.

4.7 Coverage/Rollout conditions

Summary of Consultation 15/131

4.71 Section 7.7 of Consultation 15/131 discussed coverage/rollout conditions and set out ComReg's current thinking on this matter.

Views of respondents

4.72 Three respondents (BT, RTÉ & 2RN and Vodafone) provided comments on this matter.

4.73 BT submits that coverage and/or rollout conditions are of limited benefit in a fully competitive market (and suggests that this is confirmed by ComReg in paragraph 7.85 of Consultation 15/131) and that such conditions are best suited to applications where there is little or no retail competition. BT additionally submits that the development cycle of technologies would be a relevant consideration when determining a coverage/rollout obligation.[124]

4.74 RTÉ& 2RN believe there is evidence that coverage and rollout requirements are not required for public service broadcasting in Ireland given the recent experience during analogue switch-off (ASO) where RTE voluntarily undertook

[124] BT stated *that "spectrum auctions do not necessarily coincide with the technology development cycles, and sometimes a licence might be obtained in preparation for the next generation of technology which might not yet be launched. Such strategic purchases could fall foul of a coverage/rollout condition which has been set on a "use it or lose it" basis; this could result in an operator having to deploy the current technology, rather than waiting and using the band for the next generation of technology."*

actions to increase coverage beyond the requirements of the Broadcasting Act of 2009.[125] RTE&2RN submit that:

- these actions were taken to help ensure the success of the platform all in the absence of prescriptive coverage obligations, or retail pressure;
- this shows that traditional economic analysis and regulatory measures for commercial/competitive use of spectrum do not apply where services with important social value such as public service broadcasting are concerned; and
- it is important that there is a clear delineation within ComReg with respect to how spectrum is managed for these different types of uses.

4.75 Vodafone submits that:

- it supports reasonable coverage obligations in order to maximise access to mobile broadband services; and
- coverage obligations should not be changed once a licence has been issued, except by genuine mutual agreement.

ComReg's assessment and position

4.76 While ComReg notes respondents' suggestions in relation to the appropriate coverage and/or rollout obligation (if any) for specific circumstances[126], given the broad range of relevant factors[127] and relevant legislative provisions[128], ComReg does not believe it appropriate to set out specific views on coverage and/or rollout obligations in advance of considering the specific circumstances of a particular spectrum award. In particular, ComReg remains of the view that it is necessary to determine the appropriate nature and extent of coverage and/or rollout

[125] RTÉ & 2RN noted that:

- the 98% population coverage provided by Saorview actually exceeds the coverage of analogue TV coverage in Ireland at the time of ASO substantially (assuming standard receiving equipment without mast-head amplifiers), particularly for TG4 which did not benefit from VHF transmission; and
- RTÉ voluntarily undertook to provide infill coverage to the remaining <2% of the population via a FTA satellite solution (SAORSAT).

[126] For example, the suggestion that coverage and/or rollout obligations are not required or are of limited benefit for fully competitive markets and for public service broadcasting, and reasonable coverage obligations in order to maximise access to mobile broadband services.

[127] See for example paragraph 7.82 of Consultation 15/131 and the development cycle of technologies factor as outlined by BT above.

[128] For example, the Broadcasting Acts set out legislative provisions specific to the broadcasting service.

obligations (if any) on a case by case basis in light of the particular facts and circumstance arising.

4.77 In relation to Vodafone's view that coverage obligations should not be changed once a licence has been issued except by genuine mutual agreement, ComReg recalls that 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).

4.8 Mobile retail consumer experience issues

Summary of Consultation 15/131

4.78 Section 7.8 of Consultation 15/131 discussed mobile retail consumer experience issues and set out ComReg's current thinking on this matter.

Views of respondents

4.79 As discussed in section 3.3.6 above, two respondents (Eir Group and Vodafone) submitted views on this matter.

ComReg's assessment and position

4.80 In light of ComReg's assessment of respondents' views as set out in section 3.3.6 above and other relevant information ComReg considers that its views as set out in paragraph 7.96 of Consultation 15/131 remain appropriate.

4.9 Technology and Service neutrality

Summary of Consultation 15/131

4.81 Section 7.9 of Consultation 15/131 discussed technology- and service-neutrality and set out ComReg's current thinking on this matter.

Views of respondents

4.82 Three respondents (BT, Three and Vodafone) submitted comments on this matter.

4.83 BT supports the service classifications set out by ComReg (namely fixed, mobile, satellite, amateur radio, and radio navigation) and considers that the service(s) in a band determine the constraints. BT states that *"We agree that the principle of technology neutrality then acts as the incentive to make the most efficient use of the spectrum within the conditions set"*.

4.84 Three supports ComReg's views on awarding service- and technology-neutral licences (provided same would not lead to harmful interference.[129] Three also considers that service- and technology-neutral licences facilitate technology evolution and can allow greater efficiency in spectrum use. It agrees with ComReg's position to facilitate such licences where possible, particularly in harmonised bands.

4.85 Vodafone states that it supports the GSMA's position on technology and service neutrality observing that *"…The GSMA supports the RSPG view on the importance of technology neutrality, and the increasing importance of promoting compliance to standards, in order to minimise the risk of interference, particularly where poor equipment design (for example, WiFi modems, cable TV modems) fails to provide adequate rejection of adjacent mobile frequencies."*

ComReg's assessment and position

4.86 ComReg agrees with respondents' views that service- and technology-neutral authorisations can facilitate licensees in making appropriate and timely technology choices to make efficient use of their spectrum rights which can, in turn, ultimately benefit consumers. In addition, ComReg agrees that liberalisation should not lead to harmful interference and notes that paragraph 7.100 of Consultation 15/131 states that:

> *"Where appropriate, ComReg favours and promotes the application of technology and service neutrality in line with the relevant harmonisation measures"* (Emphasis added)

4.87 In light of the above, ComReg considers that its views, as set out in paragraph 7.100 of Consultation 15/131, remain appropriate.

[129] Three states:

- *"…One attribute of licences that can help operators to make the most of existing licenced spectrum is service and technology neutrality. This allows operators to upgrade as technology advances, and gives the licensee flexibility to choose the optimum technology to deploy, taking into account the various bands they operate in, and the capability of their network and base of terminals. Such flexibility allows operators to change technology in response to consumer demand, so ultimately is beneficial to consumers. Service and technology neutrality also allows operators to maximise spectrum efficiency. Three supports ComReg's general intention to allow service and technology neutral licences, as described in paragraph 7.100 of the consultation document. …"*

4.10 Transparency of radio spectrum information

Summary of Consultation 15/131

4.88 Section 7.10 of Consultation 15/131 discussed transparency of radio spectrum information and set out ComReg's current thinking on this matter.

Views of respondents

4.89 Two respondents (ESBN and RTÉ & 2RN) provided comments on this matter.

4.90 ESBN observes the EU's initiative towards publishing licence details for various radio users and services and welcomes this initiative generally. However, ESBN suggests that radio users operating critical and emergency services, such as itself, require radio spectrum usage locations and frequencies to remain confidential. It submits that publication of such licence details from its licence(s) could facilitate co-ordinated attacks against targeted points in its telecommunications network and cited cyber-attacks on national power grids in Ukraine, US and the UK[130] in support of this view.

4.91 RTÉ & 2RN submit that it would be very helpful if the data already available on Siteviewer was also available in a list format and further that this data should be made available for microwave fixed links and any other licensed services.

ComReg's assessment and position

4.92 ComReg notes the general support of these respondents for the publication of non-confidential radio spectrum information. While respondents did not elaborate on the benefits of such publication, ComReg considers that the general availability of this information can contribute to the efficient use of spectrum including by:

- better informing consumers on important parameters (such as the coverage or performance of a particular service), thereby empowering consumers to make better informed choices which, in turn, can improve their user experience;
- better incentivising spectrum rights holders to take measures to improve aspects of their service provision which are particularly valued by consumers (e.g. coverage and quality of service);
- better informing interested parties and existing licensees of the areas where other licensees may be open to transferring or leasing spectrum rights. For

[130] http://www.bloomberg.com/news/articles/2015-01-09/power-grid-under-cyber-attack-every-minute-sees-u-k-up-defenses

instance, such publication could enable identification of the spectrum bands and/or geographic areas where spectrum rights are not currently being fully utilised by licensees, thereby potentially increasing spectrum transfer or leasing activity.

4.93 In relation to ESBN's suggestion that the location and frequency information of radio spectrum users operating critical and emergency services should remain confidential, ComReg is of the view that this is a matter that would need further consideration in line with ComReg's guidelines on the treatment of confidential information (Document 05/24[131]). Relevant factors in any such assessment could include a consideration of the potential negative side-effects that might result from publishing information. In this regard, ComReg observes that:

- whilst noting ESBN's cited examples, it is not entirely clear to it how the provision of location and frequency information would increase the risk of any such attack given that the content of modern wireless transmissions are generally encrypted and, of itself, knowledge of the base station locations would not appear to compromise those radio transmissions;
- the information on radio users currently published on ComReg's website (via Siteviewer or the publication of licence details) does not appear to have resulted in any additional negative side-effects for the radio user. The information published can include frequency and location information, and some of this information has been published for a considerable number of years (e.g. Siteviewer has been in existence since August 2002[132]). Further, the information published covers a wide variety of radio users, including the national broadcasters and mobile network operators;
- it is possible to obtain location and frequency information on networks via other means, e.g. observation and the use of directional antenna or triangulation with standard radio frequency equipment; and
- information from other member states or elsewhere may assist ComReg in its understanding of this matter.[133]

4.94 In response to RTÉ & 2RN's request to provide Siteviewer information in list format for download, ComReg observes that there are a number of issues related to this request that would need further consideration including:

[131] http://www.comreg.ie/_fileupload/publications/ComReg0524.pdf

[132] http://www.comreg.ie/_fileupload/publications/Annual02-03b.pdf (page 25)

[133] For example, in the UK Ofcom provides a range of information about authorisations, licences and trades at http://stakeholders.ofcom.org.uk/spectrum/information/ .

In France, site location and frequency information for certain radio spectrum users is published by ANFR at http://www.cartoradio.fr

- the ability to readily make information available in such a format; and
- the additional benefits/costs of providing information in such a format, including whether the provision of information in a list format could result in negative unexpected outcomes.

4.95 In relation to the former, ComReg notes that the information currently available on Siteviewer is not created or stored by ComReg in list format. This information is uploaded individually by licensees and then used by ComReg to populate the various licences for each operator which suggests that there are likely to be a number of technical issues to first address.

4.96 Subject to further consideration of the issue in line with Document 05/24, and noting the general practice of greater transparency on the assignment and usage of radio spectrum in Ireland and across Europe, ComReg notes that it may be appropriate to consider alternative formats for making Siteviewer or other radio spectrum information publicly available, including list format.