Commission for
Communications Regulation

Response to Consultation on ComReg's new Radio Spectrum Management Strategy Statement

Non-Confidential Submissions to Document 18/74

Non-Confidential Submissions to ComReg Document 18/74

Reference: ComReg 18/117s

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Content

Section

1 Three Ireland Ltd.

Spectrum Strategy 2019 to 2021

Response from Three Ireland

1. Introduction

Three is pleased to provide comments on ComReg's "Strategy for Managing the Radio Spectrum – 2019 to 2021". We agree with ComReg that use of the radio spectrum is integrated into almost every aspect of our day to day lives. Our economy and the functioning of our society as we know it is completely dependent on devices, technology, and services that use the radio spectrum.

The radio spectrum is a renewable natural resource (it is not consumed by use) that should be harnessed for the benefit of the citizens of the state, and ComReg plays an important role as "gatekeeper" for access to spectrum. Ireland has some challenges in that it lacks critical mass for industry investments and its rural population makes it more difficult to provide services to all of the population, however one advantage this brings is that the radio spectrum is less congested than is the case in many other European countries, added to the fact that we are an island with only one neighbour in the north which means coordination is less of an issue.

To get the greatest benefit from the radio spectrum, we should maximise the degree to which it is in use providing service at any time. It can sometimes be difficult to determine what constitutes efficient use of the spectrum, and users need certainty against which they can plan their investments and network build, however ComReg also needs to be agile and responsive as new opportunities to use the spectrum develop. A failure to gain access to the spectrum quickly can mean the difference between success and failure for many of these emerging services.

In the proposed strategy for managing the radio spectrum (18/74), ComReg outlines its objective to ensure the efficient management and use of the radio spectrum. ComReg is obliged to effectively carry out this function, which includes the issue of licences/exemptions and the protection of licenced services from unlicensed use and interference. ComReg should carry out its functions in a timely manner and on an objective basis. ComReg exists to serve the needs of users, and ComReg itself including the availability or lack of resources cannot become the reason why spectrum is used at any particular time, whether this relates to licensing/access or interference investigation.

Our specific comments on the proposed spectrum strategy are given below.

2. Eradicating Interference

Three has noticed a significant increase in the number of incidences of external interference to its network in recent years. In the vast majority of these cases, this interference is caused by unlicensed, illegal equipment, which should not be in operation in Ireland. The effect of this interference is significant and drives poor customer experience in our network, and at present:

- There are over 50 cases of interference to Three's network which is impacting on 200 sectors of the network
- This interference is affecting service to approximately 25,000 customers
- Most of these cases have been on-going for several months.

This issue was highlighted to ComReg by Three in response to the Spectrum Strategy 2016 – 2018, and unfortunately it is an area which has deteriorated during that period. Offenders are not penalised, whereas spectrum users are still required to pay their spectrum fees without compensation.

Licensees like Three are limited in the steps they can take to eliminate this interference. ComReg is the statutory body whose function it is to investigate and eradicate these cases of interference caused by illegal radio equipment, and ComReg should deploy adequate resources to do this without further delay. ComReg should also engage with operators and provide feedback when cases have been closed. This would help operators to recognise future sources of interference and would help speed up the whole process of elimination.

3. Work Plan and Agility

Three has been a supporter of ComReg's Test & Trial licensing process and has used these licences itself. This is a good initiative that makes use of our available resource to facilitate and encourage the development of new products and services. But ComReg must now reflect on what happens beyond Test and Trial. When new services or technologies have been tested and are ready for market deployment, ComReg can play a vital role in its success or failure. Access to spectrum, delay in access to spectrum, or delay to commencement of an existing spectrum licence can be a critical factor in determining whether a technology is deployed, and is deployed in a timely way. ComReg itself does not "pick winners" however ComReg's action can be the determining factor as to whether any particular technology or service succeeds or fails.

ComReg's work plan for spectrum gives all interested parties visibility of the activities it is planning to complete and the ability to comment on the same. It cannot however be the case that new technologies can be considered only during the four-week window that occurs every three to four years when ComReg is out to consult on this. ComReg must appreciate that new requests for access to the spectrum will emerge during the lifetime of the work plan. If a new access request is delayed because it was not included in the work plan then this can mean the difference between success and failure.

By way of example, in September 2015, Three approached ComReg with a proposal to deploy LoRa technology in the 900MHz spectrum that is already licensed to Three under its Liberalised Use Licence. Compatibility and 3GPP compliance tests were

successfully demonstrated in May 2016, Three obtained a Test & Trial licence, and carried out tests to examine and demonstrate how it performed, and validated once again compatibility with existing services in the band. While Three received assistance from ComReg in this matter, the fact that it was not identified on ComReg's work plan meant that it was difficult to have the matter prioritised. In 2016, LoRa in the licenced bands had an opportunity to "get a significant head start" on other 3GPP IoT technologies which were not yet standardised. LoRa in the licenced 900MHz liberalised spectrum would have not only been sustainable, but would have also placed Ireland as a world leader in this emerging and fast growing space. Today as of August 2018, were are still waiting ComReg consultation on LoRa in 900MHz liberalised licenced spectrum; however, it would seem that after two and a half years the opportunity has been lost in Ireland.

ComReg must retain the flexibility and the resources to accommodate new access requests that emerge during the term of the work plan. This is a critical part of the process by which spectrum can be used to make Ireland a location for investment in innovation.

4. Awards and Auction Mechanism

ComReg has awarded spectrum on four occasions so far using an auction as the selection mechanism. Overall, Three supports the use of auctions to award spectrum, though it is not necessarily suitable in all cases, and the auction mechanism and rules must be chosen to suit the award in each case. ComReg has used a Combinatorial Clock auction on two occasions, and a Single Round Sealed- bid auction on two occasions, with a second-price rule all four times. While Three has participated in all four auctions, and they have been successfully completed, we do not believe this auction format is optimal in all cases.

For upcoming awards, and in particular the next multi-band award, ComReg should "start from fresh" and consider all options for the award mechanism. These mechanisms should then be examined against the auction objective and consulted upon before the final rules are set.

5. 26GHz Band

In the 26GHz band, there have been several developments recently that are worthy of mention:

- The selection of 26GHz as a pioneer band for 5G by the RSPG
- A requirement in the European Electronic Communications Code that at least 1 GHz in the 24.25 – 27.5GHz band should be awarded by 31 December 2020

- Completion of the award of spectrum for national point to point link licences in July 2018, assigning spectrum in the range 24.745 – 26.285GHz until 2028, which has left 224MHz of this band unassigned.

The completion of the national point to point award this year means there is just over 1,097 MHz of spectrum available in the 26GHz band for award in 2020, unless some changes are made. It is not known yet how much bandwidth will be required to act as a guard-band between fixed links and the 5G service in this band, however in the mmWave band, the best performance will be obtained by the use of large contiguous bandwidth by each network.

Three notes that the minimum to be released in 2020 is 1GHz of spectrum, however given the need for contiguous assignments, Three believes that 1.2GHz of spectrum should be targeted for release. This will require that the P2P individual licence links that currently operate in the 26.285 – 26.453 GHz band are relocated to a different part of the band, or to a different band altogether. ComReg should now begin the process to remove the individual links that are licenced to operate in this band.

6. The 3.6GHz Band

It has been 14 months since the 3.6GHz award concluded, yet at this point no licence has been commenced, as the licences were issued without a commencement date. While some short delay in the spectrum coming available was provided for in the award process, which would have allowed for an orderly transition out of the band by the previous licensees, it is difficult to understand how it is still the case more than 18 months after the applications were submitted. This kind of delay, only serves to undermine confidence of bidders in entering auctions, and prevent consumers in Ireland from being served with the latest wireless broadband technologies which are critically lacking in this country.

Of equal concern is the apparent change in approach that has been taken after the award process has completed and the lack of two way communications with the successful bidders. This brings into question the difference in status between a “Protected Licence” and an “Unprotected Licence”. Three wrote to ComReg on 25th January this year setting out its concerns with the approach that is being taken to the transition in the 3.6GHz band. Three has not received a response to that letter, however the relevant points have been again included in the annex to this document.

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Annex – 3.6 GHz Transition

Extract from letter dated 25th January 2018

In advance of the award process, ComReg set out the process that would be followed afterwards to permit Existing Licensees some continuation of existing services while transitioning out of the band. The proposals were consulted on and clarified in ComReg documents 15/40, 16/57, and 16/71. It is clear from those documents that the Transition Plan was intended to facilitate Existing Licensees in transitioning out of the band, while in no way encumbering the new licensee's ability to deploy its network. The process as described required that Existing Licensees prepare to cease operation in the band; that information would be gathered from Existing Licensees (not new licensees) which would be verified by ComReg (and this information was to be provided in advance of the award process); ComReg specifically rejected a transition period of 18 months suggested by one respondent as ComReg was of the view that such a period is likely to be excessive in light of the inherent short term nature of such licences, and that such a lengthy termination process could also significantly delay the roll-out of new advanced services using this spectrum by a new licensee.

Further, it was always to be the case that a new licensee could issue notice to any Existing Licensee on a Transition Unprotected Licensee at any time during the implementation of the transition plan to facilitate roll-out by a new licensee. The above requirements were developed and specified by ComReg through the consultation process leading to the final Information Memorandum, including the following:

> *ComReg Document 16/71*
> *3.211 . . . . ComReg will take appropriate and effective measures to ensure that there is no undue delay in the availability of liberalised 3.6 GHz Band spectrum rights of use.*
>
> *ComReg Document 16/57*
> *7.30 . . . in paragraph 7.67, envisaged that the Transition Plan would provide a reasonable time period to the Existing Licensees (including TUL licensees) to transition to the outcome of the Award Process;*
>
> *7.31 Notwithstanding the above, ComReg reiterates its view as set out in paragraph 7.77 of Document 15/140 that all Existing Licensees consider and, where practicable, make preparations for the Transition Activities which might be required of them, noting that there are a number of options that an Existing Licensee can consider in seeking to mitigate the scale and time of any Transition Activity required. An Existing Licensee's consideration of transition activities could include making preparations to mitigate the practical matters as proposed by Imagine, for example, by ensuring that contractual agreements can be terminated at short notice without penalty.*
>
> *ComReg Document 15/140*
> *7.11 ComReg then outlined the high level steps for establishing the transition rules and plan. This included:*

- *the collection of information from Existing Licensees and analysis and verification of the information provided;*
- *the setting of transition rules in advance of the award process; and*
- *the determination and implementation of the transition plan.*

7.12 With regard to the collection of information, ComReg noted that whilst the precise nature and extent of transition activities would only be known until the outcome of the proposed award process [sic], it was nevertheless important to collect information from Existing Licensees in advance of the award process so as to inform ComReg's transition proposals and rules.

7.65 In relation to Ripplecom's comment that TULs should not necessarily have a maximum term, ComReg notes that TULs are intended as a tool to facilitate transition rather than an alternative to the proposed award process for the long term grant of rights of use.

7.66 In relation to Ripplecom's proposal for an 18 month termination process of a TUL, ComReg notes that Ripplecom has provided no material to support this view and, in the absence of such, ComReg is of the view that such a period is likely to be excessive in light of the inherent short term nature of such licences. Such a lengthy termination process could also significantly delay the roll-out of new advanced services using this spectrum by a new licensee.

7.67 As discussed earlier, following the outcome of the award process ComReg proposes that the specific circumstances of the Existing Licensees (including any prospective TUL licensees who have agreed to abide by the transition rules) and new licensees would be considered by ComReg in determining the transition plan. ComReg envisages that the transition plan would provide a reasonable time period to the Existing Licensees to transition to the outcome of the award process and, in addition, it would assist ComReg in identifying the appropriate commencement date of new spectrum rights on a per spectrum block and per region basis.

7.68 Noting that a reasonable time period would already have been provided to Existing Licensees (including TUL Licensees) in the transition plan, ComReg is of the view that any subsequent notification period from a new licensee to a TUL licensee should be of a short duration. In relation to this notification period, ComReg observes that:

- *a notification from a new licensee could be issued during the implementation of the transition plan, such that any TUL licensee would have to vacate the specific spectrum block and region once the transition activities for that spectrum block and region have been completed in line with the transition plan. This would facilitate the timely deployment of services by a new licensee.*

ComReg's New Approach to the Transition Process

In the letter of 18th December, which was 4 months behind schedule, ComReg has set out a completely new process for developing the transition plan. Contrary to the information that was provided to applicants in advance of the award process, it now seems that ComReg has decided that new licensees must submit their detailed roll-out plans to ComReg for verification in advance of having their licence commence. The new process that ComReg is now proposing would require that new licensees submit detailed site-by-site plans to ComReg which must be verified by ComReg before being accepted. It is only in cases where ComReg is satisfied that a new licensee's rollout does not impact on a service of a Transition Licensee that the new licensee be given the go-ahead, and this will occur on a site by site basis.

Where ComReg believes that a new licensee site may affect a Transition Licensee site, then ComReg propose to develop a localised transition plan. This will involve consultation with the Transition Licensee; however ComReg will only undertake this consultation with the Transition Licensee where it is satisfied with the sufficiency of the new licensee roll-out milestones. Further, ComReg states that transition plans will be "progressed and prioritised" where New Licensees have "sufficiently developed" plans.

This proposal effectively means that ComReg has decided to second-guess the sufficiency of each operator's roll-out plans, on a site-by-site basis. The proposal means that new licensees will be prevented from rolling out services in the spectrum that has been awarded to them (and paid for) until ComReg has approved this, and ComReg has consulted with the Transition Licensee, and that the progress of a New Licensee against milestones will be a relevant consideration when considering priorities of New Licensees against Existing Licensees.

New Process Contrary to Regulations and Information Memorandum

This is a new feature to the award process, and cannot be simply introduced at this time. This is not the basis on which bidders entered the auction. ComReg is now giving equal or higher priority to a Transition Licence vs a New Licence. This is incorrect, and is contrary to the provisions of the Information Memorandum (ComReg Doc 16/71) and the Regulations under which the licences were issued (SI 532 of 2016, the 3.6 GHz Band Licence Regulations).

The Regulations specifically clarify who is entitled to a Transition Protected Licence, and ComReg has confirmed that there is only one licensee who qualifies. All other Existing Licensees are only entitled to avail of the Transition Unprotected Licence. The Regulations define that the Transition Unprotected Licence permits the provision of service on a Non-interference and Non-Protected Basis. The Regulations and ComReg's Information Memorandum also clarify that "on a Non-Interference and Non-Protected Basis" means that the use of Apparatus is subject to no Harmful Interference being caused to any radiocommunication service, and that no claim may be made for the protection of Apparatus used on this basis against Harmful Interference originating from radiocommunication services".

Accordingly, ComReg cannot prioritise protection of a Transition Unprotected Licence over a 3.6GHz Liberalised Use Licence, and it is incorrect to allow

unprotected licences to delay the deployment of services on a Liberalised Use Licence.

New Process is Impractical

Regardless of the validity of the proposed new process, it is not practical to proceed on the basis now proposed. Three's roll-out of service will involve the deployment of a trial/trials in the first place that will be used to learn about the capabilities and performance of service in this band. Roll-out will extend to several hundred sites, the detail of which will change as roll-out occurs. It is simply not practical for ComReg to apply the proposed process for transition planning to this type of network deployment. Even with a large team of experienced network planners, this process would be slow, burdensome, and inflexible and would delay network planning.

The proposed process does not allow for the flexibility that would be expected with any network roll-out. How will it adapt if an operator changes its priorities? These changes can and do occur all the time as a result of changing demand, a new customer, or learnings taken from existing deployment. The proposal also fails to recognise the manner in which an operator like Three rolls out its service, which is different to the way in which a local operator would. Three is more likely to cover a region (which might not correspond to ComReg's geographic regions) or multiple regions, and to sell in that region. If part of a region is unavailable or delayed, then we are unlikely to proceed on a piecemeal local basis.

ComReg will be aware that Three already submitted some detail regarding trials that it was proposed to run in discrete locations early in 2018. The specific locations were chosen at the time for several reasons, including some that are relevant to Three's upgrade of its existing networks. We note that in the six-month period since it was submitted, ComReg has not addressed that plan specifically, nor the note of discussions with Existing Licensees relevant to Three's assignment. During that time, Three's network upgrade work has continued, such that the reasons for choosing some of those locations has now disappeared and the opportunity is lost. The effort that Three put to planning and preparing for those trials, and reporting to ComReg has turned out to be a waste of time. This cannot be allowed to happen with future trials or with the main network roll-out.

ComReg has not clarified how roll-out obligations or licence fee refunds are to be treated in the circumstance where a new licensee was delayed in rolling out in part of one of the geographic licence regions, or on part of the allocated spectrum in part of the geographic region. As ComReg is aware, in a combinatorial auction, the winning bidders have won the right to be assigned a single package, which is not severable.

New Process Is Unnecessary

In the report submitted to ComReg in July 2017, Three informed ComReg that agreement had been reached with all except one of the Existing Licensees who was operating in the spectrum assigned to Three. For the one licensee where agreement could not be reached, Three noted that the licence in question is an unprotected licence, which is not entitled to claim protection from or delay a Liberalised Use Licence deployment. Further, Three notes that the primary reason for failing to

reach agreement at the time related to Three's planned trial in the Wexford area, the opportunity for which is now lost.

Three proposed a simple process which could eliminate most of the burden for ComReg, and delay associated with micro-planning the transition between several licensees. Three would give reasonable notice to the unprotected licensee of a requirement by Three to roll-out in an area that would affect their existing service. This proposal was agreed with all of the relevant existing licensees except one as noted here. By adopting this simple approach, (as was first described by ComReg in the award documents), ComReg can eliminate the need to carry out a slow and burdensome review of most of the transition service areas as described in the letter of 18th December. This would allow ComReg to instead focus on the transition plan for the one Transition Protected Licensee.

ComReg should now revert to this simplified process.

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2 Nominet UK

NOMINET

Response to ComReg's consultation on a new Radio Spectrum Management Strategy (ref: 18/74)

August 30, 2018

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Response to the consultation

Nominet are grateful for the opportunity to respond to ComReg's consultation on a new Radio Spectrum Management Strategy, dated 03/08/2018. The document addresses a wide range of issues of importance to the future of how spectrum will be allocated and managed in Ireland.

Nominet are supportive of ComReg's commitment to efficient and effective use orradio spectrum, to maximise the benefits to society. These aims will become all the more important to enable the next generation of wireless networks. We welcome the specific actions that ComReg are planning to take to encourage efficient use of spectrum in Ireland.

In particular, the document lists "*authorising spectrum on a non-exclusive basis and encouraging sharing where appropriate and technically feasible*"[1]. We would strongly endorse such approaches. Nominet believes that authorisation frameworks, tiered sharing and dynamic spectrum allocation, will all be essential parts of addressing future connectivity challenges. Furthermore, we see such approaches as a key part of ComReg's ambition set out in the consultation document to "*develop and promote Ireland's position in relation to the spectrum managementaspects of 5G technology*."[2] Nominet would welcome the opportunity to support these deliberations as ComReg takes forward the challenges and opportunities presented by 5G.

Nominet also welcomes ComReg's commitment to "*actively engage with relevant stakeholders to progress the repurposing of the 700 MHz band so as to obtain clarity on its timing availability*"[3]. We would strongly support use of the TV band and the areas where mobile services are not deployed in the 700 MHz band for TV White Space (TVWS). As we have seen in deployments in the several countries around the world (including the UK and the US), TVWS can enable currently poorly connected communities to access high speed broadband, therefore creating significant social and economic benefits. Ourmore detailed initial views are:

- The use of TVWS on a no interference / no protection basis has the potential to improve competitiveness in the market and increase user choice, while maintaining the ability to protect existing services.
- Applying dynamicspectrum management to TVWS enables the provision of new services, while making a more efficient use of frequencies.
- Proving clarity over usage of 700 MHz by geographical area is a crucial ingredient to ensure that these is a viable model for commercial investment into TVWS rural broadband.

Nominet stand ready to engage with ComReg on this issue.

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[1] 3.2.ii, p. 18.
[2] 3.36.vii, p. 26.
[3] 3.36.ii, p. 26.

Finally, Nominet welcome ComReg's commitment to promoting test and trial, in particular to "test or trial wireless products and services in a real-world environment"[4]. Nominet have experience of running a numberof trial deployments of TVWS, and have found this an invaluable learning process in order to refine our approach.

About Nominet

Nominet has been at the forefront of innovation for 20 years through its internet registry solutions, cybersecurity services, and now dynamic spectrum management. Driven by a commitment to use technology to improve connectivity, security, and inclusivity online, Nominet is a profit with a purpose company, supporting initiatives that contribute to a vibrant digital future.

Trusted by governments and businesses globally as an expert technology partner, Nominet is keen to explore the benefits that spectrum management can bring to revolutionise internet access.

Dynamic Spectrum Management Deployments

Nominet has been involved in a number of dynamic spectrum management projects using TV White Spaces to bring wireless connectivity to rural Britain, working with Microsoft to connect Africa and soon connecting rural America as part of the Microsoft Airband initiative.

The deployment of TV White Space to the Isle of Arran in Scotland, was the first commercial rollout of TV White Space in the UK and transformed the lives of the residents:

> "I had to ask people sending emails neverto put on an attachment… but now we can get photos, [even] get videos of the grandchildren playing" Elizabeth Rose, Isle of Arran Resident.

The Nominet solution is Ofcom approved, and is currently going through FCC approval in the US.

Critical National Infrastructure

Nominet is a British company founded in 1996, and today runs one of the largest internet registries in the world, .UK with over 11m domain names and over 3m customers. The DNS nameservers have been consistently available forover 10 years and Nominet has the reputation for being one of the most reliable and resilient registries.

[4] 3.2.viii, 19.

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Nominet appreciates that it has a critical role in maintaining a resilient and well managed registry which is essential in underpinning the UK's digital economy. The company is part of the UK's Critical National Infrastructure and continuously strives to ensure the name spaces it is involved with are trusted and secure, working closely with law enforcement to address criminality and malicious domains. This means Nominet is adept at working with key government stakeholders, and across departments to support the UK governments positions in key fields.

Nominet participates in various forums such as the Internet Governance Forum, CPNI's NSIE (Network Security Information Exchange) and the EC-RRG (Electronic communications, resilience and response group). Nominet also works with the NCA, CERT-UK, DCM and CESG to ensure it delivers the highest quality namespace in .uk.

Nominet holds the ISO 20000 certification for IT Service Management, ISO 22301 certification for Business Continuity and ISO 27001 certification for Information Security.

Protecting the UK Government

Nominet is proud to work with the National Cyber Security Centre (NCSC) to deliverthe UK Public Sector protective DNS service, part of the Active Cyber Defence programme.

The service has proved incredibly effective, and is now providing critical protection for over 200 publicsector organisations covering central government offices and departments, NHS Trusts, local authorities, blue light services, region-specificpublicservices networks and many more.

Profit with a purpose

Nominet is a profit with a purpose company, which is enshrined in its Memorandum and Articles of Association and acts as a guiding principle in all that it does.

The company focuses on delivering tangible outbound publicbenefit activities to:

- Promote digital engagement: all businesses, organisations and individuals should be able to reap the benefits of being online
- Play its part to ensure the internet is safe and trusted in an increasingly complex cyber landscape
- Apply technology to tackle long-standing challenges, exploring how emerging technologies can help communities

Due to the success of the registry business, Nominet has been able to donate £45m to tech for good initiatives, helping over 10 million people. This ambition grows as the company

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enters a new era as global technology provider, with the aim to achieve lasting social impact on the lives of one million people ayear.

Strategic direction

Continuing its innovation strategy – Nominet is looking towards to the registry of the future in a world of connected objects. The company's strategy focuses on provision of services in pioneering fields such as autonomous vehicles and is a founding member of the DRIVEN consortium, exploring the provision of trusted and secure data exchange for real-time transactions, including a framework for security and privacy, vital to future development of autonomous vehicles.

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3 Joint Radio Company

ComReg Consultation – Ref 18/74

Proposed Strategy for Managing the Radio Spectrum - 2019 to 2021

Consultation on ComReg's new Radio Spectrum Management Strategy Statement

Response

The Joint Radio Company (JRC) welcomes the opportunity to respond to this consultation. JRC supports the actions of the Commission for Communications Regulation (ComReg) to review and update its Radio Spectrum Management Strategy for the period 2019-2021.

We acknowledge the efforts of ComReg over recent years and currently with the proposed Multi-Band award to support the increasing demand from the consumer and enterprise for mobile data access. However, it is important that ComReg does not overlook the importance of spectrum access for other users / segments. To this end we are encouraged by the initiative[1] to enable access to the spectrum in the range 410-415.5 & 420-425.5 MHz which has the potential to support 'Smart Grid' developments in Ireland and be critical to helping the Irish Government deliver upon key environmental targets agreed with the International Community.

In light of the increasing importance of robust and resilient operational telecommunications systems to the Utility sector[2] it is surprising to note that ComReg has not acknowledged the Utility sector as a key user of spectrum both currently and more so in the future – perhaps as part of its periodic Spectrum Strategy review being undertaken here it should also consider what new services / applications will need to be accommodated.

The appraisal of economic impact of spectrum can be a very subjective exercise as has been acknowledged by ComReg and whilst the approach proposed by Frontier appears to be pragmatic there are some additional aspects worthy of consideration;

- Societal Benefit or Social Value; and
- The impact of Secondary Users.

Social Value: there is an inherent societal value of the provision of services to consumers / enterprise that goes beyond the cost / price of provision and hence economic value created. This can be characterised in the provision of Broadcast services that inform, educate and support communities / cultural identity. Whilst in the case of energy supply this is characterised by reliable and cost-efficient provision of energy on which enterprise and community are able to depend. In the case of water management, safe drinking water and efficient removal of sewage waste are essential for the welfare of society.

Secondary Users: are those that utilise spectrum as a key enabler of their operational capability. The communications systems deployed allow the enterprise to function more efficiently and cost effectively and can be critical to the safe management and operation of supply systems, e.g. energy networks. The cost to an economy from the loss of electricity supplies is several orders of magnitude greater than the cost of the electricity not supplied.

[1] https://www.comreg.ie/publication-download/consultation-proposed-release-410-415-5-420-425-5-mhz-sub-band

[2] Navigant Research White Paper, The Urgent Need for a Licensed Broadband Spectrum Allocation for Critical Infrastructure. Why the Utility Industry and Regulators Must Come Together in Support of Interoperable, Future-Proof Smart Grid Networks. Richelle Elberg, Q2 2018. Commissioned by pdvWireless

We encourage ComReg to seek to incorporate these additional components in the detailed economic appraisal to be undertaken by Frontier.

Background

Joint Radio Company Ltd is a wholly owned joint venture between the UK electricity and gas industries specifically created to manage the radio spectrum allocations for these industries used to support operational, safety and emergency communications.

JRC manages blocks of VHF and UHF spectrum for Private Business Radio applications, telemetry & telecontrol services and network operations. JRC created and manages a national cellular plan for co-ordinating frequency assignments for several large radio networks in the UK.

The VHF and UHF frequency allocations managed by JRC support telecommunications networks to keep the electricity and gas industries in touch with their field engineers. These networks provide comprehensive geographical coverage to support installation, maintenance and repair of plant in all weather conditions on 24 hour/365 days per year basis.

JRC's Scanning Telemetry Service is used by radio based Supervisory Control And Data Acquisition (SCADA) networks which control and monitor safety critical gas and electricity industry plant and equipment throughout the country. These networks provide resilient and reliable communications at all times to unmanned sites and plant in remote locations to maintain the integrity of the UK's energy generation, transmission and distribution.

JRC supports the European Utility Telecommunications Council's Radio Spectrum Group, and participates in other global utility telecom organisations. JRC participates in European Telecommunications Standards Institute (ETSI) working groups developing new radio standards, and European telecommunications regulatory groups and workshops.

JRC also manages microwave fixed link and satellite licences on behalf of the utility sector.

JRC works with the Energy Networks Association's Future Energy Networks Groups assessing ICT implications of Smart Networks, Smart Grids & Smart Meters and is an acknowledged knowledge source for cyber-security in respect of radio networks.

4 JCI Europe Communications Ltd

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August 30, 2018

Ms. Suzanne Power

Commission for Communication Regulation

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RE: JCI Europe Communications Ltd. response to Com Reg document 18/74 – Proposed Strategy for Managing the Radio Spectrum - 2019 to 2021

Dear Ms. Power,

JCI Europe Communications Ltd. (JCIEU) welcomes the opportunity to provide comment on Comreg document 18/74. JCIEU is a subsidiary of Japan Communications Inc. (JCI), Japan's leading MVNO and global pioneer of the MVNO business model. JCI, founded by Dr. Frank Seiji Sanda, is publicly traded on the first section of the Tokyo Stock Exchange and in addition to Dublin-based JCIEU, has subsidiaries in Colorado and Florida in the US. In addition to consumer services, the JCI Group provides Enterprise and loT customers a secure end-to-end network globally via its patented wireless leased line technology.

With regards to ComReg's spectrum allocation and management planning, JCIEU requests that Com Reg allow usage of 40MHz of spectrum in Band 39 (1880MHz-1920MHz) for the provision of TDD-LTE services on a license-exempt basis. License-exempt LTE access will drive innovation, competition and lead to the creation of new industries. It is being implemented by leading economies across the globe including Japan and the United States. To avoid interference with any existing licensed services in band 39, the Irish license exemption could begin with 20MHz from 1880MHz-1900MHz (the DECT band) with the remaining 20MHz added in two subsequent tranches. License-exempt LTE services would cohabit the spectrum with legacy DECT services and would support the technical conditions of DECT to ensure minimal interference. Given the decline in relevance of DECT in modern society, we believe that allowing license-exempt LTE services in this band will maxmise the efficiency of this spectrum's usage in line with Com Reg goals while mitigating impact on remaining DECT users.

There is immense global momentum towards the development of new spectrum accessstructures for the provision of mobile communications services. Japan and the US have both determined to allow companies to deliver LTE services on a license-exempt basis. Japan has designated a subset of band 39 for general access under its license-exempt LTE (sXGP} programme and the US is opening access to SOMHz of spectrum under Citizen's Broadband Radio Service (CBRS).

In Japan, 12MHz of spectrum in band 39 has been opened for license-exempt access with more expected to be opened in the future. A key element of the Japanese programme is that operators ensure that interference with PHS or DECT services is minimised. To this end, the Japanese license-exempt LTE technical standards are designed to co-exist with DECT services. As such, the base stations that JCI has deployed in Japan support DECT conditions such as listen-before-talk.In the same way, license-exempt services in Ireland using the DECT band will minimiseinterference with DECT services.

The US is currently preparing the most ambitious license-exempt access programme globally. CBRS will see a total of SOMHz of spectrum from 3,550MHz-3,700MHz opened for three license categories. License-exempt providers will be able to use any available spectrum across the full SOMHz {with base station spectrum allocation managed in real-time by companies registered with the FCC as "Spectrum Allocation Services"). The economic benefit of license-exempt LTE spectrum access is conservatively estimated to be in the tens of billions of dollars per year.

License-exempt LTE will have a tremendous positive economic and societal impact through the creation of a new, high-tech, innovative start-up space. To illustrate, in 2009 JCI became the first MVNO to interconnect with NTI docomo Inc.. Following JCI's lead, new entrants gradually began to enter the marketplace. Subsequently in 2017, JCI became the first MVNO to interconnect with Softbank Mobile. As of December 2017, there were over 800 MVNOs operating in Japan servicing the consumer, enterprise and loT markets. Japan's MVNOs now account for over 17 million wireless subscriptions. In a few short years, the wireless startup space in Japan grew from almost nothing to one of Japan's most dynamic sectors. This has led to the invention of new technologies and solutions and has dramatically increased competition for incumbent mobile network operators in the provision of wireless telecommunication services. License-exempt LTE access will have an even greater impact and will further drive innovation as myriad new entrants begin to develop not only mobile services but also the networks they run on.

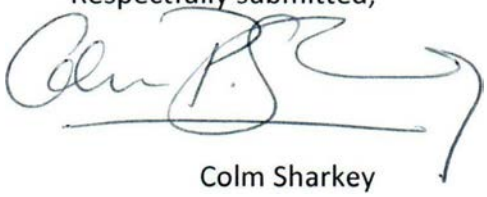
Allowing the provision of license-exempt LTE services will serve the public good. For Ireland, it will maximise the utilisation of radio spectrum, spur competition in wireless services,and lead to the creation of new, disruptive wireless services by new, innovative startups. In allowing license-exempt LTE services, ComReg will pave the way for a new wave of Irish wireless telecommunications tech startups. This impact will be amplified by orders of magnitude as other European States follow suit to allow DECT cohabitation and access to band 39. Addressing specific domestic concerns, market reviews undertaken by ComReg itself have shown that in-home service issues for voice and data services are higher than outside the home. It is also well known that service issues in rural areas are considerably higher than urban areas. The fixed-wireless services that would emerge with a license-exempt LTE provision structure would resolve these issues. Such a license regimen would also serve to remove the urban-rural divide in broadband

access. Specifically, license-exempt LTE services offer an extremely cost effective way to bridge the last mile in the provision of rural broadband services.

A key obstacle in the adoption of new wireless services is the proliferation of end-user devices. This is largely driven by economies of scale for base station and terminal equipmentmanufacturers. This will not be an issue for Irish license-exempt services in Band 39. This band isalready in use for TDD-LTE services in countries including China and Japan and devices are being designed with support built-in. Irish consumers would not be "left out in the cold" asmanufacturers already ensure that their devices support this spectrum to reach global markets.For example, JCIEU is currently conducting tests of TDD-LTE services in DECT spectrum in Ireland under the Test and Trial programme. The terminal equipment used in these tests include widelyavailable iOS, Android and laptop devices. With leading device manufacturers already involved, continued manufacturer support of this band going forward is guaranteed .

JCIEU requests the Commission allow license-exempt LTE services to be delivered using band 39 as part of its 2019-2021 Strategy for Managing the Radio Spectrum. We are confident that it is in the best interest of the Irish consumer, Irish enterprise and the people of Ireland as a whole. JCIEU welcomes the opportunity to engage with ComReg, and other regulatory or oversight bodies as required at national or European level, in further discussion and review of this matter.

Respectfully submitted,



Colm Sharkey

Managing Director

JCI Europe Communications Ltd.

5Irish Radio Transmitters Society (IRTS)

IRISH RADIO TRANSMITTERS SOCIETY
Since 1932

Amateur Radio in Ireland
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PATRON Michael D. Higgins
PRESIDENT OF IRELAND

Response to the

Consultation on ComReg's Draft Radio Spectrum Management Strategy 2019 to 2021

Published by the

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From the

Irish Radio Transmitters Society (IRTS)

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PART 1

Introduction

The Irish Radio Transmitters Society (IRTS) welcomes the opportunity provided by the Commission for Communications Regulation (ComReg) to comment on the Draft Radio Spectrum Management Strategy 2019 to 2021 published on 3 August 2018, document ComReg 18/74. Part 1 of this document is a scene setting section whilst Part 2 deals with specific suggestions concerning various issues which IRTS believe falls within the remit of a spectrum management strategy framework.

The IRTS was founded in 1932. It is a non profit organisation and is the Irish national society that represents licensed amateur radio operators in Ireland in respect of government and public relation matters. The IRTS is an active member of the International Amateur Radio Union (IARU), which is a sector member of the Radiocommunication (R) and Telecommunication Development (D) sectors of the International Telecommunication Union (ITU). The IARU also has observer status in all six regional telecommunication organisations, including the European Conference of Postal and Telecommunications administrations (CEPT), which addresses European technical telecommunications regulatory matters, often under mandate from the European Commission. IRTS Members hold within IARU Region 1 the roles of Chairman of the Political Relations Committee (PRC) and Chairman of the Spectrum and Regulatory Liaison Committee (SRLC). The SLRC Chairman represents IARU-R1 in the Frequency Management Working Group and the Conference Preparatory Working Group of CEPT as well as in ITU-R Study Group 5 (terrestrial radiocommunications).

Amateur Service

Amateur radio internationally is part of the leisure category of radiocommunications applications but has the distinction of being defined as a radiocommunications service in the ITU Radio Regulations[1], an international treaty instrument. In Article 5 of the Radio Regulations a number of frequency bands have been allocated to the amateur service and amateur-satellite service throughout the radio frequency spectrum.

Article 1.56 of the Radio Regulations describes the Amateur Service as," a radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest."

[1] Radio Regulations of the International Telecommunication Union, Geneva.

It is primarily a hobby in which participants use various types of radio communications equipment to communicate with other radio amateurs for public service, recreation and self-training and technical investigations. The term 'amateur' is not a reflection on the skills of the participants, which are often addressing state of the art techniques in radiocommunications; rather, the term 'amateur' indicates that amateur radio communications are not primarily involved in any commercial activities.

In Ireland radio amateurs, having passed an appropriate technical and regulatory examination, are licensed by the Commission for Communications Regulation (ComReg) under the Wireless Telegraphy (Amateur station Licence) Regulations, 2009 (S I No. 192 of 2009) Radio amateurs establish radiocommunications stations in order to conduct experiments with a view to the development of science or technique. Amateur stations utilise but are not limited to frequency bands allocated in Ireland to the amateur service. Irish radio amateurs are therefore involved in the recreational, public service, self training, technical investigations and experimentation aspects of the global amateur radio movement.

Amateur radio operators enjoy personal (and often worldwide) radio communications with each other and in many jurisdictions (including Ireland) are able to support their communities with emergency and disaster communications as appropriate, while increasing their personal knowledge of electronics and radio theory.

In furtherance of public service emergency activities a group of radio experimenters formed the Amateur Radio Emergency Network (AREN). This network operates under the umbrella of the IRTS and is essentially run by the AREN organisation in co-operation with ComReg. The Network was sanctioned following Ireland's adoption of Resolution 640 (1979) of the ITU Radio Regulations, which provides for the utilisation of amateur radio communications in emergency situations. Previously, Irish radio experimenters were licensed to communicate only with other radio amateurs nationally and internationally. ComReg, however, now extends the terms and conditions of the licences' of radio amateurs who are members of AREN to permit them to pass messages on behalf of a range of designated emergency services. It is worth mentioning that the contribution of amateur radio operators to providing communications in times of emergency or natural disasters throughout the world is well recognised and documented.

A side benefit of amateur and experimental radio is the fostering of an interest in STEM subjects in children and young people, which in many instances will stimulate an educational and career path for the person involved. This is turn may create a greater pool of professionally qualified persons, which are available for employment in the Irish ICT sector.

There are approximately three million amateur stations in the world, a number that is increasing at the rate of 7% annually. The number and variety of modes of emission used by radio amateurs are also expanding, creating internal pressures within the amateur service for their accommodation at the expense of users of established modes such as single-sideband telephony and manual Morse code telegraphy operations. These new modes include digital

voice, data and image. Their use improves the efficiency of amateur operations, but also increases the popularity of amateur radio and therefore the amount of frequency congestion.

Four years after the launch of the first man-made satellite (Sputnik) amateur radio enthusiasts launched OSCAR 1 (Orbital Satellite Carrying Amateur Radio) in 1961. Since then the amateur satellite programme has developed significantly and today ARISS (Amateur Radio on the International Space Station) allows school children throughout the world to speak with the astronauts while the FunCube project allows schools to experience orbital physics and satellite telemetry experiments.

In addition amateur radio operators continue to investigate propagation effects and are contributing to a greater understanding of how radio waves propagate for small percentages of time. Such scientific and investigative work requires frequency allocations in key parts of the spectrum and an extensive beacon network in order to conduct measurements over long periods of time.

In the context of the self-training and technical investigation aspects of amateur radio, the IRTS welcomed the Minister for Communications, Energy and Natural Resources'[2] commitment in the Department's 2014 Consultation on Spectrum Policy Priorities, to ensure that an adequate amount of useful spectrum continues to be available for amateur radio and scientific applications. Spectrum for these applications is important from an educational, research and recreational perspective and is vital in helping to ensure an ongoing interest in technology and in furthering our understanding of radio propagation and communications.

[2] The Department of Communications, Energy and Natural Resources (DCENR) is now the Department of Communications, Climate Action and Environment (DCCAE)

PART 2

General

The Irish Radio Transmitters Society (IRTS) has studied the document 'Consultation on Radio Spectrum Management strategy 2019 – 2021 and wishes to submit the following observations.

IRTS in common with IARU and most IARU member societies around the World continues to have three major concerns and objectives:

1. Ensure an adequate supply of suitable spectrum is allocated and is available to the amateur service and amateur-satellite service in the range 0 kHz to 3THz,
2. Ensure the overall noise floor in all current frequency bands does not increase to a level where small signal reception is not feasible in a typical domestic environment, which would make the hobby unattractive to many persons, and
3. Make every effort to encourage young people to take an interest in radiocommunications and other ICT subjects through amateur radio, thus facilitating a motivated and knowledgeable nucleus of people who are likely to be employed in the ICT sector in later years.

IRTS fully appreciates the valuable nature of spectrum and of the need to ensure that a balance is struck between the competing demands of the commercial sector, defence and public safety, the scientific community and others. Spectrum for amateur radio applications is important from an educational, research and recreational perspective and is vital in helping to ensure our ongoing interest in technology and in furthering our understanding of radio propagation and communications as well as participating in public service activities. In this regard there are thousands of radio amateurs around the World who spend their personal time training in order to provide communications and services when requested to do so. As climate change continues to influence global weather patterns with increasing severity, so the public service role for the amateur service is also likely to rise.

Although ComReg has major responsibilities with regard to implementing national spectrum policy and dealing with the many commercial users of the radio spectrum, the Society continues to find its interaction with ComReg to be very effective and productive. The Society enjoys a very good working relationship with both ComReg and DCCAE and would wish the dual complementary roles of ComReg and DCCAE to continue.

IRTS takes the view that it will probably be increasingly the case that changes in spectrum usage will be processed initially at the level of the regional telecommunications organisations such as CEPT before more general changes are processed through WRCs of the ITU. IRTS experience of this process has been generally positive. It is however unfortunate that a number of smaller administrations cannot attend project teams (PT) of the CEPT Conference Preparatory Group which become active as soon as a WRC has

finished and the provisional agenda for the next WRC is agreed. In Europe it is these PTs which are initially addressing WRC agenda items, including the consideration of European Common Proposals (ECP) as well as the CEPT position and brief. IRTS persons who attend PT meetings as IARU delegates often find that it is only the administrations opposing amateur items which speak and significantly influence the initial CEPT position. However with more administrations present in the PTs attending discussions on amateur items as well as other minority interest agenda items there would likely be a more balanced approach to the debate on these items. This would avoid the need to deal with such matters at the CPG which smaller administrations attend.

IRTS is also concerned that administrations with diminishing resources take a neutral position internationally on amateur radio agenda items when nationally they are supportive of the amateur movement and its needs. Such neutrality impacts the likelihood of finding sufficient support for ECPs on amateur issues proposed by IARU and other administrations. IRTS would appreciate a review of the situation in CEPT and perhaps some mechanism of resource sharing could be implemented by the smaller administrations and a system of multi country input documentation developed.

Licensing and Regulatory Matters

The spectrum requirements which IRTS has outlined in later sections of this response need to be addressed against the pertinent definitions and regulations in regulatory texts as follows:

The possession and use of radio equipment in Ireland is governed by the Wireless Telegraphy Act 1926, (Act No 45 of 1926), (as amended), which stipulates that an appropriate Wireless Telegraphy licence must be held, unless licence exempted.

"'Wireless Telegraphy' means the emitting and receiving, or emitting only or receiving only, over paths which are not provided by any material substance constructed or arranged for that purpose, of electric, magnetic or electromagnetic energy of a frequency not exceeding 3 million megahertz, whether or not such energy serves the conveying (whether they are actually received or not) of communications, sounds, signs, visual images or signals, or the actuation or control of machinery or apparatus.".

These requirements are considered important since CEPT as a consequence of the EU's Radio Equipment Directive (RED) is attempting to develop a regulatory framework for the use of spectrum below 8.3 kHz.

Although in Ireland there is currently no allocation or licensing regime for the use of spectrum below 8.3 kHz it is different in some other jurisdictions which include a lower band limit of 8.3 or 9 kHz in their legislation or regulations and do not require a licence to possess Wireless Telegraphy equipment. In these jurisdictions the use of this spectrum is not regulated and could be said to be exempt from licensing even though licensed radio amateurs are engaged in experimentation. In this regard surprising results have been achieved with very modest equipment.

Whilst recognising that an authorisation is required to operate below 8.3 kHz IRTS requests that means be devised to permit Irish radio amateurs to participate in the experiments being undertaken by amateurs in other countries.

A similar issue arises in Ireland concerning the use of frequencies above 3 THz which is not considered in Irish legislation to be Wireless Telegraphy and in addition is not subject to the possession of a licence. In this regard IRTS seeks clarity that such equipment would be exempt from licensing.

The following table is an extension of the one which can be found in Article 2.1 of the Radio Regulations since it includes a definition of ELF, SLF and ULF frequency designations as well as 'unofficial' designations THF and MHF covering the range 300 GHz to 30 THz. The sub 8.3 kHz range includes VLF, ULF, SLF and ELF frequencies.

Band Number	Symbols	Frequency Range	Corresponding Metric Sub-Division
1	ELF	3 to 30 Hz	
2	SLF	30 to 300 Hz	
3	ULF	300 to 3000 Hz	
4	VLF	3 to 30 kHz	Myriametric waves
5	LF	30 to 300 kHz	Kilometric waves
6	MF	300 to 3000 kHz	Hectometric waves
7	HF	3 to 30 MHz	Decametric waves
8	VHF	30 to 300 MHz	Metric waves
9	UHF	300 to 3000 MHz	Decimetric waves
10	SHF	3 to 30 GHz	Centimetric waves
11	EHF	30 to 300 GHz	Millimetric waves
12	THF[3]	300 to 3000 GHz	Decimillimetric waves
13	TBD[4]	3 to 30 THz	

Table 1 – Extended Radio Frequency and Wavelength Ranges

Concerning sub-millimetre radio spectrum requirements in this document, IRTS is seeking access to EHF frequency bands allocated to the amateur service above 70 GHz, some THF frequency bands at circa 500 GH, 700 GHz and 1-3 THz and lastly spectrum above 3 THz.

[3] THF = Tremendously High frequencies (300 – 3000 GHz)
[4] TBD = To be decided (3 – 30 THz)

Detailed Frequency Management Issues

IRTS is an active member society of IARU and is fully involved through IARU at the international and regional level, firstly in the identification of spectrum requirements through the ITU process of WRCs and secondly through the CEPT process by means of appropriate amendments to the European Common Allocation (ECA) table. Once allocations to the amateur service are included in the Radio Regulations and/or ECA, IARU Region 1 has a tradition of developing band plans to cater for all interests. National IARU member societies then develop the IARU plan to take account of any unique national requirements. IRTS believes that the amateur service should continue to self-regulate how individual frequencies and sub-bands should be utilised. Indeed IRTS has been engaged in recent months with a consultative exercise to develop national band plans in the 30.0-69.9 MHz range, which the amateur service in Ireland gratefully received as a result of the last spectrum consultation conducted by ComReg.

Table 2 below provides IRTS' spectrum aspirations for the period stated in the consultation document. Column 2 of Table 1 details frequency bands of interest and column 3 provides the reasons for proposed access or change in status. Further explanation on some of the frequency bands is provided in the text following Table 2 below.

Band	Frequency Range	Notes/Reason for Proposal
1	Sub 8.3 kHz	Currently being addressed in CEPT forums. See suggested footnote
2	5 250 – 5 450 kHz	Request transfer of 5 280 kHz, 5 300 kHz, 5 332 kHz, 5 348 kHz 5 400 kHz and 5 405 kHz from A1.4 to A1.3 of the Amateur Station Licence Guidelines 09/45. This would provide more flexibility to avoid primary services operating in 5 351.5 – 5 366.5 kHz
3	50 – 54 MHz	To harmonise 50 MHz allocation with Regions 2 and 3. See also Agenda Item 1.1 of WRC-19
4	75.5 - 77.5 GHz	75.5-76 GHz as per ECA secondary
5	77.5 - 78.0 GHz	primary
6	78.0 – 81.0 GHz	secondary
7	81.0 – 81.5 GHz	secondary see RR 5.561A
8	122.25 – 123.00 GHz	secondary
9	134.0 – 136.0 GHz	primary
10	136.0 – 141 GHz	secondary
11	241.0 – 248.0 GHz	secondary
12	248.0 – 250.0 GHz	primary
13	510.0 – 523.0 GHz	NIB basis – passive services not operating in this band
14	733.0 – 750.0 GHz	NIB basis – passive services not operating in this band
14	! – 3 THz	Similar footnote to sub 8.3 kHz
15	> 3 THz	[Licence exempt]

Table 2 – IRTS Current Spectrum Interest

Table 2 Band Comments

Sub 8.3 kHz

Prior to 2010 few expected that reliable communications could be achieved by radio amateurs at VLF. Radiated powers are low and antennas utilised are highly inefficient. However, with the advent of powerful weak signal processing software and dedicated work by a few enthusiasts, this has all changed. Some spectacular results have been, and continue to be achieved.

Radio amateurs in several CEPT countries have utilised VLF spectrum for amateur experimentation. In some countries a formal variation to their 'amateur licence' was required in others no authorisation was required as spectrum below 9 kHz is unregulated. For example, German amateurs chose several spot frequencies e.g. 8.97 kHz, 6.47 kHz and 5.17 kHz for technical convenience for their experimentation. Recently a quantitative field-strength estimate has also been conducted demonstrating that amateur stations are unlikely to cause harmful interference to lightning locator systems in the band 8.3 – 9.0 kHz, given their achievable radiated power levels in the microwatt or low milliwatt range. In the United Kingdom, following a compatibility assessment by the regulator, the band 8.7 - 9.1 kHz has been available to amateur licensees for experimental use on a case by case basis. Countries in other ITU regions have also hosted amateur activities on sub 9 kHz frequencies, notably the United States, Australia and Japan.

Recently an amateur signal on 8.971 kHz with an effective radiated power of circa 150 micro Watts has spanned the Atlantic Ocean, from North Carolina in the United States to the United Kingdom a distance of approximately 6194 km. A steady, GPS-locked carrier at 8.971 kHz was transmitted between 0000 and 0600 UTC and sophisticated digital signal processing (DSP) software was used to detect the transmission under both night-time and daylight propagation conditions at the receiver in the UK.

Proposal
In document 17/34 concerning frequencies below 8.3 kHz in national usage column add Amateur Service on a non interference basis (NIB) to services above and below 8.3 kHz.

5 250 – 5 450 kHz

The amateur service was successful in achieving a 15 kHz band in this frequency range at ITU WRC-15 and IRTS is grateful that ComReg released this 15 kHz band in a timely manner. However the allocation has a power limit of 15W eirp. Primary service usage is significant with the result that the frequency band is often unusable. IRTS therefore requests that additional spectrum is made available to the Irish amateur service.

Proposal
IRTS requests the transfer of 5 280 kHz, 5 300 kHz, 5 332 kHz, 5 348 kHz 5 400 kHz and 5 405 kHz from A1.4 to A1.3 of the Amateur Station Licence Guidelines 09/45 with the current operating conditions. This would provide more flexibility to avoid primary services operating in 5 351.5 – 5 366.5 kHz

50 – 54 MHz
Please refer to the section dealing with Agenda Item 1.1 of WRC-19.

WARC-79 Microwave Bands
It is now almost 40 years since an ITU radiocommunication conference allocated EHF frequency bands to the amateur service and amateur satellite service. In Ireland only the band 47.0 – 47.20 GHz in the EHF range currently appears in the guidelines document 09/45.

Proposal
IRTS proposes the release of the following EHF bands to the amateur service and the amateur-satellite service in Ireland:

75.5 - 77.5 GHz on a secondary basis (75.5 – 76.0 GHz as per ECA)
77.5 - 78.0 GHz on a primary basis
78.0 – 81.0 GHz on a secondary basis
81.0 – 81.5 GHz on a secondary basis (see RR 5.561A)
122.25 – 123.00 GHz on a secondary basis
134.0 – 136.0 GHz on a primary basis
136.0 – 141 GHz on a secondary basis
241.0 – 248.0 GHz on a secondary basis
248.1 – 250.0 GHz on a primary basis

THF Frequency Range 300 – 3000 GHz
Terahertz frequencies, also known as sub-millimetre wavelengths are frequencies in the 300GHz - 3THz range. This aligns with the ITU Radio Regulations that have an upper limit of 3THz.

In Ireland the Wireless Telegraphy Act recognises the ITU upper frequency limit and the licensing arrangements for all apparatus up to 3000 GHz (3THz).

In practice the ITU has two sub ranges, both of which are controlled by ITU Radio Regulation footnote 5.565.

- 275-1000 GHz – where important sub-bands for passive services are identified
- 1000-3000 GHz – where there is more flexibility

Licensed Amateurs in the UK, USA and Germany have some access to the THF range based on their own national regulations

Part of this frequency range (275-450 GHz) is currently under study as it is the topic of WRC-19 Agenda Item 1.15.

Concerning 275-1000 MHz IRTS has studied the sub-bands listed in RR 5.565 and has selected two sub-bands which are not in use by passive services and are not the subject of

WRC-19 Agenda Item 1.15, namely 510.0 – 523.0 GHz and 733.0 – 750.0 GHz. For the frequency band 1-3 THz a more flexible approach is proposed.

Proposals

1. IRTS proposes that document 17/34 should reflect the entire frequency range where wireless telegraphy is regulated e.g. 3 Hz to 3 THz.

2. IRTS also proposes (in order not to have a reoccurrence of the post 1979 situation) the release of the following frequency bands to the amateur service and the amateur-satellite service in Ireland:

   510.0 – 523.0 GHz
   733.0 – 750.0 GHz

3. In document 17/34 concerning frequencies above 1 THz in the national usage column add Amateur Service on a non interference basis (NIB) to services above and below 1 THz.

4. Also add a note in an appropriate place that the use of frequencies above 3 THz is not subject to licensing.

5.2.8 Work Plan Item for the Amateur Service

Paragraph 5.14 of the consultation document indicates that ComReg will consider allocating the 76 -81 GHz, 134 – 141 GHz and 241 – 250 GHz bands to the amateur service in Ireland and that this would align the Irish table with that of the ECA and Article 5 of the Radio Regulations.

IRTS is grateful for this work item but would request the inclusion of 75.5 – 76.0 GHz as per the ECA and 81.0 – 81.5 GHz as per RR 5.561A. The band 122.25 – 123.00 GHz is also missing from the EHF frequency range.

As mentioned in IRTS' paragraph concerning detailed frequency management issues on page 9 of this document several other spectrum issues have also been raised e.g. amateur access from 3 Hz to 8.3 kHz, tidying up the 5 MHz band, the question of 50 – 54 MHz at WRC-19 and access to THF spectrum in the range 300 GHz to 3 THz. IRTS would be grateful if these items would also be included to ComReg's Work Plan. IRTS also believes that document 17/34 should reflect the entire frequency range where wireless telegraphy is regulated e.g. 3 Hz to 3 THz.

5.2.9 Aeronautical, Maritime and Scientific Services

The last bullet point of paragraph 5.15 in the consultation document indicates that consideration will be given to the possibility of promoting and potentially establishing

“quiet zones” for particular frequency bands around specific areas of radio spectrum research such as Bir Castle.

IRTS assumes that this issue refers to the Irish Low Frequency Array (I-LOFAR) website. I-LOFAR is the Irish station in the European-wide network of radio telescopes, used to observe the Universe at low frequencies in the range 10-240 MHz. After examining the LOFAR web-site it appears that there are two distinct antenna types: the Low Band Antenna (LBA) operates between 10 and 90 MHz and the High Band Antenna (HBA) between 110 and 250 MHz. These "sensors" are organised in aperture array stations. The stations (currently, 36 stations are being constructed in the Netherlands) are distributed over an area about one hundred kilometres in diameter (located in the North-East of the Netherlands). Several international stations are to be built in Germany (5), Sweden (1), the UK (1) and France (1).

This is a very wide frequency range and for the amateur service in Ireland alone could impact allocations at 10 MHz, 14 MHz, 18 MHz, 21 MHz, 24 MHz, 28 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz and 144 MHz. Of course many of the lower frequencies will be influenced by long distance ionospheric propagation during periods of high solar flux.

At present IRTS would like to note this development and seek clarity on how amateur licensees would be impacted by this development. Also how many licensees would be affected by the quiet zone(s) envisaged?

4.1 International harmonisation of Radio Spectrum

In addition to the points raised by ComReg in paragraphs 4.4 to 4.8, IRTS believes the following recommendation from WRC-12 is very relevant.

In 2012 the ITU World Radiocommunication Conference (WRC) in Recommendation 34 recommended that future WRCs dealing with principles for the allocation of frequency bands, should

- wherever possible, allocate frequency bands to the most broadly defined services with a view to providing the maximum flexibility to administrations in spectrum use, taking into account safety, technical, operational, economic and other relevant factors;

- wherever possible, allocate frequency bands on a worldwide basis (aligned services, categories of service and frequency band limits) taking into account safety, technical, operational, economic and other relevant factor

4.1.1 World Radiocommunication Conference 2019

IRTS was disappointed to find no mention of the amateur service in paragraph 4.10. It is hoped that at least the three priority items mentioned below will feature in Ireland's priority list in future.

It is also noted that Irish preparations for major ITU and CEPT events are not prepared in the public domain IRTS continues to believe that the situation could be improved at the national and international level since most frequency allocations to the amateur service and amateur-satellite service have to be negotiated at some point in time in ITU and/or CEPT forums. In many countries a representative from the national society is encouraged to participate in the national delegation and IRTS continues to seek for such an opportunity also.

IRTS also seeks an opportunity to discuss these WRC-19 issues with the Irish WRC-19 delegation at the earliest opportunity.

The amateur service has an interest in several WRC-19 agenda items (AI) namely 1.1 (50MHz), 1.7, 1.11, 1.12, 1.13 (IMT or International Mobile 5G telecommunications), 1.15 (above 275 GHz), 1.16 ("5 GHz Wi-Fi"), 9.1.6 (Wireless Power Transmission or WPT) and 10 ("future WRC agendas"). **The amateur service has three priority items underlined above** and a further three having significant interest. The following paragraphs summarise the current status and suggest appropriate actions.

1 Agenda Item 1.1 - 50-54 MHz

WRC-19 Agenda item 1.1 addresses the consideration of an allocation in all or part of this frequency band for the amateur service in Region 1 subject to justifying the need for the allocation and subject to satisfactory sharing with existing services. The services concerned are residual television broadcasting in the 50 MHz spectrum, fixed and mobile services already using the spectrum in a few countries and a few wind profiler radars which use frequencies close to 50MHz.

Globally the frequency band 50-54 MHz is currently allocated on a primary basis to the amateur service in ITU Regions 2 and 3 as well as in a number of African countries in ITU Region 1. Based on CEPT considerations, a number of European countries have allowed amateur use in part of this spectrum under Article 4.4[5] of the ITU Radio Regulations (RR). The amateur service is therefore looking for spectrum alignment at WRC-19 in all 3 ITU regions (e.g. globally), with a 4 MHz primary allocation at 50-54

[5] Article 4.4 - Administrations of the ITU Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by a station operating in accordance with the provisions of the ITU Constitution, the ITU Convention and the ITU Radio Regulations.

MHz. An application based spectrum needs calculation method shows that slightly more than 4 MHz is required on average in CEPT countries, whilst in high density areas over 10 MHz would be required to meet anticipated needs, obviously not feasible at this time. IRTS believes that spectrum sharing can be covered through regulatory footnotes in RR Article 5, which would protect existing television service areas in Eastern Europe and provide a basis for national sharing with respect to the land mobile and fixed services and secondary radiolocation (wind profiler) usage.

- **Global harmonization of the frequency band 50–54 MHz is highly desirable.** Concerning spectrum needs an IARU study shows that, based on the average amateur density in an area of high amateur licensees, the required spectrum is slightly less than 4.2 MHz. Another study conducted by Switzerland concluded that circa 2 MHz was required based on a short duration monitoring programme and reverse engineering of the published logs of participants in an IARU 50 MHz competitive event (amateur radio contest).

  A 4 MHz primary allocation to the amateur service in Region 1 would align with the existing amateur service allocation in Regions 2 and 3. Such an allocation in Region 1 would harmonise the current use of the lower 500 kHz for inter-regional communication and allow for emerging wider bandwidth data communications applications, reduced bandwidth digital television and other applications requiring up to 500 kHz channel widths. Such an outcome would in addition satisfy the principles outlined in Recommendation 34 (Rev.WRC-12) encouraging spectrum harmonisation.

- **Sharing studies have shown 50-54 MHz can be successfully shared by the amateur service and analogue television broadcasting**. Harmful interference should not occur if the field strength produced by stations of the amateur service does not exceed 6 dBµV/m at the boundaries of the service areas of operational television broadcasting stations. Experience (current RR Article **4.4** usage in Europe and the Middle East) together with the proposed regulatory measures confirm that the allocation of the frequency band 50-54 MHz to the amateur service in Region 1 is unlikely to result in harmful interference being experienced by the broadcasting service.

- Initial studies indicate that co-channel sharing between the amateur service and the fixed and the land mobile service in Region 1 may be difficult in the same geographical area. **Mitigation factors, aligned with current operational experience suggest that harmful interference from the amateur service can be avoided and compatibility should be possible**, also recognising that the band

available to fixed and land mobile equipment in this frequency band is generally 30-88 MHz.

- Concerning wind profiler radars (WPR) the limited numbers of WPR systems in or immediately adjacent to the 50-54 MHz frequency range (and probably the expected low number of amateur systems in the vicinity of WPR installations), allows for sharing to be considered on a case-by-case basis and affected **administrations could establish coordination zones in the specific geographical areas concerned**.

- The CEPT Project Team position that only 2 MHz could be available for the amateur service at 50 MHz was confirmed by CEPT's Conference Preparatory Group (CPG). Although the IARU and IRTS spectrum need remains 4 MHz on a global basis and IARU's application based method supports this view, IARU appreciates that CEPT administrations may not be in a position to allocate this amount of spectrum to the amateur service in Europe. At the CPG, IARU therefore asked for a smaller amount of this spectrum to be on a primary basis, and proposed that 50.0-50.5 MHz be allocated to the amateur service on a shared primary basis and 50.5-52.0 MHz be allocated on a shared secondary basis.

IRTS requests DCCAE and ComReg to support the IARU 50 MHz compromise with a 50.0-50.5 MHz primary band and 50.5-52.0 MHz secondary band.

- IARU is also considering suggesting an additional footnote for the ITU Radio Regulations as follows: *In Region 1 with the exception of the countries listed in **5.169** of the Radio Regulations, administrations may allocate all or part of the frequency band 52-54 MHz to their amateur service. When making allocations within this range to their amateur service administrations shall take such steps as may be necessary to prevent harmful interference from their amateur service to radiocommunications of other countries.*

IRTS requests DCCAE and ComReg support for such a footnote and the possible **allocation** of the additional spectrum 52-54MHz to the amateur service on a **national basis** following WRC19.

2 Agenda Item 1.13 - International Mobile Telecommunications

IRTS is of the view that the spectrum requirements identified for IMT in the frequency range between 24.25 GHz and 86 GHz can be fully met in the frequency bands that are already allocated to the mobile service on a primary basis, and do not justify the allocation of 47.0-47.2 GHz to the mobile service. This narrow primary allocation is the only spectrum in which amateur experimentation with millimetre wavelengths can be

conducted without practical constraints imposed by sharing with other services. Therefore, **IRTS opposes additional allocations in this band to other services**, including the mobile service. If either or both of the bands that are adjacent to 47.0 - 47.2 GHz are identified for the terrestrial component of IMT, suitable **emission limits must be included** in order to **ensure the protection** of existing and future amateur and amateur-satellite stations in the 47.0-47.2 GHz band.

- IRTS is further of the view that any allocation to IMT in the frequency range 24.25-27.5 GHz shall include full consideration and protection for the amateur and amateur-satellite service's primary allocation at 24-24.05 GHz.

- **IRTS seeks DCCAE and ComReg support to discourage any attempt to suppress the 47.0-47.2 GHz allocation to the amateur service and the amateur-satellite service** for the reasons outlined above,

- **IRTS seeks DCCAE and ComReg support that other services should not be introduced to this band** as it is currently one of the only allocations which are primary and exclusive to the amateur services.

3 Agenda Item 9.1.6 - WPT

Agenda item 9.1.6 relates to:

"Studies concerning Wireless Power Transmission for electric vehicles WPT (EV):

a) to assess the impact of WPT for electric vehicles on radiocommunication services;

b) to study suitable harmonized frequency ranges which would minimize the impact on radiocommunication services from WPT for electrical vehicles."

These studies should take into account that the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO) and the Society of Automotive Engineers (SAE) are in the process of approving standards intended for global and regional harmonization of WPT technologies for electric vehicles."

Work is under way in both ITU and the RTOs on this subject, as well as in international standards organisations. Until now, no serious discussion has taken place on the implications of the spurious emissions from WPT (EV) systems for authorised radio services operating in the vicinity. The projected deployment of WPT (EV) is very high – there will always be a WPT (EV) installation close by – and IARU's assessment is that new limits for spurious emissions will be needed. The existing limits were not set with 24/7 wideband, high power, and a high deployment density of WPT installations in mind.

Conventional radio services are not well represented in the WPT discussions so far. National administrations have not, in general, expressed a view on the question of spurious levels. In brief:

- WPT (EV) is projected to be deployed widely in the residential environment (urban/suburban/rural),
- Existing CISPR, CEPT or ITU limits for spurious emissions will not prevent harmful interference to radio services – they allow for much to high emission levels since they were not developed with this sort of application in mind,
- WPT (EV) is a 24/7, high power technology with high harmonic content – the potential for harmful interference is very great.
- New limits are needed to safeguard existing radio services (broadcast, amateur, other) which are entitled to receive proper protection from harmful interference,
- Administrations are requested to become involved in the WPT discussions on all levels and to make their views known.

IRTS hopes that DCCAE and ComReg agree that:

- There is a **priority need to protect radio services** from high levels of spurious emissions from WPT (EV) systems,
- The high projected density of WPT (EV) deployment means that **existing spurious limits are not appropriate for a high power "always on" technology,**
- Modelling shows that harmful interference could extend to up to 1 km from a WPT (EV) installation under current spurious emissions limits, therefore
- IRTS seeks the support of DCCAE and ComReg to protect vulnerable radio services such that they will be able to operate as intended. At present the spurious emission limits being quoted for WPT (EV) are a long way from what is required and would cause severe interference to radio services in the residential environment.

4 Agenda Items 1.15, 1.16 and 10

These items are also of interest to the amateur service. AI 1.15 only covers identification of frequency bands only for the fixed and mobile service above 275 GHz. IRTS believes that all radiocommunication services, including the amateur service should be able to achieve future allocations above 275 GHz and IRTS has requested such allocations in this document, see item 13 and 14 of Table 2. IRTS believes it to be important to ensure that the amateur service is also included in any future work on the identification of frequency allocations to radiocommunication services above 275 GHz. Such proposals may come up under WRC-19 agenda item 10 (agendas for future WRCs) and IRTS hopes that CEPT

administrations would support the needs of the amateur service in any planning exercise in spectrum above 275 GHz.

AI 1.16 concerns the needs of the Wi-Fi community for additional spectrum resources including 5 650-5 850 MHz (a secondary amateur allocation) where they are proposing a primary mobile allocation to meet the needs of Wireless Access Systems (WAS) and Radio Local Area Networks (RLAN). From a European amateur standpoint such extended use may create additional problems since an IP based INTRANET for radio amateurs called HAMNET has been built which uses the secondary spectrum in 2.3 and 5 GHz.

The amateur community can do little about how this agenda item progresses in respect of the affected primary services but would wish to maintain the secondary amateur allocation since sharing may remain possible.

AI 10 is the agenda item which looks at future WRC agendas. IRTS does not foresee any amateur items below 275 GHz required for WRC-23 or WRC-27.

Summary

IRTS would like to extend its thanks to ComReg for the opportunity to respond to this consultation and hopes that the Irish telecommunications regulator will be favourably disposed to the suggestions and requests outlined in this document. These have been prepared in order to address the global concerns and objectives of the International Amateur Radio Union of which IRTS is the Irish member society:

1. Ensure an adequate supply of suitable spectrum is allocated and is available to the amateur service and amateur-satellite service in the range 3 Hz to 3THz,
2. Ensure the overall noise floor in all current frequency bands does not increase to a level where small signal reception is not feasible in a typical domestic environment, which would make the hobby unattractive to many persons, and
3. Make every effort to encourage young people to take an interest in radiocommunications and other ICT subjects through amateur radio, thus facilitating a motivated and knowledgeable nucleus of people who are likely to be employed in the ICT sector in later years.

During the period of the strategy the IRTS would wish to see the following implemented. In particular in view of the CEPT and ITU timetable for WRC-19 preparation IRTS would like an early exchange of views on IRTS proposals addressing WRC issues:

- Availability of sub 8.3 kHz spectrum for use by the amateur service in Ireland,
- Transfer of 5 280 kHz, 5 300 kHz, 5 332 kHz, 5 348 kHz 5 400 kHz and 5 405 kHz from A1.4 to A1.3 in document 09/45,
- Support of the IARU position for the frequency band 50-54 MHz in CEPT and ITU preparations for Agenda Item 1.1 of WRC-19

- Release EHF spectrum allocated to the amateur service in the ECA and Article 5 of the RR in the range 75.5 - 250 GHz (including 81-81.5 GHz and 122.25 – 123.00 GHz)
- Release THF spectrum for the amateur service in the bands 510-523 GHz and 733-750 GHz as well as 1 – 3 THz
- Clarify any terms for using spectrum above 3 THz.
- Clarify the position for amateur licensees in the vicinity of Birr Castle
- Support the IARU/IRTS position generally in respect of CEPT preparations for ITU WRC-19 - agenda items 1.1, 1.13, 1.15, 1.16, 9.1.6 and 10

IRTS remains at ComReg's disposal if further information or clarification is required. The IRTS would also like to state that **nothing in this document** needs to be considered as restricted or confidential.

6 Inmarsat

On behalf of Inmarsat, I am providing some comments in response to your consultation "Proposed Strategy for Managing the Radio Spectrum - 2019 to 2021". I note that this is a bit later than your deadline, but I hope you can still accept the submission. I would appreciate a reply e-mail to confirm you received this and to clarify whether you can accept the comments.

The comments are as follows:

"Paragraph 3.97 of the consultation document states that "ComReg is not aware of any demand for a licensing regime for SES below 3GHz and, as such, does not propose to include this as a work plan item for the forthcoming strategy period". In this regard, Inmarsat wishes to highlight that some work may indeed be required for earth stations below 3 GHz, specifically with regard to licensing of MSS systems in the "extended L-band" allocations (1518-1525 MHz and 1670-1675 MHz). These bands are designated to the MSS in CEPT and is used by Inmarsat for its MSS services in Europe. While these bands are already allocated to the MSS in the national frequency allocation table, a modification to the licence exemption regulations may be needed to permit authorisation of MSS operations in these frequency bands in Ireland. Inmarsat courteously requests that scope for this work is included in the work plan for satellite services for 2019-2021."

7 ESBN

Energy for generations

Telecom Services, ESB Networks

ESB Networks' response to ComReg's Consultation on Proposed Strategy for Managing the Radio Spectrum – 2019 to 2021 (18/74)

31/08/2018

Contents

1. INTRODUCTION

ESB Networks (ESB Networks DAC, forthwith defined as ESBN), welcomes the opportunity to respond to the Commission for Communications Regulation (ComReg) consultation in relation to its proposed Spectrum Strategy for the period 2019 - 2021.

Radio spectrum is a hugely important natural resource, enabling both critical and non-critical services to be deployed and made available to the benefit of all citizens and Ireland Inc. It is a key enabler for the provision of wireless services which in turn generates significant economic, technological, social, environmental and safety benefits. In that regard, it is vital that appropriate radio spectrum is made available in a timely manner which brings the maximum benefit for the people of Ireland.

ESBN applauds ComReg's ambitious plans for the period 2019 – 2021 and is confident ComReg can once again carry out its duties successfully to the benefit of society and industry in Ireland.

1.1 Introduction to ESBN

ESBN, a regulated subsidiary within ESB Group, is the licensed operator of the electricity distribution system in the Republic of Ireland. ESBN is responsible for building, operating, maintaining and developing the electricity network and serving all electricity customers in the Republic of Ireland.

The electricity distribution network includes all distribution stations, overhead electricity lines, poles and underground cables used to bring power to more than 2 million domestic, commercial and industrial customers connected to the electricity network nationwide. ESBN also maintains the high voltage transmission network in Ireland on behalf of the Transmission System Operator (TSO) EirGrid.

Secure telecommunications is vital to the safe and efficient operation of the grid. The electricity network depends heavily on having high quality and high availability communications infrastructure (meeting specifications for back up; redundancy; resilience; low delay and jitter). ESBN deploys and operates extensive fixed and wireless telecommunications infrastructure to provide ESB and EirGrid with necessary real time information for operational purposes (i.e. to monitor and control the distribution and transmission networks). Such critical communication cannot be provided by public communications networks, as these networks do not satisfy the operational network requirements.

ESBN telecommunications network requires connectivity in a significant number of locations throughout the country, often in remote areas where propagation of high frequency signals is limited (e.g. within High Voltage substations). A significant proportion of ESBN's telecommunications network relies solely on wireless for several reasons, e.g. cost, efficiency, resilience, reliability, flexibility etc.. In addition, wireless offers a solution where it is technically difficult and or uneconomic to use cables to connect devices to the network. Radio spectrum is a fundamental component of ESBN's existing safe and resilient operational telecommunications network.

2. COMMENTARY

ESBN has responded with comments on sections of interest below, labelling each section with a reference to paragraph or chapter number from ComReg's consultation document.

ESBN's comments are outlined below:

2.1 Chapter 2

2.1.1 Section 2.1.2

ComReg's Spectrum Management role is well defined and fit for purpose. ComReg executes this function very well and within its defined remit.

DCCAE and relevant Minister(s) are responsible for setting national policy decisions regarding telecommunications in Ireland. ESBN encourages DCCAE to engage with stakeholders to establish its own Spectrum Strategy in order to enable all spectrum users to contribute to national policy decisions.

2.1.2 Section 2.2.1

ESBN commends ComReg on the work it conducts at various international fora (e.g. ITU, CEPT, BEREC). ESBN encourages ComReg's continuing work at these fora and representing the interests of spectrum users in Ireland. ESBN believes it is necessary for spectrum users and ComReg to engage regularly on key issues in order for ComReg to be best informed of the interests of industry in Ireland. This could inform representations made by ComReg at such fora.

2.1.3 Section 2.2.2

ESBN commends ComReg on initiating the various work streams as outlined in paragraph 2.35. The proposed Multiband Spectrum release will provide a large amount of sub 3GHz spectrum which will be to the benefit of spectrum users, industry, competition and consumers. ESBN also considers ComReg's recent reports on Mobile Handset Performance (Voice) (ComReg Document 18/05) and Effects of Building Materials on Indoor Mobile Performance exceptional. These reports provide practical empirical information on major factors which affect the perceived performance of radio systems for end users. Indeed, ComReg have provided means for users to overcome some of these issues in permitting the use of mobile phone repeaters.

ComReg references a report it will publish in the future regarding '*Coverage obligations and Spectrum Awards*'. ESBN will be very interested in this report and will certainly provide comments on same. Indeed, ESBN encourages ComReg to gather interested parties thoughts on methodologies for determining coverage obligations prior to conducting the report. ESBN believes that ComReg has a difficult task in setting appropriate coverage and rollout conditions for different licences given the idiosyncrasies associated with different spectrum bands. Whilst ComReg's report may present principles which will guide coverage and roll out conditions for spectrum bands, ESBN urges ComReg to not be too definitive regarding generic rules for spectrum releases. ESBN recommends that ComReg consults with interested parties on suitable coverage and roll-out obligations during each award process. A variety of factors can influence the suitable conditions that should be applied to spectrum, for example;

- Timing of release of spectrum;
- Band harmonisation (or lack thereof);
- Ecosystem and cost of equipment;
- Potential service provided; and
- Duration of licence.

ESBN encourages ComReg to consider novel licence conditions in future spectrum releases should the circumstances be suitable. For example, as a means of bridging the digital divide, there could be a requirement on a certain amount of coverage/infrastructure to be deployed in rural areas before urban deployments can take place, similar to the award of the 800 MHz spectrum in Germany which was based on 'out-to-in' coverage obligations.

ESBN believes that an increase in availability of accurate and independent information on actual performance of different wireless networks can only be good for users and industry. These reports also highlight the difficulty ComReg have with regards to setting coverage conditions for wireless networks, as actual coverage (either indoor or outdoor) are dependent on a number of factors (clutter/building losses, sensitivity of CPE, antenna performance of CPE etc.). Perhaps a quality of service measure would be worth considering that also takes into account availability, resilience and reliability of the services. Or perhaps it is appropriate for ComReg to mandate minimum deployment of base stations to be deployed, rather than a difficult to quantify coverage requirement which is conditional on a variety of elements.

ESBN looks forward to ComReg publishing its report on '*Meeting Ireland's Connectivity Needs'*. ESBN believes that spectrum users, like utilities, should be included and considered in the report. ESBN would be happy to feed into ComReg's report, at which point it can further outline utilities' dependence on radio spectrum and associated services.

2.2 Chapter 4

2.2.1 Section 4.1.1

ESBN encourage DCCAE and/or ComReg to consult on proposed strategy for Ireland at WRC 2019. Such consultation with spectrum users could be formal (publish formal consultation document) or informal (host workshops). It is important that spectrum users contribute to the overall strategy taken. ESBN notes that Ofcom in the UK has already begun its process[1] of seeking guidance and input into its WRC 2019 strategy. ESBN encourages Ireland to carry out a similar information gathering process.

ESBN, for example, encourage Ireland's administration to proffer the potential for Utilities to be recognised as spectrum users, which they currently are not.

[1] https://www.ofcom.org.uk/__data/assets/pdf_file/0017/114524/consultation-wrc-19.pdf

2.2.2 Section 4.2.1

700 MHz Band Duplex Gap: As ESBN outlined in its response to ComReg Consultation 18/60, this spectrum should be made available for PPDR. DCCAE should enact policy decision with regards to this spectrum if necessary.

1.4 GHz Band (Centre and Extension bands): As outlined in its response to ComReg Consultation 18/60, ESBN agrees with ComReg that neither the 1.4 GHz spectrum band nor extension bands should be included in the Proposed Award. ESBN encourages ComReg to consider the release of 1.4 GHz Centre Band in the medium term, and for the 1.4 GHz Extension Bands not to be changed from current usage in the long term.

2.2.3 Section 4.3.1

ComReg have presented interesting points regarding demand and supply side factors impacting mobile data usage. Demand is increasing exponentially with supply unlikely to keep pace, even when 5G arrives well into the future. In reality, ESBN believes that there will be the need for small cell solutions to provide localised capacity for users. The pressure on operators to deliver on user demands is likely to make it increasingly difficult for MNOs to deliver wireless services to users who have more stringent requirements than the typical smart phone consumer (e.g. availability, coverage etc.). There is the likelihood that future network investments by MNOs will be targeted on delivering a 'hot spot' model to high footfall locations whilst the broader coverage footprint remains under developed to the detriment of those areas/services that are not well served. ESBN are keen to work with ComReg to ensure that the needs of other users / sectors, e.g. utilities, are not overlooked when establishing spectrum release mechanisms.

2.2.4 Section 4.5.4

ESBN commends ComReg's successful release of National Telemetry Licences in 2014. ESBN uses this spectrum allocation intensively having deployed a mission critical nationwide network. As discussed further below, ESBN encourages ComReg to make determination on the future of this band soonest.

2.3 Chapter 5

2.3.1 Section 5.2.2

ESBN encourages ComReg to release spectrum to the market over the 2019 – 2021 period. ESBN recommends that ComReg focuses its attention on the Multi-Band Spectrum release and the 700 MHz Duplex Gap for PPDR (pending DCCAE policy decision). ESBN encourages ComReg to exclude the 1.4 GHz band from the Multi-Band award, whilst in the long term ensure that the 1.4 GHz Extension Bands continues to be available to the current applications served for the reasons outlined in ESBN's response to ComReg Consultation 18/60. In the event that ComReg was to consider releasing the 1.4 GHz Extension Bands, ESBN recommends that as much notice (at least 5 years) is provided to fixed link users of the spectrum band. In line with other spectrum users (e.g. TV Broadcast), ESBN recommends that if ComReg were to move fixed link users from this band, a compensation fund should be made available to existing licences and a substitutable spectrum band for deployment (unlikely to be available given that ComReg is releasing (or has released) so much sub 4 GHz spectrum to the market).

2.3.2 Section 5.2.4

ESBN agrees with ComReg's proposal (bullet 2 in paragraph 5.10) to amend radio link guidelines to enable longer link path lengths with lower modulation and availability requirements. ESBN will engage with any ComReg consultation in relation to fixed radio links. ESBN also agrees with ComReg's proposal to release additional spectrum in the higher GHz range for radio links.

2.3.3 Section 5.2.7

ESBN urges ComReg to continue with its consultation process regarding the 400 MHz spectrum band. ESBN looks forward to responding to ComReg's next consultation on this spectrum later in 2018. ESBN applauds ComReg with its endeavours in releasing this spectrum band. Other administrations are considering such releases and there is activity in this spectrum band taking place globally. ComReg are leading the way and already have helped equipment developments as a result of its proposed release.

ESBN encourages ComReg to fulfil its proposal to permit the use of national Business Radio channels on a technology and service neutral basis. This is likely to increase innovation and spectrum efficiency.

ESBN agrees that ComReg should contribute to spectrum management considerations regarding BB-PPDR.

ESBN strongly agrees that ComReg should relaunch the TPBR scheme prior to licences expiring. As ComReg acknowledges in this consultation document, regulatory certainty enhances the incentive for spectrum users to invest in deploying infrastructure.

2.4 Chapter 6

ESBN does not believe that Frontier's proposal will factor in the economic benefit derived from ESBN's usage of spectrum. ESBN is a core spectrum user (indeed as outlined in ComReg's draft strategy, ESBN is the 10th biggest user of fixed links in Ireland). ESBN needs access to radio spectrum as a means of providing a reliable, efficient and safe electrical supply to all customers. In the event ESBN did not have access to spectrum (akin to Frontier's proposal number 4), there would be economic detriment and financial loss incurred (e.g. more potential for outages, longer restoration times etc.). ESBN encourages ComReg to consider including sectors/industries that are secondary users of spectrum in terms of their business model. ESBN also encourages ComReg to consider the social impact of service provision which is particularly relevant to public services that depend on spectrum, e.g. Broadcasting and Emergency Services.

It is unclear from current proposals whether ESBN's economic benefit is being considered. ESBN strongly recommends its economic benefit from using spectrum is included and would be happy to assist with providing metrics and assistance for calculating same.

3. SUMMARY

Radio spectrum is a vital natural resource which must be managed efficiently to facilitate economic, social, technological and environmental advances within Ireland. ESB Networks welcomes the opportunity to respond to this consultation and working with ComReg and Government to ensure that the spectrum is utilised appropriately. **ENDS**

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31 August 2018

Re: ComReg's Proposed Strategy for Managing the Radio Spectrum- 2019 to 2021

Dear Suzanne

I am writing in response to ComReg's consultation on its new Radio Spectrum Management Strategy Statement. eir welcomes the opportunity to respond to this consultation and wishes to make a number of remarks.

Very high-capacity networks (VHCNs) such as 5G will be a key asset for Ireland to compete in the global market with worldwide 5G revenues for mobile operators expected to reach €225 billion annually by 2025.[1] Recognising the importance of 5G for Europe, the European Commission, in its communications "Towards a Gigabit Society"[2] and "5G for Europe: An Action Plan"[3], has set a number of ambitious goals including;

- Early 5G network introduction by 2018, moving towards commercial large scale introduction by the end of 2020 at the latest; and
- Commercially available 5G mobile communications systems in all urban areas and major transport corridors in Europe by 2025

It will therefore be important to consider the implications for SG network deployment and building market momentum in the design of upcoming spectrum awards. Spectrum auction design should not only focus on raising public revenues but also on market outcomes including investment incentives and diffusion rates.

eir notes that at paragraph 2.35, ComReg states that it has initiated a number of work streams including "a *report for ComReg that will* assess *the extent to which appropriate coverage and ro/lout obligations can be Included in future spectrum awards".* eir would expect that in line with Goal 24 of the ECS Strategy Statement 2017-2019 to be *"proactive on engagement with* a *range of stakeholders"* and in the interest of promoting regulatory certainty, any proposals in this regard as well as the accompanying report will be published by ComReg in the form of a formal consultation. eir notes that such a consultation does not appear to currently be included in ComReg's annual plan and would therefore welcome additional clarity in this regard.

[1] https: //www .abiresearch. com/press/abi-research-projects-5g-worldwi de-service-revenue/
[2] http: //www .t-regs.com/wp-con te nl/upl oads/2016/09/Con nectiv ityfora Competitive Digi talSingleMarket-Towards a EuropeanGi gabitSo ciety-S taffWork ingDocument .pdf
[3] https: //ec.europa. eu/transparency/regdoc/rep/1/2016/EN/1 -2016-588 -EN-F1-1. PDF

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With regard to the proposed methodology for measuring the economic contribution of radio spectrum to Ireland as put forward by Frontier Economics and detailed in ComReg 18/74, eir agrees that a combination of Method One (Micro) and Method Two (Macroeconomic) would be an appropriate approach. ComReg may also wish to additionally consider whether commissioning a survey to capture the views of firms and suppliers which use spectrum as an input might be beneficial in terms of augmenting the results of the assessment.

Yours sincerely,

William Mccoubrey
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9 Carlson

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30th August 2018

Reference: Response to Consultation on ComReg's Draft Radio Spectrum Management Strategy 2019 to 2021. ComReg Document 18/74

Dear Suzanne,

Carlson Wireless Technologies welcomes the opportunity to respond to this consultation.

Bridging the Global Digital Divide

With the increasing importance of broadband Internet connectivity to the economic, social, educational and cultural wellbeing of people, businesses and institutions worldwide, the digital divide between the 'haves' and 'have not's has been a subject of growing attention and concern both within the United States and other industrialized nations and much more acutely in the developing world. More than four billion people worldwide still do not have access to the Internet.

Many factors contribute to the existence of the gap in broadband access, including the economics of low-density service provision in general, the typically lower standard of living in rural and remote areas – especially in less developed countries and regions – and a host of regulatory and technological obstacles.

The advance of wireless telecommunications technology continues to make inroads into serving areas "across the divide" and holds the key to bridging the gap. The advance and spread of cellular technology has made a significant contribution to the challenge in densely populated areas, yet the economic and technical realities of cellular connectivity make it uneconomical for lower-income and low-density populations.

However, breakthrough fixed-wireless technology using spectrum-sharing, cognitive radio systems optimized to utilize newly available, highly desirable "TV White Spaces" spectrum holds great promise to bring last-mile broadband service to a substantial number of the four billion unserved.

The Future Starts Now

The technology and regulatory developments that make this revolution possible have progressed hand-in-hand over the last ten years, and Jim Carlson and Carlson Wireless Technologies (CWT) have been on the leading edge of both fronts. We have vigorously advocated for spectrum sharing between licensed and unlicensed users since 2006, and we are a leading developer of this software-defined cognitive radio technology that makes spectrum sharing under tight bandwidth restraints possible.

After conducting three years of product trials around the world with partners Google, Spectrum Bridge, Microsoft, FaceBook and others to demonstrate the efficacy of the technology, CWT's sub-GHz spectrum-sharing broadband radio system, RuralConnect® Gen3, is now ready for mass production. Prospective customers, partners and investors are knocking on the door as The Company seeks to rapidly ramp up its resources and expertise to capitalize on its enormous opportunity. Carlson Wireless Technologies is a global leader in providing mission critical fixed wireless communications systems for rural, remote and underserved areas throughout the globe since 2000.

The TVWS Edge

Carlson's path to its "fortuitous intersection" with these rapidly developing technological and regulatory forces has been blazed by decades of developing, building and selling wireless equipment to provide modern telecommunications to rural and remote businesses and communities worldwide.

CWT began providing wireless telecommunications solutions for the rural market in 1999 with a suite of digital radio products serving a variety of communication needs and markets, including public safety, broadband telecommunications, utility & industrial, oil & gas, transportation, and enterprise. The Company's products are purchased by governments and Fortune 1000 companies in dozens of countries worldwide. CWT currently serves more than 100 wireless Internet service providers and more than 300 telephone companies located primarily in rural United States. CWT products are in use by scores of public safety agencies that serve approximately 20 million people.

When TV white spaces were opened for unlicensed use by the FCC in 2010, Carlson Wireless Technologies began to apply its market intelligence and technical knowledge gained from many years of provisioning wireless access to the highly advantageous signal propagation characteristics in this prized band of spectrum – often referred to as "beachfront spectrum" – now made available for the first time for wireless broadband.

Two compelling advantages are inherent in transmitting in the TVWS band, 470-790 MHz. First, unlike higher frequency Wi-Fi and microwave radio transmissions which require a line-of-sight (LOS) path between transmitter and receiver, TVWS signals are capable of non-line-of-sight (NLOS) signal propagation and can thus go around or through obstacles such as trees, hills, buildings and walls. Second, TVWS signals travel farther than higher frequency signals, which creates a large coverage area with a single low-powered base station, thus lowering equipment costs to cover a given area.

Making TVWS work on a dynamic spectrum-sharing basis required a series of innovations by Carlson Wireless Technologies. While the propagation characteristics of TVWS are highly favorable, the FCC-imposed restrictions to protect the incumbent license holders – TV stations – presented significant challenges.

<u>Page 52 / Point 4.1 International Harmonisation of Radio Spectrum</u>

Carlson welcomes ComReg's engagement with International Harmonisation of Radio Spectrum and we encourage this policy as it is an important contributor to Radio Spectrum in the internal market.

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4.6 Page 53

Page 23 / Point 3.2.2 Digital Television Terrestrial and the 700 MHz Band

We welcome and look forward to ComReg consulting on DTT and the 700 MHz Band / Repurposing of the 700 MHz band which will bring significant benefits to Irish end users of ECS and how it will play an important part in addressing the continuing demand for wireless broadband services and increased connectivity. We would strongly support use of the 700 MHz band for TV White Space (TVWS) rural broadband connectivity. TVWS can enable currently poorly connected communities to access high speed broadband, therefore creating significant social and economic benefits. Our more detailed initial views are:

- The use of TVWS on a no interference / no protection has the potential to improve competitiveness in the market and increase user choice, while maintaining the ability to protect existing services.
- Applying dynamic spectrum management to TVWS enables the provision of new services, while making a more efficient use of frequencies.
- Proving clarity over usage of 700 MHz by geographical area is a crucial ingredient to ensure that these is a viable model for commercial investment into TVWS rural broadband.

Carlson Wireless Technologies stands ready to engage with ComReg on this issue.

3.2 ii Page 18

3.24 Page 23/24

3.25 Page 24

3.29 Page 24

3.36 ii Page 26

Page 21 / Point 3.1.4 Test and Trial

Carlson welcome ComReg's commitment to promoting test and trial, in particular to "test or trial wireless products and services in a real world environment.

To demonstrate that The Company's DSS TVWS solution can successfully deliver broadband service without causing interference to licensed users, The Company teamed up with industry partners including Google, Spectrum Bridge, Microsoft and others to conduct field trials in 58 locations around the world. Approximately 1600 software-defined radios (SDRs) were deployed by CWT for these trials and demonstrations, helping to prove the viability of the SDR/spectrum-sharing network

topology to the FCC, other regulators, and potential users worldwide. Testimonies of the performance are written up in numerous web sites from Wanderport-Africa.com, the Malawi Project to https://spectrum.ieee.org/telecom/internet/malawi-and-south-africa-pioneer-unused-tv-frequencies-for-rural-broadband to the Cape Town South Africa project: www.tenet.ac.za/tvws

In December 2013 the FCC approved the RuralConnect Gen2 spectrum-sharing broadband radio for sales in the USA. This product was use in trials in the US and 35 countries for the purpose of demonstrating the potential of dynamically sharing spectrum using a GEO database.

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TV White Spaces: The Frontier of Dynamic Spectrum Sharing

The potential for spectrum-sharing networks exists for a wide range of wireless applications using different parts of the radio spectrum. In the USA, the FCC has issued the following rules on bands for spectrum-sharing development:

- In 2010, the FCC authorized unlicensed public use by spectrum-sharing radios in TV white spaces (TVWS)[1], a 228 MHz band of sub-700 MHz spectrum opened up by the analog-to-digital conversion of broadcast television in 2009.
- In 2012, the FCC proposed shared access in 4.9 GHz licensed bands for public safety[2] and in the licensed 3.5 GHz band for small-cell mobile use.[3]

The timing of these FCC rulings makes the TVWS band the launching pad for the spectrum-sharing cognitive radio industry. The explicit plan is that the knowledge gained in TVWS will inform subsequent development of spectrum-sharing technology and usage in other frequency bands.[4]

At this early stage of market development for spectrum-sharing radios it is difficult to predict which frequency bands will ultimately have the largest amount of shared usage and spur the most innovation. The TVWS spectrum itself holds tremendous potential by virtue of two notable advantages: its unique and highly desirable signal propagation characteristics, and its FCC-granted ability to operate license-free.

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[1] September 23, 2010, FCC Second Memorandum Opinion and Order; hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-174A1.pdf

[2] June 13, 2012, FCC Commission Document "Improving Spectrum Efficiency in the 4.9 GHz Band" www.fcc.gov/document/improving-spectrum-efficiency-49-ghz-band

[3] December 12, 2012, FCC Commission Document "Enabling Innovative Small Cell Use In 3.5 GHZ Band NPRM & Order" www.fcc.gov/document/enabling-innovative-small-cell-use-35-ghz-band-nprm-order

[4] The FCC proposed rulings make this strategy clear. From the 4.9 GHz ruling: "…we seek comment on whether the database paradigm developed in the TV White Spaces (TVWS) context itself could be extended to accommodate public safety use in the 4.9 GHz band." From the 3.5 GHz ruling: "Access to the 3.5 GHz band would be managed and controlled by a dynamic spectrum access system, building on database technology used in the Television White Spaces."

The FCC expressed great optimism about the future benefits of TVWS development when it passed the ruling in 2010.[5] Economist Richard Thanki, in his landmark 2012 study on license-exempt

spectrum, lays out a comprehensive and detailed case for extremely large global potential for TVWS devices.[6]

By expanding the ability to deliver last mile broadband wireless service to underserved homes, villages, businesses, industrial sites, farms, and government facilities –Dynamic spectrum Sharing of TVWS technology is addressing what is widely considered an urgent national and global priority.

In conclusion we welcome the opportunity to engage with ComReg on the points raised above and in particular the DTT and the 700MHz Band

Yours Sincerely

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[5] "The commissioners were excited about the prospects of new innovation blooming as a result of the vote. Genachowski looked forward to entrepreneurs and innovators developing new technologies that can be exported around the world. Genachowski quoted one analyst who said white spaces use could generate $7 billion a year. Many commissioners also said the new rule making could lead to more efficient use of other spectrum." GigaOm, Sep. 23, 2010, "Get Ready to Innovate! FCC Approves White Spaces Rules" gigaom.com/2010/09/23/get-ready-to-innovate-fcc-approves-white-spaces-rules/

[6] "[TV White Spaces] will be a powerful tool for connecting the underserved billions in the world's rural areas, for establishing layers of high quality connectivity in cities, for building a global platform for machine-to-machine communications and the ideal spectrum for use in establishing emergency broadband networks in dire disaster recovery situations. The United States has enabled the use of the white spaces, a number of nations are pressing ahead with authorising the use of this band and many more are running trials." Richard Thanki, June 2012 - "The Economic Significance of Licence-Exempt Spectrum to the Future of the Internet"

10 Ruckus Networks

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Suzanne Power
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Dear Ms Power,

Ruckus Networks would like to submit the following comments to the "Proposed Strategy for Managing the Radio Spectrum - 2019 to 2021 Consultation on ComReg's new Radio Spectrum Management Strategy Statement".

About Ruckus Networks

Beginning operations in June 2004, Ruckus Networks is one of the world's fastest growing wireless technology companies. Ruckus offers a broad range of advanced indoor and outdoor "Smart Wi-Fi" systems for service providers and enterprises. The company is credited with developing the first adaptive antenna (Smart Wi-Fi) technology that improves the reliability, performance and capacity of Wi-Fi networks. Ruckus recently announced its line of "OpenG" LTE products, which bring the simplicity and economics of Wi-Fi to the market for in-building cellular services.

According to Dell'Oro's Q3 2015 report, Ruckus is #1 in the Service Provider Wi-Fi market with 38% market-share and #3 in the Enterprise Wireless LAN market. With approximately 61,000 end customers and more than 10,000 channel partners worldwide, Ruckus sells its Wi-Fi systems directly to broadband providers and indirectly to enterprise customers through a global network of value-added partners.

Ruckus Networks is a business unit of ARRIS Group Inc.

Detailed comments

Section 4.1.1

Paragraph 4.10 states: "*To take appropriate regulatory actions (which included additional Mobile Service allocations), for Wireless Access Services / Radio LANs in the bands between 5 150 - 5925 MHz*". Reading the document there is no indication of the Irish position on this agenda item (1.16). Consequently, we would like to offer our views on this increasingly used spectrum.

Ruckus Networks agrees with the CEPT position of "No Change" for the 5250-5350 MHz, 5350-5470 MHz and 5850-5925 MHz bands. However, Ruckus Networks believes that changes are appropriate in the 5150-5250 MHz and 5725-5850 MHz bands.

In relation to the 5150-5250 MHz band; Ruckus Networks supports the removal of the indoor only restriction. Ruckus Networks believes that mitigation techniques such as antenna elevation angle restriction and registration/notification of deployments greater than 1000 access points will safeguard the MSS links operational in this band. Whilst alignment with the power levels authorised in North America of 1 Watt e.i.r.p. would be welcome, we recognise that keeping the power level at 200 mW e.i.r.p.(as currently allowed for indoor usage in Europe) would act as a further mitigation technique and Ruckus Networks would support adoption of this lower power level as part of an alternative solution for Europe.

In relation to the 5725-5850 MHz band; Ruckus Networks believes this band can be opened to accommodate Wi-Fi type operation. We would cite the situation in the U.K. where Ofcom has recently started to allow indoor operation at up to 200 mW. However, we believe that more can be done and outdoor operation at power levels of 1 Watt should be allowed. The incumbent services include Radiodetermination (primarily military in this sub-band) and BFWA systems.

The use of DFS has shown that sharing is possible with the Radiodetermination service, especially as the radars operating in this sub-band also operate below 5725 MHz. In addition, the BFWA systems operating in this band are also required to implement DFS, thus further demonstrating the ability of DFS to mitigate against interference to the Radiodetermination service. Furthermore, in an Ireland specific context, we would also question the level of usage (if any) of such radars within the Irish Republic, should Ireland consider taking a similar path to that of the U.K.

The situation regarding 5.8 GHz BFWA operation is also solvable as many of these systems are also IEEE 802.11 based and as these typically operate at a higher power than the Wi-Fi systems, the Wi-Fi systems will avoid operating on occupied frequencies thus minimizing the risk of interference between the two services.

Section 4.4.3

Paragraphs 4.65 and 4.66 describes the situation with respect to V-band usage, which Ruckus Networks fully concurs with.

Paragraph 4.67 invites comments on a future licensing regime for this band. Ruckus Networks believes that a licence exempt regime would be the most appropriate to facilitate further development of this band. This would enable the broadest possible usage of this band. The proposal for an IMT identification for the 66-71 GHz band is not desirable as IMT identification will have the effect of making this band less attractive to certain groups of users and in many cases IMT identification is generally seen as meaning “licenced mobile spectrum”, which Ruckus Networks believes is not a favourable use case for this band.

Chapter 6

Paragraph 6.17 (table) states:

Operation of mobile services	*Mobile services clearly rely on radio spectrum to support mobile communication services. Mobile network operators provide mobile services (such as calls and data) which are entirely dependent on the use of spectrum.*

Ruckus Networks believes that whilst the above is true for current mobile networks, with the move to denser high capacity networks there is a need for an alternative solution for in building, campus

and industrial site usage. Building loss and distance to the macro cell base station can have a negative effect on the user experience when compared with the user experience when outdoors in an area serviced by the MNO network. It is recognised that to maintain these service levels, e.g. data capacity, download/upload speeds, etc. small cells will often be needed to be deployed. However, the economics of deploying a small cell for each operator on each floor of a multi-storey office block or industrial complex is prohibitive. The alternative solution is to deploy a network of MNO agnostic small cells that would be under the control of the office block/industrial site owner. This solution of course requires access to suitable spectrum, which given current and planned technology developments Ruckus Networks believes should be in the 3.4-3.8 GHz band. Therefore, Ruckus Networks would encourage ComReg to explore the possibility of making available spectrum in this band accessible either on a local license or dynamic access basis. Regimes that could be referenced include the local licensing in the Netherlands (3410-3800 MHz) and those being finalized in both Germany and Sweden (3700-3800 MHz). For dynamic access, the Citizens Broadband Radio Service (CBRS) in the United States (3550-3700 MHz) could be referenced.

Thank you for the opportunity to provide our comments and recommendations on these matters. Please contact me if you have any questions regarding this response.

Yours sincerely

Ian Marshall

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30 August 2018

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Re: *Submissions to ComReg 18/74*

Proposed Strategy for Managing the Radio Spectrum – 2019 to 2021

Consultation on ComReg's new Radio Spectrum Management Strategy Statement

Dear Ms. Power:

Microsoft respectfully submits the following comments in response to The Commission for Communications Regulation ("ComReg") consultation on 'Proposed Strategy for Managing the Radio Spectrum – 2019 to 2021' ('Consultation'). We appreciate the opportunity to provide our input to this consultation and welcome follow-up discussions with ComReg on our response below.

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Executive Summary

Microsoft supports ComReg's primary objective in "promoting and creating conditions for effective competition in the provision of Electronic Communications Networks (ECN) and Electronic Communications Services (ECS)." Microsoft is a strong advocate of more efficient and effective spectrum management tools, such as spectrum sharing, licence-exempt access, and dynamic spectrum access, and believes that ComReg can leverage these tools to achieve its radio spectrum management objectives.

In concert with the ongoing transition plans for DTT services, the clearing of 700MHz band, and noting that the Government has signalled its intention to revise the Broadcasting Act of 2009, Microsoft strongly recommends that ComReg seize the opportunity to improve the utilization of VHF/UHF TV band *below* 700MHz, as part of the Digital TV transition process and the review of Broadcasting Act. Microsoft recommends that ComReg initiate a rulemaking process for licence-exempt TV White Space operations in the VHF/UHF TV band on a non-interference and non-protection basis, similar to what has been done in the U.S., UK, Canada, and a growing number of other countries. This would allow for secondary and opportunistic access of the band for broadband services, taking advantage of its favourable propagation characteristics which are particularly beneficial to rural broadband provisioning. Microsoft applauds ComReg's programmatic approach in promoting Ireland as an ideal location for spectrum development using Test and Trial Ireland. We recommend that the Test and Trial Ireland programme be utilized

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for, among other things, experimenting with TV White Space (TVWS) radios, geo-location spectrum databases, and the broader dynamic spectrum access (DSA) model.

We encourage ComReg to embrace and utilize strengthened powers under the European Electronic Communications Code ("EECC") to make greater use of the important tool of spectrum sharing in the forthcoming strategy period. We also support ComReg's consideration of a review of the licensing regime for the V-band (57-64 GHz). We hope that ComReg is following, and is supportive of, the work nearing completion in CEPT PT SE19, where work is being done to remove the outdoor fixed exclusion from the Short-Range Devices (SRD) regulations for this band. Microsoft also recommends further consideration of extending these rules into the 64-71 GHz band to provide technology-neutral support for 5G services, as has been done in the United States. Finally, Microsoft supports extending the Radio Local Area Networks (RLAN) use to the 5925-6425 MHz band for the provision of wireless broadband services.

These low-, mid-, and high-band spectrum bands enable delivery of complementary applications – from long-range connections suitable for broadband access and narrowband Internet of Things (IoT) applications to short-range connections capable of Gbps+ speeds. By allowing licence-exempt access to these complementary spectrum bands, ComReg will help close the digital divide in rural areas while also addressing increasing demand for wireless bandwidth in more congested areas.

The following sections elaborate on these recommendations.

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5.6 Continue to promote 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

Microsoft applauds ComReg's programmatic approach in promoting Ireland as an ideal location for spectrum development using Test and Trial Ireland. We recommend that the Test and Trial Ireland programme be utilized for, among other things, experimenting with TV White Space (TVWS) radios, geo-location spectrum databases, and the broader dynamic spectrum access (DSA) model.

Microsoft is a pioneer in cognitive radio research and a strong advocate for dynamic spectrum access (DSA) policies as important ingredients in extending broadband access in unserved and underserved communities and addressing the growing demand for limited spectrum resources. We believe that the VHF/UHF TV bands, which are globally harmonized and consistently under-utilized, represent an immediate and highly productive opportunity for applying cognitive radio technologies and dynamic spectrum access policies to produce a "dynamic dividend", in addition to the 700 MHz "digital dividend", that are highly suitable for rural applications. Globally, Microsoft has worked with numerous regulators, government agencies and industry partners in implementing TVWS technology trials and associated regulatory frameworks in turning unused "fallow spectrum" into invaluable "broadband gold", particularly for the under-served rural communities.

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The long-range propagation characteristics of the VHF/UHF TV band, coupled with the low cost of TVWS radios and the relatively lower power consumption and installation and maintenance costs, allows the deployment of TVWS networks to incur significantly lower capex and opex, resulting in a significantly lower Total Cost of Ownership (TCO). Furthermore, when TVWS operations is permitted with a licence-exempt regulatory framework, the barrier of entry for building and operating networks is significantly lowered, thereby fostering greater competition in the access network market, consistent with ComReg's primary objectives in spectrum management. Experimental licences under the Test and Trial Ireland programme could provide a fast-tracked instrument towards enabling local business entities, such as a rural ISP or a national carrier, or even the rural community itself, to establish low-cost, affordable broadband access networks utilizing vacant TV channels.

Such an initiative would have a strong synergy with the National Broadband Plan in providing supplementary spectrum resources and complementary technology solutions to connect the remaining Irish population who currently lack broadband access. The same initiative can also support wide-area Internet of Things (IoT) applications such as Precision Agriculture solutions that improve on yields and reduce on water usage and land pollution[1].

[1] https://www.microsoft.com/en-us/research/project/farmbeats-iot-agriculture/

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Microsoft has embarked on a similar effort through the Airband Initiative[2], a rural broadband strategy[3] recommendation and implementation programme that aims to provide a reference solution for connecting the 23 Million unconnected rural American population using a mixture of technologies, including TV White Space as enabled by the FCC regulation. As part of our Rural Airband Initiative, we have committed – through our partnerships with internet service providers (ISPs) – to extend broadband access to 2 million people living in unserved rural areas of the U.S. by July 4, 2022. As part of the U.S. Airband Initiative, Microsoft commissioned a Boston Consulting Group (BCG) study[4] on "The Economic Case for Bringing Broadband to the Rural U.S." concluded that "*TV white-space technology is the most cost-effective way to connect roughly 80% of the rural U.S. population currently lacking high-speed access.*" The regions of the United States lacking access to broadband tend to be smaller towns and more rural areas with lower population densities and longer distances between residences – the very places where TVWS technologies are most useful. While we recognize that the rural situation in Ireland is different than that in the U.S., the cost differential between various access technologies is similar and applicable to any country where the technologies are deployed. It would be

[2] https://news.microsoft.com/rural-broadband/
[3] https://news.microsoft.com/uploads/sites/289/2017/07/Rural-Broadband-Strategy-Microsoft-Whitepaper-FINAL-7-10-17.pdf
[4] https://www.bcg.com/publications/2018/economic-case-bringing-broadband-rural-united-states.aspx

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appropriate to deploy a mix of technologies, including TVWS technologies, to most cost-effectively close the digital divide in any country.

Microsoft would be pleased to support ComReg in exploring the application of TVWS technologies and dynamic spectrum access policies as part of solutions to Ireland's rural broadband challenges. We welcome an opportunity to have a more in-depth discussion with ComReg in the near future.

5.6 Assist the DCCAE in transposition of the EECC, and implement same as appropriate

We encourage ComReg to embrace and utilize strengthened powers under the European Electronic Communications Code ("EECC") to make greater use of the important tool of spectrum sharing in the forthcoming strategy period.

In general, Microsoft believes that spectrum sharing is crucial for meeting the ever-increasing demands for spectrum and for making spectrum more abundant, more efficient, and more affordable in the coming decades. This should include application of dynamic sharing approaches that increase the amount of spectrum which can be used at any given place and time and which, using databases and the cloud, can enable spectrum managers to monitor and dynamically control the availability of spectrum. The newly-adopted European Electronic Communications Code (EECC) takes some important steps

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forward in this respect – in Articles 45 and 46, the Code gives increased prominence to spectrum sharing as a tool for making more efficient use of spectrum while protecting incumbents, and it empowers and encourages spectrum managers to make more use of sharing.

Globally, leading regulators such as the FCC in the U.S. and Ofcom in the UK are increasingly taking measures to enable spectrum sharing across low-, mid-, and high-bands. Both the U.S. and the UK have enabled dynamic sharing of the UHF TV band via their respective TV White Space regulatory framework. Another good example of spectrum sharing is the Spectrum Access System (SAS) utilised by the Citizen Broadband Radio Service (CBRS) in the 3.5 GHz band in the U.S. The SAS in CBRS is a three-tier spectrum sharing framework that includes a protected incumbent tier, a licensed Priority Access Licence (PAL) tier, and a licence-exempt General Authorised Access (GAA) tier. Such a framework has allowed 150 MHz of CBRS spectrum to be dynamically shared, while also ensuring protection of military and satellite incumbents from harmful interference. More information on SAS can be obtained from the FCC and CBRS Alliance websites.[5] In Ofcom's Spectrum Management Strategy[6] published in 2013, "facilitating new spectrum

[5] See https://www.fcc.gov/rulemaking/12-354 and https://www.cbrsalliance.org/single-post/2017/06/02/The-Technology-Behind-Spectrum-Sharing-The-Spectrum-Access-System

[6] https://www.ofcom.org.uk/__data/assets/pdf_file/0025/81394/spectrum_management_strategy.pdf

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sharing opportunities" is among the priority areas outlined in the 10-year strategy document.

5.9 *Provide advice as required to DCCAE in relation to spectrum for broadcasting services*

In concert with the ongoing transition plans for DTT services, the clearing of 700MHz band, and noting that the Government has signalled its intention to revise the Broadcasting Act of 2009, Microsoft strongly recommends that ComReg seize this opportunity to improve the utilization of VHF/UHF TV band *below* 700MHz. Beyond the Experimental Licence approach under the Test and Trial Ireland programme as discussed earlier, Microsoft recommends that ComReg initiate a rulemaking process for licence-exempt TV White Spaces operations in the VHF/UHF TV band to coincide with the completion of the Digital TV transition.

A number of countries have gone through the rulemaking process and made TV White Space regulatory framework available. Among them, the Ofcom and FCC frameworks are most representative and are often used as reference models by other countries considering the development of TVWS rules. In addition, the Dynamic Spectrum Alliance (DSA), a global cross-industry alliance focused on increasing dynamic access to

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unused radio frequencies, has developed a set of "Model TVWS Rules[7]", based on best practices and learnings from the FCC and Ofcom rules, which can also be used as a reference and basis for developing Ireland's own TV White Space rules, taking into consideration the specific requirements and condition of the Irish market. Another advantage of adopting the DSA Model Rules as a baseline is that there exist generic geo-location database solutions that were designed based on the model rules and can be readily adapted to a specific country by incorporating the terrain data and broadcast station information from the country adopting the rules. Nominet[8], a UK-based operator, provides such a cloud-based TVWS geo-location database solution.

5.10 *Following a call for inputs on the future use of the V-band (57-64 GHz) consider further if a review of the licensing regime currently in place for this band is required and if so to consult on this matter.*

Microsoft urges ComReg to call for inputs on the future use of the 57-71 GHz frequency band and initiate a consultation to allow licence-exempt operations across the entire frequency range.

[7] http://dynamicspectrumalliance.org/regulations/
[8] https://www.nominet.com/

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According to the International Telecommunication Union (ITU),[9] "Licence-exempt equipment in the 60 GHz band makes it feasible to achieve multiple gigabit link throughput, and hence offers the ability to enable a multitude of new usages and applications such as:

1) The next generation TV link – transport uncompromised quality video for the next generation of HD colour depth and rates.

2) Download gigabytes of contents in seconds or less – send digital content between devices in 1/10th the time experienced today.

3) Cordless computing – gigabit speed wireless input-output (I/O) and pristine wireless display allow the user to remove the cords between computing platforms and peripherals without performance compromise."

Gigabit speeds are enabled by the availability of multiple independent large bandwidth channels in 60 GHz band, together with highly directional antennas and spatial reuse. IEEE Standard 802.11-2016 and IEEE Standard 802.15.3c-2009 each define a channel bandwidth of 2.160 GHz for Wireless Local Area Networks (WLANs) and Wireless Personal Area Networks (WPANs) respectively.

[9] REPORT ITU-R M.2227-2 (11/2017) "Use of multiple gigabit wireless systems in frequencies around 60 GHz", M Series - Mobile, radiodetermination, amateur and related satellite services, International Telecommunication Union, November 2017.

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The ITU classifies both WLANs and WPANs envisioned for the 60 GHz band as Multiple Gigabit Wireless Systems (MGWS) radio networks. The ITU MGWS standard[10] adopts the IEEE Standard 802.1-2016 channel plan and the channel bandwidth of 2.160 GHz. Centre frequencies for single channels are recommended to be at 58.32 GHz, 60.48 GHz, 62.64 GHz, 64.80 GHz, 66.96 GHz, and 69.12 GHz. In all, there are six independent 2.160 GHz wide licence-exempt channels possible in the 57-71GHz frequency range.

Global harmonization of spectrum use in the 60 GHz band is an important policy objective as it provides many benefits, including lower-cost network equipment and user devices through increasing economies of scale. Ireland can benefit from this economy of scale by aligning with countries that have already authorized licence-exempt access in the extended 60 GHz band, including the United States, Canada, and the United Kingdom. An internationally agreed-upon channelization scheme within the 60 GHz band is an important component of global harmonization. As ComReg considers the future of the V-band, it should take into account relevant existing ITU reports and documents for Multiple Gigabit Wireless Systems and commercial deployments of 60 GHz equipment around the world and start with the proposition that licence-exempt use should be authorized across the entire 57-71 GHz frequency band subject to rules that protect incumbent licensees from receiving harmful interference.

[10] Recommendation ITU-R M.2003-2 (01/2018), *Multiple Gigabit Wireless Systems in frequencies around 60 GHz*, M Series - Mobile, radiodetermination, amateur and related satellite services, International Telecommunication Union, January 2018.

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5.11 Monitor the outcome of CEPT studies on the feasibility of extending the use Radio Local Area Networks (RLANs) to the 5925-6425 MHz band for the provision of wireless broadband services.

Microsoft is pleased that ComReg is monitoring the outcome of the CEPT studies on the feasibility of extending licence-exempt RLAN use to the 6 GHz band. We believe that the mitigation techniques now under study will allow for the upper limit for RLAN operations in the 6 GHz band to extend beyond 6425 MHz, to 6700 MHz and quite possibly up to 7125 MHz.

Microsoft believes that enabling licence-exempt RLAN operation in the 6 GHz band can be an effective solution in addressing the increased congestion in the existing Wi-Fi bands, especially given the continued and projected growth in Wi-Fi demand in Ireland and elsewhere due to the further growth in mobile video. Note that Microsoft Europe participates in both the ECC SE 45 and FM 57 working groups.

Permitting unlicensed operations in the 6 GHz band is critical to meeting growing demand for Wi-Fi, driving innovation and investment, and preserving European leadership. The 6 GHz band supports multiple 80 and 160 MHz IEEE 802.11ax compliant channels, each of which can support speeds greater than 1 Gbps. The 6 GHz band also has a mobile allocation throughout the band, which means that no additional ITU action is required. Regulatory authorities across the U.S., UK, EU, and Singapore are actively consulting on opening the 6 GHz band for additional RLAN operations.

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Indoor and outdoor operations are both envisioned for the 6 GHz band. In an indoor environment, radio waves in this band at typical Wi-Fi power levels allow for penetration of one or two indoor walls. Importantly, the 6 GHz band allows Wi-Fi chip manufacturers and equipment providers the ability to leverage the existing 5 GHz band Wi-Fi infrastructure.

Microsoft urges ComReg to continue monitoring the ECC working groups examining the feasibility of licence-exempt RLAN operations across the 6 GHz band.

Once again, Microsoft thanks ComReg for the opportunity to provide our input to this consultation and we welcome follow-up discussions at ComReg's convenience.

Respectfully submitted,

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12 Vodafone Ireland Ltd

Vodafone Response to ComReg documents:

Proposed Strategy for Managing the Radio Spectrum - 2019 to 2021

Consultation on ComReg's new Radio Spectrum Management Strategy Statement

Reference: ComReg 18/74

Date: 03/08/2018

Introduction

Vodafone welcome the opportunity to respond to ComReg's document 18/74.

In its 2016-2018 Strategy Statement, ComReg estimated the economic contribution of radio spectrum to Ireland at approximately 2.4% of Gross Domestic Product ("GDP") in 2013

There is good reason to believe that this value is increasing. Because Vodafone and others have invested strongly in the capability and coverage of 4G networks more people are using new mobile based services and increasing quantities of data. Meanwhile alternative fiber services are taking longer than anticipated to reach many area of the country. With coming of 5G radio, and constantly improving backhaul radio, the value of spectrum to customers will continue to move forward. In this environment it is vital that this spectrum resource is used as effectively as possible to bring the best services to all customers in Ireland.

In principle the assignment of spectrum though open transparent auction processes has facilitated the roll-out of competitive mobile networks and will we believe be the best solution to meet customer demand for increased capacity and new technologies in the future. In our response the ComReg's consultation document we focus on two issues related to spectrum assignment: the future roll-out of services to low-population rural areas, and the timeliness of auction assignment processes.

Public Perception and Government Actions

Both operators and politicians are receiving strong feedback from the public on their desire for improved mobile services. The "Final report of the Mobile Phone and Broadband Taskforce produced by the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DAHRRGA) and the Department of Communications, Climate Action and Environment (DCCAE) articulates the value of telecommunications to all communities in Ireland and the desire of government to support the supply of these services to all part of the community:

> "As the digital economy grows, we must ensure that the business opportunities and benefits are felt in every city, town, village and rural area. We need a digital infrastructure that can support this and one that provides nationwide coverage with sufficient capacity to ensure that data can flow at the volume, speed and reliability required to meet the demands of modern life. A state-of-the-art telecoms infrastructure will be key to Ireland's continued economic competitiveness and is a key part of our future economic development strategy "

While ComReg's document 1870 acknowledges the need to be mindful of the need of Ireland's rural population the overall focus of the document is largely on the promotion of competition. In our view this emphasis may steer ComReg towards promoting increased competition in high population areas while not serving the needs of rural areas. A more balanced approach would recognise that competition should be balanced by the social advantages of ubiquitous services and pricing.

Coverage Roll-outtargets

In document 1870 Comreg indicate that they will consult on coverage commitments to attach to the next spectrum auctions.

Historically operators were profitable enough to justify rolling out covering into low density areas, often in areas in excess of licence requirements.

The remaining areas of Ireland not covered consists of many dispersed small pockets of poor coverage as well as larger 'empty areas'. Identifying the exact areas where customers require service has become a complex problem as mapping tools such as geo directories of buildings etc. do not always reflect the locations where people are experiencing coverage issues. Building coverage in very low populated areas without measured demand may be very expensive without a proportional return in benefit for customers.

A regulatory approach which seeks to cover these areas using target percentage area or population figures alone would be both an inefficient way of addressing these last areas and very difficult to administer.

Climate for investment

From an operator point of view Mobile Networks need continuous investment. This investment is need to support the new technologies that are available to customers and to maintain network capacity as demand grows. As the revenue per volume of data decreases it becomes more challenging for operators to provide the newest technologies on an equal service and equal price basis to all parts of the country.

Many of the basic cost inputs to the building a mobile network has not reduced in price. In particular, the cost of basic site infrastructure such as electricity connection, site rents etc. have not fallen.

Cost of Spectrum and Regulatory Uncertainty.

The cost of spectrum remains an additional barrier to investment. Large volumes of cash have been extracted from the Irish Mobile market through spectrum auctions. (€ 854m in the 2012 auction alone). Any further extraction of money will lead to reduced investment - this will inevitably affect rural areas more as the return on investment in these areas is so much lower.

In our view continued high spectrum prices, combined with other high costs are not compatible with the desire to continue the roll-out of new technologies and improved coverage.

Those that simply seek to maximize state revenues from spectrum pricing risk much greater costs to society if competition in communications markets is undermined and network investment is stifled as a result. To ensure widespread, high-quality affordable services, it is essential that a sufficient amount of spectrum is released for mobile use at costs which allow the necessary investment to continue.

A combination of the high costs and reduced capital available for investment will prevent operators from seeking to invest in services in rural areas, where the population per site is often tens or even hundreds of times lower than in urban areas.

New solutions to Providing Services in Rural Areas

The reductions in profitability seen above and continued high site costs mean that increase in coverage beyond current levels is no longer profitable.

To address the issue of rural coverage Vodafone would like to see a wider ranging discussion on further roll-out of services in rural areas.

Given the strong desire of government to promote rural coverage as a means of supporting rural communities and supporting rural business transformation in all regions of Ireland alternative solution should be considered. Greater coverage could be achieved by ensuring we have moderately priced national spectrum licences as well as a number of specific measures to ensure cost-efficiency in uneconomic areas:

- state subsidies to finance the construction of passive network elements (towers, roof-top installations, ducts, power supplies etc.), in more remote rural areas to allow installation of active radio equipment at marginal cost and competitive or co-investment laying of ducted fibre for backhaul
- easing of planning restrictions (e.g. increases in maximum permitted tower heights, simpler approval procedures) and access to relevant public facilities (e.g. buildings, remote emergency services network passive infrastructure etc.).
- consideration could be given to allowing different operators to build coverage in separate areas.
- This could allow for direct in input from Government in identifying target areas through, for example, broadband officers.

This actions would be in addition to the passive network sharing that already contributes strongly to the lowing of cost in rural areas. Operators could continue to use coverage as a differentiator and could add further sites themselves in this areas if they wish.

This approach would be an effective alternative to an increased licence coverage obligations. To make this alternative work effectively new spectrum licences would have to be national in nature to prevent new entrants from 'cherry-picking' high value areas and avoiding the higher cost / low return areas.

A solution based on these principles may be a better way to satisfy the demands of both the public and government and ultimately produce the best outcome for customers in rural areas.

We look forward to further discussion on this topic.

Timeliness of spectrum Assignment.

It is recognised in ComReg's document that spectrum plays a vital role in the communications value chain and the efficient allocation and assignment of spectrum, and efficient processes for the awards of mobile spectrum are a key support to the Irish economy and should be a key policy priority for ComReg.

In an open and competitive European market, it is vital that Ireland has available the best and most efficient telecommunications services.

A major input to the effectiveness and efficiency of mobile communications services is the quantity of spectrum allocated and assigned to these services. In this regard we believe that Ireland is continuing to lag behind our European neighbours. There are some cost drivers that drive higher cost in Ireland, such as our smaller scale, that we cannot control. To complete with other countries, it is then vital that we fix the cost elements that we can control. In our view we can should at least match the quantities of spectrum assigned in Ireland to European best practice.

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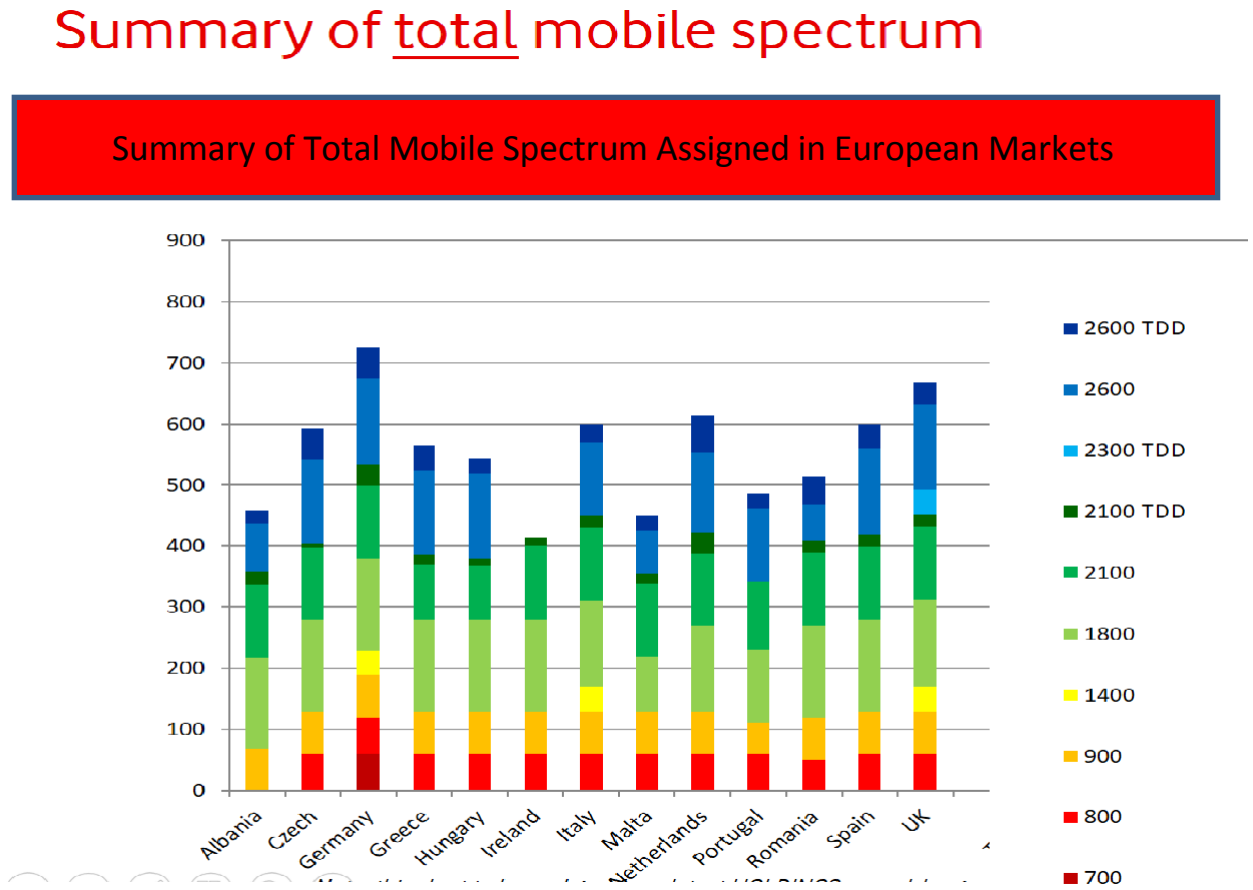

Fig 1 2018 Sub 3GHz Spectrum Assignments in EU markets where Vodafone operate

Fig 1 above illustrates the Mobile Spectrum assigned in European countries where Vodafone operate (700 – 2600 MHz bands). Assignments in Ireland clearly lags the total assignment in every other country. This disparity in allocation drives additional cost in network build. Extra costs, particularly in site build, can result in long-term increased costs of network and inevitably leading to higher costs for customers. Lower spectrum allocation will also result in lower quality services for our customers

Although ComReg's document clearly identifies that customers have every increasing demand for mobile data it does not adequately link this to a drive for timely allocation and assignment of mobile spectrum. Mobile operators cannot wait for spectrum allocations before meeting these demands and hence if a lower set of spectrum allocations is available it will drive mobile operators to invest inefficiently in implementing solutions for customers that are sub-optimal.
Late assignment of spectrum also creates an artificial spectrum shortage – driving higher spectrum costs.

The lag between assignments in other European countries and Ireland is particularly evident in the delays to allocation and assignment of the 2600MHz band. The assignment of this band have been completed in every major European market that Vodafone operates in except Ireland, and has we have said previously most handsets in the market can already use this band. We see no reason for continued delay in assignment of this spectrum
We are also concerned that the assignment of 700MHz is proceeding in other European countries while the timescale for this step in Ireland remain vague. There is further risk here that Ireland will fall behind in delivery of service to customers.

Having a smaller available spectrum pool has real negative effects for customers in Ireland leading to poorer quality of service as well as higher costs. Because of the rapid growth in usage of data, customers are now experiencing reducing data rates because of constraints caused by this lower quantity of spectrum available.

We acknowledge the work that ComReg have completed to allocate spectrum in the 3.6GHz band, and the renewal of the 26GHz band. But the 2600MHz band remains unallocated Ireland despite Comreg consultation in 2014 on "Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands" (Comreg 14/101).

Ireland has effectively foregone the value of this spectrum during the years it has remained unused and risks losing future value while this spectrum remains unassigned.

In the timescale under consideration in this document ComReg must target aligning the quantity of spectrum allocated and assigned in Ireland with that available to operators in other European countries.