Commission for
Communications Regulation

Information Notice

Publication of non-confidential submissions to ComReg Document 14/101 – Consultation on Spectrum Award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

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A.1 Non-confidential submissions to consultation 14/101.

1. Digital Europe: two submissions entitled "Releasing New Radio Spectrum Bands for Mobile Broadband in Europe", dated 10 October 2014 and "Digital Europe Position on the 700 MHz band", dated 4 January 2013;

2. eircom Group: submission entitled "Response to ComReg Consultation Paper: Spectrum Award 2.6GHz band with possible inclusion of 700MHz, 1.4, 2.3 and 3.6GHz bands ComReg Document 14/101", dated 14 November 2014 [Redacted][1];

3. ESB Networks: submission entitled "ComReg Consultation on Spectrum Award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands, ESB Networks Response", dated 14 November 2014 [Redacted][2];

4. Huawei: submission entitled "Huawei response to ComReg's consultation on the "Award of spectrum rights of use of the 2.6 GHz spectrum band with the possible inclusion of the 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz bands", dated November 2014;

5. Imagine: submission entitled "Comments on ComReg Consultation:- Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated 14 November 2014[3];

6. Ireland Offline: submission entitled "2.6 GHz Spectrum Consultation", received 18 November 2014;

7. Irish Radio Transmitters Society: submission entitled "Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated October 2014;

8. Joint response by Fastcom, Lightnet, permaNET, Ripplecom & WestNet: submission entitled "Joint Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated November 2014;

9. permaNET Ltd.: response entitled "permaNET Ltd. Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with

[1] Confidentiality of redacted material still to be determined in accordance with ComReg Document 05/24

[2] Confidentiality of redacted material still to be determined in accordance with ComReg Document 05/24

[3] Separate confidential note submitted by respondent not published

possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated November 2014 [Redacted][4];

10. Qualcomm: submission entitled "ComReg consultation Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands - Qualcomm Response", dated October 2014 [Redacted][5];

11. Ripple Communications Ltd.: submission entitled "Submission to ComReg 14/101", dated 12 November 2014;

12. RTÉ: submission entitled "RTÉ Response to Comreg Consultation - Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", received 19 November 2014;

13. Three Ireland (Hutchison) Limited: submission entitled "Spectrum Award – 2.6GHz (Also 700MHz, 1.4GHz, 2.3GHz, and 3.6GHz) - Response to Document 14/101 from Three", dated 14 November 2014 [Redacted];

14. Viatel: submission entitled "Response to Consultation 14/101 - Spectrum award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated November 2014; and

15. Vodafone Ireland Limited: submission entitled "Vodafone Response to ComReg 14/101", dated 14 November 2014.

[4] Confidentiality of redacted material still to be determined in accordance with ComReg Document 05/24

[5] Confidentiality of redacted material still to be determined in accordance with ComReg Document 05/24

1. Digital Europe: two submissions entitled "Releasing New Radio Spectrum Bands for Mobile Broadband in Europe", dated 10 October 2014 and "Digital Europe Position on the 700 MHz band", dated 4 January 2013

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Releasing New Radio Spectrum Bands for Mobile Broadband in Europe

Brussels, 10 October 2014

Background

Over the last 3 years DIGITALEUROPE and its members have supported the development of the CEPT and EU deliverables that define the harmonised usage conditions and characteristics of new spectrum bands for Mobile Broadband (MBB). New ideas and approaches to how new spectrum might be identified have been developed. These deliverables, including ECC Decisions, are now published and available to administrations to provide the basis for awarding spectrum rights to MBB service providers across the European region.

Besides the 700 MHz band, new frequency bands such as the 1.5 GHz (1452-1492MHz) and 2.3 GHz (2300-2400MHz) are already identified in the Radio Spectrum Policy Group's Opinion on *Strategic Challenges Facing Europe in Addressing the Growing Spectrum Demand for Wireless Broadband"* as vital resources in the near term to help satisfy the EC Digital Agenda objectives and increase the availability of high speed MBB services to European consumers and businesses.

The bands 3400-3600MHz and 3600-3800MHz are recognised as available for MBB in the EC Spectrum Inventory report but remain licensed to (mainly) regional BWA network operators. Only limited action has been carried out to identify a roadmap to make these bands available for MBB.

DIGITALEUROPE's objective is to encourage driving forward the national processes of Member States for awarding these bands in a timely manner, enabling new system deployments that can drive higher MBB speed, network capacity and innovative services. In this respect, DIGITALEUROPE welcomes EC President Jean-Claude Juncker's priority to "break down national silos […] in the management of radio waves."

Benefits for citizens, industry and Europe as a whole

It is widely recognised that a vibrant and responsive broadband infrastructure is a key prerequisite for a successful economy. The wireless broadband frequency band resources in question will improve capacity in MBB networks and in particular increase downlink bandwidth with Supplemental Downlink (SDL) and enable small cell deployments with high bandwidth.

For industry and consumers this will:

- Improve the responsiveness to data service requests from consumers on the move.
- Enable more advanced services to attract new customers.
- Nurture a vibrant European app development eco-system.
- Facilitate the sharing of more refined and data intensive services between businesses and consumers.
- Enable the offer and consumption of more content-rich services whilst on the move.
- Increase reliability and resilience (connection availability) through improved coverage.

From a governmental perspective this will:

- Place Europe at the forefront of MBB capability.
- Ensure the success of the digital agenda objectives and the various national initiatives.
- Maintain momentum behind the "digitization" of the economic recovery.

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Our Recommendations

DIGITALEUROPE invites the Radio Spectrum Committee (RSC) and the EU Member States to set out a clear timetable for the release and award of the 1.5GHz and 2.3GHz bands for MBB applications across Europe. New tools such as Licensed Shared Access in the 2.3 GHz Band have been developed to increase the opportunity for spectrum access where incumbent national use might otherwise block the band. When necessary, DIGITALEUROPE would like to see these tools brought into use at the earliest opportunity in order to achieve the objectives that have driven their development.

DIGITALEUROPE also invites the RSPG and BEREC to undertake a European wide study on how to de-fragment and re-purpose the 3400-3600MHz band currently assigned in many countries for Broadband Wireless Access and invites EU Member States to plan for the use of 3600-3800 MHz for MBB service. Recently, the regulatory framework has been re-shaped to better accommodate mobile services in 3400-3600 MHz and 3600-3800 MHz but there is no clear strategic direction that might lead to an improved harmonised usage framework across Europe.

Further information

- DIGITALEUROPE Position on the 700 MHz Band
- DIGITALEUROPE call for harmonization of 1.5 GHz and 2.3 GHz Band
- DIGITALEUROPE Response to the RSPG Opinion on Strategic Challenges facing Europe in addressing the Growing Spectrum Demand for Wireless Broadband
- DIGITALEUROPE Response to draft RSPG Opinion on Licensed Shared Access (LSA)
- DIGITALEUROPE Position on Licensed Shared Access (LSA): Common Understanding, Status and Next Steps

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DIGITALEUROPE

ABOUT DIGITALEUROPE

DIGITALEUROPE represents the digital technology industry in Europe. Our members include some of the world's largest IT, telecoms and consumer electronics companies and national associations from every part of Europe. DIGITALEUROPE wants European businesses and citizens to benefit fully from digital technologies and for Europe to grow, attract and sustain the world's best digital technology companies.

DIGITALEUROPE ensures industry participation in the development and implementation of EU policies. DIGITALEUROPE's members include 58 corporate members and 36 national trade associations from across Europe. Our website provides further information on our recent news and activities: http://www.digitaleurope.org

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Brussels, 4 January 2013

DIGITALEUROPE Position on the 700 MHz Band

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1 Executive Summary

The ITU World Radiocommunication Conference 2012 (WRC-12) has decided on a co-primary Mobile Service allocation identified for IMT in the 700 MHz band, below and adjacent to the 800 MHz band, to be effective immediately after the next World Radiocommunication Conference 2015 (WRC-15). The ITU-R has been tasked[1] to carry out co-existence studies, develop frequency arrangements and help define the exact lower band edge at WRC-15 under agenda item 1.2.

This decision has led to intensive discussions regarding the future use of the band to provide the maximum benefit to the European citizens. Mobile Broadband (MBB) and Digital Terrestrial Television (DTT) are the key services under consideration in the 700 MHz band.

In the context of the discussion, it should be understood that DIGITALEUROPE's membership comprises a diverse range of companies and organisations. Some are predominantly engaged in the Digital Television business, others are predominantly engaged in the Mobile Communications business. Others are involved in both. DIGITALEUROPE is thus keen to see both industry segments flourish and prosper.

Issues relating to spectrum are simultaneously good opportunities and represent challenges to various existing businesses. Also any responses on spectrum issues are affected by national context, which can vary significantly by the historical and legacy situation within any given territory in Europe. Thus what might be an inconsequential issue in one country could be a significant issue in another, especially for example a country which has a large widespread deployment of Digital Terrestrial Television. Thus on some specific issues it may not be possible to provide a simple single unambiguous position that represents the whole of Europe, as represented by DIGITALEUROPE's membership.

Linear Television remains the most popular media with, in 2010, an average daily viewing time in Europe of 228 minutes per person a day (+ 6 minutes from 2009)[2]".
Digital Terrestrial television is the most harmonized way of transmitting TV channels throughout Europe and will certainly remain an important multimedia content delivery path in several countries. In this manner, broadcasters continue to invest in the digital terrestrial platforms through interactive television like HbbTV.

Building on this popularity, DTT services support an important sector of the CE industry which represents several billion Euros.

Furthermore, DTT plays an integrated role in the Digital Agenda in enabling consumers to have access to a variation of citizen informative and entertaining multimedia content through encouraging them to use availability of different TV delivered as data services over fixed and mobile broadband networks.

In parallel, the number of subscriptions and the demand for mobile traffic has shown an unprecedented growth over the last two decades creating a multi-billion Euro industry. With the GSM technology, voice and SMS services became affordable connecting virtually every

[1] Resolution 232 (WRC-12)
[2] Source: Eurodata TV Worldwide, 2011.)

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European. UMTS with HSPA data services has opened mobile broadband access to the internet with laptops, smart phones and tablet computers and shows immense growth in data and multimedia consumption. New technologies such as LTE and LTE-Advanced address the increase with improved spectral efficiency and better user experience in terms of supported data rates and lower latency. While LTE and LTE-Advanced can use higher frequency bands such as 2.1 GHz and 2.6 GHz band in suburban, urban and metro areas, bands in lower frequencies below 1 GHz play an important role in quickly providing mobile service coverage and capacity to large remote and sparsely populated areas. Converting the band 800 MHz band (790-862 MHz) from DTT use to MBB use is reducing the digital divide between regions in countries by providing a basic broadband connectivity to previously underserved and unconnected or non-served regions in Europe.

However the capacity of the current 800MHz band is constrained and with the ambitious European Digital Agenda target of 30 Mbps to every household in the EU by 2020, access to more spectrum in bands below 1 GHz is therefore required to cost effectively provide such data rates in remote areas that cannot be addressed in an economically viable way by wire-line solutions. Consequently, opening the 700 MHz band for the MBB service will substantially add to delivering the requirements of the Digital Agenda targets and thus support the underlying targets of fostering economic growth and providing more equal opportunities, particularly for Europeans living and working in rural areas.

When assessing the opportunity of using the band 694 – 790 MHz for mobile broadband, Digital Europe observes that:

- The complete band 470 – 790 MHz band has been planned for broadcast services throughout Europe. Its usage intensity varies strongly across Europe. Certainly, it can be reasonably expected that new technologies would decrease the required spectrum to reproduce exactly the same quality and same offer as currently transmitted. However, upgrading to higher quality like HDTV, 3DTV and UHD will require additional spectrum in order to satisfy consumer demands for high quality services in DTT. Furthermore, any transition from one technology to another requires a temporary additional spectrum for transition.

- Irrespectively of future spectrum requirements, any frequency usage change has important impact on both the new entrants and incumbents (replanning, changing the transmitting equipment and solving issues). **There are also implications on the end consumer in terms of upgrading equipment and / or installation and consumer awareness.**

- **A new transition to 470 – 694 MHz in addition to the just achieved transition of the analogue digital switchover ("ADSO") and the digital dividend 790 – 862 MHz may cause additional confusion to the consumer if not appropriately addressed.**

- A change of frequency usage implies a change of interference environment for DTT reception equipment. Based on the experience of the digital dividend 790 – 862 MHz, it could be concluded that managing the interference represents a challenging task which can only be appropriately achieved by proactive measures from competent

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authorities. DIGITALEUROPE recently published a Recommendation on interference avoidance from LTE transmission[3].

Considering the above facts,

- DIGITALEUROPE supports the target of the European Parliament, Council and Commission in the RSPP to make available at least 1200 MHz of spectrum for wireless broadband by 2015. DIGITALEUROPE's members will continue to develop technological solutions to address the increase in capacity demand, which DIGITALEUROPE expects will extend beyond this timescale.

- DIGITALEUROPE welcomes the recently published Information of the Commission RSCOM12-15[4] as a well balanced approach to identify best possible use of the 700 MHz band.

- DIGITALEUROPE maintains that harmonised designation of spectrum and usage conditions are essential ingredients to support cost effective devices that will meet the needs of consumers in the future.

- Leveraging on 3GPP Band 28 as an extension and in a compatible manner with Band 20 (EU800 MHz) would be a unique opportunity for economy of scales and roaming capabilities. DIGITALEUROPE supports such opportunities.

- In achieving the objective, DIGITALEUROPE considers essential that the harmonization process should be managed by administrations in a timely manner and be properly resourced, while applying accurate frequency planning and good spectrum engineering practices, in particular ensuring that
  - The broadcast service continuity is guaranteed
  - There should be no disruption of the existing DTT services to consumers
  - Interference problems should be minimized and solved in the least disturbing way for the consumer
  - The cost impact should be minimized for both manufacturers and consumers
  - There should be a clear communication to consumers.

[3]DIGITALEUROPE Recommendations On Interference avoidance from LTE transmissions. Document publically available at digitaleurope.org under TRPG-Broadcast Document Page

[4] https://circabc.europa.eu/sd/d/bb24e589-5231-4549-a97e-f453be2612de/RSPG12-425%20-%20Discussion%20Paper%20on%20future%20use%20of%20700MHz.pdf

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2 Digital Terrestrial Television

2.1 Relevance of DTT in the context of EU / EC policy objectives

TV is a seen as primary source of information in many countries and continues to be a prime entertainment object: The European consumer spends more than three hours per day in front of his TV set at home[5]

The importance of TV of the contribution to cultural diversity is demonstrated by the requirement on broadcast service to promote European production in the AVMS directive[6] .

Overall, the important role in the European Society of television is recognized by the European Parliament and the European Council through integration of access to television within the concept of universal service provision[7] and is seen as integration factor in the society. Indeed, accessibility to television programmes is a recognized European priority.

With the introduction of connected TV, television devices play now an additional role in the society to give access to a number of connected services and to motivate citizens to step in the connected world.

The television value chain represents also an important economic sector of the European Union:

- In 2007 European broadcasters employed over 2.2 million people directly and indirectly[8]
- In 2007 European broadcasters invested around € 19bn in original European commissioned TV programming[9].
- The Television represented a turnover valued to € 84.4 Bn Euro in 2010[10]
- The TV sales business forms a substantial part of the total consumer electronics business which estimated value was € 62 Bn[11] in 2011. Alone TV the TV sales in Germany the 2012 forecast represents € 6.3 Bn[12] in Germany and € 3.8 Bn[13] in France.

Finally, undoubtedly in line with EU objectives, DTT is characterized by being largely driven by horizontal markets for equipment.

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[5] According to the IDATE DigiWorld Yearbook 2011, the European consumer spent 206,7 minutes in average daily in 2011 to consume live TV programmes

[6] Source European Comission: European Directive on Audio Visual Media & Services

[7] European Directive on Universal Service Provision

[8] Source: The Effects of a Market-Based Approach to Spectrum Management of UHF and the Impact on Digital Terrestrial Broadcasting by Oliver & Ohlbaum Associates Ltd and DotEcon Ltd

[9] Source: The Effects of a Market-Based Approach to Spectrum Management of UHF and the Impact on Digital Terrestrial Broadcasting by Oliver & Ohlbaum Associates Ltd and DotEcon Ltd

[10] Source: on the online distribution of audiovisual works in the European Union: opportunities and challenges towards a digital single market

[11] Source: Source: IDATE Digiworld 2011 Yearbook

[12] Source: handelsblatt http://www.handelsblatt.com/unternehmen/it-medien/ifa-2012-elektronikbranche-rechnet-mit-umsatzplus/7040790.html

[13] Source Gfk: Bilan GfK des ventes de biens technologiques en 2011

2.2 Status of the DTT market

In Europe to date since DVB-T introduction, more than 200 Million DVB-T receivers have been sold and 275 million European are watching television over DTT[14] [BNE]. DVB-T is available in most European countries to more than 90 % of the population. Most of the DTT platforms are based on a Free to Air business models. Hence DTT has an essential role in providing television programs direct to households without any subscription fee.
The market share of terrestrial television compared to other distribution paths in Europe is heterogeneous across Europe. In some countries, it reaches more than 60 % like France, Greece and Italy, whilst in other countries like Belgium, Germany, Netherlands it represents less than 10 % market share[15]. Some of these markets rely on portable reception concept; some others rely on rooftop aerial reception. However, in many European countries household may have an average of more than 2 TV sets with at least one used for DTT reception.

2.3 Receiver technology

The majority of receivers in the market and in operation are using DVB-T technology. DVB-T with MPEG-2 was firstly introduced at the end of the 90's. In some countries, DVB-T is used together with MPEG-4 video coding. In 2009 the second generation transmission system DVB-T2 was introduced.

2.3.1 DTT compared to other platforms

DTT as the cost efficient delivery path
The analogue to digital switchover has not changed fundamentally the split of the various delivery systems in the various countries. It has even opened the terrestrial broadcast to some usage that was not seen as feasible for years but hardly achievable in the analogue context like mobility or portability for second, third or even fourth TV. DTT is and will remain in most countries the most cost efficient reception method as it is mainly based on FTA services and on reusing of existing reception equipment or base on elementary means of reception like indoor antenna.

DTT as a mass access to new services
Even if new services (HDTV services, 3DTV services ...) are generally firstly deployed on free and Pay Satellite, IPTV and Cable delivery, they are generally getting their popularity (and success) when they become available on DTT. But they can only be introduced over DTT if there is sufficient spectrum available given their cost of delivery. In some countries, limiting the DTT offer despite the high number of HDTV capable IDTVs was aimed at to motivate households to switch to Satellite, Cable and IPTV for accessing these new services. However, this holds true mainly for the primary TV sets because of the complexity of distribution and access of Satellite, Cable and IPTV.

In some countries (UK, Sweden, France, Poland), an offer of several HD services is present over DTT. In some other countries where terrestrial is historically low (e.g. Germany), HD services are not available and no concrete plans have been announced but the network has been optimized to offer mobility and portability not achievable with other delivery means.

[14] Source: Broadcast Networks Europe
[15] Eurobarometer 362, E-communications household survey, July 2011 conducted by TNS Opinion & Social at the request of Directorate-General Information Society and Media of the European Commission.

Despite the growing number of services delivered by satellite, IPTV, cable, DTT is globally still the most popular delivery paths[16]. DTT operators have invested and continue to invest to meet the consumer's interest with enhanced offers and distribution quality.

2.4 DTT evolution

Digital Terrestrial Television will continue to be a popular delivery system for many countries in Europe. However, there may be several factors affecting its importance in the future like the service evolution, the impact of hybrid services and new technologies.

2.4.1 Future Importance of DTT vs other delivery paths

DTT is expected to remain so for many years in numerous countries, to be the most cost efficient reception mean for mass market multimedia content reception. Overall, when observing the evolution of DTT in the various markets compared to cable IPTV, Satellite distribution, one can expect that the popularity of DTT multimedia content delivery to remain unchanged or to slightly decline in terms of viewers and viewing time compared to other distribution paths.

2.4.2 Linear and non linear consumption of broadcast content

The emergence of new catch up services and video on demand services gain in popularity. However, the overall consumption of linear TV remains relatively stable and will still represent the major TV consumption mode at least in the coming 5 years following the IDATE Digiworld Yearbook 2011.

2.4.3 Impact of hybrid services

The recent interest for hybrid technologies (e. g. HBBTV-Hybrid Broadband Broadcast TV) for the DTT platform shows that broadcasters are still convinced of the attractiveness of the terrestrial platform. Broadcasters do better master the content delivery end to end on this platform because there is less third party interaction, whereas the TV / receiver, as a known mean of AV consumption, is the first entry point of these new services.
Those new services can allow broadcasters to make a better balance between the main streams (needed by majority of the viewers) and the specific streams (needed by a small part of the viewer) and decided also the balance on the delivery path (broadcast vs broadband).Thus making the use of the spectrum even more efficient.
However, the final balance will depend on the user satisfaction given their motivation to upgrade their equipment and the actual performance of both broadcast and broadband path.

2.4.4 New technologies

Successful switch over to new technologies
New technologies can only be successfully introduced and speed up the migration if the consumers recognize the value of upgrading their reception equipment (e.g. new services, better service quality). It is necessary to motivate users with existing equipment to switch over to these new transmissions by providing additional value (e.g. new services, better picture quality) in order to simplify the final band transition. In this context, government and

[16] According to the. Eurobarometer 362, E-communications household survey, July 2011 Conducted by TNS Opinion & Social at the request of Directorate-General Information Society and Media of the European Commission DTT represents the highest reception mean with 30 % in European Union

regulators need to plan with involved stakeholders how to set a framework in order to achieve sufficient motivation for the consumer to switch over.

New audio / video coding technologies
High Efficiency Video Codec is expected to allow for an efficiency increase of 50 % with a comparable quality to Advance Video Codecs. Some countries are considering the introduction of HEVC together with DVB-T2 in order to achieve a disruptive improvement in Efficiency. First HEVC capable IDTV are expected after2015. HEVC will be incompatible with current chipset. However, HEVC capable chipsets will be backward compatible which will facilitate the transition process. Those new codecs will be probably available on broadband (both fix and mobile) first. Their respective availability is expected to reduce some of the pressure on the mobile spectrum as well as on the DTT spectrum.

New broadcast transmission system
A new transmission system beyond DVB-T2 could be introduced in the future. This may allow for additional efficiency based on new technologies. However, complete new equipment will be needed if not the complete receiving equipment (incl. Antennas). Taking into account that only a minority have upgraded to DVB-T2 and the majority of countries have no published switchover strategy, the introduction of a more efficient broadcast transmission system on middle term is not likely in Europe. It could rather be counterproductive to increase the discrepancy across Europe, insecure consumers and stakeholders with respect to a possible transition to DVB-T2. In the short term, setting the target to a new transmission system would reduce the likelihood of timely availability of additional spectrum for mobile broadband.

2.5 Consequences of introduction of IMT in the 700 MHz band

2.5.1 Coexistence Issues

Coexistence between mobile and broadcast service shall be ensured with both legacy receivers and future receivers. The interference impact of IMT is not only limited to DTT receivers but can affect masthead amplifiers, distribution amplifier, active antenna as well. All receiving equipment is designed to receive the whole band 470 – 862 MHz and are therefore as such potentially impacted by mobile based on LTE technology interference signals.
In this respect, Digital Europe recently published a guideline to DTT interference [17]which shows that LTE interference cannot be simply solved by a single solution (e.g. tightening receiver characteristics) and recommends a proactive management by competent authorities.

2.5.2 Re-planning implications and their costs

DTT is currently using the whole band 470 – 790 MHz according to the GE06 agreement. The band 694 – 790 needs to be freed by re-planning the whole band 470 – 790 MHz.
Any re-planning of DTT frequency usage implies several costs:

- Re-planning costs
- International coordination costs
    - A planning conference may be needed
- Upgrade of the transmitters and additional transmitters sites

[17] DIGITALEUROPE Recommendation on interference avoidance from LTE transmissions. Document publically available at digitaleurope.org under TRPG-Broadcast Document Page.

  - On the broadcast side, the compression of spectrum usage from 470 - 790MHz to 470 – 694 MHz implies new investments and or additional transmitter sites
  - If the reduction of available spectrum leads to a more intense usage of Single Frequency Networks, this may require careful planning to avoid difficult to resolve self-interference cases.
- Additional transmitters for transition time
  - In some European countries by law, any existing free to air channels public or commercial must be simulcast in case of introduction of a new format during a minimum overlap period.
- Communication to the general public
- Assistance of the general public
- Upgrades of antenna reception and amplifiers, etc.
  - On the consumer side it implies frequency changes leading possibly to equipment changes and antenna reorientation and filter changes.
- Upgrade of set top boxes
  - Assuming a change in broadcast transmission technology, the user will have to invest in new equipment through subsidies or sufficient motivation through better user experience.

Part of these costs were already present during the ASO (Analogue to Digital Switchover) with the difference that the costs were shared between the users (motivated through an extended offer), the public organization (motivated through general interests and future spectrum auctions) and broadcasters (motivated through access to spectrum or distribution savings).
Should now the same costs arise with a pure motivation to clear out spectrum, it is likely that the main costs remain to be carried by the states (which could be a part of the revenue obtained by spectrum auctions). If not, the move towards a mobile band plan within 694+X – 790 MHz is not achievable on short to middle term. It is therefore essential for states to set out a public plan with appropriate funding in order to achieve a freeing of the spectrum 694+X – 790 MHz.

2.6 Analysis

Television represents an important economic sector in terms of employment, in which consumer electronics has a key role. Television plays further important role for the European Society to promote cultural diversity and is integrate in the universal service provision concept
DTT is the most popular delivery television path across Europe for primary sets and largely dominant for secondary TV sets. DTT is a sizeable Market in Europe with more than 275 M European watching TV over DTT. To date, 200 Million DVB-T Receivers have been sold.
The introduction of hybrid services is showing that broadcasters and manufacturers still believe in the popularity of DTT services. The growing non-linear consumption of AV content has little impact on the linear consumption of DTT. DTT will continue to play an important role as delivery path for broadcast content. Compared to the other delivery paths, DTT remains relatively stable. It can be therefore expected that it will continue to evolve and develop in terms of services and picture quality and enhancements. DTT hybrid services offer may reduce partly future transmission capacity needs by balancing broadcast and broadband delivery but a significant reduction of transmission capacity needs for DTT platforms is rather an unlikely scenario. Conversely, a transition to another system requires additional spectrum for simulcast.

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As a consequence, the release of the band 694 – 790 MHz would require the transition more efficient planning and / or more efficient transmission systems like DVB-T2 possibly combined with HEVC. **DIGITALEUROPE considers a transition to DVB-T2 an adequate measure to facilitate the release of the band 694 – 790 MHz.** Beyond its higher efficiency compared to DVB-T, DVB-T2 allows for larger SFNs than the previous DVB-T system if suitable variants are used, which can potentially reduce the required spectrum to achieve nationwide coverage.

The introduction of mobile services in the band 694 – 790 MHz introduces a new challenging interference management with requires appropriate management from the competent authorities. Also the replanning of DTT implies a number of activities with its associated costs.

DIGITALEUROPE considers essential

- **that plan transitions need to be well managed by competent authorities (e. g timely, properly resourced and accurate frequency planning, spectrum engineering).**
- **that any plan laid down is coherent with a pan-European strategy for the 700 MHz band, in order to maintain a sizeable market and to avoid market fragmentation for both mobile broadband equipment and CE equipment.**
- **that the time plan for the transition are developed with the Consumer Electronics Industry in order to enable the introduction of suitable products in time and to minimise disruption to DTT viewers.**

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3 Mobile Broadband

3.1 Mobile broadband market and impact on the European industry

Back in the analogue, first generation mobile network days, Europe used to have a variety of mobile telephony systems such as NMT, TACS, C-Netz in a variety of 450 MHz band variations. By creating the common digital technology GSM as second generation (2G) around a harmonized band of initially 2x 25 MHz FDD in the 900 MHz range, Europe created a harmonized eco-system that became the de-facto global standard for mobile telephony with a huge commercial success and connecting more than 6 billion people on the planet today. In the quest for more capacity, more bands have been added like 1800 MHz as well as bands like 850 MHz and 1900 MHz for the American markets. The 900 MHz band could be extended to 2x 35 MHz so that today commonly available devices with GSM quad band support address a global market and have global roaming capabilities. Besides bringing mobile communications to virtually every European, GSM helped to establish a healthy communications industry in Europe delivering to a global market.
This success had been replicated with the introduction of UMTS and its HSPA enhancements for mobile data primarily operating in the 2100 MHz band but more and more complemented in Europe by 900 MHz for better coverage. The Americas and parts of other regions adopted UMTS in 850 MHz, 1900 MHz and AWS (1700 MHz paired with 2100 MHz) so that a total of five FDD bands can address all of today's global deployments of UMTS. Three of these bands are identical with the GSM bands mentioned above as they are used by re-farming parts of bands prior used by 2G services. Nowadays, around 1 billion smart phone connections globally primarily based on UMTS/HSPA.

LTE and LTE-Advanced as 4G technology address the huge demand for mobile data in the six FDD bands mentioned above plus in several new bands including a set of unpaired bands by means of its TDD mode. Following the WRC-07 decisions, several countries in Europe have made available the 800 MHz band as an excellent coverage band in particular to close so-called white spots with basic broadband connectivity and to lay the foundations of a quick rollout of LTE mobile broadband services on a nationwide footprint which allows for adoption of LTE even faster than UMTS. Verizon Wireless in the US is demonstrating impressively how coverage and capacity can be rolled out quickly in a band like 700 MHz and the amount of economic value generated.

3.2 Why 700 MHz mobile broadband in ITU region 1?

Changing the use of parts of the UHF band from DTT to Mobile Broadband has become possible in the course of moving to higher spectrum efficiency when switching TV over from analogue to digital system. This allowed harvesting the so called Digital Dividend. In WRC-07, ITU region opted for the frequency range from 790-862 MHz (European 8 MHz TV channels 61 to 69) whereas ITU regions 2 and 3 due to their legacy systems decided on the frequency range of 698 to 806 MHz (US 6 MHz TV channels 52 to 69). The US defined a band plan based on the former 6 MHz TV channel grid with two FDD duplex systems and adhering to legacy systems such as narrow band public safety. Based on this band plan and auctions in 2008, the US were able to quickly roll out LTE services covering today the majority of the US population, but they need the four 3GPP band definitions 12, 13, 14 and 17 to cover the band and have created certain inefficiencies within the band plan. In-band guard bands are required to resolve the 6 MHz licence granularity not well in line with the 5 MHz channel structures of mobile broadband systems and mutual adjacencies as well as to

existing services. Consequently, ITU Region 3 bases their band plan on an efficient 2x 45 MHz FDD approach now defined by 3GPP Band 28 which most countries of the region committed to. Several Latin American countries including Mexico have expressed their intention to adopt Band 28 which led to the request of the Arab and African states in WRC-12 to also allocate the frequency range from 694 to 790 MHz to the mobile service also in ITU region 1. Many of these countries have limited use of broadcast in the band and want to make available sufficient spectrum for mobile broadband to bridge the digital divide. In addition, some of those countries have 850 MHz networks which overlap with Band 20 (EU800). Consequently, opening the 700 MHz band and using 3GPP Band 28 allows these countries to quickly roll out internet services to their population based on a terminal ecosystem shared with economies like India, Indonesia, Brazil and Mexico, to name a few. An immediate allocation across ITU region 1 as requested by the Arab and African states had not been acceptable to the CEPT countries. Therefore a compromise had been worded to allocate the band on co-primary base to the mobile service immediately after WRC-15. The time in between the two WRCs can be spent on co-existence studies and refinement of the lower band edge under WRC-15 Agenda Item 1.2. This compromise allows the CEPT countries to proceed in a well defined manner while setting the path for harmonisation with Arab and African countries based on Band 20 and Band 28 LTE networks. In the market place, momentum is increasing as e.g. recently Japan has assigned their licences in the 700 MHz band in compliance with 3GPP Band 28.

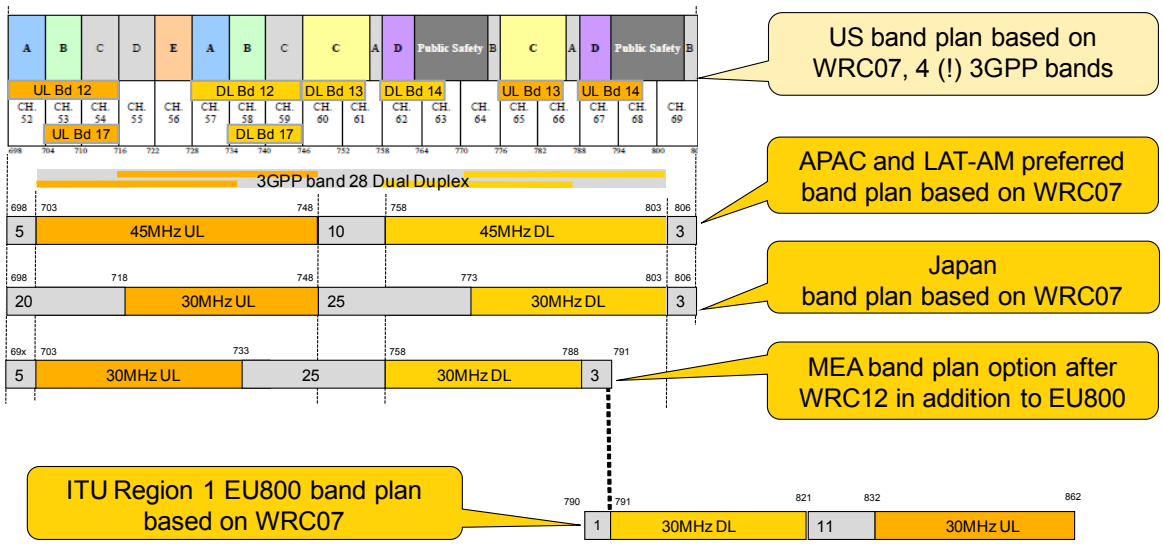

Figure 1 Band plan options around 3GPP Band 28

3.3 700 MHz for mobile broadband in Europe

DIGITALEUROPE sees two key arguments how Europe can benefit from assigning the 700 MHz band to mobile broadband:

Firstly, Europe can join and further foster a close-to-global eco-system in 700 MHz

Europe can participate in the 3GPP Band 28 ecosystem that has the potential of a close-to-global footprint ranging from Asia-Pacific, all Latin America, Africa and Middle East. This huge footprint is expected to lead to very affordable devices with excellent roaming capabilities. In emerging markets, large shares of the population will get first time internet access through affordable smart phones and tablets. Networks can be rolled out quickly and

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cost-efficiently due to the excellent coverage properties of the 700 MHz band. Likewise, Europe can benefit from the band properties and its economies of scale and expect attractive end user devices based on that eco system. With first licences assigned in Japan and multiple countries in Asia Pacific and Latin America having declared their plans for licensing, commercial networks can be expected from 2014 onwards supplied by the global ecosystem with substantial contribution of the European industry. A healthy ecosystem with a wide choice of terminals can be foreseen for the point in time, when the WRC-12 decision becomes effective.
Technically, Band 28 devices implement the 2x 45 MHz of Band 28 with two duplexers, one for the upper 2x 30 MHz and one for the lower. With this solution, any Band 28 device can address the full 2x 45 MHz band in Asia Pacific and Latin America, and the reduced lower 2x 30 MHz in the Arab States, Africa and Europe.

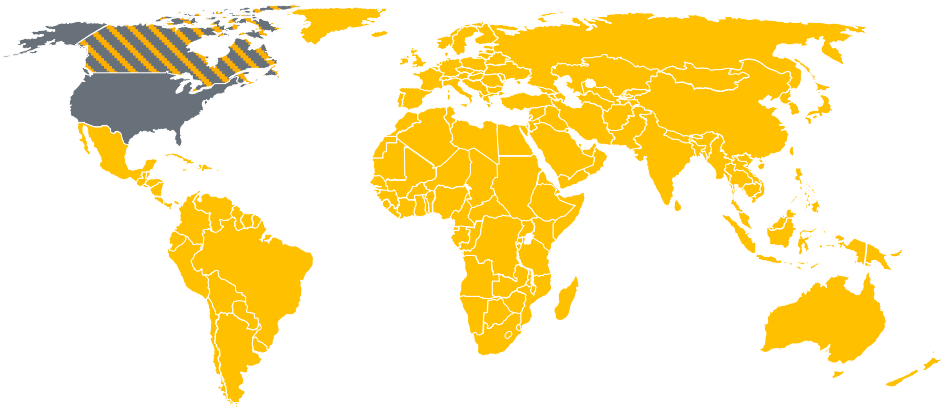

Figure 2 Close-to-global harmonization potential by the lower duplexer of 3GPP Band 28

As the lower 2x 30 MHz of Band 28 leave a duplex gap of 25 MHz, other highly prioritised services such as Public Safety (PPDR - Public Protection and Disaster Relief in ITU and CEPT terminology) may be allocated to shape an overall efficient band plan. Services like Public Safety target economies of scale with large commercial eco-systems but do not need or wish to be inside the commercial mobile bands. Consequently, a spectrum allocation close to but not within a commercial eco system may solve these targets for example by using part of the duplex gap. In this case, it has to ensure that the PPDR is not causing any additional coexistence issue to DTT and the measures discussed to avoid interference from MBB on DTT need to include PPDR interference.
This arrangement would help Europe to meet the target set in the EU Radio Spectrum Policy Programme for harmonised spectrum conditions for PPDR and at the same time contribute to efficient use of the 700 MHz spectrum.

Secondly, Europe can meet its ambitious Digital Agenda targets with 700 MHz

Europe can make available the amount of coverage spectrum required to meet the Digital Agenda target of 30 Mbps to every household in those areas where wire-line solutions are not cost efficient. With the 800 MHz band, Europe has an opportunity to offer mobile broadband in a pair of 2x 30 MHz as defined by 3GPP band 20. Several countries have awarded licences, typically in pairs of 2x 10 MHz; some countries have launched commercial service based on LTE technology. A primary use case so far has been providing internet access in remote areas where lengths of the copper land lines do not even allow for basic

broadband connectivity of 1 Mbps downstream capability. In several European countries, licences even have explicit coverage obligations to encourage quick closure of the so called white spots in internet access coverage maps. In Germany, who launched LTE at 800 MHz as a global first, in the meantime all federal states could declare coverage in prior white spot areas so that now the 800 MHz licences becomes applicable also in more densely populated areas. Typical data rates are within 10 MHz licences range from 5 to 20 Mbps, and towards the cell edges users can experience still 3 to 5 Mbps. First fully integrated smart phones supporting all today's relevant European LTE bands, i.e. 800 MHz, 1800 MHz and 2600 MHz, appear on the market so that besides providing fixed or nomadic internet connectivity to homes, LTE at 800 MHz can quickly deliver true mobile coverage on a national footprint.
In the meantime, the EU commission has set significantly more ambitious targets in their digital agenda: by the year 2020, every household in the EU shall be able to connect with at least 30 Mbps to the internet. Germany has worded the even more challenging target of 50 Mbps to every household by the year 2018. In densely populated areas, such data rates can be addressed economically viable with wired solutions such as fibre, cable or over existing twisted copper pairs with VDSL. Nevertheless, in rural areas legacy copper lines often are to long to support such data rates and replacing those with fibre or cable would come at prohibitively high cost. Consequently, wireless solutions need to be looked into as recently acknowledged in 4. Whilst today's LTE networks are capable of delivering peak data rates to an end user of up to 75 Mbps in a pair of 2x 10 MHz, average experienced user throughputs are in the range of 5 to 20 Mbps depending on network design and load. Towards the cell edge, users typically experience a range of 3 to 5 Mbps, sometimes requiring external antennas. LTE at 800 MHz over a single 2x 10 MHz licence with a limited number of base stations cannot provide for the targets set by the EU. With LTE-Advanced, improvements in technology lead to certain enhancements of the spectral efficiency, i.e. the amount of data that can be transmitted within a given spectrum, and the possibility to bond large amounts of spectrum in so called carrier aggregation. Improved spectrum efficiency e.g. by more sophisticated antenna technology may lead to an increase in data rates at the cell edge in the order of 25% whereas addressing additional spectrum translates to approximately linear increase in data rate. With a band plan compatible to 3GPP Band 28 in 700 MHz, Europe can double up the amount of spectrum provided today in 800 MHz and joint use of the total spectrum in 800 MHz could yield 60 MHz for downlink capable of delivering to remote household the targeted 30 and 50 Mbps, respectively.

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4 Recommendations

DIGITALEUROPE recommends making available the 700 MHz band in addition to the 800 MHz band for Mobile Broadband in a timely manner as a corner stone in delivering on European Digital Agenda targets, particularly to sparsely populated and remote areas in Europe, providing that the transition is managed by administrations in a timely manner and be properly resourced, while applying accurate frequency planning and good spectrum engineering practices for DTT.

DIGITALEUROPE considers essential the following aspects:

- There should be no disruption of the existing DTT services to consumers
- Consumers should be appropriately informed
- Interference problems should be minimized and solved in the least disturbing way for the consumer in applying the guidelines recently published[18]
- Time plans for the transition are developed with the Consumer Electronics Industry

DIGITALEUROPE considers a transition to DVB-T2 as an adequate measure to facilitate the release of the band 694 – 790 MHz.

DIGITALEUROPE maintains that harmonised designation of spectrum and usage conditions are essential ingredients to support cost effective devices for both the consumer electronics industry and the mobile industry.

Regarding the channelling arrangement for mobile broadband, DIGITALEUROPE supports a frequency arrangement in ITU Region 1 that facilitates a global solution, leverages on standardization activity and is compatible with EU Band 20 (800MHz). This allows economies of scale and roaming capabilities across all ITU regions.

Figure 3 illustrates an example that would achieve this; however, it will be subject to agreement on the lower band edge frequency as defined by ITU-R and CEPT.

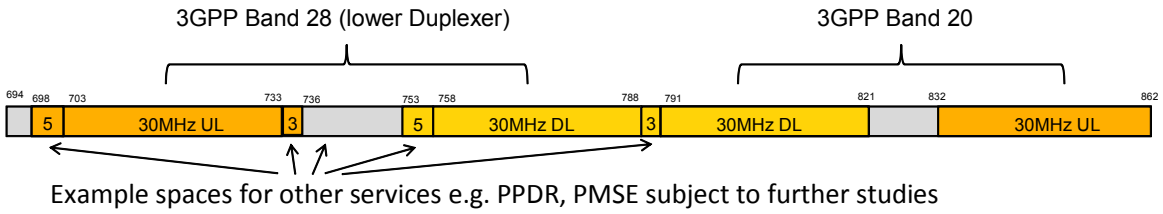

Figure 3 Example Band Plan

[18] DIGITALEUROPE Guidelines to reduce the LTE interference impact on DTT

2. eircom Group: submission entitled "Response to ComReg Consultation Paper: Spectrum Award 2.6GHz band with possible inclusion of 700MHz, 1.4, 2.3 and 3.6GHz bands ComReg Document 14/101", dated 14 November 2014

eircom Group

Response to ComReg Consultation Paper:

Spectrum Award

2.6GHz band with possible inclusion of 700MHz, 1.4, 2.3 and 3.6GHz bands

ComReg Document 14/101

14 November 2014

DOCUMENT CONTROL

Document name	eircom Group response to ComReg Consultation Paper 14/101
Document Owner	eircom Group
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Status	Confidential

The comments submitted to this consultation are those of Meteor Mobile Communications Ltd. (MMC) and eircom Ltd (eircom) collectively referred to as eircom Group.

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Accordingly, you are requested to contact a member of eircom's Regulatory Department where there is a request by any party to have access to records which may contain any of the information herein and not to furnish any information before eircom has had an opportunity to consider the matter.

Response to Consultation

eircom welcomes the opportunity to input into the development of a proposed spectrum award process.

1. The focal point for the award process

ComReg has chosen the 2.6GHz band as the starting point for its considerations. ComReg has done this in light of the fairly imminent expiry of current licenses in the band by April 2016. However in eircom's view the 2.6GHz band is an incorrect starting point. The expiry date of current 2.6GHz licences is clearly a material consideration but it should not be the primary driver behind the next multiband spectrum award. ComReg's policy for finite licence durations means that expiry dates are somewhat arbitrary in nature and may or may not coincide with important regulatory developments such as harmonisation measures and market developments. It is eircom's view that it would be more efficient if licences where issued with a guaranteed minimum term (in the region of 15 to 20 years) that could, after the minimum term, be terminated by ComReg subject to a reasonable notice period. This would allow the availability of spectrum bands to be better aligned with important developments.

The key development that should be the focus of ComReg's consideration is the harmonisation of the 700MHz (694-790MHz) band at the European level and the development of national policy regarding clearance of the band from DTT use in order to make the 700MHz band available for Next Generation Mobile Broadband (NGMB) use. ComReg and the Department of Communications, Energy and Natural Resources are undertaking parallel reviews that will settle national policy regarding the 700MHz band.

The 700MHz band is advanced in terms of the international harmonisation process and there is considerable political impetus within European institutions to release this spectrum for NGMB use. This spectrum is expected to have good propagation characteristics for wide area mobile broadband coverage.

The 2.6GHz band is important harmonised spectrum that will be available for mobile broadband in the majority of EU member states, and is key to the LTE plans of many European mobile operators. As highlighted by DotEcon "*At a European level, 2.6GHz spectrum licences for NGMB have been issued in many Member States in recent years. NGMB rollout in this band is progressing at a fast pace internationally, and the 2.6GHz band is a heavily used band for providing advanced mobile services using LTE at present. Therefore, the 2.6GHz band represents an opportunity to respond to the rapidly rising demand on a common basis internationally. As a result, NGMB is likely to be a primary contender for spectrum in this band*."[1]

eircom agrees with DotEcon and ComReg that there are substantial benefits from combining spectrum bands in a single award process where the bands in question are sufficient complements or substitutes. Higher frequency spectrum such as 2.6GHz is of limited use on its own for the provision of national services. Higher frequency spectrum needs to be complemented by lower frequency spectrum if national services are to be provided. If ComReg wishes to encourage national competition then eircom firmly believes that the correct starting point for consideration, and the focal point for a potential multi-band spectrum award, must be the 700MHz band.

eircom has reviewed the Regulatory Impact Assessment in chapter 3 of the consultation document. Generally we would observe that the RIA is deficient because it is little more than a qualitative discussion and ComReg has made no attempt to quantify the perceived costs and benefits of the

[1] Para 33, ComReg 14/102

options. We believe more rigour should be applied for the RIA to be fit for purpose to support important decision making.

eircom also considers that the RIA is not complete because of ComReg's incorrect starting point placing the 2.6GHz as the focal point. The RIA considers option 1 (2.6GHz only) against option 2 (2.6GHz plus capacity bands) and option 2 against option 3 (2.6GHz plus capacity bands plus 700MHz). From this analysis "*ComReg considers it is likely that, on balance, industry stakeholders would prefer the inclusion of all of the Capacity Bands in the award process*"[2] and "*industry stakeholders would prefer that the 700 MHz band is included in this award process, should it become available for inclusion*."[3] ComReg goes on to clarify "*Where there may be a significant delay in the availability of any particular band, ComReg may reconsider the inclusion of that and other related bands in the proposed award process (see, for example, paragraph 3.86 above in respect of the 700 MHz band)*."[4]

eircom agrees that the preferred option for the bands to be included in the award is the 700MHz band, the 2.6GHz band and the other capacity bands. eircom does not agree with ComReg that the 700MHz band should only be included in the award so long as there is not a significant delay to its availability. The 700MHz band should be the focal point. The RIA analysis is incomplete because proper consideration has not be given to comparing release of the 2.6GHz band on its own (option 1) and release of the 2.6GHz band combined with the 700MHz band (a subset of option 3). ComReg must properly assess this option.

2. The capacity bands (1.4GHz, 2.3GHz, 3.6GHz)

As noted above eircom broadly agrees with ComReg's proposals to make the capacity bands available in this award process. This is because there is likely to be substantial complementary and substitutability of the capacity bands with the 700MHz band and the 2.6GHz band.

eircom currently relies on spectrum in the 2.3GHz band to provide basic telephony services on its RurTel network. The RurTel network provides service to customers where it is not economical or practical to use traditional fixed line or mobile telephony technology to deliver service in remote locations. [redacted] We note "*it would be ComReg's intention to release, as far as possible, the entire 100 MHz*"[5]. eircom has no objection in principle to clearance of the 2.3GHz band. However ComReg will need to ensure that those customers currently served by the RurTel network will continue to have service. [redacted] We look forward to further engagement with ComReg on this point.

eircom welcomes ComReg's proposal to include the 3.6GHz band in the award process. We note "*A portion of the band (3435-3475 MHz) is in use by State services and these services are likely to continue into the future beyond the anticipated timeframe of the award process*."[6] eircom requests

[2] Paragraph 3.105, ComReg 14/101
[3] Paragraph 3.110, ComReg 14/101 (emphasis added)
[4] Paragraph 3.128, ComReg 14/101
[5] Paragraph 3.21, ComReg 14/101
[6] Paragraph 3.29, ComReg 14/101

that ComReg provide further details of the State services that are supported using this spectrum so that we may better understand whether these uses create a risk of harmful interference.

[redacted]

3. Other Bands due to expire

ComReg notes[7] that there are other spectrum licences approaching expiry in the next few years (e.g. WDMDS Licences in the 410MHz and 900MHz bands, and the 26GHz point to point and point to multipoint licences). ComReg proposes that these bands may be subject to their own award processes as they are not sufficient substitutes or complements for inclusion in this process. eircom agrees that these bands are not appropriate for the proposed multi-band award process. However eircom requests that ComReg clarifies the timeline and processes that will deal with availability of spectrum in these bands. For example, the WDMDS will expire in December 2015. We understand from the consultation document that no services are currently provided under the WDMDS licences. There may exist potential for new and innovative services to be provided in this band that may benefit from an early award process. The 26GHz band licences are due to expire in July 2018 and clarity is required here also regarding the regulatory timeline and processes.

4. Auction design

ComReg sets out its initial considerations (based on DotEcon advice) regarding auction design and proposes to largely follow the design principles used for 2012 auction. It should be noted that eircom has no objection to a competitive award process as these tend to give greater legal certainty compared to administrative assignment processes. As such we do not agree with ComReg's observation in the RIA that "*It is likely that all existing operators including MNOs would prefer some form of administrative assignment*."[8]

The 2012 auction design contained novel elements specific to the circumstances at the time, in particular the availability of spectrum across two time slices and the ability to cater for liberalisation of relevant GSM spectrum blocks. These elements are not relevant to a future award process. The future award process will have its own challenges to cater for complementarity and substitutability. There may also be band specific considerations - for example, providing flexibility for the market to determine the optimal mix of TDD and FDD spectrum in the 2.6GHz band.

eircom would recommend that the 700MHz, 1.4GHz, 2.6GHz FDD spectrum bands are offered on a national basis. The 2.3GHz, 2.6GHz TDD and 3.6GHz bands could be offered on a regional basis with the ability to aggregate national licences. These features will need to be developed in the proposed award process and we look forward to further consultation to establish the Information Memorandum for the proposed award process. We would also recommend release of the relevant algorithms and Electronic Auction Software to interested parties well in advance of the award process itself. A clear timetable including rehearsals must also be established to allow interested parties sufficient time to prepare.

[7] Footnote 31, ComReg 14/101
[8] Paragraph 3.152, ComReg 14/101

eircom requests that a review is conducted of the performance of the 2012 award process. The 2012 award process can be regarded as a successful process. However there are certain elements that could be scrutinised to assess if they could be improved. For example, due to the use of the second price rule in combination with the Main Stage primary rounds and supplementary round, bidders had to guess their financial exposure in each primary round. It was only after the supplementary round that a bidder discovered their actual financial exposure. It is difficult for businesses to make effective decisions in such circumstances. A bidder may measure its success in the award process as buying sufficient spectrum at a cost within available budget. A bidder may consider a failure the situation where it over estimated its financial exposure and consequently procured less spectrum than it could. Such an outcome is possible in circumstances where a bidder's budget is less than their valuation range. This uncertainty to financial exposure could be argued to be a failure in the auction design itself and eircom is of the view that a review is needed as to how the second price rule is implemented in the auction design. We would also observe that the Assignment phase in 2012 may not have been as effective as it could have been and this also needs to be addressed in any future design.

5. Spectrum Lots and FDD/TDD coexistence.

eircom recommends that FDD lots are packaged in units of of 2x5MHz. eircom also recommends that both TDD and SDL are packaged in units of 1 x 5 Mhz.

The potential for interference between adjacent TDD and FDD spectrum blocks is well understood. ComReg has referenced the relevant EC decisions, ECC decisions and CEPT reports which address FDD/TDD coexistence for the 2.6GHz, 2.3Ghz and 3.6GHz bands. These reports and decisions are quite clear and identify the least restrictive technical conditions required.

The base position is that a 5MHz guardband is required to minimise the potential for interference. These reports allow for the potential to use the guardband in a restricted format e.g. low power pico cells or even to remove the requirement for a guard-band through TDD network synchronisation between the different operator networks.

eircom recommends that the licensing approach should require the use of guard-bands to protect an operator's investment in spectrum. However, the licensing regime could allow for restricted use or removal of the guard-bands where bilateral or multilateral agreements between operators can be reached. This approach ensures protection against unwanted interference, while allowing for the potential of maximum spectrum efficiency.

6. Spectrum caps

We note and agree with DotEcon's view that it is too early to formulate specific proposals for caps. "*In this award, it is possible to implement such an approach using spectrum caps to preclude outcomes in which, in the absence of entry, would lead to one of the three MNOs being significantly disadvantaged. However, the details are highly specific to which bands are included and there are a large number of possible scenarios in this regard. Therefore, it is too early to formulate specific proposals for caps, other than to note that caps can be set at levels that preclude significantly asymmetric outcomes, yet not impose entirely symmetric ones and thereby inhibit competition for spectrum within the auction*."[9]

There are a number of principles that should be followed when developing specific cap proposals. eircom agrees with DotEcon's view that reservation of some spectrum lots for new entrants only is

[9] Paragraph 235, ComReg 14/102

not justifiable. "*Given the uncertainties about the viability of efficient entry, we do not believe that it would be appropriate to use a reservation, as this could simply encourage rent-seeking entry that does not contribute to sustainable long-run competition*."[10]

eircom is also supportive of DotEcon's views that significantly asymmetric outcomes should be precluded. However, in order for such outcomes to be precluded, account must be taken of the pre-award process spectrum holdings of the bidders. It is DotEcon's view that "*For spectrum above 1GHz, even though there is now a significant asymmetry in holdings of the 1800MHz band due to the recent merger, these differences are small in comparison with the amount of spectrum potentially available in the upcoming award (depending of course on the bands included). Therefore, the question of whether an overall spectrum cap should include or exclude existing holdings alongside spectrum bid for is largely irrelevant*."[11]

eircom fundamentally disagrees with DotEcon's subjective view that consideration of existing holdings is largely irrelevant. The recent concentration of H3G and O2 on the Irish market has given rise to significant asymmetry in spectrum holdings. As we highlighted in our response to ComReg 14/65[12] the implications of this asymmetry need to be understood and addressed. In eircom's view the asymmetry in spectrum holdings already in the market place is not compatible with ComReg's objectives, inter alia, to promote competition and to ensure efficient use of the radio frequency spectrum. Spectrum asymmetry is a critical issue and DotEcon must expose its detailed analysis for scrutiny.

7. Licence duration

DotEcon[13] correctly identifies that "*Spectrum use typically requires long-term, large-scale investment in networks*." In eircom's view this means that longer licence durations are preferred. As noted in section 1 above, ComReg's current approach to licence duration establishes arbitrary termination dates that do not align with significant regulatory and / or market developments. eircom recommends that licences are issued with defined minimum durations of sufficient longevity to allow the licensee a reasonable opportunity to generate a return on investment. Licences could be revoked by ComReg after the minimum term, subject to a reasonable notice period, to align with significant developments that may justify making the spectrum available to the market.

The spectrum bands under consideration for the proposed award represent the entirety of spectrum suitable for NGMB likely to come available this decade. The next batch of NGMB spectrum to become available may be 2100MHz licences in 2022 (expiry of Vodafone and Three licences) and 2027 (expiry of Meteor licence). The 2012 award process established licences in the 800MHz, 900MHz, 1800MHz bands to 2030.

ComReg is considering whether to award the licences with a 15 or 20 year duration. As noted above eircom recommends that a minimum duration should be established rather than an arbitrary finite date that bears no relationship to the state of the market or the state of art in terms of spectrum harmonisation decisions. We believe there are strong grounds that the minimum duration should be 20 years in the case of the proposed award process. In particular we agree with ComReg's view "*that co-termination with the rights of use awarded under the MBSA process is not an appropriate option for the proposed award process*."[14] A minimum term of 15 years, assuming commencement date of April 2016, would mean that the licences could become

[10] Paragraph 242, ComReg 14/102
[11] Paragraph 239, ComReg 14/102
[12] Liberalisation of the paired terrestrial 2GHz band
[13] Paragraph 10, ComReg 14/102
[14] Paragraph 4.58, ComReg 14/101

available in 2031. This would be too close to the spectrum awarded in 2012 and could prove to be very disruptive. Taking into account the need to allow a sufficient period for return on investment we believe the minimum term should be set at 20 years.

8. Reserve prices and Spectrum Fees

DotEcon and ComReg propose to set minimum reserve prices determined by a benchmarked reference to market value. DotEcon highlights the challenges of this approach. "*Setting prices that are reflective of 'market value' poses the challenge of determining market value, which is the price we expect that would be achieved in a competitive market. Prices in a competitive market would be set at the lowest level at which there is no excess demand for the lots offered. This means that the price of a lot would need to be just above the highest amount offered by bidders who failed to acquire the lot.*"[15] Such an approach is not without risk particularly if the minimum prices are set too high.

The use of combinatorial package auctions makes it increasingly difficult to assign a market value to spectrum in a particular band. eircom would question the need to set minimum prices by reference to market prices particularly as the market has yet to be established for a number of the bands. If benchmarking of previous auction outcomes is to be undertaken then appropriate adjustments will need to be made to place the spectrum in the context of the Irish market. In our view the risk of setting minimum prices at too high a level and discouraging innovative use of the spectrum is such that a better approach is to set minimum prices at levels solely to deter frivolous participation in the award process. It is the purpose of the award process to establish the market value as an output of the process and not as an input.

The 2012 award process used a 50:50 split of the minimum price to set reserve prices and to fix annual Spectrum Usage Fees (SUFs). SUFs were in part justified on the basis to promote continued efficient use of the spectrum, i.e. a rationale licensee would surrender any spectrum it no longer had plans to use in order to realise an annual cost saving from reduced SUFs. The introduction of spectrum trading means that efficient use is no longer a justification for SUFs. We note DotEcon's somewhat negative views[16] regarding trading and its view that SUFs complement the secondary market. eircom does not agree. The fundamental rationale for spectrum liberalisation is to allow the market to determine the optimal use of spectrum and this should be allowed without potentially distortive SUFs. eircom therefore recommends that SUFs are not set for the proposed award.

9. Coverage obligations & Roll-out

It would be unfair to existing licensees if less onerous obligations applied for the proposed award process just as it would be unfair for new entrants if more onerous obligations applied for the proposed award process. In the interest of a maintaining a level playing field eircom believes that coverage and rollout obligations should be established for the proposed award process that are consistent with those adopted in the 2012 award process.

[15] Paragraph 282, ComReg 14/102
[16] Paragraph 274, ComReg 14/102

3. ESB Networks: submission entitled "ComReg Consultation on Spectrum Award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands, ESB Networks Response", dated 14 November 2014

ComReg Consultation on Spectrum Award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

ESB Networks Response

Status: **Final**

Date: **14/11/2014**

ESB Networks Response to ComReg Consultation Document 14/101

ESB Networks (ESBN) welcomes the opportunity to respond to the Commission for Communications Regulation (ComReg) consultation in relation to a proposed spectrum award, potentially including the 2.6 GHz, 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz spectrum bands[1].

Radio spectrum is a hugely important natural resource, enabling both critical and non-critical services to be deployed and made available for all citizens. It is a key enabler for 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 recently made a submission to the Department of Communications, Energy and Natural Resources (DCENR) Spectrum Policy consultation[2]. ESBN recognises that allocation and assignment of spectrum can attract significant fees for the State. Within its response to the DCENR consultation, ESBN stated that DCENR should recognise the significant benefits that can be derived from Smart Grid, and consider reserving radio spectrum in an appropriate spectrum band (e.g. sufficient bandwidth sub-1GHz) for the utility sector. ESBN awaits DCENR's response to this consultation. Irrespective of any DCENR policy decision in this regard, ESBN welcomes the timely release of radio spectrum by ComReg. ESBN believes that it should be directly assigned 2 x 5 MHz of sub 1 GHz spectrum, and comments below are made without prejudice to this position.

1. Introduction

ESB Networks Ltd. (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.

Secure telecommunications is vital to the safe and efficient operation of the grid. Dedicated fixed and wireless communications are used to ensure service is delivered under all conditions. This dedicated telecommunications infrastructure is also used to provide EirGrid with services to control and monitor the transmission network.

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

[1] http://www.comreg.ie/_fileupload/publications/ComReg14101.pdf

[2] http://www.dcenr.gov.ie/NR/rdonlyres/8D2F913A-60C5-46C6-97A6-9DB8EEA4AB02/0/SpectrumConsultationDocument.pdf

network nationwide. ESBN also maintains the high voltage electricity network in Ireland on behalf of the Transmission System Operator (TSO) EirGrid.

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 an extensive telecommunications infrastructure to provide ESB and EirGrid with necessary real time information for operational purposes. Such critical communication cannot always be provided by public communications networks, as these networks cannot provide the network characteristics required.

Services which ESBN deploy and manage include:

- Supervisory Control and Data Acquisition (SCADA)
- High Voltage protection circuits
- Disturbance recorders
- Energy metering
- Operational Telephony
- Private Mobile Radio (PMR)
- Corporate telecommunications

ESBN uses numerous media to deliver required telecommunications, namely:

- Microwave Radio
- Fibre network
- Satellite
- Polling Radio
- Power Line Carrier
- Copper/DSL

ESBN's telecommunications network requires connectivity in a significant number of locations within the country, often in remote areas and with inhospitable environment (e.g. within High Voltage substations). A significant proportion of ESBN's telecommunications network relies solely on wireless for several reasons, including situations where it is technically difficult to use cables to connect devices to the network, or where it is not economically feasible. Radio spectrum is an important enabler of ESBN's existing network.

Radio spectrum will be even more significant it the future. In order to meet Ireland's challenging 2020 renewables energy targets, the amount of wind power connected to

Ireland's electricity grid must be greatly increased. Ireland has some of the most ambitious 2020 targets within Europe, with EirGrid stating[3] that ;

> "*No other synchronous system of scale manages the same levels of instantaneous wind penetration levels (50%) seen today, and no other synchronous power system is aiming to safely and securely manage real-time wind generation penetration levels of 75% by 2020.*"

To meet these challenges ESBN needs to continue to be at the forefront of Smart Grid developments.

Smart Grid technology is being deployed worldwide. Such deployments requires appropriate radio spectrum to facilitate communications between large numbers of endpoints nationally and aggregation point/nodes. Often, such endpoints are in very remote locations without coverage from public communications networks. Connecting all of these endpoints with a purely wired or fibre network would be cost prohibitive, and would limit severely the implementation and the value of a smarter electricity network.

A Smart Grid network requires a long service life to justify the investment. Due to the dispersed and generally inaccessible endpoints, many of which are on electricity poles and the dangerous nature of the high voltage electricity network, there is a high cost to installing the endpoints. Therefore communications devices on the network must have a long service life. The technology refresh cycle for electrical systems is far longer than the comparatively rapid technology refresh cycle of the ICT industry.

Smart Grid technology realises substantial benefits from an economic, social and environmental perspective. In the event that ESBN did not have access to a sufficient amount of appropriate radio spectrum, this could create vulnerabilities through lack of resilience in key areas of the electricity network, with potentially significant impact on the Irish economy, environmental targets and protecting safety of life. Access to appropriate spectrum and the timely introduction of appropriate licencing regimes has a vital influence for ESBN in permitting investment and innovation.

ESBN considers that there is a pressing requirement for appropriate spectrum to be made available within Ireland to facilitate the implementation of an advanced Smart Grid. Smart Grids can provide significant socio-economic benefits. For example, some studies carried out in the United States conclude the following[4]:

- Smart Grids can reduce emissions by 60 to 211 million tonnes of CO2 per year by 2030. [Electric Power Research Institute 2011]

[3] Annual Renewables Report 2013, Eirgrid
http://www.eirgrid.com/media/EirGridAnnualRenewableReport2013.pdf

[4] Source: "The Socio-economic value of spectrum in providing utility services to support their operations": Report by The Joint Radio Company Ltd on behalf of the European Utilities Telecommunications Council: 20 January 2014

- Smart Grids are expected to achieve a 12% reduction in electricity consumption and CO2 emissions in 2030. [Pacific NorthWest National Laboratory]

- Smart Grid combined with changes in generation and end-use options could reduce by 2030 annual CO2 emissions from the electric sector by 58% relative to 2005. [Electric Power Research Institute 2011]

These studies show how Smart Grids provide social, economic and environmental benefits. Indeed, CER in conjunction with DCENR established a National Smart Metering Programme (NSMP)[5] in 2007. CER and DCENR recognise the considerable merit in deploying Smart Metering, yet necessary radio spectrum has not been reserved for this purpose.

A recent report by the Irish Corporate Leaders on Climate Change[6] outlines the major benefits arising from deploying a Smart Grid in Ireland, stating;

> "*The roll out of the Smart Grid is a critical lever for enabling and capturing green-growth possibilities across the economy. It is critical to managing variability of wind. Low-carbon power in turn can be used to decarbonise end-use sectors (through the electrification of heat and transport, see below), and allows for the more optimal use of generation assets through "demand response" (for example, decreasing electricity tariffs to households when the wind is blowing). Deployment of the Smart Grid therefore joins together three of the most important pillars of Ireland's decarbonisation: integration of wind, smart zero energy buildings, and electrification of transport and heat…*
>
> *The optimal use of electricity in end-use sectors, and the optimisation of grid resources, will be facilitated by the deployment of a Smart Grid (see above), allowing the heat and transport sectors to play a role in managing variable electricity production. Electric vehicles and plug-in hybrids will be key technologies, and smart electrical heating technologies and heat pumps are very likely to also play a significant role…*
>
> *SEAI estimate that more than **10,000 Irish jobs will be created** by the implementation of Smart Grid infrastructure and its associated technologies; up to **eight million tonnes of CO2 mitigation could be derived** directly from the implementation of Smart Grid; and a **net reduction in energy imports of over 4.3 Mtoe**, [equating to **savings of €2.4 - €5.2bn** in direct fuel offset by 2050] would also be delivered."* [emphasis added].

The Radio Spectrum Policy Programme ('RSPP') was published in April 2012 on behalf of the European Parliament. Article 8 (2) of the RSPP states the following;

> "*2. The Commission shall, in cooperation with the Member States, conduct studies on saving energy in the use of spectrum in order to contribute to a low-*

[5] http://www.cer.ie/electricity-gas/smart-metering

[6] http://www.corporateleaders.ie/sites/default/files/CLG%20Unlocking%20Opportunity_FINAL_0.pdf

> *carbon policy, and shall consider making spectrum available for wireless technologies with a potential for improving energy saving and efficiency of other distribution networks such as water supply, including smart energy grids and smart metering systems.*"

Article 8 (2) aims to reduce emission and improve energy savings with radio spectrum as the key enabler. Smart Grids and all the benefits it delivers, requires radio spectrum, without which Smart Grid technology is redundant. Without dedicated radio spectrum, citizens of the state will not reap the economic and social benefits of Smart Grids. Society and industry will not reap the economic benefits, and society as a whole will not reap the significant environmental benefits.

The European Commission issued a report to the European Parliament and the Council on the implementation of the RSPP, published on 22 April 2014. Section 2.4 reviewed progress with respect to Article 8 (2) of the RSPP.

The EC is considering usage of commercial mobile networks to carry such mission critical communications. The European Commission appointed consultants (early 2014) to study the potential use of commercial mobile networks in "*mission-critical sectors*"[7]. The study is examining four critical sectors, utilities being one of these. Consultants SCF Associates Ltd have distributed documentation on their work in progress. The SCF report states the following;

- commercial networks are favoured if;
  - they can offer the resilience required,
  - they can offer 99.999% availability, and
  - cost is not excessive.
- It is likely that between 2018 – 2020 LTE could provide the required services,
- SCF consider that MNO's should ensure;
  - required reliability is available,
  - long term (15-30 year) contracts are made available to mission critical sectors
- SCF believe that NRA's should mandate access for the mission critical sectors and should enforce certain contractual arrangements to suit these sectors. SCF also recommends that there is prioritised access for these sectors.

It is unlikely that NRA's would intervene in the market place to the degree recommended by SCF. Also, it is unlikely that Mobile Network Operators (MNO's) will offer the required services on long term contracts as they are not guaranteed to have the supporting spectrum for the period suggested (up to 30 years). Additionally, MNO's would find it extremely challenging to deliver the network characteristics (as outlined below) required by utilities in addition to providing commercial wireless services to mobile users. Robust cyber security is imperative for critical infrastructure. Transmission System Operator's (TSO's) and Distribution System Operator's (DSO's) need to control its own network to ensure the necessary level of protection.

[7] https://ec.europa.eu/digital-agenda/en/news/study-use-commercial-mobile-networks-and-equipment-mission-critical-high-speed-broadband

In reality this leaves the mission critical sectors (which includes ESB) with little choice but to deploy its own wireless services. However, supporting radio spectrum is required for this.

The European Utilities Telecom Council (EUTC) outlined the requirements of a mission critical network such as that required by ESBN;

> "*Trust and control over these important mission-critical communications is of the utmost importance for utilities: the stability of the grid is dependent on these communications.*
>
> *The communication systems needed by utilities can be characterised as follows:*
>
> - *low to medium data rates;*
> - *enhanced resilience*
> - *longevity of products and support*
> - *extensive geographic coverage (including less populated areas);*
> - *stringent latency requirements;*
> - *low jitter and synchronous requirements; and*
> - *high levels of security.*
>
> *The optimal combination of these different characteristics depends on the type of utility, the type of application or system, the environment in which the utility operates and the legacy systems already in place*."[8]

Public networks cannot provide ESBN with all the requisite security, guaranteed Quality of Service, resilience as well as the other requirements noted by EUTC above.

ESBN believes that ComReg should ensure that in any future spectrum releases, that the government's policy objective of facilitating "*world-class communications infrastructures, technologies and services for the express purpose of raising our competitiveness, contributing to our economic development and improving the quality of life of our citizens*"[9] by ensuring that appropriate radio spectrum is made available. This would be consistent with the third of DCENR's *Current Spectrum Policy Objectives*[9], *"Adequate spectrum will be made available for essential public services and for the fulfilment of social and cultural objectives using appropriate assignment mechanisms"*.

ESBN's telecommunications network relies greatly on radio spectrum. ESBN invests significantly in its national critical infrastructure to ensure that its operational network is world class. In December 2013 IBM Worldwide chose ESB Networks as the exemplar international utility for 2013 because of its work in the Smart Grid area[10] [11].

[8] http://eutc.org/system/files/UTC_private_file/EUTC%20Spectrum%20Position%20Paper-9April2013.pdf

[9] http://www.dcenr.gov.ie/NR/rdonlyres/83EB5634-66B9-45DE-9362-24414408E4AC/0/SpectrumPolicyStatement.pdf

10 http://www.ibm.com/smarterplanet/uk/en/leadership/article/esb.html

A key enabler in building world class networks is access to spectrum to support the radio network.

The *Current Spectrum Policy Objective* states that the Minister is committed to ensuring radio spectrum is "*managed and used effectively and efficiently*". ESBN considers that where there is demand for unused spectrum, efficient and effective management would require the rapid allocation and assignment of that spectrum.

2. Consultation Issues

ComReg's consultation document addresses a significant number of issues, without providing any direct specific questions. ESBN gives its comments below on matters of interest to it.

Spectrum available in the proposed auction

ESBN is encouraged that ComReg is releasing radio spectrum in the near future. As mentioned previously in this response, spectrum is a key enabler for ESBN as well as the telecommunications industry as a whole. ESBN welcomes ComReg's proposals to release the 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz bands and agrees with ComReg that all of these bands should be included. However, ESBN believes that ComReg should also include other spectrum in its release.

From the outset of its consultation, ComReg appears to promote the view that spectrum proposed to be released is only of interest to commercial wireless telecommunications providers like MNO's. The expiring 2.6 GHz spectrum is the trigger for the proposed spectrum release, with the other spectrum bands proposed are considered either substitutable or complementary to the 2.6 GHz spectrum bands. ComReg's rationale on whether a spectrum band is substitutable or complementary appears to be made from solely the point of view of commercial telecommunications providers.

ESBN considers that spectrum bands, which, from its perspective, are substitutes or complements, are not included in the proposed spectrum release. For example, all of the existing WDMDS spectrum (licensed for 10 years from December 2005) will become available in December 2015 when the existing licences expires. The spectrum that will become available is 410 – 414 MHz paired with 420 – 424 MHz (denoted '410 MHz spectrum' for the rest of this document), as well as the 872 – 876 MHz paired with the 917 – 921 MHz (denoted '870 MHz spectrum' for the rest of this document). From an ESBN perspective, these spectrum bands are substitutes to the 2.3 GHz, 2.6 GHz and 700 MHz spectrum bands, and should be included in the auction.

ESBN has a requirement to deploy telecommunication services to both urban and rural areas, often with a relatively low data rate and low duty cycle. ESBN therefore requires radio spectrum to meet this requirement. In the event that ESBN could not get access to appropriate spectrum bands (e.g. 410 MHz and 870 MHz spectrum

11 http://www.ibm.com/smarterplanet/global/files/us__en__us__leadership__esb_case_study.pdf

bands) in the near future, it would be forced to consider lesser ideal alternatives like the 2.3 GHz and 2.6 GHz spectrum bands.

ComReg will be aware that ESBN have been successfully trialling equipment in the 2.3 GHz spectrum band for some time. Equipment availability in the 2.6 GHz spectrum band is considerable at this time. However, the inherent propagation characteristics of these spectrum bands are not ideal for ESBN's requirements. The 410 MHz and 870 MHz spectrum bands are more appropriate for wide scale deployment of remote devices in all economic manner. The 2.3 GHz and 2.6 GHz spectrum bands are substitutes in the event that the more desirable sub 1 GHz spectrum were not available. However, the deployment costs utilising 2.3 GHz and 2.6 GHz spectrum would be significantly more than that associated with sub 1 GHz spectrum.

ComReg has omitted the existing 410 MHz spectrum band in the proposed auction without providing sufficient rationale. The spectrum licence is due to expire in 2015. ComReg has set a precedent that it consults on the future of spectrum bands in advance of licences expiring (e.g. 900 MHz and 1800 MHz spectrum bands, the 3.6 GHz spectrum band, the 2.6 GHz band). ESBN urges ComReg to continue with this precedent. In the event that ComReg does not consider including the 410 MHz spectrum band in the proposed auction, it will either let the spectrum lay fallow (even if there is demand) for several years, or it will grant licence extensions to existing licensees like it has done in the past (900 MHz and 1800 MHz spectrum). Neither of these outcomes would result in efficient use of spectrum.

[redacted]

ESBN deems it essential that ComReg include the 410 MHz spectrum band in the proposed spectrum auction for numerous reasons. In doing so, ComReg would satisfy its primary objectives of contributing to the development of the internal market, promoting the interests of users within the Community and ensuring the efficient management and use of the radio frequency spectrum in Ireland. ComReg would also satisfy Policy Direction No. 11 on the Management of the Radio Frequency Spectrum

[12] http://media.ofcom.org.uk/news/2006/ofcom-awards-licence-following-spectrum-auction/

by taking account of all users of radio spectrum and not just commercial public telecommunications providers.

The 870 MHz spectrum band is currently licensed by ComReg to Digiweb with this licence expiring in December 2015. ComReg has not made clear what the intention is for this spectrum once the licence expires, but does state that it may be assigned by a competitive award process in the future. ESBN believes that ComReg needs to clarify as soon as possible its intentions surrounding this spectrum band. The spectrum is due to expire in one year so it is timely for ComReg to have a clear plan for the band at this time to ensure the band is not left fallow for some time after the licence expires.

It would be difficult for ComReg to auction the 870 MHz spectrum (which ComReg suggests may happen in the future as per footnote 31 of ComReg's consultation document) given that a CEPT Recommendation exists, there is supporting technical criteria and such Short Range Devices (SRD's) are available throughout Europe. There is potential for such SRD's to be wrongly utilised in Ireland. This could create interference issues for any licensed user of this spectrum and create a considerable administrative burden for ComReg protecting the licensee.

ESBN believes that ComReg should implement the CEPT ERC Recommendation (70-03)[13] as soon as the 870 MHz spectrum band licence expires in Ireland. This CEPT ERC Recommendation permits licence exempt usage of the 870 MHz spectrum band, with up to 4W ERP. Ofcom let the 870 – 876 and 915 – 921 MHz spectrum remain unused for nearly 10 years at great cost to "UK PLC"[14] before implementing ERC Recommendation (70-03) in June 2014[15].

Ofcom made the following statement on the 870 MHz spectrum band during its consultation process[16];

"*we concluded that, given the progress made in Europe with new harmonising measures for SRDs and Radio Identification Devices (RFIDs) by the CEPT and European Telecommunications Standards Institute (ETSI), as well as evidence from the responses to our earlier consultation, we should make the bands 870 to 876 MHz and 915 to 921 MHz available on a licence exempt basis consistent with the CEPT's harmonised technical measures so long as those measures permit the efficient use of the spectrum.*"

Therefore ESBN encourages ComReg to immediately align with CEPT ERC Recommendation (70-03) when the existing Digiweb licence expires in December

[13] http://www.erodocdb.dk/docs/doc98/official/pdf/rec7003e.pdf

[14] Source http://www.silverspringnet.com/silver-spring-connect/friday-5-withsimon-dunkley-ofcom-leads-uk-to-iot/#.VFuE-vl_ubE

[15] http://stakeholders.ofcom.org.uk/binaries/consultations/proposal-wireless-telegraphy-exemption-2014/statement/2014update.pdf

[16] http://stakeholders.ofcom.org.uk/consultations/short-range-devices/summary

2015. ComReg should make its position on this spectrum known soonest to provide regulatory certainty.

Sequential release or a single multiband release

ESBN agrees with ComReg that it is makes sense to release multiple spectrum bands together in the one auction to permit participants to dynamically make decisions on the most advantageous spectrum taking into account prevailing price information generated from the auction.

More importantly, ESBN deems it necessary from a timing perspective to include multiple spectrum bands in the one auction. ESBN does not believe that ComReg will consider or initiate a separate spectrum release for any other spectrum bands until the current proposed spectrum auction is complete. It could be 2016 or 2017 when ComReg considers releasing similar spectrum to that being proposed. ESBN therefore considers it essential that ComReg release multiple appropriate spectrum bands in this proposed release.

Auction type

ESBN agrees with ComReg that a Combinatorial Clock Auction (CCA) is the most appropriate auction format for releasing spectrum in this process. This is without prejudice to the view that ESBN has made with DCENR that it should be directly assigned sub 1 GHz spectrum.

First price rule vs. second price rule

ESBN agrees with ComReg that employing a second price rule is the most appropriate for this spectrum release.

Technical criteria

ComReg have adopted a prudent approach to setting technical criteria (e.g. band plans, block edge masks, maximum transmit power etc.) for the various spectrum bands. Where possible it is best practice to adopt European standards and technical criteria as a harmonised approach creates efficiencies. ESBN requests ComReg to continue monitoring European developments in the various spectrum bands. Technical criteria should provide users with maximum flexibility in deployment of services whilst ensuring that the objective of interference mitigation is satisfied.

Channel size

ESBN agrees with ComReg that paired spectrum should be released in 2 x 5 MHz blocks, and unpaired spectrum should be released in 5 MHz blocks. 5 MHz (paired or unpaired) is likely to be the smallest amount of spectrum that a user would require, whilst accumulation of multiple blocks allows for participants to win its optimum mix

of spectrum. ESBN recommends that ComReg release the 410 MHz spectrum band in one package of 2 x 4 MHz.

Timing of award

EBSN considers that there is a pressing need for radio spectrum to be released. The spectrum auction held by ComReg in 2012 took over four years from initial consultation to spectrum award. This involved renewing expiring licences which is not necessarily efficient use of spectrum. ESBN urges ComReg to expedite this proposed spectrum release and host the auction as soon as it possibly can, and for the auction process to be as fast as possible. With this in mind, ESBN encourages ComReg to publish a draft decision on the spectrum award in its next consultation on the issue to assist with expediting of the spectrum release.

2.3 GHz and certainty of release

ESBN considers it necessary that ComReg makes the future of the Rurtel spectrum matter known soon. ComReg's statement on the future of Rurtel in paragraph 3.21 of its consultation was not entirely satisfactory. If ComReg were to permit Eircom utilise this spectrum indefinitely, this would have a consequential impact on the 2.3 GHz band. A perspective user of the same spectrum would have to plan around Rurtel to ensure there was no interference. In effect this creates a sub-national licence. This could distort valuation of the different blocks within the band and artificially inflate the price of spectrum not used by Rurtel in the 2.3 GHz band.

Eircom have the option of acquiring spectrum in the auction should it wish to continue to offer this service. In this regard, ComReg needs to make it clear what spectrum is being released in the 2.3 GHz band and if licences are truly national licences.

Spectrum caps

It is important that ComReg sets appropriate spectrum caps for the proposed forthcoming spectrum release. As outlined by ComReg, setting too high a cap (or none) could allow for competition distorting outcomes whilst setting the cap too low could create inefficient outcomes.

ESBN notes that ComReg's chosen sub 1 GHz spectrum cap utilised in the spectrum auction held in 2012 guaranteed that a new entrant could acquire at least 2 x 5 MHz. ESBN urges ComReg to set a spectrum cap which ensures that at least 2 x 5 MHz of sub 1 GHz spectrum is available for a new entrant once again.

ComReg can afford to apply a less onerous spectrum cap for spectrum above 1 GHz as asymmetric holdings of such spectrum is highly unlikely to cause competition issues. ESBN recommends ComReg apply a sub 1 GHz cap, another cap for spectrum over 1 GHz and specific band caps for 700 MHz and 2.3 GHz spectrum given the limited amount of spectrum in these bands compared with 2.6 GHz and 3.6 GHz spectrum bands.

ESBN considers it prudent for ComReg to take account of existing spectrum holdings when applying spectrum caps. ComReg need to take account of the strong grip that MNO's have on prime sub 1 GHz spectrum.

Licence Duration

Long term licences permit parties to make investments in modern networks safe in the knowledge that its investment is secure. It should be recognised that utilities often invest over a 10-50 year life cycle, and radio licences should reflect the significant difference between utilities and the mobile data market. ComReg should consider the prospect of issuing longer term licences for spectrum which is unlikely to be used by public wireless telecommunications providers (e.g. 410 MHz spectrum) given that the technology refresh rate and the return on investment period can be a lot longer.

Guard Bands

ESBN appreciates that there is a requirement to protect licensees from harmful interference from other users of the radio spectrum. ESBN encourages ComReg to apply the least onerous technical restrictions whilst satisfying itself that licensed users are given sufficient protection from harmful interference. In this regard, ESBN recommends that ComReg permit adjacent TDD users attempt to negotiate synchronisation of networks to increase spectrum efficiency prior to enforcing a guard band. Equally, ESBN would encourage ComReg to release spectrum blocks with usage restrictions applied rather than utilise guard band from the outset.

Assignment round

ESBN agrees that it is appropriate to have a Frequency Generic (as per Section 5.5 of ComReg consultation document) auction followed by an Assignment Round. However, it is important that spectrum blocks within each spectrum band are homogenous. For example, if Eircom were to maintain its Rurtel spectrum in the lower part of the 2.3 GHz band, an auction participant may not win its desired assignment in the assignment round. This could result in it being assigned spectrum which is not available nationwide (i.e. not in areas where Rurtel is deployed). This winning bidder's business case may not be satisfied by the spectrum it was assigned. It is important that all spectrum bands are as homogenous as possible.

Pricing structure

ESBN notes that certain spectrum users (e.g. Department of Defence) are absolved from paying any spectrum fees. ESBN considers that the electricity network offers similar significant societal benefits and should be considered in the same category in terms of spectrum fees. ESBN also made this point to DCENR in its response on its recent Spectrum Policy consultation. ESBN's comments below on fees is without prejudice to this position.

ESBN agrees with ComReg that it is prudent to have the total fee payable separated between upfront fees and on-going fees. This approach allows successful auction participants to spread out the cost of the licence over the licensing period. This

enables participants invest in deploying services. Splitting the fees in this manner also creates an incentive for licensees to return to ComReg or sell on any unused spectrum.

ESBN considers a 50/50 split between SAF and SUF to be prudent.

ESBN agrees with ComReg that a business modelling approach for setting appropriate minimum prices is fraught with difficulty, subjectivity and complexity. In this regard ESBN agrees that benchmarking of minimum price could be the optimum solution. However, ESBN deems it important that ComReg err on the side of caution when selecting appropriate benchmarks for spectrum bands where there is limited observed prices in concluded auctions available (e.g. 1.4 GHz, 2.3 GHz, 410 MHz, 3.6 GHz) as this is likely to return an inappropriate and inefficient minimum price.

ESBN is concerned with ComReg's following statement in paragraph 6.36:

"*By so establishing a minimum price, lots would not be sold in the event of a lack of short term demand and* ***rights of use should not be inefficiently assigned in low demand scenarios.****"* [emphasis added]

This approach could result in leaving spectrum on the shelf for years rather than allow it be sold at a market determined price ("*inefficiently assigned*") in the proposed auction. The minimum price may be inappropriate and choke demand. ESBN does not agree with ComReg's position that it would rather not assign unused spectrum even if there is limited demand. ESBN would argue that assigning unused spectrum to a user is efficient and effective use of spectrum. ESBN believes that ComReg's preferred approach to withhold spectrum where demand exists, contravenes three of ComReg's primary objectives (and also Article 8 of the Framework Directive), namely to;

- contribute to the development of the internal market;
- promote the interests of users within the Community;
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act.

ESBN believes that inefficient and ineffective use of spectrum occurs when there is radio spectrum unused and there is one or more organisations who wish to use that radio spectrum.

2.6 GHz spectrum can be objectively benchmarked due to the reasonable amount of direct auction samples within Europe. 700 MHz can also be objectively benchmarked as there has been a significant amount of 800 MHz and 900 MHz spectrum auctions throughout Europe over recent years. There is concern when using auction result data, where package bidding was utilised, as it is not possible to accurately decouple winning package bids to determine the actual fees generated for spectrum in each spectrum band.

Each of the 1.4 GHz, 2.3 GHz, 3.6 GHz and 410 MHz spectrum bands do not have sufficient or satisfactory applicable auction sample data within Europe which would allow ComReg determine a suitable benchmark. This will in turn lead ComReg to make approximations and assumptions and what spectrum bands are similar and try and deduce an appropriate benchmark for each spectrum band.

For example, ComReg may try and determine an appropriate minimum price for 2.3 GHz in comparison to 2.6 GHz due to their close proximity from a spectrum and propagation perspective. However the difference between these spectrum bands is significant. 2.6 GHz is a mature spectrum band with a significant amount of devices operating in this, numerous licences issued and is mostly FDD increasing the attractiveness. 2.3 GHz and 3.6 GHz are not widely licensed throughout Europe, standardised equipment is not widely available in these bands and they are also TDD bands which creates difficulties surrounding guard bands/synchronisation of networks.

ComReg's attempts to subjectively link the minimum price of 1.4 GHz, 2.3 GHz and 3.6 GHz (note ESBN would be hopeful that the 410 MHz spectrum band would be assigned directly to ESBN; failing this the band to be included in the upcoming auction) could result in an inappropriate minimum price for each spectrum band. This could choke demand for spectrum in these bands, and consequently spectrum could be inefficiently unassigned due to inappropriate minimum pricing for these spectrum bands. ESBN therefore urges ComReg to reconsider setting benchmarks for the 1.4 GHz, 2.3 GHz, 3.6 GHz and 410 MHz spectrum bands at market value as this is something ComReg cannot do with any conviction due to the lack of robust market information to the benchmark process.

ESBN encourages ComReg to consider applying a low but non-trivial minimum price for the 1.4 GHz, 2.3 GHz, 3.6 GHz and 410 MHz spectrum bands. This would allow for a market determined price to be achieved for the various spectrum bands, whilst facilitating efficient and effective management of the radio spectrum and encouraging investment. ComReg raise a concern (paragraph 6.13 of its consultation) that this approach:

"*could facilitate the acquisition of spectrum at a significant discount to its true market value, which would not ensure the optimal use of that spectrum."*

It is important to stress that ComReg has no means of estimating what are the "*true market value*" of the 1.4 GHz, 2.3 GHz, 3.6 GHz and 410 MHz spectrum bands. The only means ComReg has of determining the "*true market* value" of these spectrum bands is by letting the market decide. The market can decide the market value only in the event that demand is not choked and the minimum price is appropriate (i.e. low but non-trivial) There are tools available (e.g. limited transparency, stringent rules and sanctions regarding explicit collusion) which could assist ComReg's concerns regarding strategic bidding behaviour when applying a low but non-trivial minimum price. This would also allow ComReg to satisfy three of its aforementioned policy principles in addition to Article 8 of the Framework Directive, as well as Policy Direction No. 11 on the Management of the Radio Frequency Spectrum which states;

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

Licence conditions

ESBN agrees with ComReg that it is important to include licence conditions for the spectrum being released. ComReg should be cognisant of the various users, technology and services that may be deployed in the various spectrum bands and ensure it selects appropriate conditions. For example, ESBN's network planning and rollout could be very different to that of a commercial operator, e.g. an MNO. Additionally, ESBN may favour deploying wireless services in more rural areas and use physical connections in urban areas. With renewable projects, frequently these are located in areas of low population to minimise detrimental environmental degradation. It is in precisely these areas of low population coverage where utilities require coverage, but public operators have little incentive to extend their networks as it contributes little to their commercial objectives, and does not contribute greatly to their regulatory roll-out obligation.

As a result, ESBN's network may be widespread geographically but with a lower population coverage. ComReg traditionally issues licences based on population coverage which could disadvantage ESBN. ComReg should carefully select licence conditions taking into account the users and services being delivered.

ESBN believes that only the 700 MHz spectrum band should have a high (e.g. 70%) population coverage. Setting the coverage conditions too high for the various other bands in the auction and the 410 MHz spectrum band could create a significant barrier to entry for interested parties. This could affect the business case for interested users, choking demand which in turn could leave spectrum inefficiently unassigned.

4. Huawei: submission entitled "Huawei response to ComReg's consultation on the "Award of spectrum rights of use of the 2.6 GHz spectrum band with the possible inclusion of the 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz bands", dated November 2014

Huawei response to ComReg's consultation on the "Award of spectrum rights of use of the 2.6 GHz spectrum band with the possible inclusion of the 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz bands."

INTRODUCTION

Huawei encourages the inclusion of the 2.6GHz, 1.4 GHz, 2.3GHz and the 700MHz bands into this consultation on the award of spectrum rights. This is a good time for operators to have the opportunity to own and make use of these bands for the benefit of Ireland.

Huawei believes that the industrial business for the 3.6GHz band will still need time to nurture. We do believe that 3.6GHz LTE is an ideal spectrum band for FWA , and that the use of 3.6GHz LTE FWA for delivery of broadband services in Ireland is realistic to decrease the cost for fixed line engineering, especially in rural areas and some high capacity urban indoor area, and that the use of BAND 42/43 LTE TDD should be encouraged for FWA.

Huawei would also like to highlight the fact that other administrations in key European markets are also considering and preparing for similar multi-band auctions that will be held in the next 2 years: consistency in the approaches among the Member States is very important for the establishment of healthy pan-european market.

We appreciate the thorough analysis presented and the fact that the consultation has taken an extremely pragmatic approach in working to provide flexibility to operators regarding the amount of spectrum they might acquire and, where possible, allowing them to mix and/or substitute spectrum across different bands.

2.6GHz band

Huawei believes that it is right time for Ireland to consider assiging the 2.6GHz spectrum to IMT use. This is one of the most used spectrum bands for LTE deployments globally and accordingly also has an enormous choice of terminals. According to a very recent GSA report[1], over 1000 types of 2.6GHz devices were available as of October 2014, and most of which simultaneously support FDD mode (Band7) and TDD mode (Band38/41). The forecast addressable market for the 2.6GHz band

[1] http://www.gsacom.com/gambod/lte/

shows continued rapid growth, particularly from a number of operators in markets such as China, Japan, US and European countries, whose large-scale network deployments are seeing dramatically increasing demands for a range of 2.6GHz devices. It is believed that this will benefit the market in Ireland with the proposed award of licences in the 2.6GHz band.

To secure the optimal use of this band and meet explosive data demands, large block size is highly preferred. It is recommended that a minimum block size of 20MHz (for 2 operators) should be adopted for 2.6GHz (B38 TDD) whenever possible. In addition, it is also necessary to synchronize adjacent TDD networks to avoid interference and maximize spectrum efficiency (i.e. all base stations in the two networks transmit on exactly the same downlink timeslots as each other and at the same time). This regulation is essential to improve the synchronization between TDD networks. Thus, the common ratio (UL and DL at the same time for all TDD networks) and other common technical characteristics (see ECC Report 116 "Pratical guidance for TDD networks synchronisation") should be defined before the auction. Once spectrum usage rights are assigned, mobile operators should be given the possibility to reach further agreements on a voluntary basis on specific technical aspects (e.g. uplink and downlink ratios and out of band emission limits) targeting improved spectrum utilization, provided the continued operation of existing services is ensured.

1.4GHz band (1452 – 1492MHz)

Huawei believes that the L-Band should be included in the upcoming auction as the regulatory and standardization aspects have been addressed, and there are important signs for the development of a healthy ecosystem: chipsets have been announced for the first half of 2015; Huawei is recording significant interest from operators on this band; the network equipment availability will be aligned with spectrum and chipsets availability.

Based on the fact that there a number of countries (in Europe and also outside Europe) where the digital radio service did not actually develop as anticipated, these frequencies remain unused. Following CEPT work and decisions, the ongoing preparatory work for WRC-15 about the 1.1 AI have very good prospects for the development of a nearly global ecosystem for this band.

Within Europe, Germany is now carrying out a public consultation on the rules for a multiband auction which will also include the L-Band and which is planned for Q2 '15, the Italian government has announced its plans for an L-Band auction within Q2 '15. Other European administrations are also currently defining their plans and additional public consultations are expected for the near future.

With the aim of complementing the very accurate factual analysis provided in the consultation document, Huawei would like to highlight a few aspects:

Regarding the technical conditions for base stations, the 13(03) ECC Decision (recently adopted for public consultation) allows for higher Equivalent Isotropically Radiated Power (EIRP) values for the base stations' in-band emissions. Based on compatibility studies towards services operating in adjacent bands (see ECC Report 202), and specific local circumstances, the above mentioned ECC

Decision states that for national administrations "It is not desirable to restrict the in-band e.i.r.p.". The higher EIRP at 1.4GHz will compensate, in general, the better propagation characteristics of the spectrum below 1GHz. Such provisions will enable the L-Band to match coverage from lower frequency bands therefore allowing aggregation of the L-Band SDL carrier with FDD carriers from lower frequency bands, such as the 800MHz band.

As for the standardization work, 3GPP has recently completed the specifications for the new band 32 (1452-1492MHz) whose operation as SDL is defined to operate with Carrier Aggregation (CA) with external uplink (3GPP 36.101/3GPP 36.104 c40 or later version). Carrier Aggregation between band 32 and band 20 (800MHz band) and with band 1 (2.1GHz FDD band) has been specified already.

In terms of the possible complementarily between L-Band and 2.6GHz TDD band, Huawei in general agrees with the ComReg conclusions on the benefits in offering these bands. In addition, the excellent propagation characteristic and the technical regulation framework (BEM) of the L-Band is more aligned on the spectrum below 1GHz (e.g. 800MHz) than the 2600MHz TDD band. Thus, to address the asymmetric traffic patterns which are being recorded in mobile operators' networks, the L-Band and 2.6GHz are two independent frequency bands.

2.3GHz band (2.3 – 2.4GHz)

Huawei fully agrees with ComReg's intention to release, as far as possible, the entire 100 MHz on a service and technology neutral basis based on the ECC Decision (14)02.

Huawei would like to suggest some proposals for ComReg's consideration:

Firstly, from this year onwards, technology improvements should be taken fully into account, because advanced technologies such as LTE-Advanced will improve spectrum efficiency and ensure best user experience. For this reason, licensing wide spectrum for use, typically in no less than 40 MHz blocks, is appropriate so as to utilize carrier aggregation technology (one key feature of LTE-Advanced) to provide significantly higher through-puts. It is expected that carrier aggregation in one band is becoming matured and end-to-end 4 carrier aggregation (up to 80 MHz) will be on the market around mid-2015. Furthermore, given that the 2.3GHz band will be using TDD technology, full synchronization amongst MFCNs is becoming universally adopted around the world, thus maximizing spectrum efficiency and reducing network rollout costs (i.e. there is no need for customized equipment).

Operators in China, India and Nigeria have chosen the full synchronization path, with operators in Hong Kong, Japan and the Philippines expected to follow. Also, Regulators' policies are beginning to promote/enforce a common synchronized approach with China being an important example. The regulation is a key issue to improve the synchronization between TDD networks. Thus, the adoption of a common uplink/downlink ratio as well as other common technical characteristics among TDD operators (see ECC Report 116 "Practical guidance for TDD networks synchronisation") should be defined before the auction at national level. Once spectrum usage rights are assigned, mobile operators should be given the possibility to reach further agreements on a voluntary basis on specific

technical aspects (e.g. uplink and downlink ratios and out of band emission limits) targeting improved spectrum utilization, provided the continued operation of existing services is ensured.

Demand for more uses of spectrum is likely to grow over the next decade, sustaining the need to adopt more spectrally efficient technologies. Licensing spectrum in larger blocks within the 2.3GHz band (i.e. at least 20 or 40MHz) with full synchronization amongst MFCNs represent two key measure to maximize the spectrum efficiency with clear benefits for end users.

We are well aware of potential concerns that LTE interference could impact adjacent band WLAN services (i.e. 2.4GHz band), and Huawei follows the solutions provided in the ECC Decision(14)02 to protect the WLAN service.

Thus, Huawei believes that more specific guidance for administrations is required in Annex 2 of the ECC Decision(14)02 "Harmonised technical and regulatory conditions for the use of the band 2300-2400MHz for MFCN" to protect adjacent band WLAN services. In this draft ECC Decision, there are some technical constraints on TDD LTE to improve the compatibility with WIFI/RLAN compatibility. Please note the following technical parameters:

"In-block requirements for MFCN base stations…

- ***2390-2400 MHz:*** *The in-block e.i.r.p.[2] limit shall not exceed 45 dBm / 5 MHz to ensure coexistence with systems above 2400 MHz."*

3.6GHz band (3.4 – 3.8GHz)

(Please note that Huawei uses the term '3.5GHz' to represent all 400 MHz in the 3400-3800 MHz range, hence the wide use of this term in this section.)

Huawei recommends that this spectrum should be licensed in large blocks (at least 40 MHz) and that full synchronization amongst MFCNs is ensured. These are the two essential and critical approaches required to secure the optimal use of spectrum in this band and will deliver the greatest value.

Huawei welcomes that ComReg conforms to ECC decision to adopt TDD mode in the 3.5GHz band. This decision ensures that Ireland can quickly benefit from existing 3.5GHz TDD ecosystem.

Regulators must facilitate use of bands 42 and 43 for LTE TDD and for the delivery of both fixed and mobile services. Regulators must also facilitate access on a technology-neutral basis, for the delivery of a full range of telecoms services. Any hurdles to voice or mobile service provision should be removed.

[2] The e.i.r.p. is the total radiated power in any direction at a single location independent of any base station configuration.

3GPP spectrum bands 42 and 43 are set to become important global spectrum bands, used worldwide for the delivery of mobile broadband services based on LTE TDD. Bands 42 and 43 have the potential to become some of the most widely available bands.

A whole ecosystem centered on 3.5GHz is beginning to be built, and many major industry partners are getting involved. In fact this ecosystem was evident more than 1 year ago. According to a report from lte-tdd.org.[3]

- "The biggest driver will be capacity exhaustion in mobile networks"
- "Another, smaller but more immediate driver for the growth of this market will be the desire of WiMAX operators to migrate their networks to LTE. The main reason they want to do this is to take advantage of the ecosystem that has developed, to access an improved range of devices for their customers, and wider choice of network access technologies."

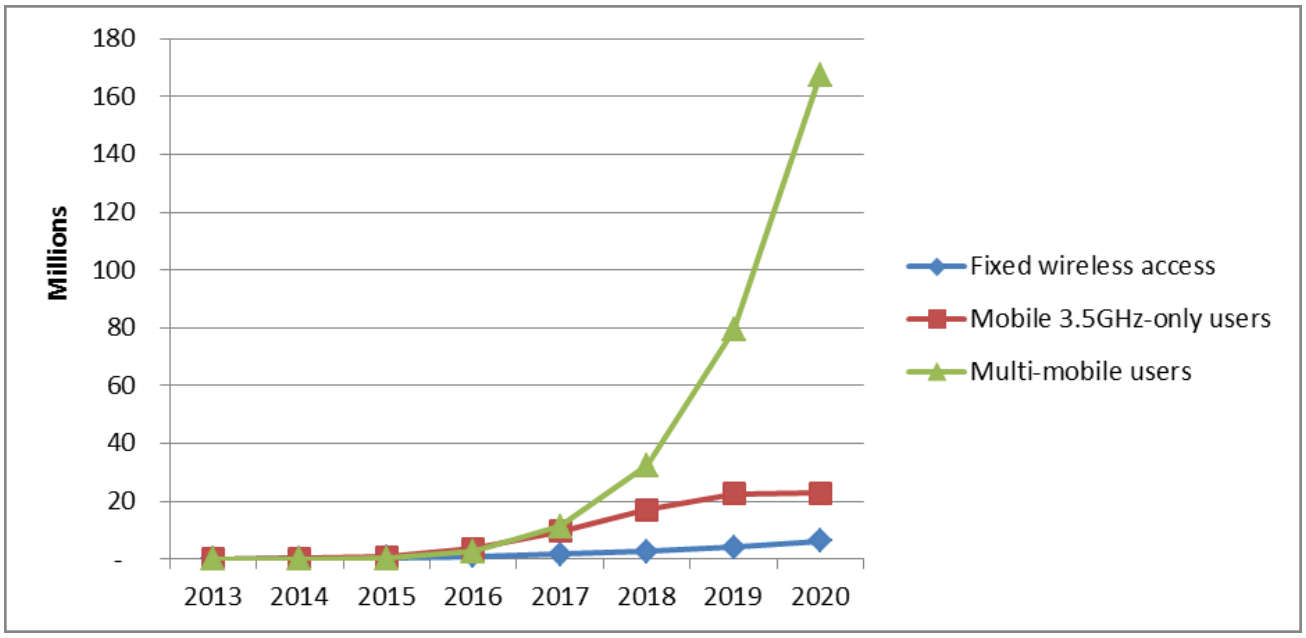
The report also gives growth assumptions for the number of active TDD-LTE 3.5 GHz network users between 2013 and 2020 include three categories of user:

- Users whose home networks[4] have been configured for broadband fixed wireless services ("fixed wireless access" in the chart below)
- Users whose home networks have been configured for mobile services, using TDD-LTE at bands 42 or 43 exclusively ("mobile 3.5GHz only users")
- Users whose mobile services are delivered using TDD-LTE at bands 42 or 43, in combination with other mobile modes and spectrum bands. This covers situations where this is enabled in the home network; and also where the home network does not use bands 42 or 43 but the service provider has enabled wholesale carriage on a third party network over bands 42 or 43 ("multi-mobile users").

[3] http://lte-tdd.org/upload/accessory/20139/201391311577882263.pdf

[4] i.e. the networks whose services they use, not the home area network

Forecast of users of LTE TDD 3.5GHz services, upside case scenario. Source: Innovation Observatory



Availability of chipsets and devices

Chipsets that support LTE TDD at 3.5GHz are now available. Chipset vendors that are known to have 3.5GHz capability for their LTE TDD chipsets include Huawei/Hisilicon, Sequans and Altair Semiconductor. Other important chipset providers such as Qualcomm and Intel will have 3.5GHz LTE TDD chipsets ready in 2014/2015.

Availability of devices that can support 3.5GHz LTE TDD remains growing. The earliest devices available to operators are indoor and outdoor CPE to support fixed wireless broadband applications. In late 2013, multimode MiFi (GSM/UMTS/LTE TDD) has become available serving many significant markets. Furthermore, during MWC 2014, Huawei showcased the world's first 3.5GHz LTE TDD smart phone, which is expected to come into the market in 2015. According to GSA statistics, there were 26 devices in the market in mid-October 2014.

Availability of network equipment

The status of the network equipment market is similar to the status of the device market i.e. improving. A number of vendors of radio network equipment are making available eNodeB base station equipment to support LTE TDD at 3.5GHz, including Huawei, NSN, Datang Mobile, Airspan, Accelleran, etc. Existing products are currently mostly macro cells and microcells, but pico/femtocells are expected in a very short timeframe as chipset vendors such as Qualcomm/Broadcom also have small cells reference-designs that are nearly ready to work on 3.5GHz.

Operator commitments to invest in LTE TDD at 3.5GHz

Many global operators have signaled their clear desires to use in the 3.5GHz band.

Operator commitments to LTE TDD at 3.5GHz are growing steadily. At the end of September 2014, there were six live commercial LTE TDD networks at 3.5GHz: UK Broadband in UK, Smart (PLDT) in Philippines, Menatelecom in Bahrain, ABC Communications in Canada, b•lite in Belgium and Neo-Sky in Spain. In addition to these live commercial networks, over 20 operators have announced plans to launch services using 3.5GHz LTE TDD. These include players from all parts of the world, e.g. Xplornet Communications in Canada, Azqtel in Azerbaijan, b•lite Telecom in Belgium, VipNet in Côte d'Ivoire, etc.

Except for the operators mentioned above, a couple of major global markets have signaled their intention to make spectrum in bands 42 and 43 available in the coming two years, including Japan, United Kingdom, Czech, France, Bulgaria and so on. Specially, all leading operators from Japan promise to make a great contribution to 3.5GHz LTE TDD. By the end of this year, Japan government will allocate 120MHz to three major operators in the 3.5GHz band.

	docomo	KDDI	eAccess	SoftBank
System and Duplex scheme	LTE-Advanced TDD	LTE-Advanced TDD	LTE-Advanced TDD	LTE-Advanced TDD
Bandwidth	As much as possible	More than 40MHz	More than 40MHz	More than 40MHz
Use case of 3.5GHz Coverage	Traffic offload with small cell Not nation wide	Traffic offload with Small cell and Street cell	Traffic offload with small cell Not nation wide	Traffic offload with small cell Not nation wide
Guard band between operators	No guard band (synchronization between operators)	No guard band	No guard band	No guard band
Service in	FY2015	1Q FY2016 (2QFY2014 license)	Not mentioned	2016
Target DL peak rate	Not mentioned	1Gbps	1Gbps	1Gbps

Huawei believes that the model that Ofcom is using in the UK for its current encumbant (UK Broadband) in the 3.5GHz band should be considered by ComReg. Concerns expressed by UK Broadband about their future when this band was cleared by the UK MoD and available for mobile broadband meant that a major investment it was planning may not go ahead because of the uncertain situation. This investment was subsequently judged by Ofcom to be of considerable benefit to its customers.

(UK Broadband secured spectrum rights in the 3.4 GHz band covering most of the country via auction in 2003. It acquired further rights through spectrum trading after the auction. Its rights were subsequently consolidated into a single UK wide licence which would have expired in 2018. The

licence is currently made up of two non-adjacent 20 MHz spectrum blocks [at 3480-3500 MHz and 3580-3600 MHz]).

Ofcom's response was to extend UK Broadbands licence for its 3.5 GHz spectrum on an indefinite basis and give flexibility to UK Broadband on how they would approach the 'Principal' and 'Assignment' stages for the proposed spectrum award for Band 42, and also gives them an opportunity for their spectrum blocks to be realigned to improve contiguity.

700MHz band

Huawei is pleased that ComReg recognizes the potential future use of the 700 MHz band for WBB and the fact that ComReg is committed to conduct a fully reasoned cost/benefit analysis of the likely costs and benefits (economic, social, and cultural) of RTÉ and PMSE users migrating out of the 700MHz band and into the remainder of the UHF band (e.g. below 1350MHz and/or above 1525MHz).

Huawei agrees to support the harmonization of the 694-790MHz band: the achieved agreement on the 2*30MHz frequency arrangement, aligned with the 3GPP band 28, within CEPT was a major achievement.

Given the diverging views from administrations, the actual utilization outside of the 2x30 MHz blocks could be a national decision, and various options are currently being discussed.

The opportunity of the Asia Pacific band plan (3GPP Band 28) to become virtually a global band, means the ecosystem (and reuse of part of the Asia Pacific band plan in Region 1) will offer the greatest benefit for consumers and mobile operators. Large parts of the Asia Pacific region and some Latin America countries have declared support for the Asia Pacific band plan.
It is essential to ensure that the timing of the release of Irish spectrum bands for mobile broadband services and the release of spectrum bands elsewhere in Europe fall within a relatively short and synchronised window.

The following extract from a recent 'Commission Staff Working Document' gives an overview of the current EU situation:

"In Finland, the 694-790 MHz band will be available as of 1 January 2017, and in Sweden as of 1 April 2017. In France, the principles of the reallocation of the 700 MHz band for mobile services have been partially approved, although it is not expected that the interest in the 700 MHz band for wireless broadband will materialise in France before 2020. Discussions are advancing also in the Czech Republic, Germany, Ireland, the Netherlands, Poland and the United Kingdom. In some

Member States (Malta, Latvia) decisions concerning the usage of 700 MHz in mobile are constrained by cross-border issues."[5]

While fully supporting the inclusion of the 700 MHz band, Huawei would like to underline the need to ensure the minimum possible lead time between usage rights assignments in this band and actual frequency availability.

Band Summary

In our 'Introduction' we supported the opportunity for operators to mix and match the bands that they would be able to make the best use of. Whilst generally supporting Option 3, we would advise caution when ComReg decides on which capacity bands (if any) will be included. Ireland, with its population size and density, its large rural areas, and its anticipated spectrum availability in the near future, is unique in comparison to most of the other countries in northern Europe and this is bringing some interesting challenges for ComReg.

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[5] Brussels, 14.7.2014 SWD(2014) 249 final COMMISSION STAFF WORKING DOCUMENT Implementation of the EU regulatory framework for electronic communications - 2014

5. Imagine: submission entitled "Comments on ComReg Consultation:- Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated 14 November 2014

Imagine

Comments on ComReg Consultation:- Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

14th November, 2014

Contents

1 Executive summary

Imagine have provided a confidential note on Imagine's investment plans which should be read in conjunction with this Executive Summary and this report.

Imagine Communications welcomes this opportunity to comment on ComReg's proposals for a Spectrum Award of 2.6 GHz alongside other possible bands. ComReg has suggested the inclusion of 3.6 GHz, a spectrum band perfectly suited to expanding Ireland's inadequate next-generation broadband via fixed wireless access FWA, alongside bands more properly suited to mobile broadband. This response by Imagine Communications summarises reasons why Imagine believes that including the 3.6GHz band as part of this award process would not be beneficial for Ireland or consistent with ComReg's responsibilities and could jeopardise DCENR's ability to support the delivery of the Ireland National Broadband Plan to satisfy Ireland's response to the European Digital Agenda.

ComReg has duties in relation to the regulation of the electronic communications market, and spectrum management, which are relevant to the issue of whether 3.6 GHz should be included in the auction. Key amongst these are:

- Efficient management and use of the spectrum - optimising the use of spectrum for economic benefit, including balancing narrow economic efficiency goals with public policy requirements and the potential wider benefits to society
- Promotion of competition – including promotion of competition in multiple markets, recognising that distinctions between markets and services of mobile broadband and fixed broadband markets.
- Promoting the interest of users in the Community - includes the objective of encouraging access to the internet at reasonable cost to (all) users, and achieving national broadband targets.

We are of the view that ComReg has arrived at this proposal by inappropriately conflating two quite distinct markets, for fixed and mobile broadband, under a single vague category of 'wireless broadband' apparently because the two services can use similar underlying technology (LTE). In fact, the fixed broadband and mobile broadband markets serve distinct consumer service and pricing expectations (mobility and convenience versus stationary reliability and next generation data speeds), distinct competitors, distinct devices (high-performance fixed routers vs smartphones and tablets), different network designs (short-range, low reliability, dense spectrum reuse vs long-reach, needing large spectrum bandwidths for committed service levels). A similar confusion was apparent in the UK under Ofcom's proposals for the same spectrum band: but Ofcom has now corrected this error in its recent decision, removing the currently used 3.6 GHz from auction and leaving it in the hands of the existing licence holder under a national licensing regime with an indefinite term. *ComReg should now reach the same conclusions, for the same reasons*.

When these markets are properly separated, entirely different conclusions obtain which should lead ComReg to remove 3.6 GHz from the proposed award and rapidly establish long-term certainty to ensure

that fixed wireless access services, such as that to which Imagine is committed, can flourish with a security of tenure over spectrum, thereby meeting ComReg's duties to promote competition, promote the interests of users and ensure the efficient management of the radio frequency spectrum.

In the mobile broadband (MBB) market, other bands considered by ComReg (700 MHz, 2.3 and 2.6 GHz) have a far stronger mobile industry ecosystem than 3.6 GHz. They have a wide range of attractive consumer mobile phones and tablet devices, have many operators actively deploying and selling networks, have been standardised around the world, and have attractive propagation characteristics in the context of MBB. Together they represent ample spectrum for the long-term future of MBB in Ireland. Reflecting the lack of demand and unsuitability versus ample alternative spectrum, 3.6 GHz, by contrast, has no mobile deployments existing or planned and essentially no mass market mobile devices apart from highly limited (1) pre-commercial announcements. All deployments existing and planned and almost all available devices are for FWA applications. There are essentially no mobile broadband operators providing true commercial services in this band worldwide.

The propagation characteristics are entirely unsuited to wide-area mobility services. While the band is hypothetically of use in providing high capacity density to particular hotspots, ComReg has failed to establish the need for 3.6 GHz for MBB capacity given the relatively low Irish population density even in Dublin in comparison to highly dense locations in overseas markets and the many other bands which are suitable: all of the other bands available provide higher capacity per unit of spectrum. Such an award would run ahead of the supply in other markets with much more significant capacity needs, in a situation where the existing spectrum remains underutilised. *ComReg's own consultants indicate a significant risk of no demand for the band in any auction, creating a serious risk of inefficiency, at odds with ComReg's duties.*

Based on the above, we do not believe that the evidence supports including the 3.6GHz band in the proposed licence award process, or that doing so would be consistent with ComReg's duties, economically efficient for large parts of Ireland, or facilitate DCENR in meeting the NBP targets. Moreover, ComReg has already expressed concern at mobile competition in Ireland following the acquisition of O2 by Three, which reduced the number of MNOs in Ireland from four to three. This award proposes to increase the spectrum available for mobile use in Ireland by a factor of nearly 3 and could consolidate the lack of competition in the MBB market.

The situation for the fixed wireless access market (FWA) is entirely different. There is a clear need for Ireland to improve both the availability and the competition in fixed broadband access, especially for Next Generation Access (NGA) under the National Broadband Plan, representing Ireland's commitment to meet the EU Digital Agenda. Ireland's existing provision of basic broadband lags other nations in both speed and affordability, and prices are higher. It is recognised under the EU broadband State Aid Guidelines (the SAG) that mobile broadband cannot meet NGA requirements of a reliable 30Mbps+ download service, but that properly-designed Advanced LTE FWA plays an important role. This is especially so in the Irish context where 38% of the population lives in rural areas. 3.6 GHz is an ideal band for FWA: the use of specialised home routers CPE with high efficiency antennas allows very long reach from base stations, covering a wide area and many homes and businesses cost effectively. Such routers are widely available at affordable prices. The large quantity of spectrum in the band allows an assured and required NGA service with high capacity and speed to be provided to a large number of

homes. While the current Advanced LTE capability harnessing 160MHz of spectrum can deliver speeds of up to 150MB suitable as an alternative to and competitive with other NGA technologies, with 240 MHz of spectrum planned LTE-Advanced releases will enable services matching Fibre, creating an upgrade path which remains competitive for the future. The need for expanded NGA availability is not limited to rural areas: the wireline alternatives for NGA (fibre and cable) suffer from problems of reach even in towns and cities, so without a FWA solution, many homes and businesses will not benefit from NGA creating a severe risk of Ireland missing its NBP commitments. *Moreover, ComReg's duty to promote competition is poorly served by the incumbents, whereas FWA creates a new and dynamic alternative, giving consumers choice, and avoiding the damaging loss of competition which has occurred in the MBB market.*

Imagine has made substantial investments and committed to rolling out a new super-fast broadband FWA infrastructure using advanced 4G Time-Division Long-Term Evolution TD LTE. Imagine will be providing competitive wholesale access to other service providers and to other infrastructure operators to improve or extend their current and planned network deployment footprint and improve the service portfolio to their customers. The Imagine service will be offered as a competitive complementary alternative to the established high speed 'NGA' service offered on Eircom's FTTC network. By rolling out over 1000 base station sites, servicing areas of up to 13 km diameter, we plan to revolutionise the affordability, availability and choice of NGA services for consumers and businesses throughout Ireland. The Imagine TD LTE service has been fully tested and ready to deploy. *With clarity on the continuation of our licences we estimate that Imagine can service up to 500K customers by December 2018 with NGA services they would otherwise be unable to access*.

But to execute our plans, we require long-term certainty over our spectrum position. By considering inclusion of 3.6 GHz in this auction, ComReg has thrown the FWA market into uncertainty, creating a major limitation and "vacuum" for current planned and future investment, risking the provision of NGA services to 100's of thousands of consumers in the next 3 years at the very least and a significant risk for Ireland's NBP both in terms of meeting the timelines and cost. *As ComReg correctly identifies, 3.6 GHz is 'brownfield' spectrum, containing existing customers, networks and investment the development and future of which are all now threatened by this consultation*. ComReg has not provided any evidence to suggest that any other user is likely to use the spectrum more efficiently than the existing FWA service providers. Therefore, while it is highly unlikely that auctioning 3.6GHz will bring any benefits, it is sure to delay investment in FWA to provide much needed NGA services. We urge ComReg to resolve this uncertainty immediately by ensuring that the allocated 3.6 GHz is available on a licenced nationwide basis for an indefinite term. This has precedent in Ofcom's decision in the UK, is in Ireland's interest and is consistent with ComReg's duties. Further, we urge ComReg to make this decision urgently to avoid further uncertainty and the inhibition of much needed investment. Ofcom made the equivalent decision within three months and we believe this is a realistic timescale for ComReg to come to the same conclusion.

The consultation has created significant uncertainty in relation to the future viability of "existing" operators using 3.6 frequencies and undermining substantial current investment plans. There is a significant risk that this investment interest and opportunity will be lost. We therefore strongly recommend that ComReg immediately and at the very least issues a clear statement to clarify ComReg's

intentions that existing 3.6 operators will be facilitated and retain sufficient spectrum to deliver the services that they provide and secure investment for planned deployments.

2 The structure of our response

In the remainder of this document:

- Section 3 provides an overview of Imagine's business, the services we provide and identifies the market that would be threatened if long term access to 3.6GHz is not secured
- Section 4 identifies the roles and responsibilities that ComReg has, including their need to support access to spectrum to achieve high level objectives that can support national targets and improve service provision across Ireland
- Section 5 provides an overview of the high level service targets agreed by DCENR in the form of the European Digital Agenda and Irelands National Broadband plan, including responsibilities to manage spectrum to achieve these targets. Failure to facilitate access to spectrum for FWA could jeopardise provision of low cost high speed fixed broadband access to a large number of Ireland's population
- Section 6 distinguishes between different markets that can be served using a variety of fixed or wireless communications methods. We demonstrate that the markets for provision of (wide area) mobile broadband is a different market from Fixed Wireless Access, and that the equipment ecosystem clearly demonstrates this distinction. ComReg has however inappropriately conflated these markets together. Failure to treat these markets as distinct risks precluding cost-effective access to spectrum that can help Ireland provide broadband access to consumer premises – but not significantly improve access or performance of mobile networks.
- Section 7 provides an overview of the fixed broadband marketing Ireland, the role of FWA in meeting the objectives of the National Broadband Plan and the role of Imagine in particular in achieving this.
- Section 8 provides an overview of the mobile broadband market in Ireland and demonstrates that mobile services in Ireland are likely to be well served using mobile spectrum bands, and that access to the 3.6GHz band is unlikely to improve mobile services and is different from regulatory practice elsewhere – indeed releasing 3.6GHz as part of this spectrum award can jeopardise facilitating a more effective use of 3.6GHz spectrum (FWA) and result in inefficient spectrum use.
- Section 9 explains why auctioning 3.6GHz along with spectrum at 700MHz, 1.4GHz and 2.3GHz is likely to result in an inefficient auction award, and is inconsistent with International norms.
- Section 10 summarises this document.

3 About Imagine

Imagine is an Irish full service telecommunications company providing voice and broadband services nationally to both residential and business customers. These services are provided utilising the incumbent Eircom's fixed infrastructure and Imagine's own fixed wireless infrastructure. This includes the 4G WiMax service in the 3400-3600 MHz spectrum range. The WiMax service has proven the high demand for fast broadband in the regional and rural areas and that 4G wireless technologies satisfied this demand.

Imagine was a participating member of the Next Generation Broadband Task Force. As an Irish company with considerable expertise and experience in both the Fixed and Mobile industries across Europe and the Irish communications market structure and development, Imagine informed the task force on the then existing capabilities and future expected development of wireless technology and the importance of wireless infrastructure in Ireland meeting the EU objectives as set out in the DAE. Of critical importance was the developing Global standards for 4G LTE wireless technology and the distinction between LTE deployed to provide fixed versus mobile services. These inputs were adopted into the NGB Task Force report and the Government's National Broadband Plan (NBP) in which it is considered that "4G Fixed Wireless" would be an important infrastructure to use in order to meet the European and NBP objectives.

Since publication of the NBP and as recognised by the EU, there has been a step change in the development of next generation wireless technology. Driven by the rapid evolution of "smartphone" and "tablet" capability and the global demand for high speed data centric IP infrastructure to meet "explosive" consumer demand, the development and deployment of LTE infrastructure has been unprecedented. Reflecting demand, take up of 4G services is at a rate of 10 times faster than 3G. This market demand driven environment has significantly accelerated the requirement for ever increasing network capacity and increased speed and a global ecosystem of infrastructure and device development. Initial LTE standards and roadmaps for future development have been rapidly surpassed by the new "LTE Advanced" standard.

Of particular importance has been the development and take up of the Time Division Duplex protocol variant of LTE (TD LTE) designed to maximise the use of spectrum in the most efficient way to deliver higher bandwidth services. Derived from fixed wireless protocols and standards, TD LTE uses the same channel for downloading and uploading data where the spectrum resources are allocated proportionally to reflect and cater for normal broadband usage where the primary requirement is downloading data. TD LTE significantly increases the capacity to deliver high speed broadband services and is driving the convergence of fixed and wireless networks delivering service capabilities in terms of speeds of 150Mb, similar to fibre, superior to alternatives such as FTTC and fully capable of meeting and exceeding NGA requirements. New advanced standards and vendor roadmaps over the next 5 years envisage the further convergence of fibre and wireless with speeds of 700Mbs being demonstrated by vendors today.

Requiring ever increasing larger bandwidth and the capability to use LTE for fixed services, the frequency bands 3.4-3.6 GHz and 3.6-3.8GHz were adopted as LTE bands 42 and 43. Recognising the importance of TD LTE infrastructure in delivering NGA services, Europe has designated these frequencies as preferred TD LTE.

Imagine has concluded trials and selected a vendor partner to deploy a new super-fast broadband infrastructure using advanced 4G Time-Division Long-Term Evolution (TD-LTE Advanced) which uses LTE spectrum in a more efficient way to deliver higher capacity broadband services to users. This infrastructure will be deployed using Imagine's current (3400-3800) spectrum in the 3GPP defined LTE bands 42 and 43. Imagine's spectrum position combined with the advanced capability of TD LTE Advanced deployed for fixed wireless using high channel bandwidths (initially 2x20MHz) will enable the company to deliver high-speed NGA services of a minimum of 30Mbps and up to 150Mbps to a large population over a wide area of 13km in diameter.

Continuing the evolution of high speed 4G wireless networks, as a global standards based infrastructure, TD-LTE Advanced will derive the benefit of ongoing development to meet the industry anticipated increasing demand for high speed broadband services, capacity and speed.

As recognised by the EU and set out in the SAG[1], the rapid development and deployment of LTE Advanced infrastructure in the last few years has provided a step change in the technologies available to deliver NGA services to European citizens. The imagine TD-LTE Advanced network not only meets the guidelines set out in SAG, it exceeds the performance in terms of capacity, speed and user experience that could be envisaged in the SAG to be available in *any* other European market. With the quantum of spectrum available to be utilised in the Imagine network we can fully exploit the full potential of the TD-LTE Advanced network to deliver the very best high speed services possible with the most efficient frequency plans to minimise cross channel interference. Performance enhancements such as 4x4 MIMO and future LTE Advanced releases are planned. While a 2x20MHz channel utilisation today delivers a throughput of 300Mbps, Softbank have demonstrated 700Mbps throughput using a 4x20MHz configuration[2] and this capability will be available to Imagine should we retain sufficient spectrum.

Imagine's unique spectrum position, harnessed to provide ultrafast NGA fixed broadband services, provides Ireland with a significant advantage over other European markets in addressing the digital divide, meeting the objectives set out in the NBP of delivering high-speed broadband to all citizens by 2020. Imagine intends to provide wholesale access to the network to other operators and service providers on a competitive basis ensuring consumers benefit from competitive and innovative services. This will be a useful mechanism to extend TD-LTE Network capability to smaller regional operators who currently operate localised fixed wireless networks but may be unable, due to the significant investment requirement, to deploy LTE Advanced networks themselves. This ensuring the continuity of the valuable service that these companies have provided to communities that were underserved for even basic broadband.

Imagine believes that its TD-LTE Advanced network will be an essential component in the integrated and effective solutions required to meet the expected targets set out in the National Broadband Plan (NBP) and that the NBP's targets can only be delivered on time and cost effectively to all consumers if a combination of new FTTH, FTTC and Fixed Wireless infrastructure is deployed.

[1] http://ec.europa.eu/competition/state_aid/legislation/broadband_guidelines_en.pdf

[2] http://www.fiercewireless.com/tech/story/softbank-huawei-lte-test-reaches-770-mbps-35-ghz-band/2013-09-15.

With a single base station costing approximately €135K capable of providing NGA services to customers within an area of 13km diameter and up to 22km, TD-LTE Advanced fixed wireless is the quickest, most economic and cost effective method of connecting customers to fibre. With the planned deployments of FTTx and FTTC of other infrastructure providers already set out we anticipate that significant areas of the country can only be serviced by TD-LTE Advanced Fixed Wireless and others will gain important consumer choice and competition.

In addition, the economic case for FTTX infrastructure is not only limited to densely populated areas but within those areas to the effective distance from the fibre node, which in the case of FTTC is from the cabinet. The technical restrictions of FTTC means that it does not uniformly deliver NGA level speeds and bandwidth to all household/business in an 'area', While operators may talk about a service being available in a general area, being available *in* an area does not necessarily mean that the service is available to *everyone in* that area. Therefore not only will TD-LTE Advanced Fixed wireless be required to deliver NGA in areas where FTTX infrastructure will not be deployed at all, there will be a significant requirement for TD LTE Fixed wireless to extend NGA coverage in 'areas' where actual availability of FTTC is extremely limited, though claimed by fixed network providers.

Imagine will be providing competitive wholesale access to other service providers and to other infrastructure operators to improve or extend their current and planned network deployment footprint and improve the service portfolio to their customers. In this regard we are in discussions with the main operators and service providers in the market with a view to concluding wholesale agreements**.**

The Imagine service will be offered as a competitive alternative and complimentary alternative to the established high speed 'NGA' service offered on Eircom's FTTC network. It is dimensioned and specified to deliver a comparable or better service and user experience and will be provided to customers on the same or equivalent terms and conditions as other NGA services. The imagine network is fully flexible to meet consumer demand and dimensioned to meet expected growth in data consumption and demand. Already planned TD-LTE Advanced releases and roadmap developments will further enhance overall speed and capacity. Additional capacity to meet demand in an area will be provided by overlapping multi base station deployments and additional overlay sectors where required.

Imagine's intent is to provide new infrastructure to deliver NGA services across Ireland and the potential of the developing 4G TD-LTE Advanced Technologies. This is predicated upon Imagine have long term security of access to appropriate spectrum required to deliver this FWA network. We are engaged and working with the DECNR to ensure that the full benefit of the Imagine TD-LTE Advanced infrastructure can be fully exploited to deliver the objectives set out in the Government's NBP.

4 ComReg's objectives and duties

In this section we discuss ComReg's duties in relation to the regulation of the electronic communications market, and spectrum management which are most relevant to the issue of whether 3.6 GHz should be included in the auction.

In Annex 2 of the Consultation, ComReg states that its primary objectives in carrying out its statutory functions in the context of electronic communications are to:

- promote competition;
- contribute to the development of the internal market;
- promote the interests of users within the Community;
- ensure the efficient management and use of the radio frequency spectrum in Ireland in accordance with a direction under Section 13 of the 2002 Act; and,
- unless otherwise provided for in Regulation 17 of the Framework Regulations, take the utmost account of the desirability of technological neutrality in complying with the requirements of the Specific Regulations in particular those designed to ensure effective competition.

We believe that the most relevant of these objectives are: efficient management and use of the spectrum; promotion of competition, development of the internal (fixed) market and promoting the interests of users within the Community including providing access to the Internet at reasonable cost. Below we set out what these mean in detail for the decisions facing ComReg in assessing the options for the of 3.6 GHz band.

Efficient management and use of the spectrum

Efficient management and optimising use of the spectrum are central to deciding how to allocate spectrum between different uses, how to assign spectrum to individual users and spectrum auction design. ComReg states[3] in the Consultation that, from its perspective, optimising the use of spectrum involves a range of competing factors including:

- ensuring that the requirements of all radio services are met in an appropriate manner and that there is a balance between the public policy requirements;
- maximising social benefits arising from radio use, for example in relation to public safety, national security and health care; and,
- enhancing Ireland's competitiveness by ensuring that adequate spectrum is allocated and assigned to uses that derive the highest economic value from it.

Furthermore, as noted in the Consultation, ComReg must have appropriate regard to policy statements, published by or on behalf of the Government or a Minister of the Government and notified to the Commission, in relation to the economic and social development of the State.

This highlights two issues which we consider are of central importance to the assessment of the 3.6 GHz band in the Consultation: the need to balance narrow economic efficiency goals with public policy requirements and the potential wider benefits to society (the European Digital Agenda and the Irish National Broadband Plan in the next section are particularly relevant here).

[3] http://www.comreg.ie/radio_spectrum/spectrum_management.540.html

Promotion of competition

In promoting competition, ComReg is required, amongst other things, to:

- take all reasonable measures which are aimed at the promotion of competition, including: ensuring that users, including disabled users, derive maximum benefit in terms of choice, price and quality;
- ensure that there is no distortion or restriction of competition in the electronic communications sector; and,
- encouraging efficient use and ensuring the effective management of radio frequencies [and numbering resources].

Where competition is not effective, increases in the level of competition can generate considerable benefits for consumers, through greater usage and service quality, lower prices and wider choice.

Competition is clearly an important factor in assessing whether and how to auction the bands covered in the Consultation. However, as we set out in more detail in section 6, ComReg has conflated FWA and mobile broadband, whereas the two services are in separate markets. ComReg then focused on competition in one of these markets, the MBB market, and ignored the fixed broadband market.

This is important because FWA is having a significant impact on competition in the highly concentrated fixed broadband market. FWA will have be even more important for competition as NGA develops in the next few years, because, absent FWA, many customers will face a severely restricted choice of operator, with Eircom being the only choice outside the footprint of the cable TV network. The experience of the UK corroborates this as Ofcom recently concluded that FWA operator UK Broadband would bring valuable competition in fixed broadband as a result of its 3.6 GHz licence extension[4].

More effective competition in the fixed broadband market could also reduce the high use of mobile broadband dongles as a (poor) substitute for basic fixed broadband services in Ireland. The high use of dongles is anomalous compared to other EU countries and has arisen because of the poor quality of the basic broadband on offer to some subscribers. This is further evidence of the impact of limited fixed broadband competition in Ireland. Providing a competitive high speed NGA service in areas previously poorly serviced by fixed operators will address this anomaly and will also drive the benefit of competition in the mobile market. It is also inappropriate to attempt to utilise mobile networks as a source of 'fixed' broadband as is commonly the case with dongles. Mobile networks are not designed or engineered to reflect the asymmetric download demands of a typical 'fixed' broadband customer and the deployment of symmetric spectrum inevitably leads to underutilisation of the uplink spectrum and is an inefficient use of spectrum resources.

ComReg has also not addressed an issue on competition in the MBB market. If 3.6 GHz spectrum is acquired by the existing mobile operators, it will consolidate more spectrum into the hands of the existing mobile operators. This will exacerbate the competition concerns ComReg expressed following

[4] http://stakeholders.ofcom.org.uk/binaries/consultations/uk-broadband-licence/statement/UK_Broadband_Statement.pdf

the acquisition of O2 by Three, which reduced the number of MNOs in Ireland from four to three[5]. In particular, while respecting the EC's position as the decision-making body for the acquisition, ComReg concluded that competition concerns had not been fully addressed, and that significant negative consequences for Irish consumer welfare might result. In ComReg's view, the Final Commitments given by Three appeared inadequate and ineffective to address the structural competition deficit that was likely to result and the consumer harm identified by the EC (for example higher prices); and the commitments did not appear to comply with the EC's requirements as set out in its Remedies Notice.

We believe that once all these fixed broadband and mobile competition issues are taken into account, the costs of including 3.6 GHz in the auction outweigh the benefits, as we explain in more detail in section 9.

Promoting the interest of users in the Community

Finally, promoting the interests of users is relevant in so far as it includes the objective of encouraging access to the internet at reasonable cost to users. This ties in with the Irish National Broadband Plan mentioned previously and the way in which 3.6 GHz could help meet its objectives. In the absence of a FWA solution meeting the required NGA requirements set out in the SAG as being deployed by Imagine the interests of consumers will not be met.

4.1 Comparison of ComReg and Ofcom

Ofcom has recently issued a Consultation[6] on the award of spectrum in the 2.3GHz band and 3.4GHz band (3410-3480 MHz and 3500-3580 MHz) and a Decision[7] to grant an extension to the spectrum licence held by UK Broadband in the 3.4 GHz band (3480-3500MHz and 3580-3600MHz)[8].

These documents are highly relevant to how the 3.6GHz band should be treated in Ireland, since Ireland and the UK are subject to a common European framework for spectrum management, and their communications sectors share many similarities, e.g. many of the same telecoms companies operate in both countries. Given the structure of both the mobile and fixed markets and the unique population distribution and significant requirement for FWA to provide alternative and competitive NGA services in

[5] "European Commission completes its investigation into the proposed acquisition by Hutchison 3G UK Holdings Limited of Telefónica Ireland Limited", ComReg Info. Notice 28 May 2014. http://www.comreg.ie/publications/european_commission_completes_its_investigation_into_the_proposed_acquisition_by_hutchison_3g_uk_holdings_limited_of_telef_nica_ireland_limited.583.104614.p.html

[6] See http://stakeholders.ofcom.org.uk/consultations/2.3-3.4-ghz-auction-design/

[7] See http://stakeholders.ofcom.org.uk/binaries/consultations/uk-broadband-licence/statement/UK_Broadband_Statement.pdf

[8] It is noted that Ofcom refer to the band 3410-3480 and 3500-3580 as 3.4GHz band. This is a subset of the frequencies being considered for release in Ireland, referred to as the 3.6GHz band. In this document we refer to 3.4GHz, 3.5GHz and 3.6GHz to refer to the equivalent band available for use in any of the countries being considered.

Ireland it is the case that the view adopted by Ofcom is of even more significance in the context of the Irish market.

Issues pertinent to including 3.6GHz in a multiband auction

Even though current levels of mobile spectrum utilisation are higher in the UK than in Ireland, Ofcom found that mobile broadband demand for the 3.4GHz band was intangible at present and uncertain in the future. A survey of mobile operator demand found more interest in the band for backhaul, in the short to medium term, than providing mobile broadband capacity. The availability of other bands with better propagation, and the potential use of WiFi (supported by fixed broadband), made the future importance of 3.4 GHz for MBB doubly uncertain.

Ofcom also found significant differences between the 3.4GHz band and 2.3 or 2.6 GHz. For example, Ofcom highlighted the relatively poor propagation of the 3.4GHz band and the much less developed equipment ecosystem for mobile broadband at 3.4GHz compared to 2.3 or 2.6 GHz. This supported its view that 3.4GHz is not a perfect substitute for these bands and implies that the economic efficiency argument for auctioning 3.6GHz with the other bands is not strong.

Ofcom established the importance of having wholesale network service providers in the UK as an essential assurance of choice, price and service competition. The number of mobile operators in Ireland has already been reduced to three. Further strengthening their position and at the cost of essential competition in the fixed market this could not assure or benefit competition. We believe that there are substantial benefits to the Irish economy in having dynamic wholesale telecoms services and that ComReg should encourage this. Accordingly, ComReg should recognise the benefits that Imagine will bring in providing wholesale services in the last mile of the local loop, given that competition at the retail and wholesale level in basic fixed and particularly NGA broadband in Ireland remains weak.

Although we do not believe that an auction of 3.6GHz is justified, we note Ofcom's decision to renew existing licences in use indefinitely and reserve price proposals which differ in one important respect to ComReg. Ofcom proposes setting a reserve price based on 2.6GHz auction prices, as does ComReg. However, Ofcom proposes to set reserve prices at as much as 20% of the value of 2.6GHz given the uncertainty over demand for 3.4GHz and that unduly high reserve prices may discourage smaller bidders from participating. These issues are, so far, absent from ComReg's discussion of its minimum price.

It is also the case that for the delivery of a competitive NGA services using Wireless requires the limitation of the number of customers per cell, the addressable market and revenue that can be generated from the utilisation of the spectrum, thereby increasing the spectrum cost per user relative to mobile. This will become increasingly relevant in areas where the delivery of services will be marginal from a commercial economic view in that a prohibitively high spectrum fee will only serve to prohibit investment and the deployment of services to customer who need them and will essentially become an additional cost to be recovered from those customers who depend upon FWA for service. This could lead to price disparity in the market with customers is dense areas having a lower cost of accessing the internet than citizens in Regional and Rural Ireland.

Issues pertinent to the renewal of existing FWA licensees in the 3.6GHz band

Ofcom has renewed the 3.4GHz spectrum used by UK Broadband for FWA on an indefinite basis, effectively exempting it from the auction. It can only feature in the final stage of the auction which allows spectrum holdings to be re-aligned to improve contiguity.

Ofcom recognised that certainty was critical to UK Broadband's plans for significant investment in its network and made its decision on the licence extension in only three months. Ofcom accepted that, if UK Broadband's 3.4GHz was put up for auction instead of extended, its investment was not likely to go ahead as planned due to the uncertainty and delay.

Ofcom judged that UK Broadband's FWA services could create considerable benefits for consumers. UK Broadband would compete at the infrastructure level in fixed broadband, where BT has entrenched market power and entry is generally considered unlikely. Furthermore, infrastructure competition can generate pressure to reduce costs at all levels in the value chain and enable more intense competition at the retail level. Even if that infrastructure competition were restricted to certain geographical areas, it could create potential for dynamic benefits (innovation and cost reductions over time) across the market more generally. UK Ofcom also expected that UK Broadband would deliver: faster broadband speeds in under-served areas; lower prices for broadband; provision to under-served customers and it might also encourage future roll out of superfast broadband into underserved areas by BT or others.

As a result Ofcom decided to extend UK Broadband's licence because auctioning the spectrum risked clear consumer benefits without any certainty about whether the same level of competition, innovation or investment will come about through another spectrum user. Moreover, the benefits of any alternative use to UK Broadband's, from a so far unknown user, were uncertain and not easily identified.

Many of these UK-based issues have a direct analogue with the 3.6GHz band and the FWA opportunity in Ireland. We believe that UK-based regulator has taken steps that ComReg should be cognisant of these, and modify the award process accordingly.

It should be noted that the NGA services to be provided by Imagine, the impact on infrastructure competition, the NBP and derived consumer benefit far exceed that envisaged by UK Broadband in the UK, but were still sufficient to justify Ofcom's decision.

5 Digital agenda and Irish national broadband plan (NBP)

5.1 Digital agenda

In May 2010, the EU established a Digital Agenda for Europe[9] (DAE), with the aim of establishing "sustainable economic and social benefits from a digital single market based on fast and ultrafast internet and interoperable communications".

The DAE highlights the benefits of providing high speed connectivity and states that "more needs to be done to ensure the roll-out and take-up of broadband for all, at increasing speeds, through both fixed and wireless technologies, and to facilitate investment in the new […] networks that will be the arteries of the future economy".

Key Action 8 of the Digital Agenda requires that member states:

- Establish National Broadband Plans (NBP) that meet the coverage, speed and take-up targets defined in the DAE.
- Implement the European Spectrum Policy Programme to "ensure the coordinated allocation of the spectrum needed to meet the targets of 100% coverage of 30Mbps internet by 2020 and the NGA recommendation".

Linking implementation of the spectrum policy programme to satisfy 100% coverage of the 30Mbps target indicates the key role that wireless broadband is anticipated to make in providing coverage.

The DAE also requires member states to report on progress towards meeting these targets. The performance in Ireland and the rest of the member states is reproduced in Section 7.

5.2 Ireland's national broadband plan (NBP)

In response to the EU DAE, the Irish Department of Communications, Marine and Natural Resources (DCENR) established a National Broadband Plan[10]. This NBP has been updated by a DCENR statement in April 2014[11].

Ireland's NBP sets to surpass the Europe 2020 targets, aiming to deliver improved speed ahead of the European target date. Specifically, the NPB aims to:

- Provide download speeds of 70Mbps with a minimum rate of 40Mbps generally available and 30Mbps in harder to reach rural areas.

[9] The Digital Agenda for Europe. http://ec.europa.eu/digital-agenda/

[10] "Delivering a Connected Society - A National Broadband Plan for Ireland". August 2012. http://www.dcenr.gov.ie/NR/rdonlyres/1EA7B477-741B-4B74-A08E-6350135C32D2/0/NBP.pdf

[11] http://www.dcenr.gov.ie/Communications/National+Broadband+Plan/National+Broadband+Plan+Update+April+2014.htm

- The plan aims to provide a minimum speed to 70Mbps to 50% of the population by 2015, with an expectation of providing speeds of up to 100Mbps to the majority of premises in this category.

The April 2014 update announced a proposed intervention[12] by DCENR to "[deliver] quality and reliable high speed broadband that includes a major fibre build out to rural areas" and stated that "to date [April 2014] 1,000 locations have been identified as target areas for the proposed fibre based connections".

According to the EU2020 scoreboard[13], the performance and extent of fixed broadband provision at the end of 2013 in Ireland was:

- Basic broadband available to 96% of households (93% in rural areas) , compared to an EU average of 97%
- NGA (>30Mbps) available in 54% of homes (compared to an EU average of 62%).

We note that Ireland is a highly rural society with 38.1% population in rural areas (see Section 7.1). This presents a challenge in achieving both the DAE and the NPB in a cost-effective manner. Completing the "last mile" in low population density areas is an area where wireless and particularly Fixed Wireless Access (FWA) technology can provide rapid and cost-effective connectivity. Conditions for this are governed by the State Aid Guidelines (SAG[12]). In particular, it should be noted that basic broadband (including ADSL and ADSL+) do not satisfy the >30Mbps speed requirement to qualify as a next generation network and therefore do not meet the state aid funding requirements.

6 Wireless broadband includes two distinct markets: MBB and FWA

In the Consultation, ComReg treats FWA and mobile broadband (MBB) as if the two were synonymous and considers them under the blanket term "wireless broadband". However, in our view, FWA and MBB services belong to separate markets. The term wireless broadband artificially conflates FWA and MBB and, as a result, some important competition and public policy issues are not addressed in the Consultation. Understanding the nature of these markets is therefore critical to a proper assessment of the options for the multiband auction, in particular regarding the 3.6 GHz band which is currently being successfully used for FWA[14] and Imagine is planning to introduce advanced FWA using LTE to deliver High Speed NGA broadband.

ComReg points out that LTE radio technology is now common to MBB and FWA. Using a common technology does not signify convergence, however. When we look at the service level we see that MBB

[12] The EU has published guidelines on what is considered suitable state aid (State Aid Guidelines (SAG)). This considers providing NGA connectivity using LTE-A in some environments to be suitable, but not some lower speed connectivity. See http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF.

[13] https://ec.europa.eu/digital-agenda/en/scoreboard/ireland#broadband-markets

[14] as recognised in ComReg's Fixed Wireless Access Local Area Licensing Information Notice of 2010 - http://www.comreg.ie/_fileupload/publications/ComReg1029.pdf

and FWA services are in fact very different in terms of functionality, pricing and the consumer needs they fulfil.

There are also major differences between the underlying networks which provide communications capability at different speeds and quality of service, to different locations and environments and different mobility requirements. Although a common technology may be used to support the transfer of information between the communications infrastructure and the end user, the network design, topology and investment requirements are highly dependent upon the services intended to be provided and the capabilities of the end-user devices. The differences are even starker for NGA broadband which is defined in the EC Communication on State Aid Guidelines on broadband networks[15] as providing a reliable, 30Mbps+ download service (with substantially higher upload speeds than basic broadband) in the busy hour. MBB networks simply cannot guarantee this level of service which is one reason they are considered unsuitable for NGA service delivery by the EU. It should be noted that only certain "Advanced Wireless" solutions, as provided by Imagine, are recognised as qualifying as NGA under the SAG. Mobile is not recognise as meeting the NGA standards.

As the diagram below sets out, we therefore conclude that Wireless Broadband should only be used as a generic term for broadband services using wireless methods which can belong to two distinct markets which we characterise as:

- Fixed Broadband (FBB): This refers to provision of broadband services to fixed premises. This connectivity can be provided by Wireline Access – using fibre, cable, copper or other tethered connection methods to fixed premises – or Fixed Wireless Access (FWA) – using wireless communications methods.
- Mobile Broadband (MBB)[16]: This refers to the provision of broadband services to mobile terminals in a wide area environment, which function as the user moves from place to place.

[15] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF

[16] We note that this definition of MBB is not the same as the term "mobile broadband" used by ComReg in their quarterly market data reports to represent a fixed broadband substitute provided through dongles as opposed to a mobile service accessed by hand-held devices.

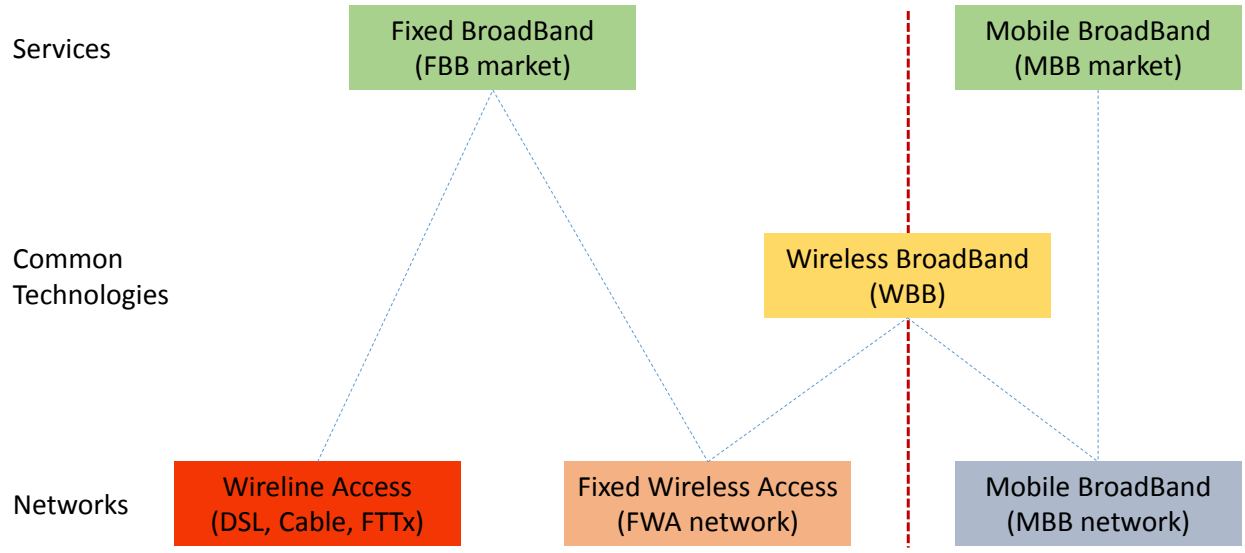


Figure 1: Illustration of the markets relevant to the 3.6GHz Band

In recent years there has been migration towards adopting a common Air Interface technology, based upon the 3GPP LTE family of standards, used to transfer information between radio transceivers, irrespective of the end-use. The globally harmonised mass market and highly efficient radio interface, with a spectrum efficiency that approaches the Shannon Limit[17], has formed a virtuous circle where high performance, global markets and economies of scale make LTE technology adoption highly attractive for a range of uses. Recognising this CEPT's European Communications Committee (ECC) PT1 working group are currently investigating appropriate technical conditions that could be used as the basis of an ECC Decision to allow harmonised use of radio spectrum to support this efficient technology[18] for different MFCN (Mobile/Fixed Communication Networks), which is termed WBB systems above. Though similar technical conditions can be used to mitigate co-existence with other spectrum uses, this does not imply common services, devices, network design approaches, or markets.

Services provided

MBB services aim to provide always-on connectivity to personal devices as subscribers move from place to place, including roaming to other countries. This requires that the form factor of the personalised devices facilitates portability and that the device supports frequency bands supported in other countries and regions where users may travel. Users recognise the difficulty in providing high quality services in all locations at all times and are tolerant to accepting 'there is no signal' or that the achievable data rate may reduce in some locations. Users' mobility 'averages' out variability in service coverage. In a few cases, e.g. where users are very close to a base station, MBB services may be good enough to act as a partial substitute to fixed broadband (basic but not NGA). However, these cases are too limited and

[17] The Shannon Limit is the maximum information transfer rate that can reliably be used in a communications channel, see, for example, "Digital Communications", J.G.Proakis, M.Salehi. McGraw Hill. ISBN 978-007-126378-8.

[18] CEPT ECC PT1 Meeting Documents, http://www.cept.org/ecc/groups/ecc/ecc-pt1/client/meeting-documents

piecemeal for MNOs to launch services competing with fixed broadband services in a conventional sense.

FWA services aim to provide high quality (high speed, low latency, continuity and consistency of service), always-on connectivity to premises where the communications link is potentially tethered to multiple devices (computers, entertainment devices, mobile phones, and PDAs) belonging to one or more users. The Customer Premises Equipment (CPE) is required to provide a high quality link but does not have constraints on international use or portability and can have higher power consumption and larger form factor than would be found in a mobile phone. This facilitates more efficient use of spectrum by incorporating sophisticated antenna designs that are not possible in mobile devices due to their form factor constraints.

Network Design Considerations

Mobile network design strives to provide a quality communications service despite difficult propagation conditions, but this requires the link budget to accommodate fading and blockage environments, necessitating small cell (typically 100's meters to several km) sizes and thus high site densities. Cells must be adjacent to allow handover and provide wide-area coverage. This, inevitably, raises the investment cost per unit area covered and tends to prioritise network coverage in high density (urbanised) areas.

FWA network design aims to provide high quality performance for users in particular locations. Users are able to select the location of the CPE terminal and the resulting relatively benign propagation channel allows large cell ranges (~10km or so) able to support higher data rate links than copper or other wireline technology remote from an exchange or cabinet. Mobility is not required, so 'islands' of coverage can be served, as long as backhaul can be economically provided to the serving base-station. On the other hand, to meet fixed broadband expectations on data rates and quality of service, capacity must be carefully planned to ensure every user has a high probability of access to wide spectrum bandwidths, necessitating different frequency planning approaches and a greater quantity of spectrum than would be adequate for MBB. In addition, the number of users per cell is limited in order to ensure quality of service.

Markets

These network design considerations suggest that an operator would have to completely re-engineer an MBB network to be able to meaningfully offer a fixed wireless broadband service – particularly one meeting NGA requirements - given the differences in network design and architecture detailed above. Hence MBB networks could neither simultaneously support both mobile and fixed requirements nor suddenly be switched to provide services that would compete with FBB (wireline or wireless) and the subscription base and devices used are substantially different. As a result, it is unlikely to be either practical or cost effective for MBB networks to target High Speed NGA broadband services as defined by the EC[19], hence "supply-side" substitution by MBB network operators into the fixed market is unlikely.

[19] EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks (2013/C 25/01) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF

Although a basic fixed broadband service is provided to some 470,000 consumers in Ireland over mobile networks through dongles, this is a service which is limited in scope to underserved areas where basic wireline broadband service is poor. As we stated above in Section 4 this is an anomaly in EU terms and reflects the poor quality of wireline broadband networks in some parts of the country. Mobile broadband dongles are also not a substitute for NGA broadband which cannot be delivered over current mobile networks. The limitations of this service were exposed in the National Broadband Scheme which finished on 24 August 2014. The aim of the programme was to bring broadband to areas in Ireland where it was previously unavailable, and Three was awarded the contract. However, Three will no longer provide previously guaranteed minimum service speeds now the Scheme has ended and is reducing data limits[20]. This illustrates further that MBB networks cannot deliver reliable and competitive fixed broadband services.

Demand-side substitution is also unlikely because of the major differences in service functionality and performance described above. Hence, consumers are unlikely to respond to a hypothetical small but significant increase in fixed broadband prices by switching to mobile (as they would do if MBB was a close substitute). Fixed broadband prices would have to rise by a very substantial amount for most users to consider switching.

As a result, both the MBB and FBB markets must be separately taken into account when considering the costs and benefits of including 3.6GHz in the auction. ComReg has ignored the FBB market and as a result the impact on consumers of auctioning 3.6 GHz has not been properly assessed. ComReg has not considered how the auction might jeopardise the ability of Imagine and other FWA providers to help alleviate the risk of market failure in fixed broadband – increasing competition and creating wider social value through providing NGA services in underserved areas – using 3.6 GHz. This is discussed in Section 7. In the UK, Ofcom explicitly weighed up these concrete benefits from existing and continued use of 3.6 GHz for FWA against the intangible benefits from uncertain future demand for mobile use in its Decision[21] to extend the licences of UK Broadband's 3.6 GHz licence indefinitely. ComReg should follow the same approach in assessing whether to include 3.6 GHz in the auction and on the process of renewing the licences of the existing licensees.

[20] http://www.three.ie/shop/broadband-plans/national-broadband-scheme/

[21] http://stakeholders.ofcom.org.uk/binaries/consultations/uk-broadband-licence/statement/UK_Broadband_Statement.pdf

7 Fixed broadband market in Ireland – needs FWA3.6 to meet NBP and provide choice/competition

7.1 Comparative geostatistics

Global population statistics are available on a regional and country basis from Geohive (http://www.geohive.com/earth/pop_urban.aspx). Using these data is useful to compare some key population metrics of Ireland with other parts of the world.

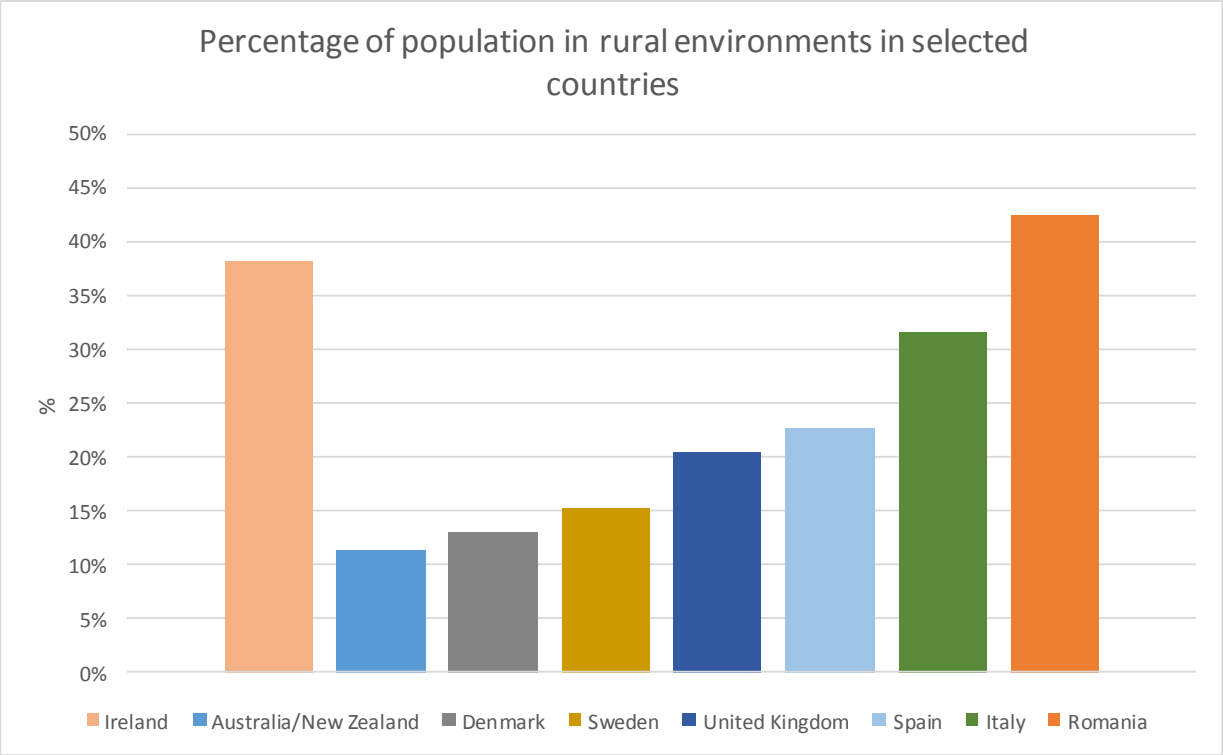


Figure 2: Percentage of population in rural environments in selected countries (data taken from Geohive: http://www.geohive.com/earth/pop_urban.aspx)

Figure *2* demonstrates that Ireland has a higher rural population than is typical of other developed European Countries. From the same reference source, Ireland has a higher rural population (38.1%) than any other Northern European country (except islands such as the Channel Islands and Faroes), and similar to Eastern European states such as Poland or Romania. Having a large proportion of the population in rural areas makes it economically and technically difficult to deliver 100% population targets defined in the NBP[22].

[22] As shown in Section 8, using FWA to deliver NGA is more cost effective in may less populated environments than other technologies, such as FTTx.

Figure 3 shows the population density (2007 data) of major cities. This demonstrates that Dublin has a significantly lower population density than other global cities including London and is thus unlikely to pose particular difficulties in serving the capacity demand of a large number of users in small areas compared to other Global or regional world cities. In particular, Ireland is unlikely to have a tougher challenge offering similar services in dense urban areas of Dublin than other European cities with similar spectrum allocations. It would therefore be surprising if ComReg was to make significantly more spectrum available for Mobile Network Operators than other European regulators.

Figure 2 and Figure 3 therefore show that **there is little evidence that Ireland needs to make more spectrum available to serve dense urban areas in order to meet capacity demand compared to other major cities. Instead, the challenge in Ireland is to use spectrum in order to deploy cost effective networks to support the large rural population.**

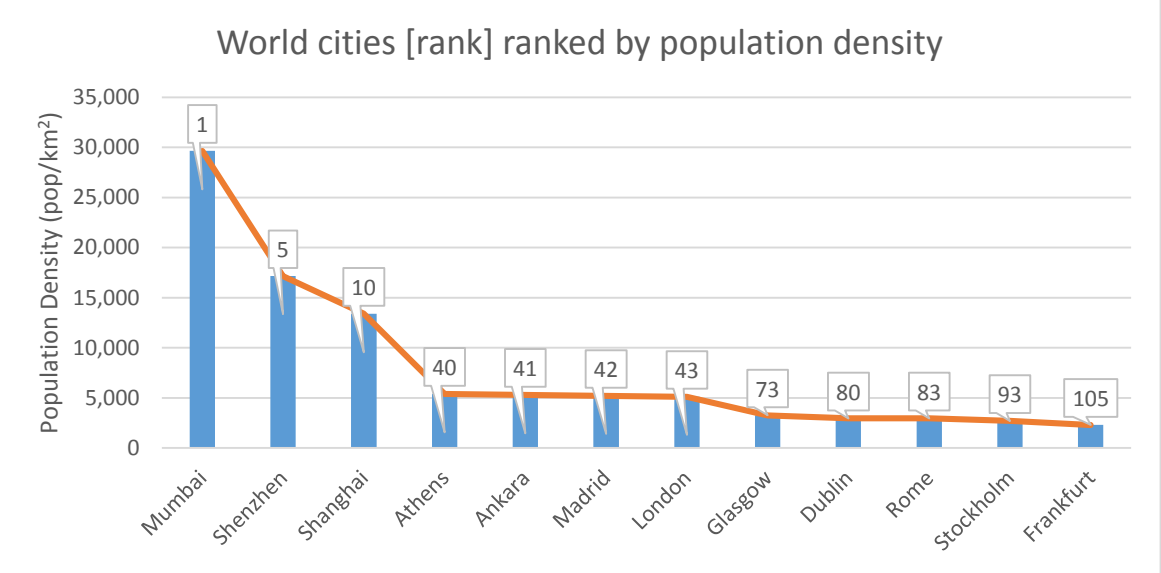


Figure 3: Population density of selected world cities showing their ranking (data taken from http://www.citymayors.com/statistics/largest-cities-density-125.html).

7.2 Broadband performance in Ireland

International comparisons of broadband services show that Ireland is lagging behind much of Europe in the coverage and the uptake of broadband services.

Basic FBB coverage in Ireland was 96% in 2013 (according to the 2014 EU Digital Agenda Scoreboard) a little below the EU average of 97.5%. However, NGA coverage in Ireland at 54% was significantly below the EU average of 62% and even more so in rural areas (6% compared to 18%), as shown below.

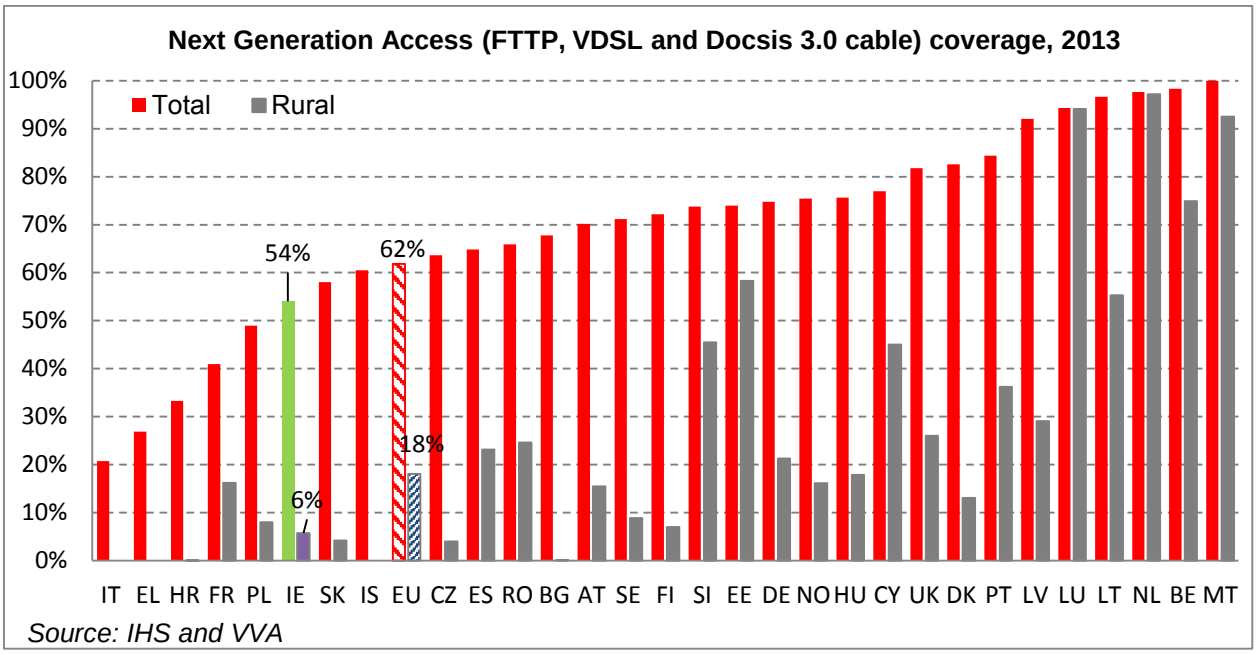


Figure 4: NGA Household coverage in the EU (Source: EC Digital Agenda Scoreboard 2014[23])

Industry has indicated that the following broadband penetration levels will be delivered as a consequence of commercial investment: 50% of the population will, by 2015, have access to headline speeds of between 70Mbps to 100Mbps (using cable, advanced DSL and fixed wireless LTE); a further 20% to 35% of the population will, by 2020, have access to headline speeds of between 30Mbps to 100Mbps (using advances in copper, cable and fixed wireless LTE platforms), and 15% to 30% of the population may only have access to the basic level of services currently available, by 2020[24]. *(NOTE: This was based on the expected investment in and significant impact of FWA).*

The penetration of broadband services in Ireland, is a similar story to that of coverage. The chart below again show Ireland significantly below the EU average for household penetration of basic broadband. Furthermore, the gap widened between 2009 and 2013.

[23] http://ec.europa.eu/digital-agenda/en/news/scoreboard-2014-trends-european-broadband-markets-2014

[24] Enabling a connected society, Report from Next Generation Broadband Taskforce, May 2012. https://ec.europa.eu/digital-agenda/en/news/enabling-connected-society-report-next-generation-broadband-taskforce.

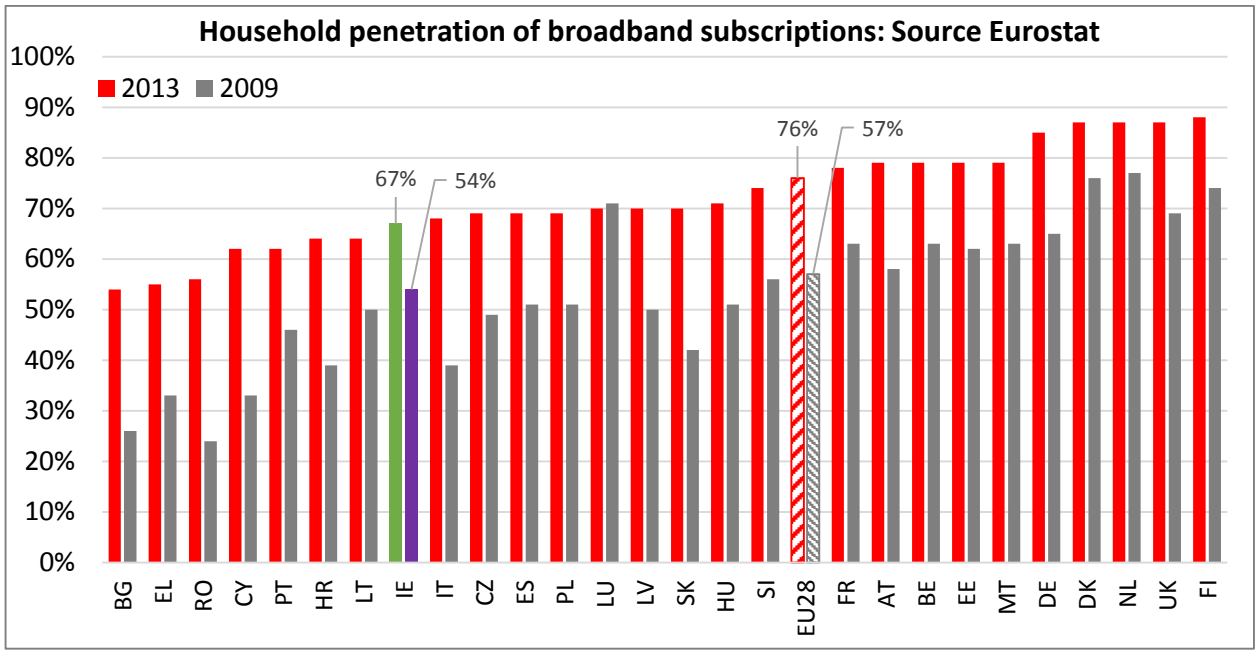
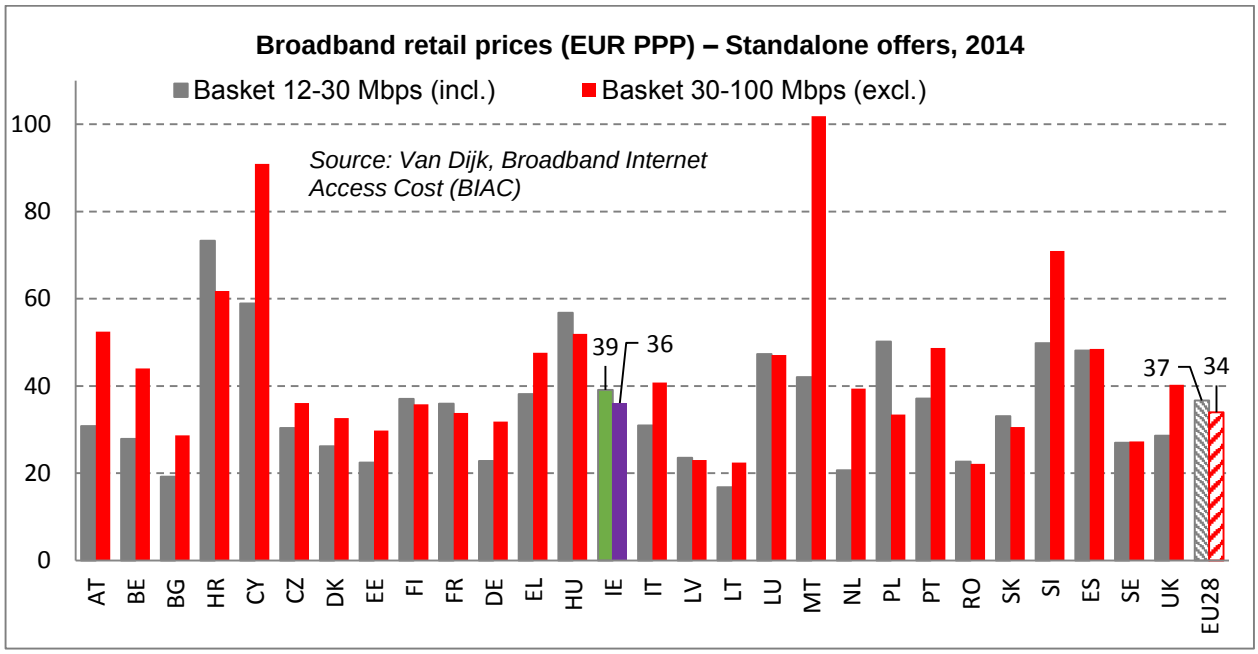


Figure 5: Household penetration of broadband subscriptions (source: Eurostat[25] and ComReg[26])

The Irish FBB market fares little better in international price comparisons. Ireland also ranked below the EU average for a residential basket of FBB prices taking all speeds at 15th place for speeds above 10 Mbps and 19th place for broadband in general.



[25] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_bde15b_h&lang=en

[26] http://www.comreg.ie/_fileupload/publications/ComReg1497.pdf

Figure 6: Broadband prices in Ireland (Source: Van Dijk – BIAC and EC Digital Agenda Scoreboard 2014[27])

DSL and Cable are the leading FBB platforms in Ireland in Q2 2014 representing 66% and 29% of the market. FWA services had a small but significant share of the FBB market at 4.4% in Q2 2014 as the table below shows.

	Subscribers	Share of FBB market
DSL	672,384	54.8%
VDSL	132,764	10.8%
Cable	355,396	29.0%
FWA	100,000* (53,687)	8% (4.4%)
Other	11,824	1.0%

Table 1: Subscribers and shares of the FBB market in Ireland, Q2 2014 (source: ComReg[28])

** ComReg reported 53,687 subscribers however an additional 50,000 subscribers served by unlicensed fixed wireless providers have been identified by DECNR*

In the very recent past, NGA access has grown very quickly. Cable is the leading platform with 73% of all NGA subscribers – 99.8% of cable subscribers enjoyed 30 Mbps services or above – and growing 9.7% year-on-year. Eircom's VDSL services, delivered over its FTTx network, account for the other 27% of NGA subscribers. It has grown more strongly than cable, though full year-on-year figures were not available in the ComReg report.

As we mentioned before in section 6, an anomalously high number of customers in Ireland – 470,823 – access fixed broadband services over mobile broadband networks using dongles. This has been an alternative in areas where wireline services are poor.

Ireland is lagging behind much of Europe in the coverage and the uptake of broadband services and the prices are higher. Ireland is significantly below the EU average for household penetration of basic broadband. Furthermore, the gap widened between 2009 and 2013. Ireland is ranked below the EU average for a residential basket of fixed broadband prices taking all speeds at 15th place for speeds above 10 Mbps and 19th place for broadband in general.

7.3 Wireline technologies not suitable to meet 100% targets in NBP

Providing coverage to less dense areas costs more per person served owing to the reduced ability to share fixed cost elements, often coupled with cost of new civil work required to augment poor legacy networks. It is for this reason that communication coverage in more dense population areas (whether Wireless or Wireline) is more widely available – coverage can be provided at reasonable cost, permitting even a low take-up of services to recoup initial infrastructure costs. Increased take-up allows additional capacity to be funded. This is a particular issue in low density areas where increasing distance from an

[27] http://ec.europa.eu/digital-agenda/en/news/scoreboard-2014-trends-european-broadband-markets-2014

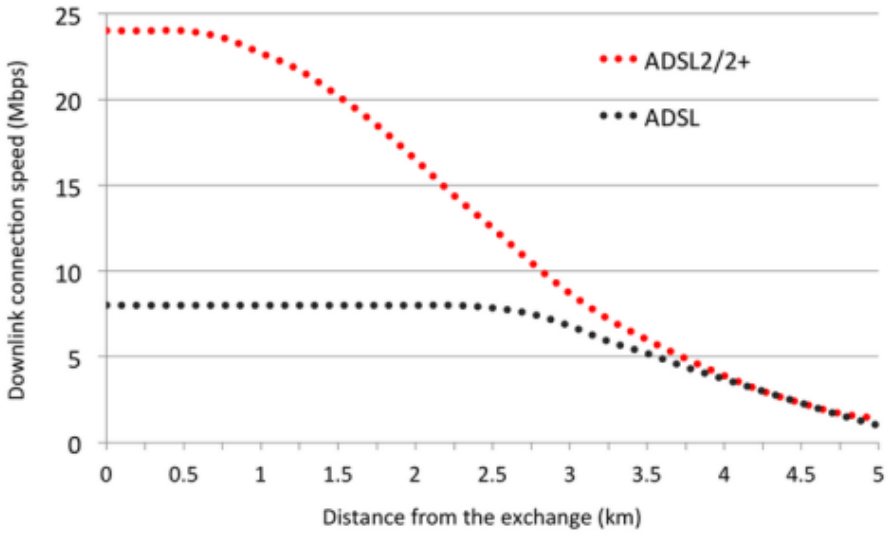
[28] Quarterly Key Data Report, Q2 2014, http://www.comreg.ie/_fileupload/publications/ComReg1497.pdf

exchange reduces the data rate that can be provided – lower density areas have higher average distances from exchanges and lower data rates.

As shown in Figure 7, ADSL speed are unlikely to meet NGA need even close to an exchange and date rate reduces over copper wireline as distance increases. Figure 8 shows that the datarate available to customers using FTTx technology is also limited and that NGA speeds are undeliverable in excess of 1.2km from a cabinet. This will limit NGA availability in many urban areas of Ireland, as well as much of the large rural population. The technical restrictions of FTTC means that it does not uniformly deliver NGA level speeds and bandwidth to all household/business in an 'area', While operators may talk about a service being available in a general area, being available *in* an area does not necessarily mean that the service is available to *everyone in* that area.

As well as the technical restrictions on wireline technology, there are economic factors that will limit wireline coverage. Distance from an exchange limits existing DSLx data rates and are typically in areas where provision of fibre to the cabinet would be costly owing to the low number of subscribers served by metre of trench digging required. It is noted that only 5% of rural Ireland is covered with NGA wireline technology. However 38.1% of Ireland is classified as rural and therefore meeting the 100% coverage of 30Mbps is likely to be a more challenging for Ireland than many other member states.

The Taskforce report notes that providing rural coverage is a challenge in rural areas. "[Provision] of a reliable and consistent service at an affordable price continues to be a challenge in some parts of the country, particularly in rural areas"[29]. This same Task Force report also notes (pp13) that "[in rural areas only] 15% to 30% of the population may only have access to the basic level of services currently available, by 2020].



[29] Enabling a connected society", Report from Next Generation Broadband Taskforce, May 2012

Figure 7: Representative copper wireline downlink data transfer rate variation with distance from the exchange (from http://www.increasebroadbandspeed.co.uk/2012/graph-ADSL-speed-versus-distance).

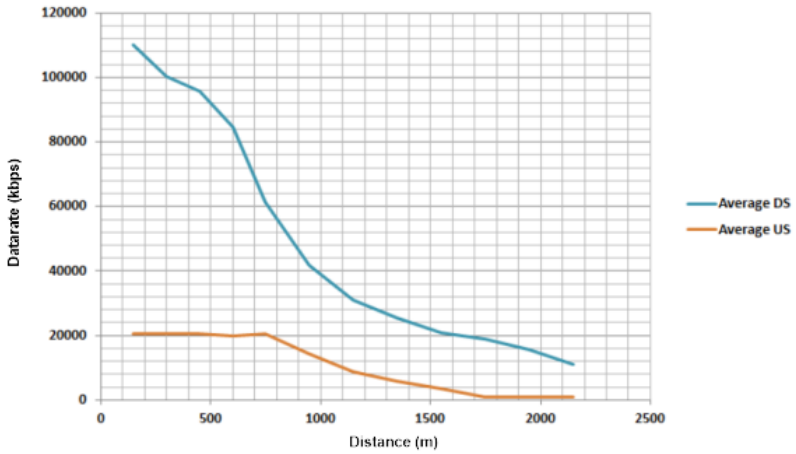


Figure 8: Representative VDSL wireline DS (downstream) and US (upstream) data transfer rate variation with distance (from http://www.dcenr.gov.ie/Communications/National+Broadband+Plan/Published+Stakeholder+Consultation+Oct+2014.htm)

7.4 FWA in general and 3.6 GHz in particular are essential components in meeting the NBP

FWA is an opportunity to provide lower cost NGA connectivity to rural users at a lower cost than alternative 'last mile' technologies:

- FWA can be provided to premises within 13km diameter of a suitable base station without needing to dig cables or other civil engineering effort.
- FWA range exceeds mobile technology since the fixed (not mobile) devices can be located to optimise connectivity given the constraints of the premises to be served. The RF link does not need to account for fading issues associated with providing wide-area mobile coverage and can therefore extend cell ranges and improve link performance compared to mobile. Small enhancements to cell range translate into large reductions in required infrastructure.

FWA technology can be rapidly deployed to all premises within range of a suitable FWA base station – with self-installed domestic equipment (much like a fixed line router/access point) able to be set-up by the subscriber, or outdoor units that extend coverage and improve connectivity to a base station. This allows rapid NGA rollout and delivery of service over a wide area.

Therefore not only will TD-LTE Advanced Fixed wireless be required to deliver NGA in areas where FTTX infrastructure will not be deployed at all, there will be a significant requirement for TD LTE Fixed wireless to extend NGA coverage in 'areas' where actual availability of FTTC is extremely limited, though claimed by fixed network providers.

There is therefore a need for investment in a suitable technology to close the rural gap in the next 5 years. Imagines Advanced TD LTE planned deployment meets this requirement. Uncertainty in the long term spectrum availability would prejudice required investment in this infrastructure. Any uncertainty or delay in investment until after the spectrum award would be a lost opportunity for rural Irish communities with the associated economic losses.

FWA can therefore provide a Next Generation Access technology that can cost-effectively cover the large rural population within Ireland and provide access to users unable to access wireline technology in more dense areas and/or provide another level of competition where wireline technology is available.

7.5 Imagine's role in the FWA market

Currently Imagine has a readily available ecosystem and a real world platform serving rural population using the available 3.6 GHz spectrum assets. ComReg has also provided the essential regulatory support i.e. set up a full system of licences, frequency coordination procedures an operator code of practice which provided the certainty in the market. ComReg also chaired the Fixed Wireless Access Local Area (FWALA) Forum which was established to provide licences and to address issues of common interest to FWALA licensees. It also has code of practice focusing on the 3.6 GHz band. Imagine now need to have confidence in being able to secure continuity of access to 3.6GHz spectrum to justify imminent investment in forward-looking LTE-A technology able to support NGA using FWA.

Under the current business plan, Imagine will be rolling out a TD LTE fixed wireless network of 933 sites. In the initial 261 areas identified, approximately 200,000 premises currently do not have high speed data access and are not covered in Eircom's NGA plan. The Advanced LTE Network has been live on two sites for testing and demonstration purposes for the last 8 months. Imagine is planning full commercial launch and rollout of services commencing in March 2015) and will be deploying at least 15 additional areas per month initially, ramping up to a deployment rate of 30 sites/areas per month. This plan is based on a capital investment of c. €150 Million in radio equipment. Imagine has agreed terms with a major international infrastructure investor who already has significant existing infrastructure investments in the Irish market.

Imagine has an existing network and is already fully operational and providing services to thousands of business and consumers on a national basis. The TD LTE network rollout project will leverage the existing infrastructure assets and capability already in place. We have made substantial investment in bringing Advanced Wireless solutions to the markets and currently provide services on a national basis. Our experience in doing this over many years together with our existing network assets, we believe we can continue to connect the "un-connected" users at a faster rate compared to any other operator. However, the uncertainty, derived from the consultation, over the 3.6GHz spectrum already licenced to Imagine and planned to be used to support Imagine's NGA FWA network puts these deployment plans at risk. Imagine's existing 3.6GHz licences terminate in July 2017– but an inability to invest before then

risks stagnation at the existing level of FWA provision. Imagine seek improved certainty in access to future spectrum to justify the LTE-A network investment.

In summary, we have proved the technology and commercial viability of next-generation FWA in the Irish market context and are ready to roll out on a wide scale – provided we have certainty regarding our spectrum holdings.

7.6 Imagine's current and planned network

Imagine's current phase 1 plan is to deploy circa 993 base station sites. Each site will deliver high-speed NGA broadband services of between 30 and up to 100Mbps over a 13km diameter from the base station site. An initial 261 planned 'areas' which will be covered using 433 base station sites has been provided to the DCENR. Of the estimated 750k homes and businesses able to get service in the 261 areas covered, approximately 200k of these will be additional premises in areas not covered in Eircom's NGA plan. Imagine will provide competitive tension in these areas.

With the full funding for the current plan of 993 sites in place, Imagine will evaluate and identify additional areas (in addition to the 261 areas already identified) where the business case is met and where it plans to roll out the additional 560 sites.

This process will be further assisted and influenced by current discussions with other retail and wholesale operators. Discussions including extending and "in filling" coverage in areas where other NGA networks are being deployed will also inform our planned infrastructure deployment. The outcome of these discussions could lead to a faster and more extensive rollout of the Imagine infrastructure and underpin further investment.

Where required Imagine will seek further private sector investment and funding to deploy additional base stations in as many areas as possible and where we consider the business case to be commercially viable. Where this is not possible within the proposed timeframe and or where the population density does not meet the minimum business case requirements, imagine will identify those areas where it will not be deploying infrastructure which will inform the DCENR in relation to the classification of "white areas" for the NBP.

It is Imagine's intent to conclude wholesale discussions and a full assessment of the areas where we will deploy infrastructure, in advance of the conclusion by DCENR of the mapping exercise and publication of the proposed areas requiring intervention or support. Where intervention and support is required, given the relatively low cost per base station and the effective wide area coverage in which NGA can be provided we believe that Imagine's TD-LTE Advanced network will provide the most cost effective solution.

Spectrum requirement to meet current and future requirements:

To secure the required investment to execute the above plan we require certainty on the retention of sufficient spectrum.

Frequency planning an FWA network to meet NGA requirements is very different from frequency planning in MBB. In MBB, it is feasible to reuse spectrum in each sector and each site, because users are mobile and it is sufficient to ensure that the overall user experience is high, rather than guaranteeing

service at any given location. Our network design has examined this issue in great detail to determine the quantity of spectrum needed to meet NGA requirements and has concluded on the following:

- We require 40 MHz of spectrum per sector to meet required data rates for a fixed max number of households
- This cannot be reused between sectors of one site to avoid contention and/or interference which would unacceptably degrade the service for households on the overlap between sectors, so given a minimum of 3 sectors per site, a bare minimum requirement is 3x40=120 MHz for a single site
- We need similarly to avoid interference between clashing sectors of adjacent sites, and also provide upgrade path for increasing bitrates to meet rising customer expectations and to remain competitive against fixed line.
- Hence we plan in future to upgrade to 80 MHz per sector, so we need total of 3x80 MHz = 240 MHz to support a viable upgrade roadmap

Additionally, it is not sufficient for us to access such spectrum on a purely regional basis. As previously highlighted, there is an acknowledged need for FWA to provide NGA in rural areas where there is no other viable option. But beyond this, in urban areas and in remote towns, long line lengths affect many households meaning that there will be plenty of gaps in wireline NGA which can only be met with FWA. Even in urban areas where NGA wireline is available, FWA will provide much needed competition/choice for consumers, avoding the lack of competition that consumers face in the MBB market. Hence it is essential that FWA can access 3.6GHz via national licences, starting immediately.

In conclusion, the spectrum requirement for Imagine to fully meet its plans to rollout and maintain NGA access across Ireland via FWA is at least 240 MHz, on a national basis, with security of tenure over an indefinite period.

8 Mobile Broadband Market in Ireland – doesn't need 3.6 GHz

8.1 3.6 GHz is not a good choice to support wide-area mobile

Provision of wide area mobile services requires that connectivity be provided to a mobile handset whilst this handset transits through a variety of environments where the user operates. Higher frequencies are less suitable for this purpose owing to propagation in wide-area environments and propagation losses associated with mobility considerations (such as fading, blockage, etc).

This means mobile networks using 3.6 GHz would typically require more base stations to cover the same area as a network deployed in lower spectrum bands. This makes the 3.6 GHz band less attractive for mobile services and/or any rural coverage more expensive to achieve. Compared to a frequency band of 1800 MHz, the coverage area at 3.65 GHz decreases by approximately 66%, i.e. reduction in cell area from 37.8 km^2 down to 12.6 km^2. These numbers are based on the delivery of 64 kbps service at cell

edge in a rural environment with the antenna height of 30 m[30]. Further, for an area of 100x100 km^2, the number of sites needed increases by almost 3 fold when a frequency band of 3.6 GHz is used compared to 1.8 GHz (see *Figure 9*).

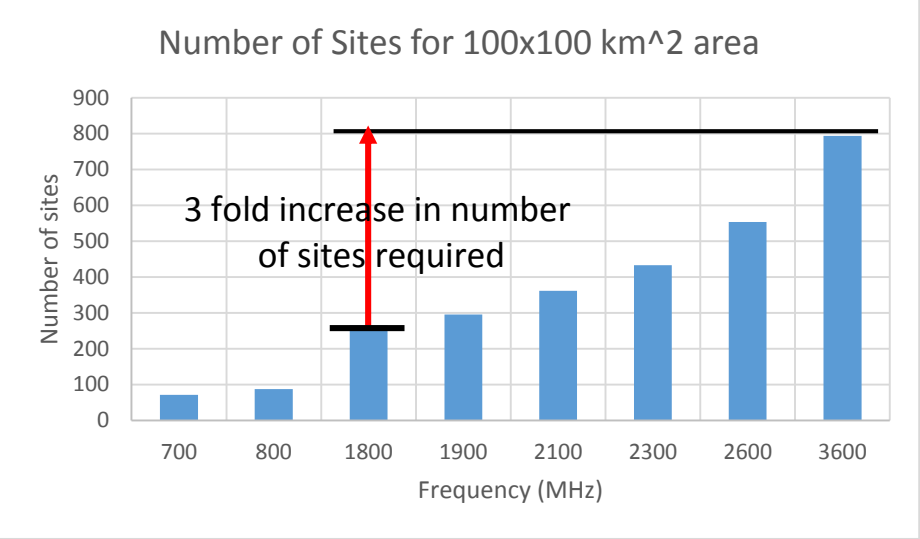


Figure 9: Number of sites required to cover 100x100 km2 area for MBB

From a propagation perspective, 3.6GHz is therefore not a good frequency for the provision of wide-area mobile services. We note that these numbers are slightly more conservative than the figures used by DotEcon in the ComReg consultation where they suggest that the cell range would reduce from 6.5km at 1800MHz to 2.1km at 3.5GHz – suggesting an increase in the sites required to by a factor of 9. We conclude that 3.5GHz can be used to provide cost effective FWA network provision – but not wide-area MBB network coverage.

8.2 3.6HGz is not supported to complement MNOs' networks

In many European countries mobile device subsidy is part of the customer acquisition and retention strategy of mobile operators. In order to support provision of services in mobile networks, operators seek to use devices that are attractive to users, but use spectrum that supports their network and can support roaming. This is part of the customer acquisition package and mobile operators are motivated to use spectrum that is harmonised since this combines scale economies for both handsets and network infrastructure and roaming. Ideally, these devices need to support all the bands that the mobile operator uses (or at a minimum set of bands that are available everywhere) in order to secure network coverage (as well as capacity). This is not possible with the 3.6 GHz band and therefore this band is not substitutable for other mobile network bands included in this award.

[30] Extrapolated to 3.6 GHz based on the information provided in http://www.gsma.com/spectrum/wp-content/uploads/2013/07/ZTE-LTE-APT-700MHz-Network-White-Paper-ZTE-June-2013.pdf

In section 3.35 of the consultation document, ComReg point out that the standardised equipment in the 3.5 GHz band is already available and state that “only 17 LTE handsets are currently compatible with the 3.5GHz band”. A recent GSA document[31] identifies 26 devices can support operation in the 3.6GHz band. Figure 10 shows the device availability in the different bands considered in this consultation as published in a recent GSA publication. Clearly the 3.6GHz band is poorly supported and would be unlikely to support services whilst being available in a wide range of handsets. However not all of these devices are suitable for wide area mobile use – and so the 3.6GHz band is even less attractive for mobile use. Imagine has tried to identify the availability of 3.6GHz devices and found that none are suitable to augment mobile networks. From 2218 LTE devices that are available, 644 are for TDD mode and of these only 26 support 3.6 GHz. Almost all of these are fixed CPE or MiFi-style routers. A selection of these is shown in

Figure 11. Only one smartphone has been located, and may not be commercially available. This does not constitute an attractive device ecosystem that a mobile network operator would seek to use to support services on, and attract subscribers to, a mobile network. There is however a range of devices that can support a FWA operator.

[31] “Status of The LTE Ecosystem” , Oct 14th 2014, http://www.gsacom.com/downloads/pdf/GSA_lte_ecosystem_report_141014.php4

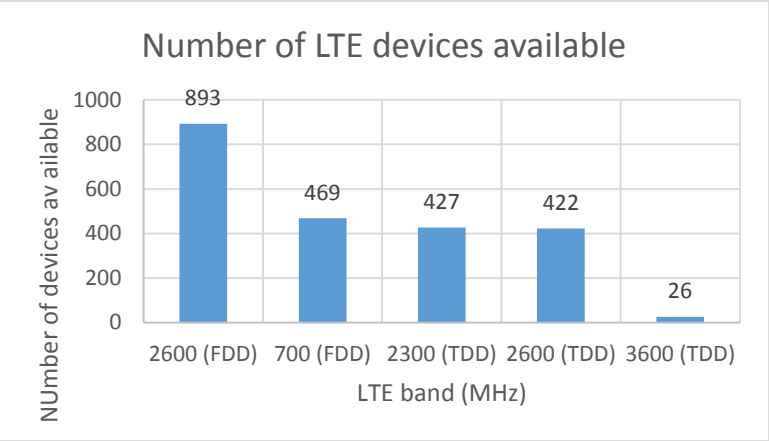


Figure 10: LTE device availability in the bands considered in this consultation (see [31]).

Figure 11: Selection of 3.6 GHz band devices available32,33,34,35,36,37

In summary, there are almost no MBB devices available for 3.6 GHz, but many CPE devices for FWA at 3.6 GHz.

[32] http://www.airspan.com/products/end-user-devices/mrt/

[33] http://www.greenpacket.com/devices/lte+wimax-modem-specs.html

[34] http://www.greenpacket.com/devices/dx-wimax-indoor-modem-specs.html

[35] http://lte-tdd.org/Industry_Status/content.aspx?nodeid=5&categoryid=4&contentid=940

[36] http://lte-tdd.org/Industry_Status/content.aspx?nodeid=5&categoryid=4&contentid=939

[37] http://lte-tdd.org/Industry_Status/content.aspx?nodeid=5&categoryid=4&contentid=925

8.3 3.6 GHz operators are predominantly FWA, not MBB

Of the 318 operators who have launched LTE services in 111 countries[38] , only 6 have launched LTE in bands 42 or 43. Of these all 6 (in Bahrain, Belgium, Canada, The Philippines, Spain and the UK) areFWA operators[39].

ComReg notes that 3.6 GHz band has recently been used for the deployment of advanced mobile services and commercial services have been launched in the UK, Spain, Bahrain and Canada. However, we found that four operators in these countries provide FWA rather than MBB in the 3.6 GHz band (UK Broadband, Mena Telecom, Neo-Sky and ABS Communications) – we have been unable to clearly identify the role of the other two operators.

At the LTE World Summit in Amsterdam in June 2014, Boston Consulting noted that:

> "European operators have not expressed significant value in TDD spectrum in recent spectrum auctions"
>
> "It appears that even large European telcos do not (yet) have a clear TDD spectrum strategy"

Likewise, at Broadband World Forum in October 2014, a panel session identified[40] that mobile operators in Europe remain “cool” on the use of TDD, using it only for special projects and backhaul, and saw little sign of that changing in the near future.

So we have identified no true European MBB operators providing services in 3.6 GHz and see little prospect for that changing.

8.4 The evidence that there is MBB demand for 3.6 GHz is not compelling

The current award process being considered by ComReg proposes to award a disproportionate amount of spectrum for mobile use in Ireland. We maintain that the benefits of increasing the amount of mobile spectrum would not justify the potential risk to deployment of FWA networks using the 3.6GHz band and that the 3.6GHz band should not be considered in this award process.

A report by Plum identifies the spectrum assignment for mobile operator use below 3GHz in different EU countries[41]. As well as the core 3GPP bands at 900 MHz, 1800 MHz and 2100MHz, many states had completed the award of mobile spectrum at 800MHz and 2600MHz at the time of this report. A large reason for the relative reduction in assigned spectrum in Ireland between 1 and 3GHz is that the 2.6GHz band had been assigned in countries such as the UK (though this spectrum is not yet in use). For example, the UK total includes 185MHz of paired and unpaired spectrum at 2600 MHz.

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[38] Evolution to LTE report published by GSA on 28 July 2014

[39] Status of the Global LTE TDD market, report published by GSA on 10th November 2014

[40] http://www.mobileworldlive.com/euro-operators-cool-td-lte-potential

[41] Valuing the use of spectrum in the EU”. April 2013. http://www.plumconsulting.co.uk/pdfs/Plum_June2013_Economic_Value_of_spectrum_use_in_Europe.pdf.

Ireland is seeking in this award to release in excess of 759MHz in paired and unpaired spectrum – 1.75 times the bandwidth currently assigned. In many ways Ireland could be seen as leading Europe, since as ComReg's consultation notes "The final [ECC] report in response to this [EC] mandate is expected by December 2014 and it is expected that an EC technical harmonisation decision will follow". Imagine does not see any advantage in ComReg moving ahead of the market in releasing this amount of spectrum. CEPT has not yet fully agreed how all the bands that are the subject of this release process should be co-ordinated.

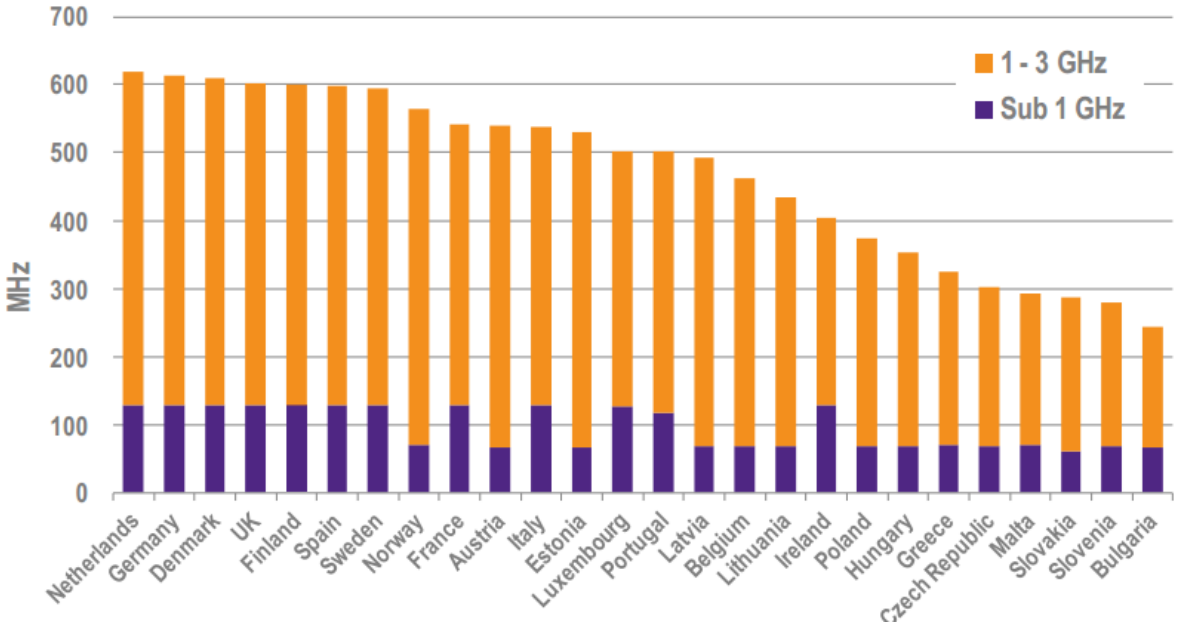

Figure 12: Mobile spectrum assigned in the EU (Figure 3.1 from [12])

This contrasts however with other spectrum that is heavily utilised by Mobile Network Operators in many other countries. As ComReg notes on its own website[42] "Ireland is unusual in a European context in that it has large quantities of unused spectrum in the GSM and 3G bands" and "[only] 59% of the available 2G spectrum and 85% of the available 3G spectrum has been licensed [[43]]". Put another way, 41% of highly desirable 2G spectrum (including the 1800MHz band, harmonised for LTE use and supported by more devices than any other LTE band) is underutilised. Against this backdrop, it must be questioned if ComReg are fulfilling their duties in seeking to release 3.6GHz at this time. This combines two separate aspects of inefficient use of spectrum:

- ComReg is seeking to release more spectrum for mobile use when highly valuable mobile spectrum was only recently released and is not yet in use[44].

[42] http://www.comreg.ie/radio_spectrum/search.541.490.10003.0.rslicensing.html

[43] http://www.comreg.ie/radio_spectrum/search.541.490.10003.0.rslicensing.html#sthash.hjw62f2c.dpuf

[44] http://www.comreg.ie/_fileupload/publications/ComReg12123.pdf

- ComReg is seeking to release 3.6GHz spectrum, jeopardising securing access for its use to help provide broadband fixed wireless access

In addition, it is not clear that it is desirable to release such a large amount of mobile spectrum at this time. DotEcon's report also suggested that there may be a lack of demand for 3.6GHz spectrum. The European Commission's Radio Spectrum Policy Group (RSPG) holds that spectrum demand for MBB is driven by the traffic demand in urban areas[45]. Ireland looks on target to meet its NBP targets for urban areas – the key challenge will be in providing service in more difficult to reach areas (including its large rural population). This however, according to RSPG, is not an area that drives spectrum demand for wide area mobile services. It is therefore interesting to question why Ireland should seek to facilitate access to 3.6GHz along with prime mobile spectrum. Given the timetable for release, this could create uncertainty in the business case of FWA operators (such as Imagine) whilst providing no benefit to improving MNO service provision. This contrasts with the UK regulator's position in a very recent statement on the UK's plans to release[46] 40MHz of spectrum in the 2.3GHz band and 150MHz within the 3.4 GHz band. It is interesting to compare the WBB availability in these two neighbouring European countries.

Spectrum Band	**Region 1 Allocation (MHz)**	**Assigned in UK (MHz)**	**Unassigned in UK (MHz)**	**Assigned in Ireland (MHz)**	**Unassigned in Ireland (MHz)**
700 MHz	TBD – likely to be EU wide 2x30MHz	n/a	n/a	n/a	n/a
800 MHz	791-821 with 832-862	2x30	0	2x30	0
900 MHz	880-915 with 925-960	2x34.4	2x0.6	2x30 (till 2015) 2x35 (from 2015)	2x5 (till 2015) 0 (from 2015)
1800MHz	1710-1785 with 1805-1880	2x71.6	2x0.1 (with 2x3.3 for low powered shared access)	2x35 (till 2015) 2x75 (from 2015)	2x40 (till 2015) 0 (from 2015)
1400 MHz	1452-1492	1x40	0	1x40 (subject to this consultation)	0
2100 MHz (paired)	1920-1980 with 2110-2170	2x120	0	2x120	0

[45] See pp10 of: RSPG13-511 Rev 1, February 13th 2013, https://circabc.europa.eu/d/d/workspace/SpacesStore/9367e691-df81-408c-a17e-ef895449bd7f/RSPG13-

[46] See http://stakeholders.ofcom.org.uk/consultations/2.3-3.4-ghz-auction-design/.

2100 MHz (unpaired)			Assigned – but not used		Assigned but not used
2300 MHz	2300-2400	1x40 (under consultation)	0 (1x60 assigned for other uses)	1x100 (subject to this consultation)	1x100
2600 MHz	2500-2690	2x70 and 1x45	5	2x70 and 1x30 (subject to this consultation)	15
3600 MHz	3400-3800	3410-3480 and 3500-3580 (under consultation) 3480-3500, 3580-3600, 3605-3698, (assigned to UK Broadband)	After award (150 + 133 existing Brownfield UK BB)	1x360 MHz (subject to this consultation) 40MHz State Service	Existing brownfield. 197 Licences to 13 different operators..

From the above table it is clear that whilst ComReg has only recently seen the need to release conventional mobile spectrum in highly attractive mobile bands (such as 1800MHz band) it plans on releasing a large amount of so-far unused TDD spectrum at 1.4 and 3.6GHz already used to deliver fixed services. This is occurring whilst there are question marks over any demand for additional mobile spectrum and risks jeopardising future access to existing FWA operators (and hence their incentive to invest in their networks – in turn jeopardising fulfilling DCENR's NBP). This approach differs from that adopted by Ofcom in the UK who are seeking to protect the brownfield operations of the incumbent operator (UK Broadband).

Comparing these two example cases we have a strange contrast in the geostatistics of neighbouring countries and different policies that are working in contradiction to the challenges that each country faces in meeting the needs of achieving European policy objectives:

- The resident population in the dense urban areas of the UK (London) is 1.72 times that of Ireland (Dublin). It is suspected that the daytime population of London grows more than Dublin – and we believe that the minimum population density increase of 1.7 times is sufficient to support the argument. Ireland has a rural population of 38.1% of population characterised by "ribbon development", the UK rural population is 20.4% and more concentrated.
- ComReg and/or MNOs active in Ireland have not shown any appetite for seeking to aggressively release spectrum in Ireland like most European countries – even for the 'popular' mobile spectrum bands.
- Despite this ComReg are now seeking to release spectrum ahead of European harmonisation, evidence of equipment availability or any demonstrated demand – whilst failing to make special provision for current FWA providers and the special needs that Ireland faces in achieving the NBP objectives

- There appears to be no demand for use of so much mobile spectrum in Ireland. Including 3.6GHz which is currently used for FWA in this auction will undermine both the NBP and the mobile auction award process by establishing conditions for economic inefficiency in both markets.
- ComReg is failing to make due consideration for brownfield operations, in contrast to the UK, even though the spectrum awarded to Imagine is likely to help Imagine continue to support existing and future householders gain access to the essential connectivity required to help meet the DCENR objectives.

8.5 Summary

In this section we have shown that:

- 3.6GHz is not well suited to provide wide-area mobile services (poor propagation properties, poor economies of scale and little competition (if any) for suitable handsets;
- Operators and equipment suppliers have demonstrated any support for use of this band is in using 3.6GHz to provide FWA services
- Spectrum allocation in Ireland is not efficient and inadequacies in spectrum allocation are not going to be helped by this award process in its current form
- The process creates uncertainty and a vacuum for investment by Imagine and other FWA operators
- This award process jeopardises the future security of access to spectrum for Imagine (and other FWA providers) and therefore risks providing the benefits of broadband access to Irish residents and all objectives that would be delivered as part of conformance with the NBP
- There is an opportunity for Ireland to improve use of spectrum by releasing more popular mobile bands and bring these into efficient use, and taking the opportunity of wide bandwiths available at 3.6GHz and 2.3GHz to serve the relatively large rural population that Ireland has.

9 ComReg's proposed auction design is flawed in respect of 3.6 GHz

9.1 The grounds to include 3.6 GHz in the auction are weak and it would impose significant costs on consumers

As ComReg explains, the case for including other bands in an auction with the 2.6 GHz band rests on the degree to which they are either complements or substitutes with 2.6 GHz and in our view, the economic justification for including 3.6 GHz in the auction is weak.

First, ComReg and DotEcon themselves point out differences between 3.6 GHz and the other bands concluding that 3.6 GHz is an "imperfect substitute" for them. For example, DotEcon notes that "… the 3.6GHz band is relatively far away within the radio spectrum from the 2.6GHz band, and has less

favourable propagation characteristics and poorer building penetration."[47] Hence 3.6GHz is much more suited to providing FWA services (particularly given the advantages of the higher antenna gain of the CPE) or hotspot services.

Second, although we have not been able to identify any mobile deployments in the 3.6 GHz band, the ecosystem for MBB networks is not well established, and FWA networks area much better supported, for example, the proportion of LTE mobile devices that support 3.6 GHz is currently negligible.

Third, ample spectrum is available for MBB services in Ireland and this spectrum is available in bands which are more favourable for MBB than 3.6GHz. MBB operators are unlikely to be exposed to substitution risks if 3.6 GHz is not included in the auction hence the economic efficiency arguments for its inclusion are weak.

Indeed, DotEcon acknowledge that "the supply of spectrum without this band [3.6GHz] may already be sufficient to meet demand at the time of the award"[para 128] and the risk that "demand [for 3.6 GHz] is low relative to availability" [para 88]. The situation is similar in the UK, where, Ofcom concluded in its recent Consultation on an auction of 2.3 and 3.4GHz spectrum[48], that MBB demand for 3.4GHz in particular is uncertain, despite the higher utilisation of mobile spectrum in the UK compared to Ireland. Ofcom's demand survey found that most MNOs were only interested in the 3.4GHz for backhaul in the short to medium term.

For completeness, we look at the degree of substitutability and complementarity from the perspective of FWA service providers. In theory, the other bands considered by ComReg could be attractive to FWA service providers, however, in reality it is unlikely that FWA service providers will be able to acquire spectrum in frequency bands such as 2.3 or 2.6 GHz given that there is substantial demand for that spectrum from MBB and MBB is likely to have the highest value use for the bands under these conditions.

Hence, we consider that the evidence above strongly suggests that 3.6 GHz is not a close substitute or complement to 2.6 GHz nor the other bands considered by ComReg.

9.1.1 Auctioning 3.6 GHz could impose significant costs on the economy once the separate markets for fixed and mobile broadband are considered

For the reasons set out above it is highly unlikely that any tangeable MBB demand for 3.6GHz would arise in the future and hence there could be any measurable economic efficiency benefit from including 3.6 GHz in the auction. In any case, our analysis suggests that the costs are likely to outweigh the benefits, in particular because there is a risk of market failure.

Auctions work well in allocating spectrum between different uses when the markets relevant to the auction are well functioning and the potential to generate wider social value such as social inclusion or national competitiveness is limited.

[47] Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands, DotEcon, September 2014, paragraph 72. http://www.comreg.ie/_fileupload/publications/ComReg14102.pdf

[48] http://stakeholders.ofcom.org.uk/consultations/2.3-3.4-ghz-auction-design/

However, this is not the case in the FBB market. First, there are strong public policy goals attached to fixed broadband and FWA at 3.6 GHz could have a major role to play in helping to achieve them; it provides a cost effective way to meet the targets of the NBP and create NGA competition in Ireland generally, and particularly in rural areas where it will be the primary alternative NGA provider. Second, competition in the fixed broadband market in Ireland is limited, particularly for NGA broadband (although the anomalous use of mobile broadband dongles is evidence of a lack of competition in in basic broadband services as well). Moreover, competition is particularly limited outside the footprint of next generation cable and FTTX where, FWA apart, Eircom is the only potential NGA service provider. FWA could, therefore, have a significant impact on FBB competition, particularly for NGA broadband.

This gives rise to two important implications. First, an auction may not maximise the value for consumers and society because it allocates spectrum to the use with the highest private value, but in this case there is a large imbalance in the public value associated with the two leading candidate uses for the band, FWA and MBB. Therefore, MBB services providers could be successful in an auction even if the overall value to society – the sum of private and public value – were greater for FWA.

Second, we consider that the benefits from auctioning 3.6 GHz now and alongside the other bands are limited. Mobile demand for the band is highly uncertain as we have demonstrated, hence the potential efficiency benefits from satisfying future MBB are intangible and speculative. Existing FWA operators have sufficient spectrum, therefore is unlikely that an auction would lead to a reallocation of spectrum between the existing operators. Finally, there is no evidence of alternative, and as yet unknown, providers are looking to provide FWA services. Indeed Eircom previously held 3.6 GHz spectrum, but has now returned it.

These limited benefits should be balanced against the potential risks either that FWA providers are squeezed out of the band (which lies unused for some time) with the concomitant loss of the benefits from increased FBB competition and meeting the NBP targets or that the uncertainty created delays investment at a critical point in time for network rollout. This would be in line with ComReg's objective of ensuring that that the requirements of all radio services are met appropriately in optimising the use of the spectrum.

We consider that in the light of these costs and the fact that there is likely to be sufficient spectrum for MBB in Ireland for some years (given the existing 2G and 3G spectrum is underutilised and ComReg is proposing to release a large amount of new spectrum for mobile even without 3.6GHz), it would not be appropriate to include 3.6 GHz in the auction. There is no need to auction the spectrum now. As an alternative, ComReg could consider making the spectrum tradable so that the secondary market could resolve any future allocation issues in the unlikely event that 3.6 GHz did become an attractive band for MBB.

We note that In the UK, Ofcom took a similar view and concluded that the intangible and uncertain benefits of MBB use of 3.4 GHz spectrum were unlikely to exceed the proven benefits of the existing FWA use of the spectrum.

Minimum pricing proposals

Without prejudice to the above, we would also like to comment on ComReg's proposal to set a minimum price for 3.6 GHz in the auction based on 2.6 GHz. We believe that ComReg's concerns over

hoarding and its minimum price proposals illustrate the weakness of the argument for including 3.6GHz in the auction. In our view ComReg is proposing a solution to a problem of its own making (from seeking to include 3.6 GHz when it is not confident that MBB providers will need the spectrum or will bid according to its true economic value).

Moreover, the proposal to set a minimum price for 3.6 GHz could have serious unintended consequences, which further weakens the justification for auction. Existing users could be priced out of the band and, there is a real risk that the spectrum could be left unsold given that by ComReg's own admission, MBB is likely to have enough spectrum for several years and even in the longer term MBB demand for 3.6 GHz is uncertain.

ComReg could subsequently hold another auction if 3.6 GHz were unsold, but the delay would further disrupt Imagine's plans for investment in deploying NGA networks. It could also give Eircom an early mover advantage and set back competition in the FBB market and undermine the achievement of the NBP.

We believe that ComReg should first reconsider whether to include 3.6 GHz in the auction at all since it's minimum price proposals betray its lack of confidence in MBB demand for the band. If ComReg were still minded to include the band in the auction, it must reconsider whether 2.6 GHz is an appropriate benchmark for setting a minimum price for 3.6 GHz. The approach in Ofcom's recent Consultation[49] on auctioning the 2.3 and 3.4GHz bands in the UK supports our case. Ofcom is proposing a reserve price for 3.6 GHz spectrum which is 20-40% of its estimate of the value of 2.6 GHz. Moreover, with less 3.6 GHz spectrum available for auction in the UK than in Ireland (roughly half as much), if anything we would expect the value of 3.6 GHz to be higher in the UK, all other things being equal. The higher amount of spectrum required to deliver NGA services would also dictate a lower cost or there would be a further risk of price distortion in the fixed market.

9.2 ComReg's previous re-auction of 900 and 1800 does not create a precedent for 3.6 GHz

ComReg noted in the Consultation the benefits of regulatory consistency with the 2012 multiband auction. In that auction, the existing 900 MHz and 1800 MHz, whose initial licence terms were near to expiry, were included alongside other spectrum in the multiband auction. However, the underlying situations are different in a number of important ways. As a result, consistency with the 2012 multiband auction does not imply that 3.6GHz should be included in the current spectrum award licences simply because the licences are due to expire shortly in 2017.

First, the extent to which existing and new spectrum bands were substitutes was significantly different. We have already shown that 3.6 GHz is not a close substitute for 2.6 GHz spectrum and the other bands considered in the current Consultation. In contrast, the existing spectrum at 900 MHz and 1800 MHz was a close substitute for the new 800 MHz spectrum in the 2012 Multiband auction due to their similar propagation characteristics and the fact that a full ecosystem for 4G mobile services of standardised network and terminal devices was already well under development for the new and existing bands. This

[49] http://stakeholders.ofcom.org.uk/consultations/2.3-3.4-ghz-auction-design/

provided a strong economic rationale for including 900 and 1800 MHz in the 2012 auction which is absent in the case of 3.6 GHz.

Second, at the time of the Multiband auction, ComReg was also proposing to liberalise 900 and 1800 MHz spectrum. Hence there was an argument for auctioning the spectrum because new rights were effectively being granted due to liberalisation. In addition, liberalisation raised competition issues and re-auctioning the spectrum was appropriate method to addressing them. In contrast, such concerns do not apply to 3.6 GHz.

Third, the level of excess demand for existing spectrum is also different. ComReg has already concluded that current MBB demand for 3.6 GHz is low and, in our view, while there is demand to use 3.6 GHz for FWA (and more spectrum may be necessary in future to remain competitive against fixed NGA services), demand is unlikely to exceed the available supply in the band. We note that ComReg did not provided any evidence to suggest the contrary.

In contrast, in the 2012 Multiband auction it was generally acknowledged that the supply of low frequency spectrum in particular was scarce hence the case for including 900 was correspondingly stronger. Moreover, there was an asymmetry in the distribution of spectrum between the 3 GSM operators and the UMTS operator, hence there was a greater potential for alternative distributions of the spectrum to increase efficiency than in the 3.6 GHz band.

The case was more complicated for 1800 MHz because much of the band was unused at the time (2x26.4 vs. 2x43.2 MHz in use). ComReg did consider excluding 1800 MHz from the multiband award because the demand may not have exceeded supply in the band. However, in the end 1800 MHz was included on efficiency grounds and its impact for new entrants and all spectrum will be available for use from 2015.

Moreover, in addition to excluding 3.6 GHz from the multiband auction, this suggests that there is no justification for a separate auction of 3.6 GHz. This is because ComReg's key rationale for auctioning spectrum, given its duties and objectives, is to optimise the use of spectrum by putting it in the hands of those who value it the most. Hence, as it is unlikely that there will be excess demand, there is little justification to auction the spectrum either separately or as part of a wider auction. Further, unlike the 2.3 and 2.6 GHz spectrum, 3.6 GHz is brownfield spectrum. ComReg has not provided any evidence to suggest that other users are likely to make more efficient use of the spectrum than the existing FWA service providers.

10 Summary

ComReg is consulting on a process considering releasing spectrum allocated with Mobile use at 700MHz, 1.4, 2.3 and 3.6GHz in parallel with the plan to release the 2.6GHz band. These bands are all 3GPP IMT designated bands. In this report we summarise reasons why Imagine believes that including the 3.6GHz band as part of this award process would not be beneficial for Ireland or consistent with ComReg's responsibilities and could jeopardise DCENR's ability to deliver the NPB to satisfy Ireland's response to the European Digital Agenda.

ComReg has duties in relation to the regulation of the electronic communications market, and spectrum management, which are relevant to the issue of whether 3.6 GHz should be included in the auction. Key amongst these are:

- Efficient management and use of the spectrum - optimising the use of spectrum for economic benefit, including balancing narrow economic efficiency goals with public policy requirements and the potential wider benefits to society;
- Promotion of competition – including promotion of competition in multiple markets, recognising that distinctions between markets and services of mobile broadband and fixed broadband markets;
- Promoting the interest of users in the Community - includes the objective of encouraging access to the internet at reasonable cost to (all) users, and achieving national broadband targets.

In May 2010, the EU established a Digital Agenda for Europe with the aim of establishing "sustainable economic and social benefits from a digital single market based on fast and ultrafast internet and interoperable communications". Ireland's National Broadband Plan sets to surpass the minimum European levels of performance and has a target to:

- Provide download speeds of 70Mbps with a minimum rate of 40Mbps generally available and 30Mbps in harder to reach rural areas.

International comparisons of broadband services show that Ireland is lagging behind much of Europe in the coverage and the uptake of broadband services and the prices are higher. Ireland is significantly below the EU average for household penetration of basic broadband. Furthermore, the gap widened between 2009 and 2013. Ireland is ranked below the EU average for a residential basket of fixed broadband prices taking all speeds at 15th place for speeds above 10 Mbps and 19th place for broadband in general. In the very recent past, Next Generation Access has grown quickly in some areas served by cable, or NGA fibre services. It is not economically efficient or likely in the time available for these wireline technologies to serve 100% of Ireland's population – particularly when nearly 40% of Ireland's population are in rural environments. NGA FWA technology can be used to cost-effectively provide competition with cable and fibre, and meet the needs of serving those parts of the population that are 'hard to reach'.

ComReg has already expressed concern at mobile competition in Ireland following the acquisition of O2 by Three, which reduced the number of MNOs in Ireland from four to three. This award proposes to increase the spectrum available for mobile use in Ireland by a factor of nearly 3 (i.e. to release nearly twice as much as is currently available for use in Ireland). Some of this spectrum is in bands that are not well suited to mobile use or do not have devices generally available to support wide area mobile network deployment. Releasing this spectrum in one 'big bang' will not lead to economically efficient outcomes and ComReg's own consultants questioned the demand for 3.6GHz spectrum. ComReg's key rationale for auctioning spectrum, given its duties and objectives, is to optimise the use of spectrum by putting it in the hands of those who value it the most. Hence, as it is unlikely that there will be excess demand, there is little justification to auction the spectrum either separately or as part of a wider auction. Further, unlike the 2.3 and 2.6 GHz spectrum, 3.6 GHz is brownfield spectrum. ComReg has not provided any evidence to suggest that other users are likely to make more efficient use of the spectrum

than the existing FWA service providers. Hence, while it is highly uncertain what benefit auctioning 3.6GHz will bring, it is sure to delay investment in FWA to provide much needed NGA services.

Spectrum at 3.6GHz is well suited to helping to provide a fixed NGA network. This is a globally harmonised band with the global economies of scale to provide cost effective and high performing communications equipment. This band is not, however, well suited to provide Mobile Coverage owing to propagation issues with providing wide-area mobile coverage at 3.6GHz – these drawbacks do not apply when the spectrum is used to provide point to point links to provide Fixed Wireless Access. Despite this, ComReg seeks to include this 3.6GHz band in the award process aimed at releasing more spectrum for mobile use. Imagine believes that including the 3.6GHz band as part of this award process would not be beneficial for Ireland or consistent with ComReg's responsibilities and could jeopardise DCENR's ability to deliver the Ireland National Broadband Plan.

The UK communications regulator Ofcom is also seeking to release 3.6GHz spectrum – and has a Fixed Wireless Access operator providing services. Ofcom analysed the opportunities for using this 3.6GHz band and has arrived at different conclusions to those being proposed by ComReg. Ofcom has found that 3.6GHz band is a not a perfect substitute for 2.3 or 2.6GHz bands – a key argument for not including this band as part of the same auction process in Ireland. Recognising that an auction can create uncertainty in securing access to spectrum, and that certainty was critical to FWA operators for their investment decisions. Ofcom granted existing users of 3.6GHz spectrum an indefinite right to use their existing licences.

It is noted that the position in Ireland would strengthen all of these UK arguments. The NGA services to be provided by Imagine, the impact on infrastructure competition, the NBP and derived consumer benefit far exceed that envisaged by UK Broadband in the UK.

As ComReg correctly identifies, 3.6 GHz is 'brownfield' spectrum, containing existing customers, networks and investment the development and future of which are all now threatened by this consultation. *The consultation has created significant uncertainty in relation to the future viability of "existing" operators using 3.6 frequencies and undermining substantial current investment plans. There is a significant risk that this investment interest and opportunity will be lost. We therefore strongly recommend that ComReg Firstly and immediately issues a clear statement to clarify ComReg's intentions that existing 3.6 operators will be facilitated and retain sufficient spectrum to deliver the services that they provide and secure investment for planned deployments.*

Secondly ensure that the allocated 3.6 GHz is available on a licenced nationwide basis for an indefinite term. This has precedent in Ofcom's decision in the UK, is in Ireland's interest and is consistent with ComReg's duties. Further, we urge ComReg to make this decision urgently to avoid further uncertainty. Ofcom made the equivalent decision within three months and we believe this is a realistic timescale for ComReg to come to the same conclusion.

6. Ireland Offline: submission entitled "2.6 GHz Spectrum Consultation", received 18 November 2014

irelandoffline

2.6 GHz Spectrum Consultation

Submission by: IrelandOffline

Scope of Submission

ComReg has written that this consultation '*is guided, in principle, by the approach taken to identifying appropriate licence conditions under the MBSA [Multi-Band Spectrum Award] process and the rationale for that approach*'.

We note the preliminary views of ComReg with regard to allocation in ComReg 14/101 but given the above we think it is appropriate to look back at the approach and licence conditions that emerged from the MBSA in the light of further information and recent developments.

Consultants

The development of the coverage condition in the MBSA

At first DotEcon advised using geographic coverage[1]. Later DotEcon became ambivalent as between population and geographic[2], then DotEcon settled on geographic coverage[3], then it was back to population coverage[4] and finally DotEcon asserted that the level of coverage was not important[5].

Conflict of Interest

We note DotEcon's role as advisor to ComReg on methods of allocation. We note also that DotEcon is supplier of auction software. DotEcon's advice in relation to allocation methods cannot therefore be seen as independent.

At a minimum, in the interests of transparency, ComReg should publish a breakdown of all consultancy and auction costs relating to the MBSA and the anticipated costs under those headings in this allocation. In any case it is not possible to evaluate the allocation options without estimating their respective costs.

ComReg on DotEcon analysis

"Furthermore, ComReg relied on independent expert advice from its economic and technical advisors in arriving at the above licence condition [70% population coverage]." - ComReg 14/101 para. 7.9

In light of the continuing confusion over coverage methodology (see below) we question whether ComReg should rely on advice from DotEcon on Irish demographics, the appropriate type of spatial data to use in formulating coverage conditions, the coverage conditions themselves, or the appropriate way to measure compliance with those conditions.
It would seem inadequate for ComReg to claim that it was relying on expert technical advice if that advice were shown to have been flawed or unduly changeable..

Coverage

Towns and Townlands.

It was pointed out to ComReg that it had been confusing the terms 'towns' and 'townlands', that they have very different meanings in an Irish context and that ComReg was using them interchangeably. In ComReg 12/25 ComReg settled (incorrectly) on 'townlands'.

Consistent terminology has been used in this document in relation to 'townlands' and '70% population' obligation. ComReg 12/25 para.5.169

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[1] "Ideally, these obligations would be expressed in terms of geographical coverage, rather than population coverage, to give better incentives for operators to provide coverage where it is most valued." - ComReg 09/99 para. 48

[2] "We noted that where an operator rolls out its network with a strict priority given to higher population density areas, both approaches are effectively equivalent." - ComReg 11/58 para. 428
See also Appendix 1 - Population vs Area using CSO small areas data.

[3] "Nevertheless, despite the similarities between the two approaches we set out the following good reasons to favour a geographic, rather than population based, obligation: " - ComReg 11/58 para. 429

[4] this coverage level be set at the level of area coverage sufficient to serve 50-70% of the population. - ComReg 11/58 para. 434

[5] In addition, we considered that the precise level of coverage is not especially critical, as a wide range of alternative levels would probably equally well achieve the objectives of ensuring that 'cherry picking' of solely high-density urban areas does not occur, without enforcing inefficient duplication of rural networks. - ComReg 12/24

In document 12/25A , paragraphs A11.33 - A11.38 continue to use the terms interchangeably. A further difficulty was raised by referring to 'inhabitants' in ComReg 10/71 but to 'inhabited houses' more recently.

Lack of transparency

The issue re-occurs in this consultation also (ComReg14/101 para. 7.8). ComReg's continuing use of townland data (if that is what it is actually using) is hard to understand as the boundary data is corrupted due to overbuilding. Moreover there are alternatives such as 'electoral divisions' or 'small areas'[6] which are both supported with free CSO GIS files for further analysis and are consistent with Eurostat. In contrast, 'townland' boundary information is not readily available. OSI will sell it of course; the price is €18,213.93 . In the circumstances the use of this data disables a transparent process.

MBSA area coverage condition of 0.36%

Either way, the use of towns/townlands can be no more than illustrative as the licences themselves do not mention them. The active coverage condition from the MBSA is 35% of population. And it can be seen using CSO 'small areas' data that the effective GSM coverage obligation has declined from 92% to 0.36%.

Comparison of methodologies

Description	Status	%age area
Vodafone GSM licence	Expired	92%
H3GI 3g Licence - 85% Population coverage	Active	31%
All townlands with 50 or more occupied houses* (ComReg 14/101 para 7.8)	Illustrative	9.3%
Population coverage of 70% (MBSA for new entrants - see Appendix 1)	N/A	6.6%
Population coverage of 35% (MBSA for existing operators - see Appendix 1)	**Active**	**0.36%**

*Specific townlands data query supplied on request from CSO[7]

Roll-back

ComReg continues assert that roll-back will not occur. Those arguments are dealt with in Appendix 2

Measurement of Coverage

Drive test methodology

At the time of the MBSA, ComReg's drive-test methodology included 2,743Kms of National primary roads. While the drve-test might include some radial routes from urban centres and joining urban centres they cannot purport to give an accurate or even worthwhile measure of whether licence obligations are being met. ComReg has supplied no analysis of how measuring coverage on roads can reliably indicate population coverage.

Measurement of outdoor coverage

IrelandOffline is of the view that it is incoherent to set coverage conditions for population coverage and then measure it by means of outdoor quality.

DotEcon has previously defended outdoor measurement as follows

1. Measurement indoors would be too difficult.
2. Competition for urban users with laptops would cause 900 MHz spectrum to be used in urban areas.

[6] CSO 'Small Areas' are a subdivision of 'Electoral Divisions' which are used by Eurostat and referred to as LAU 2

[7] 6587 square kilometres. (source CSO)

3. ‘Smart repeaters’ and femtocells were likely to be used indoors.
4. ComReg would require the field strength to be of an appropriate level to insure indoor coverage.

We would question the seriousness of any of the above and to what extent they had happened.

Rural Consumers and ComReg

ComReg’s interaction with consumer concerns is limited to using competition as a proxy for consumer benefit and ignoring the fundamental cost of lack or loss of access.

“the assessment of the impact on consumers draws substantially upon the assessment carried out in respect of the impact on competition.” - ComReg 14/100 para. 3.69
“ComReg also notes that, in achieving its objectives, its ultimate aim is to choose regulatory measures which maximise the benefits for consumers in terms of price, choice and quality. “ - ComReg 14/101 para 3.83

Interactions with consumer representatives are rare; two relevant events are recorded below.

Consumer Panel - June 2012
It was noted during the MBSA consultation that ComReg’s Consumer Panel had offered no public view on the effects of a very low coverage obligation.

“The lack of input from consumers or consumer groups [including ComReg‘s Consumer Advisory Panel], as perceived by this respondent, is outside of ComReg‘s control. “

It later transpired from a fuller inspection of the minutes of Consumer Panel meetings that ComReg had never put the matter of coverage on the agenda. Seemingly, ComReg had never thought that the fundamental question of what proportion of the country would be afforded regulated access might be an item of interest for Consumer Panel members.
Ireland Offline raised this issue with the Consumer Panel in June of 2012 and the Consumer Panel in turn then raised it with Comreg. The response from ComReg, which we have seen, offered no explanation of why the issue had not been raised over the previous three years, but offered the arguments described in Appendix 2 below and additionally stated,

“ComReg’s position on matters that are the subject of decisions and final positions made and reflected in the Decision (Document 12/25) and Information Notice (Document 12/52) is that these are not being re-opened or reconsidered in principle. I trust this adequately addresses the matter raised.”

IrelandOffline notes that ComReg has since ceased publishing the minutes of Consumer Panel meetings.

Oireachtas Joint Committee on Transport and Communications - October 2014
ComReg met the Oireachtas Joint Committee on Transport and Communications on Wed 8th of October 2014 to discuss “Mobile Coverage and High Speed Broadband Availability”

Chairman of ComReg Commissioners, Kevin O’Brien prefaced his responses to public representatives with the assertion that...

“Anecdotal is a good way to describe people's comments on mobile coverage.”

Deputies Colreavey, Dooley, Fleming, Griffin, Harrington, McEntee, Moynihan, O’Donovan, Senator Coughlan and Chairman O’Mahoney described both their own experience and the public perception of coverage, measurement, and enforcement of mobile and broadband services. Extracts are below.

Deputy Helen McEntee,
" I spent most of the day in my car if I am not here. I do not know how many times I have almost thrown my phone out the window. I have a hands-free kit and everything is legal and above board. The main stakeholders, namely, O2, Vodafone and Meteor, all claim to have 99% population coverage. Perhaps this is clever use of language but it is false advertising because more than 50% of the population are in the top five or six cities. What the companies should state is what percentage of geographic coverage they have. A person who signs up to a contract thinks they will have coverage everywhere they go but they do not. The

regulator needs to make this clear. What are the requirements laid down for the companies? Evidence-based measures were mentioned. What measures are taken into account? Will ComReg consider asking the companies to state their geographic coverage?
I will also pick up on the drive tests. Where are these tests carried out? Are they on main roads, motorways or regional local roads? I drop calls all the time, and not just on small roads. There is a large road network in Meath and many people are sick of listening to us going on about it. If I leave my office in Kells to go to Dublin on the M3, which is a relatively new motorway, phone calls may drop five or six times during the journey. There are 20,000 people using that motorway every day, so that should not happen."
"*What about coverage of the population? When most people see 99% population coverage, they would equate it to coverage of 99% of the country. It is a misleading term as it does not relate to geography. Much of the population is in cities and I might make the same assumption about population coverage.*"

Deputy Patrick O'Donovan,
"*Both organisations [ComReg and DCENR] have successfully managed to let the operators off the hook, particularly regarding rural broadband, by focusing on population rather than an area.*"

Deputy Brendan Griffin
I reiterate what I am hearing from my constituents. When they are not happy with the service from their provider they go to ComReg, but many of them are very unhappy with ComReg's service. They believe they are not getting adequate responses, and in some cases nothing happens. I am not exaggerating in that regard. That is what I hear from people across my constituency including in Templemore recently, Dingle, Camp and all parts of Kerry. I assume it is the same for other members also. There has to be a serious improvement in the level of response. There is no point in having a regulator unless something happens, and consumers are very frustrated with the responses they are getting from ComReg. That service has to improve. I emphasise that not only must there be greater acknowledgement of the problems, solutions have to be provided for people.

Senator Eamonn Coghlan,
"*I live on the west side, just outside the Phoenix Park, and there are days when I have to go outside just to answer my mobile phone, whereas my son is able to answer his phone in the house because he uses a different operator.*"

Deputy Tom Fleming
"*There is terrible frustration about mobile phone service provision. In rural County Kerry, I travel a huge constituency, occasionally doing clinics, etc. As part of our work, naturally, people are trying to contact us throughout the day. One must often try to explain to them that coverage is bad in a particular area so the call may break down shortly, and that is what inevitably happens.*"

Deputy Timmy Dooley
"*I was one of the people who was anxious to see a presentation because there is a crisis in our communications systems across the State. This includes mobile broadband and mobile telephony through to fixed-line broadband. While the witnesses have set out their stall and the Department has set out its stall on the difficulty of extending broadband to rural areas, I am not convinced by anything I have heard that it will solve the difficulties.*"
"*With regard to mobile broadband, does ComReg think the way the State sold access to the radio frequency spectrum acted as a disincentive to companies to achieve the broadest geographical cover? Deputy O'Donovan was very quick to try to suggest that in a previous era the then Government's sale of Eircom had an impact on the roll-out of broadband and the fixed-line business. I would accept that because of the large price paid by the company which bought it. Have we learned nothing from the decisions taken then? We are still selling spectrum for 4G, tempting and all as it might be to take in close to €800 million, but is that effectively spancelling the people who purchase these licences in any attempt to give the greatest geographical spread? Would we be better, in selling spectrum, to demand 100% geographical cover in return for the licence to operate rather than eliminating a portion of the geographical area, concentrating on population and taking a once-off windfall payment which, sadly, will get spent? We will then have large tracts of rural Ireland with no access to mobile broadband and poor mobile phone coverage.*"

Deputy Michael Colreavy

I have been saying for the past couple of years that things are getting better, that there is a plan in place and so forth. At this stage it is a question of credibility in me, the Government and the witnesses [ComReg and DCENR].

Deputy Michael Moynihan,

"*there is a crisis out there*"

Chairman, Deputy John O'Mahoney

There is an acute problem in rural areas as summed up in the members' contributions. Another point made was that the targets should be set based on geography or population density, and that priority should be given as soon as possible to areas not on the radar of the commercial companies that would be interested or could afford to do it.
The other strong point made by all contributors is that the mobile phone coverage has disimproved.

Market

Fifty percent of the market is regulated outside Ireland

The recently published conditions on commitments between H3GI, Meteor, two MVNOs, and DG Competition mean that two out of the three networks must report directly to London-based appointees of Three and the European Commission. Well over half the mobile market is now effectively out of the hands of ComReg. This situation could have been avoided by more enlightened choices in the MBSA - see conclusions.

Market irrational.

The Irish mobile market is extremely small and the main players are subsidiaries of much larger parent entities. Vodafone Ireland's turnover as a percentage of Vodafone group is less than two percent. In the case of H3GI and Hutchison Whampoa[8] group it is less than half of one percent. Meteor is part of the much larger Eircom group which has recently been in examinership. All three operators could therefore be said to be subject to significant international and financial considerations that preclude simple economic assumptions.

Cost of infrastructure competition

Instead of moving to a properly regulated RAN, the three networks have formed into an informal monopoly in physical network infrastructure. H3GI has booked €200M from its relationship with Vodafone alone. Extrapolating for the rest of the industry and making some allowance for write-downs, the net value of network sharing will exceed €500M over the life of the network and could reasonably be in excess of €1Bn.

Unregulated and unsupervised consolidation has meant

1. At least €500M has been lost to consumers or the State or some combination of the two because solely providers have benefited from the cost savings. Further cost savings can be expected to accrue solely to MNOs because of the likely extension of current agreements and the additional benefits of economies of scale in purchasing, shared operating costs and the transfer of 3g onto lower frequencies.

2. The experience of H3GI in acquiring market share through network build-out will have been cautionary to other would-be market entrants. The options for potential new entrants are to either repeat H3GI's experience or to attempt to negotiate entry into the unofficial infrastructure monopoly. It is therefore reasonable to assume that the MNO market is effectively closed to new entrants

3. The EU commission now actively supervises half the Irish market in relation to concentration. It is therefore unlikely that ComReg will be able to apply any remedies without seeking EU approval.

[8] HWP group turnover 2013 $52,940M vs H3GI €180M, Vodafone Ireland turnover 2013 €1018 M vs Vodafone group £44 Bn

The overall result is that barriers to entry are extremely high both in fact and perception and that realistically there will be no bidders for spectrum in the mobile bands outside the existing three providers.

Efficiency

Spectrum Efficiency

DotEcon and ComReg have considered efficiency of spectrum in terms of designing the substitutability, and complementarity of bands, block size, block consolidation, timing, pairing etc.

Of far greater significance is the issue of spectrum sharing. Currently available spectrum is up to 66% redundant due to lack of sharing, with consequent impairment of coverage, reliability and data speeds. ComReg has been on notice of the MNOs willingness to share spectrum for over five years.

ComReg also notes the suggestion to permit spectrum sharing put forward by two respondents. ComReg is of the view that there may be justification to permit sharing when making future licences available in the 900 MHz and 1800 MHz bands, but within the context of existing licences there is insufficient demand at present due to limited availability of wideband systems. ComReg 09/14 para. 5.1.3

ComReg is of the view that there may be justification to consider such options when making future licences available in the 900 MHz and 1800 MHz bands and ComReg will continue its practice of reviewing proposals as matters develop. ComReg 09/14 para 6.2.1.2

Ericsson would urge ComReg to allow for the utmost flexibility in spectrum co- ordination, spectrum swapping and even spectrum sharing in the future license conditions. ComReg 09/14 - Ericsson

As the number of independent mobile network operators is increased, the efficiency of spectrum use (for a given amount of spectrum) decreases due to infrastructure duplication, a reduction in statistical multiplexing and reduced coverage and service quality ComReg 09/14 - Meteor

Vodafone considers that ComReg must therefore make comprehensive provisions for spectrum sharing between the operators if the potential benefits of liberalisation of use of the 900 MHz spectrum band are to be obtained by end users. ComReg 09/14 - Vodafone

Given the size of the Irish market and it's split demographics, the merits of RAN sharing are unarguable. The length of time that ComReg has taken considering the issue is therefore hard to explain. Nor do we accept the argument that it is up to providers to present ComReg with a ready-made plan. IrelandOffline concludes that ComReg has set the revenue effects (SAF/SUF) of contrived spectrum shortage above the obvious benefits to consumers of RAN sharing.

Economic efficiency

The efficiency argument dictates that spectrum should go to whoever values it highest and they in turn derive the highest value from it. In that context, we assume that operators wish to maximise profits and achieve this having regard to both revenues and costs.

On the revenue side,we note that penetration is already well over 100%, that sectoral turnover has been declining consistently since 2007, but that ARPU in Ireland is still above the EU average. The prospects for increased revenues are therefore low. In relation to innovation, the European Commission foresees that "the deployment in rural areas [of 4g] will be limited to a few of the largest towns. "[9]

On the cost side, the possibility of network reduction enables substantial savings and the MBSA has facilitated those savings by reducing regulated coverage of GSM voice from 92% to less than 1% of the national territory and further by allowing 3G networks to be transferred to the 800/900Mhz bands.

[9] http://ec.europa.eu/competition/state_aid/cases/243213/243213_1504550_221_2.pdf

Vilicom estimated that the cost savings from deploying 3G infrastructure at 900MHz relative to 2.1GHz was as much as 35%. As evidenced below, this saving relates to the dramatic reduction in the number of base stations required to reach a high proportion of the Irish population:

IrelandOffline therefore conclude that the economic value estimated by operators in the MBSA related entirely to cost reduction and that consumers would not benefit in terms of network reliability, or coverage. or price. Rural consumers would predictably loose service and gain no benefits.

The disadvantage (cost) to rural consumers of loss of coverage has not been measured. The socio-economic costs of diminished networks and less coverage to the country as a whole have not been measured either[10]. In the circumstances subjective assertions by ComReg or DotEcon about economic efficiency are unsubstantiated. Moreover any provider benefits due to lower network costs will occur outside the state due to substantial foreign ownership of the networks.

Regulated coverage, the EU, State Aid and ComReg.

The Digital Dividend

ComReg has claimed previously that one of its MBSA goals was….

"….in cooperation with the Commission, to promote access to broadband services using the 800MHz band in remote and sparsely populated areas, where appropriate." - ComReg 12/25 para 5.139

As we have seen above ComReg in fact released the 800Mhz band with a 6.5% coverage obligation for new entrants and a 0.36% coverage obligation for existing providers. There were no new entrants, and so the area coverage obligation for the 800Mhz, 900Mhz, and 1800Mhz bands combined stands at 0.36% of the national territory.

Maps

ComReg has on the one hand delegated responsibility for 'not-spots' to the government but has chosen a methodology which it says makes it impossible to identify where they are. ComReg were invited to produce a representative map of where regulated coverage was likely to occur. ComReg responded..

It is not appropriate for ComReg to produce a representative map of its own as ComReg does not set the exact areas which a licensee will cover. Rather, licensees are free to choose their service areas provided the 70% population coverage is met.

…. the European Commission does not agree…

The role of NRAs in designing a pro-competitive State aid measure in support of broadband is particularly important. The NRAs have gained technical knowledge and expertise due to the crucial role assigned to them by sectoral regulation. They are best placed to support public authorities with regard to the State aid schemes and should be consulted when target areas are being identified. [11]

The Department has since spent many hundreds of thousands of euro in an exercise to map basic and NGA broadband in order to deal with the consequences of market and regulatory failure. The Department has no powers to compel participation by operators and less than half of them chose to do so. In designing regulatory options ComReg should do so in a way that makes areas of likely market failure easy to identify.

Regulation before State Aid

The State Aid Guidelines in provision of broadband require that regulatory options be exhausted before State Aid can be contemplated. In that regard it seems likely that ComReg's low coverage conditions and functional waste of the digital dividend would prejudice approval of any anticipated government intervention.

[10] "the assessment of the impact on consumers draws substantially upon the assessment carried out in respect of the impact on competition." - ComReg 14/100 para. 3.69

[11] EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks. para.42

ComReg's independence

ComReg's description of Government interventions.

"Finally, within Ireland, the Rural Broadband Scheme ('RBS') is progressing and it is currently processing the 3700 (approx.) applications which have qualified under the terms of the scheme.[210] The RBS is a follow-on scheme to the National Broadband Scheme ('NBS') and by the end of 2012 it aims to provide broadband to the remaining small percentage of premises that have not been able to procure a broadband service in Ireland.[211] - ComReg 12/25 para. 5.142

and…

ComReg notes that Ireland is different to many other European countries, as in Ireland the availability of broadband to all households has already been addressed via the RBS and NBS. Given this, ComReg believes that a further 'not spot' coverage obligation is not necessary in Ireland. - ComReg 12/25 para.5.151

In fact the Rural Broadband Scheme eventually qualified 509 of the original applicants from a stated target group of 25,000[12]. None of those 509 received material or financial assistance of any kind. While DCENR claims ignorance of the technology solutions adopted, it can be assumed most are expensive satellite options. It is known that all 509 are paying full retail price.

The National Broadband Scheme (NBS) ended in August 2014 with all participants returned to full retail prices. The NBS was acknowledged as stop-gap technology[13] by DCENR and was in any case under-provisioned by a factor of 1:20. Moreover the European Commission foresees closure of NBS mast sites due to consolidation of the Three and O2 networks.[14]

There are no government interventions currently active. Best estimates for the NBP are that it will go to tender in 2016 and will take 4-5 years to deliver, subject to specification and funding. It is advertised to provide broadband at fixed locations. Access technologies and funding have not been announced at the time of writing. DCENR's current position is that non-NGA technologies (including 3g and possibly 4g) will be denied access to NBP backhaul.

ComReg is required by law to be independent in the exercise of its functions[15]. The puffing of demonstrably ineffective or unfunded government schemes does not meet those statutory obligations.

[redacted]

Redacted because of, inter alia, potential concerns under the Defamation Act,

[12] http://ec.europa.eu/eu_law/state_aids/comp-2009/n607-09.pdf para. 8

[13] The take up at its peak was 44,000 from a target group of 235,000 homes and business

[14] "On this basis, the merger in itself did not bring significant additional network quality benefits. The Commission found that the merger would have brought limited efficiencies in relation to broadband access in isolated rural areas of Ireland where Three - currently the beneficiary of the National Broadband Scheme - may have decommissioned some loss-making sites upon expiry of the scheme."

[15] http://www.irishstatutebook.ie/pdf/2002/en.act.2002.0020.pdf Section 11

Conclusions

1. Analysis relating to coverage and demographics remains confused, archaic and incoherent.
2. Consultants DotEcon were and are conflicted by their dual role as advisors on allocation and suppliers of auction software and services.
3. The coverage obligation of the Multi-Band Spectrum Award is 0.36% of the National Territory.
4. ComReg's refutations of roll-back are unlikely under all headings. (see Appendix 2)
5. ComReg has been allocating mobile spectrum in a particularly inefficient way causing systemic redundancy of 66%, with consequent impairment of service reliability and average data speeds.
6. ComReg's methodology for measurement of coverage (drive-test, outdoor) is unfit for purpose and incompatible with the methodology of its licence condition. It signals to operators that coverage will not be policed because the methodology means it cannot be policed.
7. ComReg's indifference to random network sharing and consolidation has signaled to operators that licence conditions concerning the independence of their physical networks will not be policed.
8. Multiple unsupervised network sharing agreements have raised additional barriers to entry and thereby harmed competition.
9. Efficient allocation arguments are misplaced in the Irish market due to size, ownership structure, irrationality of the market, and demographics.
10. Overestimation of previous Government schemes by Comreg have increased digital divide and prejudiced State Aid approval of the NBP.
11. In light of conclusions 3,4,5,6, and 7 above, it is probable that ComReg was pursuing a singular revenue maximisation strategy during the MBSA.
12. The "*approach taken to identifying appropriate licence conditions under the MBSA process and the rationale for that approach*" has been damaging to physical infrastructure deployment, competition, spectrum efficiency, costs, reliability of service, quality of service, and most importantly coverage.

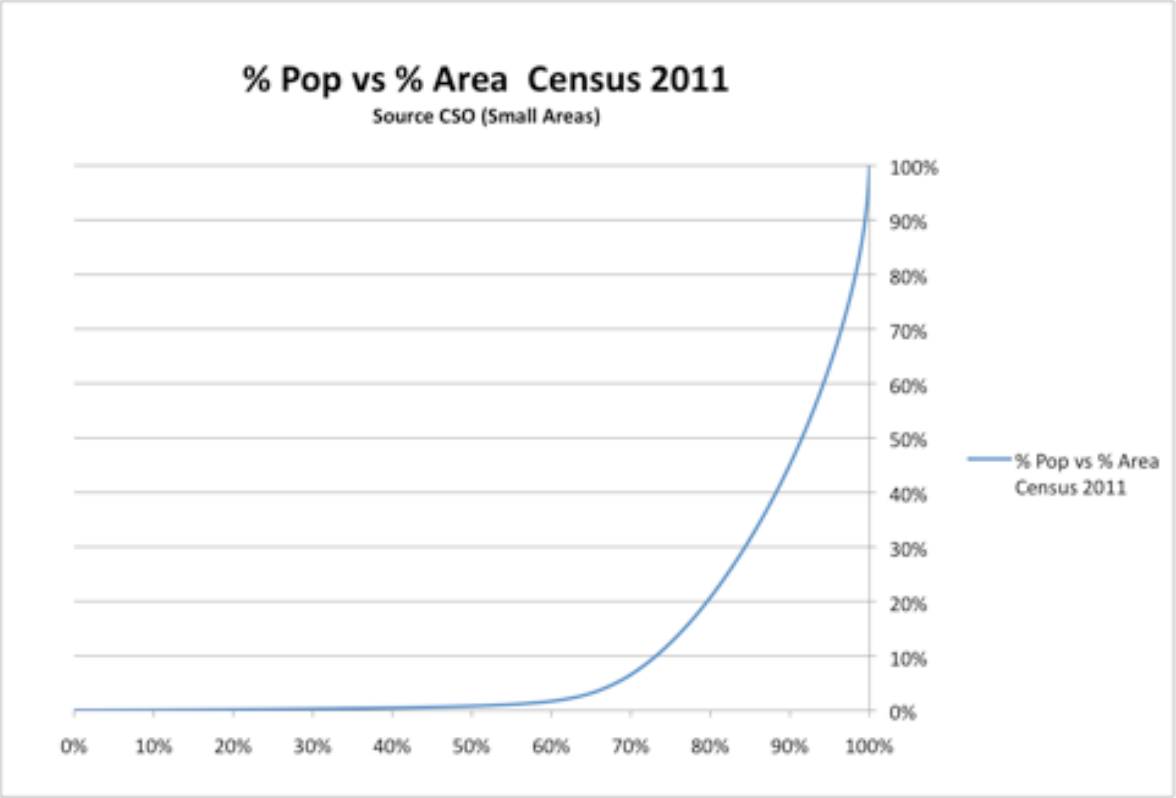
Recommendations

We recommend..

1. That ComReg publish all correspondence with the Oireachtas Communications Committee and its members since 1st January 2013.
2. That ComReg conduct the rest of the consultation with modern uncorrupted spatial data that is accessible to the public.
3. That ComReg resolve the conflict of interest between DotEcon in its role as consultant to the process while also being a potential supplier of auction software and services.
4. That ComReg publish a methodology to quantify the economic cost experienced by citizens who are currently excluded from coverage.
5. That ComReg seek independent assistance to assess the full socio-economic cost of partial coverage in the mobile bands.
6. That ComReg develop a framework for single wholesale RAN sharing in 2g, 3g and 4g technologies within 6 months so as to improve network reliability, reduce spectrum inefficiency, increase data speeds and reduce costs.
7. That ComReg develop a framework for a single mast infrastructure, including ownership and SMP status within six months, so as to reduce the barriers to entry, increase retail competition at MVNO level, complete and ensure national coverage, and lower costs.
8. That ComReg develop a framework for rescinding and reissuing active GSM, 3g and MBSA spectrum in preparation for single wholesale RANs.
9. That ComReg adopt area coverage in its RAN licence conditions.
10. That ComReg adopt a coverage measurement methodology that is compatible with the licence coverage conditions. (see 9 above)
11. That ComReg introduces meaningful[16] coverage measurement and publishes it to the fullest extent possible.
12. That ComReg act independently in its assessment of government schemes in terms of their capability, coverage and likely deployment schedule.

[16] Plans to drive-test national secondary roads do not add a meaningful improvement.

Appendix 1


% Pop vs % Area Census 2011
Source CSO (Small Areas)
100%
90%
80%
70%
60%
50%
40%
30%
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10%
0%
0%
10%
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30%
40%
50%
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80%
90%
100%
% Pop vs % Area Census 2011

Appendix 2

Roll-back - the ComReg Arguments
During the MBSA, ComREg argued against the possibility of roll-back and we review the arguments below.

The Inertia Argument
ComReg argues that because masts and base stations are up, they will stay up.

Vodafone has estimated the cost of ownership of rural mobile masts at close to €30,000 per year. The operating costs are also substantial. Reinstatement bonds of €10,000 per site are required by local authorities with consequent effect on operator cashflow. IrelandOffline is aware of substantial churn in the activity of mobile masts and the EU Commission foresees the closure of 'loss-making' sites in former NBS areas. While new planning guidelines may reduce the future costs of ownership to a limited degree,the terms of existing planning permissions are unchanged and the bulk of the overheads remain.

There are therefore compelling reasons to close existing 'loss making' base stations. Liberalised use licences with trivial coverage obligations allow that to happen and feedback from public representatives confirms the trend.

The Marketing Argument
ComReg argues that the market is competitive in the provision of coverage and that any reduction in coverage would affect market share.

We note that other themes such as churn avoidance, media relations, lifestyle[17], loyalty, emotional response, value for money, cross selling, bundle tailoring, premium device availability, device financing and introductory offers make up the overwhelming proportion of marketing and advertising.

Operators offer trial type introductions and so are willing to concede on coverage at the individual customer level.

Multiple cross-cutting infrastructure sharing and roaming agreements make it difficult for any operator to sustain a claim of superior coverage, or denigrate a competitor, either in perception or fact. In practice they don't - all claim 99% population voice coverage.

IrelandOffline notes that the EU Commission did not assess 'coverage' to be part of H3GI's competitive strategy.

"Three's competitive strategy appears to be mainly focused on a three-prong strategy, namely (i) unique data offers including All You Can Eat ('AYCE') data, (ii) attractive or unlimited minutes and text bundle allowances, and (iii) market-leading/free device pricing and competitive tariff plans."- EU Commission decision

The Past Behaviour argument.
ComReg argues that operators have exceeded their coverage obligations in the past[18] and therefore can be expected to exceed them in the future.

It is not clear how this assertion has been justified in quantitative terms or by any meaningful release of statistics. Measurement to date has seemingly been carried out by drive-tests. We have dealt with drive-tests above but in our view they are not fit for purpose and do not have public confidence[19].

The highest coverage obligation that will obtain from 1st Jan 2016 is the 85% population condition attaching to H3GI's 3g licence which converts to just 31% area coverage[20]. IrelandOffline notes that having obtained substantial mixed spectrum in the 'liberalised use' MBSA that it would be open to H3GI and others to return their 3g licences and meet only the 70% population obligation under the MBSA.

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[17] (e.g. TV tagline "Vodafone sponsors hair and make-up")

[18] Consultants DotEcon also make this claim in ComReg 11/58 para. 424; similarly without substantiation.

[19] See 'Oireachtas Joint Committee on Transport and Communications' p5

[20] See Appendix 1

It should be an obvious point, but if ComReg believed that specific coverage obligations would in fact be exceeded, then formalising those expectations in higher coverage conditions would not have predjudiced the interests of providers and would have reassured consumers.

IrelandOffline believes that all three arguments presented by ComReg are weak and unsubstantiated. It seems likely that their only purpose is to attempt to justify the exceptionally low coverage condition in the licence.

7. Irish Radio Transmitters Society: submission entitled "Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated October 2014

Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

Document 14/101

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ComReg Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

Document 14/101

1. Introduction

The Irish Radio Transmitters Society (IRTS) welcomes the opportunity provided by the Commission for Communications Regulation (ComReg) to comment on the recently published Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands, document 14/101.

The IRTS was founded in 1932. It is a non profit organisation and is the national society that represents licensed amateur radio operators in Ireland in respect of governmental 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 the regional telecommunication organisation for Europe, the European Conference of Postal and Telecommunications administrations (CEPT), which addresses technical telecommunications regulatory matters, often under mandate from the European Commission.

2. Amateur Service

Amateur radio internationally is part of the leisure category or 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." Further details concerning the amateur service in Ireland were contained in the IRTS response to 09/49, Part1 – paragraph2.

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

3. The frequency bands under consideration

IRTS understands that the purpose of this consultation is principally to consult on the award of spectrum rights in Ireland for the use of radio spectrum in the band 2 500 – 2 690 MHz to provide International Mobile Telecommunications (IMT) and IMT-Advanced services, including mobile-broadband. IRTS further understands that a secondary consideration is to consider the award of spectrum rights in other frequency bands already identified in Article 5 of the ITU Radio Regulations, or likely to be identified for this purpose at the ITU World Radiocommunication Conference (WRC) in 2015.

In paragraph 3.71 of the consultation ComReg considers that the 700 MHz, 1.4 GHz, 2.3 GHz and 3.6 GHz bands could reasonably be considered for inclusion in an award process for 2.6 GHz spectrum.

Spectrum within two of the bands under consideration are of interest to the amateur service namely 2 300 – 2 400 MHz in which the amateur service has secondary status in Ireland in the Radio Frequency Plan and the band 3 400 – 3 410 MHz in which the amateur service has secondary status in CEPT's European Common Allocation table (ECA) – ERC Report 25. These two bands are addressed in more detail in subsequent paragraphs.

4. Status of Secondary Frequency Allocations

ComReg in its 6 October 2009 document 09/76, the response to its consultation entitled - Release of Spectrum in the 2 300 – 2 400 MHz band stated , *"While ComReg notes the basis on which four respondents oppose the release of 2 300 – 2 400 MHz spectrum, ComReg believes that the social, economic and potentially educational value of the spectrum is significant. ComReg must point out that the amateur service access to the band has not changed, and will continue to be available for amateur use on a secondary (non-interference, non-protected) basis"*. Further in the final paragraph of paragraph 4.2.6.2 on page 18 of ComReg Document 09/76 the following is stated, *"Another respondent requested that ComReg protect 2 395 – 2 400 MHz or alternatively allow experimenters access to spectrum in the 3.5 GHz band. ComReg respects the spectrum usage of experimenters and amateurs, however amateur usage is allowed on a non-interference, non-protected basis. With this in mind, ComReg cannot consider offering the protection requested for 2 395 – 2 400 MHz spectrum"*. The issue relating to 3.5 GHz is discussed in paragraph 7 below.

IRTS was somewhat surprised at these statements. Now seems an appropriate time to discuss the issue of "non interference, non protected basis".

The ITU Radio Regulations govern the radio regulatory relationship between Member States of the Union and define the regulatory terms employed. The situation may be different within a geographical region such as the 48 CEPT countries where the ECA

provides more details and provides a definition for a band designation, or within Ireland where the Radio Frequency Plan predominates. Concerning the Irish Radio Frequency Plan, text addressing primary and secondary services can be found on page viii) of ComReg doc 13/118.

Since Ireland follows the regulatory concepts outlined in the Radio Regulations regarding primary and secondary services within its national Plan, the definitions (and associated definitions) from the Radio Regulations are reproduced below:

> **5.28** 3) Stations of a secondary service:
> **5.29** *a)* shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;
> **5.30** *b)* cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;
> **5.31** *c)* can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date.

In addition IRTS believes number **15.10** of the Radio Regulations is also relevant in respect of adjacent band interference irrespective of whether it is a primary or secondary service causing the harmful interference:

15.10 § 6 The out-of-band emissions of transmitting stations should not cause harmful interference to services which operate in adjacent bands in accordance with these Regulations and which use receivers in conformity with Nos. **3.3**, **3.11**, **3.12**, **3.13** and relevant ITU-R Recommendations.

Therefore IRTS accepts that amateur stations operate on a non interference, non protected basis in frequency bands allocated to the amateur (and/or amateur-satellite service) service on a secondary basis with respect to primary services allocated the same frequency band as per **5.29** and **5.30**. However this cannot be the case in relation to other secondary services or services which are exempt from licensing, which themselves operate on the basis of non interference and without protection. In such cases IRTS believes **5.31** above is applicable.

As an example IRTS believes that the relationship between stations of the amateur service and stations of the radiolocation service and short range devices in the band 2 300 – 2 450 MHz would be governed by number 5.31 of the Radio Regulations, which is reproduced above.

5. DCENR Consultations

The report of the Working Group on Spectrum Policy published in 2008 by the Department of Communications, Energy & Natural Resources reflects the value of the amateur service, where it stated:

> *"Spectrum reserved for use by amateurs and for science research is vital in helping to ensure an ongoing interest in technology and in furthering our understanding of radio propagation and communications."*

IRTS recently responded to the Department of Communications, Energy and Natural Resources 2014 Consultation on Spectrum Policy Priorities. One question involved current and emerging issues which is pertinent to this ComReg consultation. IRTS responded as follows:

"The principal issue for the amateur service is the constant threat of eviction from frequency bands which become of interest to commercial or governmental sectors. IRTS recognises the burgeoning demand for spectrum to meet the needs of mobile-broadband; however in many cases it may be technically feasible to implement sharing arrangements which protect other primary or co-secondary users. A case in point would be in the range 3 400 – 4 200 MHz which is seen as a likely candidate for mobile broadband and where several operators around the World are implementing LTE systems either by choice or by phasing out WiMax technology.

Amateur use of such spectrum in Ireland is never likely to be excessive or even significant. The 3 400 – 3 410 MHz band has been recognised in Europe as capable of providing spectrum for the amateur service as this small piece of spectrum provides a guard-band between the radiolocation service below 3 400 MHz and the fixed, mobile and fixed-satellite services above 3 400 MHz. Most amateur emissions are narrow-band in nature and this 10 MHz could be utilised without too much difficulty. Similar considerations may apply at other frequencies. The message from IRTS is, please try to find means of sharing spectrum before assuming that band edge frequencies cannot be used by the amateur service.
In summary the IRTS suggests that:

- *Sharing studies should be conducted in the vicinity of band edge frequencies, where spectrum currently having an interest to the amateur service is likely to be transferred to other services e.g. 2 300 MHz, 2 400 MHz, 3 400 MHz and 3 410 MHz. The objective is to ascertain whether sharing is feasible under normal conditions."*

6. Band 2 300 – 2 400 MHz

The band 2 300 – 2 400 MHz is allocated to the fixed and mobile services on a primary basis and to the amateur and radiolocation service on a secondary basis.

The band was first allocated to the Amateur Service in 1947 on an exclusive basis. At subsequent ITU conferences the amateur allocation changed from primary to secondary and is now allocated to the Amateur Service on a secondary basis in all three ITU regions.

The change from primary to secondary status did not impact significantly on amateur activities due to the nature of use by the services with the primary allocation (limited geographic use or limited time use). Consequently to date it has been feasible for the amateur service, operating on a secondary basis, to co-exist effectively with primary fixed and mobile services.

The 2 300 MHz band forms an important part of the overall package of spectrum available to the amateur service. This band is an important start-up band for beginners in microwave operation. Furthermore with the availability of commercial equipment that can be readily adapted for use on the band coupled with the increased availability of components and of excellent kit sets, at a reasonable price, there is increased interest in experimenting with this band.

The operational characteristics of amateur stations operating in the 2 300-2 400 MHz range vary significantly. They can be categorised as:

- Long range weak-signal reception of narrowband terrestrial (e.g. CW, SSB, digimodes) and EME (Earth-Moon-Earth - Moonbounce) operation - notably in the harmonised sub-band 2320-2322 MHz, including propagation beacons;
- Some additional narrowband activity in the 2300-2305 MHz range, including long range EME (Earth-Moon-Earth - Moonbounce) contacts with North America;
- Data, multimedia, and TV repeaters (point-to-point links and area systems) in other parts of the band.

Activity levels vary with propagation conditions and peak when national or international contests, or other activity events, are scheduled.

A change in use by one of the services with a primary allocation (Mobile/Fixed) from a specialist application, where the deployment may be limited in either location or time or both, to one involving the provision of IMT consumer based services operating on a 24/7 basis would generally tend to make the band unusable by services having a secondary allocation unless some mitigation measures are taken.

Licence conditions in some countries which authorise amateur operation already require secondary non-interference operation in the 2.3 GHz band. In practice, the options are typically based on directional antennas, time, frequency and geographic sharing, as well as coordinated assignments by administrations of unattended systems such as propagation beacons or repeaters. The duty cycle of individual amateur transmissions can also be assumed to be quite low and is typically on a listen-before-transmit basis.

Current examples of shared access are based on where amateurs share with other incumbent services such as wireless cameras (PMSE), airborne telemetry and IMT WBB include:

- In the Netherlands where there is significant PMSE usage in the band, a regularly used notification system has been introduced by the administration that restricts amateur transmissions at defined times and locations when PMSE usage needs priority.

- In the United Kingdom where amateurs are required to share on a non-interference basis, Ofcom have recently defined geographic, zones, field strength limits and times of day around certain sites to protect airborne telemetry use, as well as migrating amateurs out of the core 2 350 – 2 390 MHz sub-band which will be made available to WBB (and making a new provision for amateur usage at the 2300-2302 MHz band edge). Amateur users of the 2.3GHz band have are also been requested to register their details with Ofcom to facilitate email notifications.

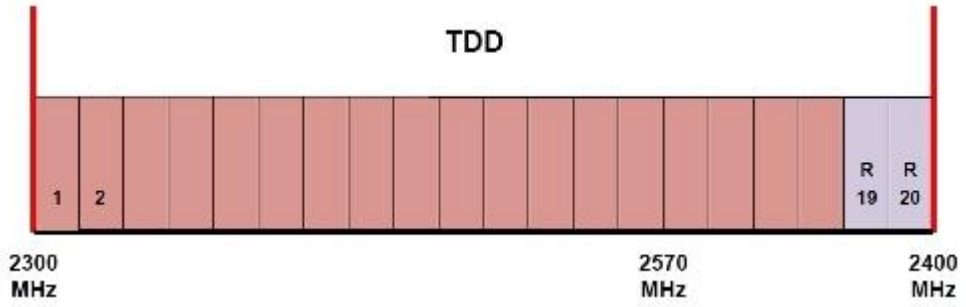

Figure 1 – Proposed arrangement for the band 2 300 – 2 400 MHz[2]

Minimal changes to the preferred ComReg arrangement might ameliorate the situation in Ireland significantly, in a similar manner. It is already acknowledged in the consultation document that a guard-band of at least 5 MHz is required if operators in the same geographical area do not synchronise their transmit and receive TDD timings.

Where cross-border situations arise and more than one jurisdiction is involved there is no guarantee that the amount of spectrum awarded to operators either side of the border will be aligned, further complicating matters. At the 2 400 band edge IMT base stations could in

[2] Please note this diagram has been reproduced from the ComReg Consultation Document. The upper band edge of slot 14 should be listed as 2370 MHz not 2570 MHz as shown.

addition adversely impact the use of the band above 2 400 MHz. In addition handset design may have to incorporate the use of 2 300 – 2 400 MHz and 2 500 – 2 690 MHz for IMT and WBB whilst maintaining the integrity of Bluetooth and WiFi communications in 2 400 – 2 500 MHz, within the same terminal device. It is for this reason that it is believed the United Kingdom is unlikely to introduce TDD IMT WBB to slots 19 and 20 in Figure 1 above.

In a similar manner IRTS believes that for the band edge at 2300 MHz there will be a need to protect services operating below 2 300 MHz and again a guard band of 10 MHz could be appropriate, represented by slots 1 and 2 in Figure 1 above.

As mentioned earlier in this paragraph moon bounce communications takes place in this part of the spectrum between North America and Europe. It is therefore pertinent to mention the situation in the United States. AT&T is currently petitioning the FCC (the US NRA) to permit the introduction of a ubiquitous air-to-ground wireless communications service (WCS) in the 2.3 GHz band. WCS in the United States is assigned the sub-bands 2 305 - 2 320 MHz and 2 345 – 2 360 MHz.

The US IARU Region 2 Member Society, the Amateur Radio Relay League (ARRL) believes such a development will render the secondary amateur allocation status of spectrum above 2 305 MHz to be somewhat difficult. ARRL has therefore invited the FCC to recognize Amateur Radio's "de facto primary status" at 2 300 - 2 305 MHz and to elevate that segment to a national primary allocation for the amateur service. In addition it has requested the FCC to clarify the obligation of WCS licensees in all contexts to protect the adjacent-band Amateur Service operations at 2 300-2 305 MHz from harmful interference. Finally, the ARRL has requested that AT&T provide a complete technical compatibility and interference analysis that would demonstrate compatibility between its proposed service and amateur operations at 2 300-2 305 MHz.

These issues are further addressed in Paragraph 8 of this response.

7. Band 3 400 – 3 410 MHz

In the final paragraph of paragraph 4.2.6.2 on page 18 of ComReg Document 09/76 ComReg addressed the possibility of amateur access to the 3.5 GHz band:

" In relation to the amateur usage of spectrum in the 3.5 GHz band, ComReg may review this as a part of any such consultation which may take place in the future in relation to spectrum in that band."

Also in its May 2011 response to the ComReg Strategy for Managing the Radio Spectrum 2011-2013 set out in ComReg Document 11/28, IRTS stated in respect of the 3.6 GHz band:

"In its response to the consultation on the release of spectrum in the 2300-2400 MHz Band in Document 09/76 of 6 October 2009 in paragraph 4.2.6.2 on page 18 ComReg indicated, that in relation to the amateur usage of spectrum in the 3.5 GHz band, ComReg may review this as part of any consultation which may take place in the future in relation to spectrum in that band. On the basis of the information included in the proposed strategy it seems that any such review will not take place for a number of years. In the meantime the Society requests that ECA Footnote EU17 be implemented and reflected in the Radio Frequency Plan for Ireland and that in addition the segment 3400-3410 MHz be allocated to the amateur service on a secondary basis. The band 3400-3475 MHz is amateur secondary in Northern Ireland and in the UK generally."

It would appear that column 3 of the latest Radio Frequency Plan indicates that the amateur service has been provided with a secondary allocation in the ECA throughout the whole band 3 400 – 3 600 MHz, with no reference to EU17. However EU17 is mentioned later in the document in Annex 2, Part 7 of the Plan which includes the European footnotes in their entirety.

The amateur service is essentially interested in harmonised global allocations and sharing conditions, which will facilitate communications capabilities with link budgets designed to facilitate the reception of emissions having extremely low power flux densities. All allocations to the amateur and amateur-satellite services in the range 1 GHz to 24 GHz are on a secondary basis. This was recognized during the development of the CEPT ECA when it was determined that elevating the status of amateur allocations in the 1 to 24 GHz range was not generally feasible, however key sub-bands of interest to the amateur and amateur-satellite service were recognised in what is now EU17[3] to the ECA. This footnote requests administrations to recognise the amateur service in its assignment policy towards other services. Furthermore, a small allocation of up to 10 MHz in the range at 3400 - 3410 MHz was proposed to align CEPT countries with countries in ITU Region 2 which would in addition take into account the situation existing in two CEPT countries mentioned in number 5.431[4] of the ITU Radio regulations.

In addition, seventeen CEPT administrations have already notified national allocations to the amateur service at 3.4 GHz in the European Communications Office's Frequency Information System (EFIS). The concerned administrations are Albania, Andorra, Austria, Bosnia & Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland,

[3] **EU17** In the sub-bands **3400 - 3410 MHz**, 5660 - 5670 MHz, 10.36 - 10.37 GHz, 10.45 - 10.46 GHz the amateur service operates on a secondary basis. In making assignments to other services, CEPT administrations are requested wherever possible to maintain these sub-bands in such a way as to facilitate the reception of amateur emissions with minimal power flux densities.

4 **5.431** Additional allocation: in Germany, Israel and the United Kingdom, the band **3 400-3 475 MHz** is also allocated to the amateur service on a secondary basis. (WRC-03)

Germany, Netherlands, Norway, Romania, Slovak Republic, Slovenia and the United Kingdom.

Unfortunately ComReg has not so far agreed to a similar arrangement in Ireland. A secondary allocation to the amateur service is therefore suggested in frequency slots 1 and 2 in Figure 2 below. IRTS therefore invites ComReg to reconsider this matter prior to any award process for IMT applications. This matter is addressed further in paragraph 8 below.

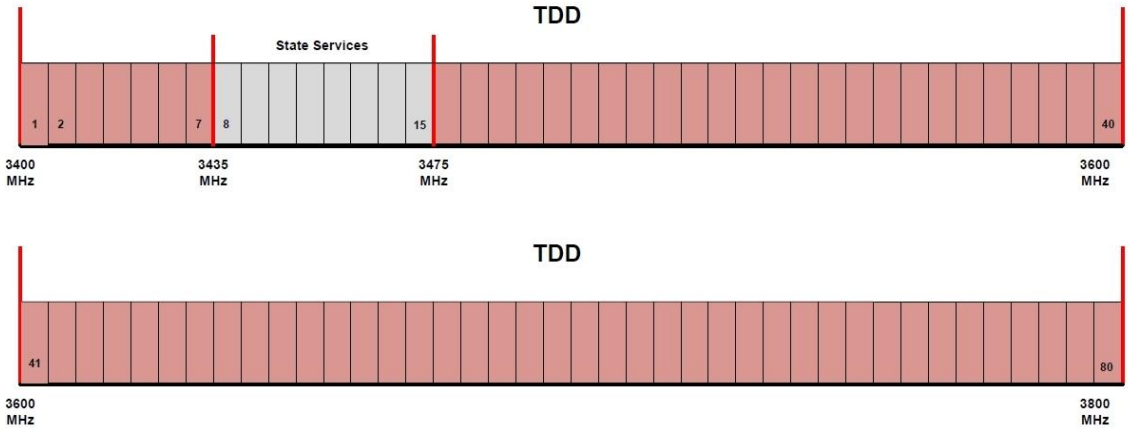

Figure 2 – Proposed arrangement for the band 3 400 – 3 800 MHz

8. Preferred IRTS options for amateur use in the 2.3 and 3.4 GHz bands

Taking account of the foregoing IRTS believes that it would not be unreasonable to introduce 10 MHz guard-bands at the edge of the IMT allocations e.g. 2 300 – 2 310 MHz, 2 390 – 2 400 MHz and 3 400 – 3 410 MHz. Subject to sharing studies IRTS believes that such an arrangement would provide the minimal feasible amount of spectrum for the amateur service to realistically continue in the 2.3 GHz frequency band using narrowband modes and highly selective receivers. It would also permit the adoption of the 3.4 GHz band-slot included in the body of the ECA and referenced in footnote EU17.

As mentioned in the IRTS response to 09/49, one possible way that ComReg could give practical application to the importance of spectrum for the amateur service as outlined in the 2008 DCENR policy paper, would be to designate a part of the 2.3 GHz band as a primary allocation for the amateur service on a national basis, while leaving the amateur service in the remainder of the band 2 300 to 2 450 MHz as a secondary allocation. The IRTS would be willing to discuss this further with ComReg in order to identify the most suitable segment for upgrading to primary on a national basis, though our initial proposal would be for the segment 2 300 to 2 330 MHz or parts thereof.

9. Conclusion

The IRTS would like to extend its thanks to ComReg for the opportunity to respond to this consultation and hopes that the Commission will be favourably disposed to the suggestions outlined in this document. The IRTS remains at the 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.

8. Joint response by Fastcom, Lightnet, permaNET, Ripplecom & WestNet: submission entitled “Joint Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands”, dated November 2014

Fastcom, Lightnet, permaNET, Ripplecom & WestNet

Joint Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

Document 14/101

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Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

Document 14/101

Joint Response

1. Introduction

Fastcom, Lightnet, permaNET, Ripplecom and WestNet (hereafter referred to as the 'Operators') currently provide consumers (business and residential) with broadband services with a focus on rural Ireland. The operators submitting this joint response welcome the opportunity provided by the Commission for Communications Regulation (ComReg) to comment on the recently published Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands, document 14/101.

The Operators have invested considerably in the establishment of fixed wireless networks in the 3.6 GHz band. The Operators combined networks account for connections to more than 23,000 premises, residential and business and provide extensive coverage throughout the State with the exception of Dublin City. The combined networks also provide broadband connections to more than 700 of 4000 schools nationally. They are especially focused on delivering services in rural areas that are economically unattractive to large national ISPs. The Operators companies have a combined workforce of 91.This document therefore focuses on the 3.6 GHz band and the provision of fixed wireless broadband services.

Before addressing the contents of Document 14/101 a brief overview of the five companies has been provided:

1.1 Fastcom

Fastcom was established in 2004 under the National group broadband scheme to deliver services to a number of urban and rural areas in Sligo.

Since 2004 Fastcom's network has grown to cover all of County Sligo and significant parts of Co Leitrim and Donegal. All of Fastcom's fixed wireless services are delivered from commercial transmission sites including ESB Telecoms , Towercom and RTE and various County Councils.

Fastcom services both residential and corporate customers delivering symmetrical speeds of up to 500Mb.

From their Sligo base Fastcom's 15 strong staff support 3000+ customers.

1.2 Lightnet

Lightnet was created out of necessity as a result of the poor availability of quality broadband services in the west of Ireland. Lightnet has developed a high quality network, servicing small towns and rural areas, throughout Galway, Clare and surrounding counties using high capacity point to multi-point links which utilise WiMax and 802.11n technologies.

Lightnet offers an affordable range of wireless connectively speeds with no hidden costs or data caps. It is a locally owned Galway company providing direct and indirect employment to 20 staff.

Some of the biggest challenges facing our delivery of services to rural areas have been the lack of available licensed spectrum. Despite this problem Lightnet continues to grow due largely to an excellent reputation for customer service and an affordable pricing model.

1.3 permaNET

permaNET has been providing predominantly rural customers, both business and residential, with high speed affordable licensed broadband since 2005. permaNET has extensive coverage throughout Kerry and Wexford and also serves large areas of counties Cork, Limerick, Clare, Carlow, Kilkenny and Waterford.

permaNET operates a licensed wireless Point to Multi-Point system to provide broadband connections to 7000 subscribers including a large number of schools. permaNET offers download speeds of up to 20Mbps and is currently rolling out DOCSIS 3.0 technology that will enable the company to increase speeds to up to 50Mbps. In addition to our team in Kerry and Wexford permaNET also operates a call centre at our headquarters in Cork.

1.4 Ripplecom

Ripplecom is a rapidly growing telecommunications operator providing solutions and services via radio and fibre optic networks. Headquartered in Limerick, Ripplecom has a staff compliment of 30 people servicing 6,000 customers.

Ripplecom is one of Ireland's largest suppliers of broadband services to the Department of Educations' primary school sector. In addition to Government contracts, Ripplecom provides wholesale and retail solutions to Corporate, SME and Residential customers across 25 counties.

The company has a focus on engineering excellence and is one of only two telecommunications providers in Ireland that has achieved the prestigious Engineers Ireland CPD Accredited Employer standard. Ripplecom has featured twice in the last three years in the Deloitte & Touche "Fast 50" technology awards.

With a shareholder base including the Irish Farmers Association (IFA) and Farmer Business Developments PLC, Ripplecom is focused on the development, deployment and delivery of high speed Internet solutions to businesses and communities in rural Ireland.

1.5 WestNet

Western Broadband Networks Ltd (trading as WestNet) is an ISP based in Castlebar, Co. Mayo offering fixed wireless broadband services in Mayo, Sligo, Roscommon and Galway. WestNet has worked since 2005 to bring broadband services to rural areas in the west of Ireland and to bridge the digital divide between urban and rural areas.

Our business was founded on the belief that it's good for the economy of our region as a whole, and by extension for the country as a whole, for homes and businesses in rural areas to have access to high-quality, reliable broadband services. In addition to broadband services we provide on-net LAN extension services to business, local authorities, state agencies and connectivity for HEAnet to over 120 national schools within our coverage footprint.

2. History –Regulatory and Technology Issues – 3.6 GHz Specific

Section 2 addresses matters which are often beyond the control of administrations and regulators and individual telecommunications operators.

Such issues generally arise from decisions taken by a major manufacturer or a consortium of network and terminal equipment manufacturers concerning standardisation and product specification. A Trade Association of manufactures or operators might also be involved. Specific issues would include:

- Promotion of a standard or technology in one or more sectors,
- Withdrawal of support for equipment produced to a specific standard
- Development of a specific evolutionary standardisation or technology path
- Abandoning a particular technology or standard in favour of a competing technology
- Equipment specifications which do not address regional spectrum requirements.

The remainder of this Section describes the route towards today's standardisation and technology situation, in particular the developing dominance of a single technology and a single evolutionary path in frequency bands identified by the ITU for International Mobile Telecommunications (IMT) which also cater for systems providing Fixed Wireless Access (FWA).

The technology is the extended third, fourth and subsequent generations of the GSM (Global System for Mobile) standard known as Long Term Evolution (LTE) and LTE Advanced. The point of interest is the demise of WiMax technology for FWA.

Furthermore, since a number of the Operators submitting this document currently provide FWA services based on 3.6 GHz WiMax technology, of which a significant number of connections are to rural customers, major issues are likely to arise in switching to state-of-the-art LTE technology in the current regulatory environment in Ireland.

2.1 ITU WRC 2007 and Assembly

Prior to the ITU WRC 2007 conference, WiMax mobile (802.16e) was accepted as an IMT (3G) mobile technology by the ITU Radio communication Assembly. WiMax proponents featured heavily in the debate at WRC on additional bands for 3G and LTE. The 2.3 and 3.6 GHz bands were proposed inter alia as additional IMT spectrum. With its new recognition as an IMT family member, WiMax mobile thus achieved recognition of its possible right of access to spectrum designated for IMT. In addition, the 2.3 and 3.6 GHz bands are allocated to the fixed service on a primary basis.

Because of the use made of the 3.6 GHz band by the fixed satellite service especially in areas of high rainfall, the band 3.4 - 3.6 GHz did not gain recognition at WRC as a principal IMT designation. It was only identified as a national option by individual countries opting for a mobile allocation in a rather restrictive footnote 5.430A of the ITU Radio Regulations, effective from 17 November 2010. The footnote also identified the allocation for International Mobile Telecommunications (IMT).

2.2 Standards and Spectrum

Prior to WRC-07 the evolutionary path for various mobile/mobility technologies in terms of spectrum was reasonably clear. However rationalisation occurred at several levels. The GSM operators (and former US IS-132 operators) evolved towards W-CDMA at 2.1 GHz leading to LTE at 2.5 - 2.69 GHz. IS95 operators had a defined path to cdmaOne and CDMA2000 through the refarming of 1900 MHz spectrum.

Importantly their trade association (CDMA Development Group – CDG) composed of operators and manufacturers) determined that their future lay with LTE and these two competing technology groups focussed their standardisation activities in 3GPP, of which the European standardisation body ETSI is a predominant member.

In parallel FWA technology was developing with the first WiMax deployments at 3.6 GHz using 802.16d IEEE standards. Presumably for marketing considerations WiMax manufacturing interests determined that a 3G mobile technology standard was needed. The IEEE 802.16e Mobile WiMax standard was therefore developed to substantively challenge existing 3G technology purveyors and was accepted by the ITU as an IMT family member.

Licensed FWA WiMax operators had been steered by regulators towards 2.3 and 3.6 GHz (depending on regional preferences). Following WRC-07 many decided to upgrade to 802.16e, which in addition to base-station handover capabilities, of interest to mobile operators, also offered the FWA operator additional advantages since it was the closest comparable technology to the LTE mobile wireless standard in terms of capability as well as technology. Some operators operating at 2.3 or 3.6 GHz were also permitted to provide mobile services from November 2010.

In the standardisation organisations work on a 4G standard was continuing. In the merged 3GPP activities LTE-Advanced was being developed. In the WiMax camp an attempt to develop a WiMax 4G standard (802.16m) was started. However from a commercial standpoint such equipment is unlikely to be marketed. Instead LTE and LTE Advanced options have been developed with a 3.6 GHz capability. The Chinese company Huawei is heavily engaged in these developments.

These developments will result in the future technology of choice for most FWA operators will be LTE, a mobile technology. However not all FWA operators around the World are generally licensed to provide mobile services, including those in Ireland.

Looking to the future, the first step in LTE Advanced is a technique known as carrier aggregation. It offers very high peak data rates as well as increased data rates for all users in the cell, and can bring higher capacity for bursty applications. Carrier aggregation continues to evolve, supporting more carriers and aggregation across FDD/TDD utilised spectrum.

Provided service and technology neutrality remains a major factor in the provision of spectrum for electronic communication networks (ECN), carrier aggregation and the use of LTE-Advanced technology may offer additional facilities and opportunities to provide broadband to rural communities.

2.3 Europe – CEPT and European Commission

In Europe CEPT and the European Commission have been cooperating to identify spectrum to take account of future mobile broadband requirements. On 21 May 2008 the European Commission published its Decision 2008/411/EC on the harmonisation of the 3.4 to 3.8 GHz bands for Electronic Communication Networks. The Decision required implementation of the band 3.4 to 3.6 GHz within 6 months of publication and implementation for the band 3.6 to 3.8 GHz by 1 January 2012. ComReg consulted on the Decision in document 10/55.

The Operators believe that at that time and indeed now, the absence of mobile services in the band does not mean that the State is non-compliant with the Decision. This opinion is derived from the use of the terminology used in Articles 2.1 and 2.2 that spectrum in the band 3.4 to 3.8 GHz shall be available for terrestrial electronic communications networks. Although Article 3 states that Member States shall allow the use of the band for fixed, nomadic and mobile electronic communications networks. It is believed that if this 400 MHz were to be utilised for fixed and nomadic services the intent of the Decision would be realised.

2.4 Licensing of Electronic Communications Networks

A mobile service is often defined in administrations' licensing documentation in terms of its handoff capabilities to adjacent cells e.g. *"A Mobile telecommunications service enables service across boundaries between different areas of radio coverage with an imperceptible interruption or no interruption of service."*

On the other hand use of a sophisticated mobile technology such as LTE by FWA operators does have attractions. For example under fault conditions a customer might automatically roam onto an adjacent base station. Reconfiguration of the network could also be readily effected. There may also be considerable advantages in being able to utilise USIM technology in FWA network devices, for *inter alia* innovative service offerings.

2.5 Summary

The role of the market and manufacturing industry in the setting of regulatory frameworks cannot be ignored. If major manufacturers of terminal or infrastructure devices determine that they will not support a specific technology or include a particular frequency band in their terminal device, regulators need to consider adjusting their policy accordingly. In this particular case we find that FWA operators utilising the 3.6 GHz band may have few alternatives to LTE and LTE advanced technology for the future provision of services.

However there remain uncertainties in the direction that manufacturing industry will take and other technologies such as WiMax and WiDox may play a role in the provision of FWA for some years to come.

Although technology and service neutrality is a desirable aim it has been shown that convergence can interfere with such objectives. If LTE and other similar technologies become the dominant technology in the mobile and FWA market and if they are to be deployed to maximum effect, an appropriate regulatory regime should follow, regardless of developments envisaged in the consultative document. Such an outcome might also permit the licensing of spectrum for electronic communications networks (fixed, mobile and nomadic) rather than one or more of the component parts.

Section 2 can be summarised as follows:

- 3.4 - 3.8 GHz became an IMT band through standardisation processes and WiMax mobility aspirations
- Other technologies such as WiMax and WiDox may have a role for some time in the future
- LTE may become the technology of choice for electronic communications networks in 3.4 - 3.8 GHz All operators should be able to utilise technological developments to suit their business plan
- The licensing model employed in 3.4 - 3.8 GHz should take account of technology trends
- Major investment in state of the art technology may be required to take account of the changing technological and regulatory environment

3. Technical Suitability of 3.6 GHz for Rural FWA Services

The 3.6 GHz band is very well suited to rural fixed wireless deployments owing to its low susceptibility to attenuation resulting from precipitation. Reliable high speed connections can be provided at distances of up to 20 km. For this reason the band is well suited to areas of low population density but only where there exists a clear line of sight to a high site from a large number of consumers. Given the propagation characteristics of 3.6 GHz, the band is less suitable for mobile telecommunications e.g.

- 3.6 GHz has a worse non line of sight performance. This translates into a need for a higher number of Base Stations and higher costs for the initial network build and poorer rural coverage.
- 3.6 GHz has poor building penetration resulting in ineffective indoor coverage
- 3.6 GHz is not yet proven although operators in Europe and Asia are currently deploying LTE networks.

4. Investment Issues and Policy Direction with respect to 3.6 GHz

The Operators concerned with this submission have been rolling out their telecommunications services for a significant number of years. It has been known from earlier consultations that ComReg favoured a relatively short licence term for FWALA in order to retain flexibility to curtail licences and reassign the spectrum if so decided. In 2010 a licence cessation date of July 2017 was reconfirmed in document 10/55, mentioned above.

Operators' networks are continuing to expand, yet the uncertainty surrounding the 3.6 GHz spectrum since ComReg announcement 10/55 in 2010 has influenced the operators decisions regarding investment in 3.6 GHz equipment and as a consequence impacted rural broadband provision. Absent a clear strategy for 3.6 GHz licensing post July 2017 it is questionable whether from a business perspective Operators should continue to invest in new equipment or continue with the expansion of their 3.6 GHz networks.

5. Availability of Spectrum

Paragraphs 3.29 to 3.31 in document 14/101 deal with the availability of spectrum in the 3.6 GHz band. Notwithstanding the contents of Section

5.6 ComReg maintains that for the purposes of Chapter 3 dealing with the assessment of the suitability of whether or not to include additional frequency bands in the award process, any rights pertaining to the 3.6 GHz band would be available for award on a national basis.

The Operators are concerned with this interpretation. The Operators do however recognise that an award process which offers spectrum on an all-Ireland basis would be easier to administer.

The Operators are also of the opinion that some spectrum at 3.6 GHz should be available for licensing as to do otherwise, when there is a significant demand for spectrum would not result in efficient and effective spectrum management on economic and technical grounds.

As mentioned in paragraph 3.75 and discussed in paragraph 3 of this response, clearly 3.6 GHz is not the most suitable band for the provision of true mobile services to hand-held terminals in rural areas; the path loss will be high, the antenna in hand-held devices will be inefficient and the power needed to establish a link will be high. Even if a reasonable battery life in a small terminal can be implemented there may be health concerns concerning the amount of power emitted.

Concerning the provision of broadband service to hand-held devices, Operators therefore believe that the 3.6 GHz band will be most useful in the conurbations and at places and events where large numbers of persons congregate e.g. in shopping malls, transport hubs or sports stadia. The Operators suggest that the frequency range 3.4 - 3.6 GHz should be utilised for such purposes.

With respect to FWA, the 3.6 GHz band is currently the lowest licensable band available in Ireland for such applications and is thus ideal for providing service to CPEs, although a line of sight path is still required.

In summary the Operators believe that frequencies in the range 3.6 - 3.8 GHz should be reserved principally for the provision of quality FWA broadband services to business and residential users, focussing on the small towns and rural areas of Ireland. How this might be achieved is addressed further in Sections 7 and 8.

6. Licence Duration

As stated in paragraph 4, an appropriate licence duration for all public telecommunications licensees is required which on one hand encourages investment and on the other hand providing the regulator with sufficient powers to withdraw licences in certain circumstances and to decline renewal where spectrum efficiency can be improved.

If the current uncertainly with fixed wireless licences can be overcome and the regulatory environment can be improved for a realistic period of time, a situation will be created where operators can raise the required investment for next generation equipment, introduce higher speeds and procure additional sites. A realistic licence duration should provide a sufficient period of time for operators to deploy next generation equipment and generate an adequate return on investment. The licence price and fee structure should also be reflective of the market segment involved.

The Operators submitting this response would support a licence duration towards the upper end of the 15 to 20 year range.

7. Sub-National Licences at 3.6 GHz

In Section 5.6 of document 14/101 it is mentioned that it may be appropriate to award a subset of the 3.6 GHz band on a regional or local basis.

As mentioned in Paragraph 5 above the Operators are of the opinion that the band 3.6 - 3.8 GHz should be utilised for the provision of broadband services by means of sub-national or regional frequency licences. Ideally licences should be available prior to the expiry date for FWALA licences (July 2017) to enable operators to acquire licences, in order to maintain the provision of licensed services to existing customers. This would leave 3.4 - 3.6 GHz available for national ECNs, including mobile broadband deployments.

If sub-national licences were not introduced the likely market price of national licences would be prohibitively high for those operators focussing on the provision of broadband to small towns and rural areas. Furthermore, in the event that regional operators are unable to acquire sub-national licences, there would be an immediate reduction in broadband options and an absence of equivalent replacement services for rural broadband users including schools, SMEs and home workers.

If the concept of sub-national licences appears to be feasible the first question arises, whether the award process should be part of a national award process for the bands agreed to be included in such a mechanism. However if a sub-national award process was considered to be the optimum way forward, Operators would be concerned if as a consequence, a sub-national process would delay the award later than summer 2015. New equipment might need to be procured and networks might require reconfiguration. If a new technology was to be deployed the availability of LTE equipment in 3.6 - 3.8 GHz might become an issue, if sufficient lead time cannot be provided to manufacturers. If timing were to be a significant problem Operators would have no objection if it was decided to extend the current licences for an appropriate period.

Paragraph 5.79 and footnote 121 in document 14/101 suggests that circa 37,342 customers in Ireland are utilising 3.6 GHz equipment to receive their broadband service. The Operators query whether this figure can be substantiated since several of the Operators involved with this submission have not been requested to provide figures concerning the type of equipment deployed to their customers.

In addition several of the Operators have indicated that they offered the only means of obtaining cost effective, low latency quality broadband services for a significant number of their customers in remote locations. Furthermore, providing such access without having access to spectrum at 3.6 GHz would have proved extremely difficult.

One of the European 2020 Initiatives is a Digital Agenda (DAE) for Europe. The DAE contains 13 specific goals which encapsulate the changes to be achieved. The first three are as follows:

- The entire EU to be covered by broadband by 2013.
- The entire EU to be covered by broadband above 30 Mbps by 2020.
- 50 % of the EU to subscribe to broadband above100 Mbps by 2020.

According to European Commission statistics, 95.5% of Europeans who live in urban areas have access to fixed broadband services whereas only 83% of the European rural population has access. Clearly no Member State would wish to administer a broadband digital divide. Suffice to say the Operators associated with this submission maintain the view that adequate spectrum resources in the 2 – 4 GHz range is required if rural residents in the State are to be provided with broadband services at an affordable price. And to provide every resident in Ireland with an efficient and reliable 30 Mbps service by 2020 will require a major effort in rural areas. The Operators are ready to meet this challenge.

It might be queried why the current arrangements have not been as successful as anticipated? The Operators believe a number of factors have contributed to the current situation, including:

- Cherry picking –service providers focussing on geographical areas giving the best financial returns.
- Lack of 3.6 GHz spectrum in the period 2005 - 2009 in areas adjacent to urban centres. 3.6 GHz spectrum was initially acquired for FWALA networks in urban centres (Dublin, Cork, Limerick and Galway). The imposition of 30 km exclusion zones to protect these networks significantly restricted the number of geographical areas and suitable high sites where licences could be obtained.
- Hoarding of spectrum by some service providers.
- Limited equipment availability in the 3.6 GHz band and the higher cost of 3.6 GHz equipment relative to equipment for licence exempt bands.
- The lack of investment in 3.6 GHz FWALA due to uncertainties surrounding licences following the announcement of licence's expiry in July 2017.

Despite these factors FWALA operators have been successful in deploying high speed connections to thousands of subscribers and continue to increase network speeds and capacity with resulting quality of service improvements.

The NBP announced by DCENR is likely to reduce the dependence of rural subscribers on fixed wireless over time, however the timing of this remains uncertain for many and maintaining a suitable interim solution for many thousands of households and SME companies is essential. Indeed it may transpire that for the NBP to be affordable there will be an ongoing dependence on licensed fixed wireless technology.

Section 8 below examines some of the criteria which may need to be addressed in a future sub-national licensing process.

8. Sub – National Licences – Award Principles

The Operators responding to the consultation document believe that a new philosophy is required for sub-national FWA or ECN licences. It is not

considered appropriate to attempt a detailed award design within the remit of the current consultation process; however some of the key points could be as follows:

- The regional licensing areas (RLA) need to be designed with care; geographical boundaries should be included on a vector map.
- Four possible RLAs;
    - Borders – Counties Donegal, Leitrim, Cavan, Monaghan and Louth.
    - Connacht – less County Leitrim.
    - Leinster - less County Dublin.
    - Munster.
- Decision required on other major urban areas e.g. Cork and Galway and whether the Dublin area needs to be extended.
- Goal would be two to four operators per RLA.
- Broadband services must be offered to residential and business consumers.
- 3.6 - 3.8 GHz should be available for regional licensing.
- Licensees in the Borders RLA would need to comply with an Ireland – UK coordination agreement.
- Sub-national operators in consultation with ComReg should develop a code of conduct and dispute resolution procedure.
- The cost of a licence should be affordable for companies wishing to provide rural broadband services, market based national licences would be beyond the financial capability of most sub-national FWA operators.
- No individual operator or group of companies under the same ownership should be able to hold all the available 3.6 GHz regional licenses for a single RLA.

The operators would welcome the opportunity to participate with ComReg in the development of a new regional licensing scheme for 3.6GHz

Given that the award process addressed in this consultation process is likely to include 2.3GHz(100MHz) and 1.4GHz(40MHz) in addition to 2.6GHz (190MHz) this will add a very significant amount of spectrum to that already utilised by mobile operators. Since the propagation characteristics for these bands make them better suited to wide area mobile deployments than the 3.6GHz band, it is likely that these bands rather than 3.6GHz would be used for rural deployments, with 3.6GHz possibly being used for urban hot-spots and areas of very high population density.

To reserve all 400MHz of the available spectrum at 3.6GHz spectrum for national licences, a scenario which might result in spectrum being used in a limited number of urban deployments, would not, in the opinion of the Operators, be consistent with ComReg's obligation to make optimal use of spectrum for the benefit of all.

9. Conclusion

The Operators submitting this response would like to extend their thanks to ComReg for the opportunity to respond to this consultation and hope

that the Regulator will be favourably disposed to the suggestions outlined in this document. The Operators remain at ComReg's disposal if further information or clarification is required. The Operators would also wish to state that nothing in this document needs to be considered as restricted or confidential.

9. permaNET Ltd.: response entitled "permaNET Ltd. Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated November 2014

permaNET Ltd. Response to the Consultation Paper entitled Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

Document 14/101

published by

The Commission for Communications Regulation

November 2014

permaNET has provided input in conjunction with a number of other regional WISPs but we would also like to submit the following comments pertaining to section 5.6 "Sub-national licences at 3.6 GHz".

permaNET funded the development and manufacture of 3.6GHz point to multipoint (P-MP) wireless equipment to be compatible with the 3.6GHz FWALA FDD wireless band-plan with a channel separation of 100MHz between Tx and Rx and utilising max 25MHz DS and 25MHz upstream. ComReg determined to support the principal of technology neutrality in the original FWALA scheme and in the subsequent revisions of the scheme which provided additional spectrum to operators. This decision on the part of ComReg enabled permaNET and others to develop affordable equipment in order to provide affordable, reliable broadband services in rural areas.
We submit that ComReg should ensure that any subsequent scheme for allocation of 3.6GHz spectrum should adhere to this principal.

Spectral efficiency of FDD vs. TDD systems has been debated for some time. The wireless-DOCSIS (WiDox) system developed by permaNET uses fixed QAM64 downlink (DL) carriers and QPSK uplink (UL) carriers, and can deliver highly reliable high speed services at distances of over 20km with a DL spectral efficiency of 4.3bphz and UL spectral efficiency of 1.6bphz. We submit that the spectral efficiency of currently available alternative 3.6GHz technologies when used over similar distances for LoS connections do not differ greatly in terms of carrier spectral efficiency.

The main issue in ensuring spectral efficiency of FDD vs. TDD systems is the appropriate balance in assignment of DL vs. UL spectrum. Under the current FWALA band plan, the assignments for DL and UL for FDD equipment are equal, 25MHz from base to CPE and from CPE to Base. In our network of primarily residential internet traffic, monitoring over several years has identified that for almost any time of day the traffic split in a P-MP system is approximately 85% DL and 15% UL. Based on the DL and UL spectral efficiencies described above this translates to a spectrum requirement of almost exactly 2:1. We would therefore propose that in a future licensing scheme that TDD and FDD spectrum efficiency can be achieved if available spectrum be divided into 10MHz assignments, with certain 10MHz UL blocks being paired with suitable 20Mhz DL blocks. This would not preclude bidders from bidding for any particular 10MHz slot for use by TDD equipment, but would permit an operator using FDD equipment to bid for a pair of suitably combined slots. We also submit that non-technology factors contribute far more significantly to spectral inefficiency, for example situations where licenses are used for provision of a limited number of services or for the provision of exclusively high end business services. The provision of both business and residential services was a criteria for the evaluation of requests for spectrum in the initial FWALA scheme.

[redacted]

10. Qualcomm: submission entitled "ComReg consultation Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands - Qualcomm Response", dated October 2014

Qualcomm Europe Inc.

ComReg consultation

Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

Qualcomm Response

[redacted]

October 2014

Introduction

Qualcomm would like to thank ComReg for the opportunity to provide more information about the latest market development and the related opportunities for Ireland.

The mobile traffic increase reported in many places [1] is a challenge for mobile operators, but should be seen as an opportunity for governments. The link between mobile broadband and economic growth is stressed by many economic forums[2]. The timely availability of additional spectrum enables Mobile Network Operators (MNOs) to deliver better services at reduced price, which is critical to position Ireland in the digital economy race.

[1] e.g. Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2013–2018.
[2] E.g. http://www.weforum.org/reports/global-information-technology-report-2013

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The global and growing demand for mobile broadband services pushes the boundaries of networks capabilities and requires more harmonised spectrum to deliver everywhere these new services to smartphones, tablets and all new possible devices types. Mobile data traffic has doubled every year over the past few years. If this growth rate continues for 10 years, we will see a 1000x increase. Qualcomm's vision to achieve this 1000x capacity is built upon three pillars, which are related to one another and must be pursued simultaneously: additional spectrum in low and high bands, denser networks and greater efficiency across the system. These three pillars are complementary to address data traffic growth in rural, suburban and urban environments.

We believe that additional frequency bands are needed to meet the future demand for mobile broadband services by 2020. In this context, Qualcomm supports the RSPP target to identify at least 1200 MHz of spectrum by 2015 in low and high frequency bands to be made available for mobile broadband in the EU.

Qualcomm sees ComReg's proposal to award additional spectrum as both timely and forward looking, as the bands considered enable Ireland to:

- Catch up with other EU-countries: the 2.6 GHz is already used widely throughout Europe (2.6 GHz).
- Adopt new bands in a timely manner: the 1.4 GHz and the 2.3 GHz bands will become available in the near future in many European countries, providing valuable extension [redacted] capacity bands [redacted]
- Get ahead of the curve: the 700 MHz and 3.6 GHz bands are considered by many countries as promising bands, in the mid-term, for the evolution of networks in respectively coverage (700 MHz) and high performance/speed (3.6 GHz).

Every single band proposed by ComReg has been standardised by 3GPP:

- 2.6 GHz as 3GPP Band 7,
- 1.4 GHz as 3GPP Band 32,
- 2.3 GHz as 3GPP Band 40,
- 700 MHz as 3GPP Band 28,
- 3.6 GHz as 3GPP Band 22 (FDD Version) or 3GPP Band 42 (TDD Version).

The vast majority of existing LTE smartphones and mobile devices already support the 2.6 GHz band. Qualcomm products already support the 2.3 GHz and 700 MHz bands, while support for the 1.4 GHz band will be available early 2015.

Product availability is expected to follow the award of corresponding spectrum in EU countries. The 1.4 GHz band is expected to be made available to MNOs in the majority of Western EU countries in the near future, discussions are on-going for the 2.3 GHz band and depending on national terrestrial broadcasting situations the 700 MHz should be made available in the 2016-2025 timeframe.

The 3.6 GHz band represents a special case, as it proposes characteristics which are not available in other bands (very wide bandwidth) but requires a much denser deployment, matching very well with the expected introduction of pico- and femto-cells in mobile networks. At the same time, the band was auctioned in the past in many European countries for services that did not develop and must be repurposed before mobile broadband services can be launched. This explains why mass market prospects for this band correspond to middle term (around 2020) at European level.

ComReg's proposals provide a very good basis to build a high quality mobile broadband infrastructure throughout Ireland, providing coverage, bridging the digital divide and opening opportunities for advanced services. Further information is provided below on each specific topic. Qualcomm remains committed to assisting ComReg, to the best of its ability, throughout this exciting process.

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Sections 2.2 to 2.12: 2.6 GHz band for mobile broadband

The 2.6 GHz band represents an opportunity for the deployment of LTE networks with 20 MHz channel bandwidth. This 2x20 MHz channelization will enable to achieve the promises of the LTE technologies, i.e. support for a large number of simultaneous users and reduced price of the Mbit/s.

Sections 2.15, 2.16, 2.17 and 2.18: FDD, TDD and SDL

Qualcomm agrees with most of ComRegs view on the characteristics of FDD, TDD and SDL systems. However, Qualcomm would like to stress three further aspects:

- FDD, TDD and SDL systems are not opposed, but complementary to each other. Qualcomm has developed products supporting all three bands, including carrier aggregation of TDD and FDD (including SDL) carriers. The availability of such devices enables MNOs to leverage and combine the benefits linked to each technology.
- On the other hand, only mass market bands are typically supported in terminals, due to the very large number of bands that must be supported in a terminal. Therefore, it is critical for Ireland to harmonise the spectrum awarded with band plans already benefiting from an international ecosystem. MNOs will be able to acquire FDD, TDD and SDL spectrum in bands harmonised internationally for such use, i.e. respectively 2.6 GHz, 2.3 GHz and 1.4 GHz.
- [redacted]

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[redacted]

Section 2.19: [redacted] capacity and performance bands

Qualcomm generally agrees with ComReg's assessment, with two caveats:

- [redacted]
- Though in general bands above 1 GHz provide capacity, not all bands above 1 GHz can be considered equally. There are major differences in propagation characteristics between e.g. 1.8 GHz and 3.6 GHz. On the other hand, very large channel bandwidths are supported in 3.6 GHz. While macro cells operating at lower frequencies have so far dominated the mobile network operators' rollouts, higher frequencies such as the 3.6 GHz bands will be a key marker of the future in enhancing capacity requirements in urban areas and providing additional capacity where needed by enabling heterogeneous networks (HetNets). It could be argued that 3.6 GHz belongs to another category, i.e. 'performance bands', which are especially suited for the deployment of HetNets.

Sections 2.39 and 2.40: 1.4 GHz band

Qualcomm would argue that the 1.4 GHz band is already harmonised at European level through ECC Decision (13)03.

Furthermore, ECC Reports 188, 202, draft ECC Report 227 and draft CEPT Report 54 provide a very comprehensive regulatory framework for the introduction of mobile broadband systems in 1452-1492 MHz.

The 1.4 GHz band is not just theoretically harmonised: Italy has officially announced the auction of the band in 2015, Germany has proposed the award of the band in its upcoming spectrum award and UK is consulting on the band. France is expected to launch a public consultation in the upcoming weeks on the future availability of various frequency bands including the 1.4 GHz band. The band is also considered by many countries outside of Europe.

Qualcomm fully expect the 1.4 GHz band to become available Europe wide and more in the middle term future.

Sections 2.39 and 2.40: 2.3 GHz band

European Commission (EC), CEPT, ETSI and RSPG activities on the 2.3 GHz band

The 2.3GHz band has been identified in the RSPG opinion for WBB use in the near term and there are a lot of activities in Europe in relation to it. Some of the reasons for such a high interest can be found when considering the social and economic benefits of a 2.3GHz deployment in EU that could be as much as 22B Euros according to a recent study by Plum Consulting .

In terms of harmonization and standardization, EC, ETSI, the RSPG and the CEPT have all been working on the 2.3 GHz for mobile broadband. A key role in the band harmonization at European level is also being played by the innovative regulatory framework under the name of LSA (Licensed Shared Access). The following are some of the latest key developments:

- CEPT adopted in June 2014 the ECC DEC (14)02 on 'Harmonized conditions for MFCN in the 2300-2400 MHz band'. This decision provides the harmonized technical rules for mobile broadband use and guidelines for LSA implementation in the band.
- In March 2014, the EC issued a mandate to CEPT to develop harmonized technical conditions for the 2300-2400 MHz frequency band in the EU for the provision of wireless broadband electronic communications services and CEPT is currently working on ECC Reports 55, 56 and B2 in response of this EC mandate. In particular:
    - ECC Report 55 was approved in October 2014 by CEPT WG FM and will be published following the final approval of the ECC expected in November 2014. This provides common and minimal technical conditions for WBB usage of the 2.3-2.4 GHz band based on the provisions developed in ECC/DEC(14)02
    - ECC Report 56 was approved for Public Consultation by CEPT WG FM in October 2014. This details possible options and associated implementation measures for the shared use of the band between WBB and the incumbents based on LSA.
    - ECC Report B2 on the co-existence between MFCN and PMSE in the band is expected to be completed and sent to the EC by July 2015.
- CEPT kicked off in October 2014 the development of an ECC Recommendation to provide guidance to administrations in implementing a sharing framework between MFCN and PMSE in 2.3-2.4 GHz. This new recommendation is expected to complement ECC Report 172 whose results in terms of sharing were very restrictive.
- ETSI published a System Reference Document defining the criteria and operational features for the introduction of WBB under LSA at 2.3 GHz [2] and approved a work item on the requirements for LSA in the band: "System requirements for operation of Mobile Broadband Systems in the 2300-2400MHz band under LSA regime". The System Requirements document for LSA in 2.3GHz is considered "stable" since December 2013 and it will be released during 2H 2014

- ETSI has also initiated work stream on System Architecture for LSA in January 2014 and this is expected to be completed by end 2014.

Qualcomm believe that the introduction of LSA coupled with the above mentioned initiatives by ETSI, RSPG, EC and CEPT will enable substantial progress in the harmonization of the band. Such harmonization, as pointed out by ComReg was hampered so far due to a range of existing incumbent services operating in the band throughout Europe and to the restrictive ECC Report 172 which did not account for innovations in terms of sharing frameworks such as LSA.

Member States activities on the 2.3 GHz band

- In the UK, the MoD (Ministry of Defense) has decided to release 40 MHz of spectrum within the 2.3 GHz band (2350-2390 MHz) to Ofcom for civilian use. Ofcom is also considering LSA as a tool to unlock additional 50 MHz of spectrum in the 2.3GHz frequency range.
- Italy has included ECC DEC (14)02 in its new draft National Table of Frequency Allocations.
- In France, a national committee involving all stakeholders (including Ministry of Defence, telecom regulator, MNOs, vendors) has been working on a sharing framework between LTE and defence telemetry in the 2.3 GHz band. An LSA trial in the 2.3 GHz band is planned to start in 1H 2015. The implementation will be ETSI compliant. The trial will involve spectrum regulator (ANFR), MoD, an operator, an infra vendor and a device/chipset provider.
- The Joint Research Centre of the European Commission is currently assessing the feasibility of a 6 months LSA trial to be carried out at EXPO 2015 in Milan starting in May 2015.

Device Availability in the 2.3 GHz band

According to GSA, 427 devices are already compatible with LTE TDD in the 3GPP Band 40. Most of them are designed for the larger Asian markets and thus in the future Europe and Ireland could benefit from global economies of scale.

Sections 2.42-2.43: Opportunity to auction 700 MHz band for mobile broadband services

The 700 MHz is one key band to bridge the digital divide and bring wireless services to rural areas at reasonable costs.

The 700 MHz frequency range has been considered by many countries of ITU Region 1 as highly beneficial to support significant improvement of their mobile broadband infrastructure for the delivery of broadband services in rural areas. The other two ITU Regions, Region 2 and Region 3, have already identified this band for mobile broadband at previous WRCs and some countries have or are about to award this band. The 700 MHz band (694-790 MHz) in Region 1 is currently studied by the ITU under Agenda Item 1.2 of the World Radio Conference 2015 (WRC-15).

Sections 2.44-2.48: Opportunity include '5G bands'

Qualcomm agrees with ComReg that it is too early to include frequency bands above 6 GHz in the award as they have yet to undergo compatibility studies at the European or International Telecommunication Union (ITU) level to determine the feasibility of these bands for next generation WBB. Furthermore, Qualcomm view is that 5G is not just the addition of higher spectrum bands like mmWave but it will target all spectrum to provide new 5G services everywhere; from lower bands around 1 GHz that provide excellent coverage, to higher bands up to 6 GHz to provide more capacity and emerging much higher bands for more targeted capacity boost.

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Sections 3.8: Availability of 1.4 GHz band

Qualcomm agrees that the 1.4 GHz band remains fallow in many European countries. Furthermore, Qualcomm would like to point out to ECC Decision 13(02) *on the withdrawal of ECC Decision (03)02* which states:

In 2013, the ECC Decision (03)02 related to the designation of the frequency band 1479.5-1492 MHz for use by satellite digital audio broadcasting systems was reviewed and it was concluded that this Decision was suitable for withdrawal as it was not in line with the decision to harmonise the use of the band 1452-1492 MHz for terrestrial mobile/fixed communications networks supplemental downlink (MFCN SDL) within the CEPT.

Therefore, Qualcomm argues that the 1.4 GHz band is no longer harmonised in Europe for S-DAB, but on the contrary is harmonised in Europe for MFCN SDL.

[redacted]

Sections 3.10-3.11: Equipment Availability for 1.4 GHz band

Qualcomm would like to provide the following additional information to ComReg:

- The 3GPP work item to standardise the 1.4 GHz band is completed and the band is included in the standard (e.g. 3GPP 36.101/3GPP 36.104 c40 or later version) as 3GPP Band 32.

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- Qualcomm's products (MSM8994/MDM9x35 and WTR3925) will support 3GPP Band 32 (1.4 GHz band) in Q1 2015. Availability of 3GPP Band 32 (1.4 GHz band) capable commercial devices is subject to market demand.

Sections 3.12-3.16: Suitability for Inclusion of 1.4 GHz band in spectrum award

Qualcomm supports ComReg's view that the 1.4 GHz band is suitable for inclusion in the spectrum award.

As mentioned before, Italy has officially announced the auction of the band in 2015 and the band is expected to become available in the near future in other major European countries.

[redacted]

Sections 3.18-3.20: 2.3 GHz band harmonisation

Qualcomm believe that the introduction of LSA, coupled with the initiatives by ETSI, RSPG, EC and CEPT mentioned above in the response to Section 2.39, will enable substantial progress in the harmonization of the band. Such harmonization, as pointed out by ComReg, was hampered so far due to a range of existing incumbent services operating in the band throughout Europe and to the restrictive ECC Report 172 which did not account for innovations in terms of sharing frameworks such as LSA.

Sections 3.23: Equipment Availability for 2.3 GHz

According to GSA, 427 devices are already compatible with LTE TDD in the 3GPP Band 40. Most of them are designed for the larger Asian markets and thus in the future Europe and Ireland could benefit from global economies of scale.

Sections 3.24 and 3.25: Suitability for Inclusion of 2.3 GHz in spectrum award

Qualcomm fully agrees with ComReg that the 2.3 GHz should be included in the award process.

Qualcomm also agrees that the 2.3 GHz can be considered as a close substitute to the 2.6 GHz unpaired band.

Sections 3.27 and 3.28: Degree of Harmonisation of 3.6 GHz band

The 3.6 GHz bands are attracting a lot of attention and important actions not only in Europe but also by major worldwide economies:

- In Japan the MIC (Ministry of Internal Affairs and Communications) issued the 3.5 GHz Deployment Policy (for LTE-A) in July 2014. Under this policy, the 3480 - 3600 MHz band will be divided into three blocks of 40 MHz each for 3 operators that shall support 50% of population coverage in 4 years. The developments in Japan might soon trigger further actions on this band on a worldwide basis.

- In the United States, the 3.5 GHz spectrum is used by naval radars. That said, the NTIA (an agency within the US Department of Commerce, which manages the US government's spectrum including Defense spectrum) has carried out a number of tests collecting data on co-existence between LTE-based small cells and radars in the band both on interference from the radars to the LTE small cells, and vice versa. Results show that applying the LSA framework there can be co-existence between the radars and the LTE small cells with minimal exclusion zones. NTIA has published two reports with the test results. Qualcomm, Verizon, and Ericsson will be performing joint field tests in the 3.5 GHz band next year. Qualcomm supports ComReg decision to include the 3.6 GHz bands in its award process.

Qualcomm is of the view that the emergence of a broad and healthy ecosystem in the 3.6 GHz bands will depend on a certain number of factors including a band plan to achieve global economies of scale and the successful application of innovative regulatory frameworks such as LSA enabling future worldwide availability and use of these bands for mobile broadband on a shared basis with incumbents.

To this extent, in Europe, in September 2014, CEPT ECC PT1 agreed to open a new WI (Work Item) focusing on the sharing, in the 3.6 – 3.8 GHz frequency range, between registered Fixed Satellite Service Earth Stations and Fixed Service radio links and mobile systems ensuring the continued operation for incumbent users by the use of LSA.

An important step towards harmonization is currently ongoing at CEPT in preparation of WRC-15 for the bands 3400 – 3600 MHz and 3600 – 3800 MHz as they are currently being supported for both a co-primary mobile allocation and IMT identification.

Sections 3.32: Propagation Characteristics of 3.6 GHz band

Qualcomm agrees with ComReg's assessment of the propagation characteristics of the 3.6 GHz band but notes that short propagation distances also translate in positive interference mitigation characteristics. While macro cells operating at lower

frequencies have so far dominated the mobile network operators' rollouts, higher frequencies such as the 3.6 GHz bands will be a key marker of the future in enhancing capacity requirements in urban areas and providing additional capacity where needed by enabling heterogeneous networks (HetNets).

Sections 3.33: Equipment availability for 3.6 GHz band

The support of 3.6 GHz bands either for TDD and/or FDD on Qualcomm's chipsets will depend on future market demand and ecosystem readiness. This demand has not materialized yet. The support of FDD and/or TDD modes on our chipsets will also be subject to future market demand.

Sections 3.34 to 3.38: Suitability for Inclusion of 3.6 GHz band in spectrum award

Qualcomm is of the view that the frequencies ranges 3400 – 3600 MHz and 3600 – 3800 MHz will be key in the deployment of small cells in the context of heterogeneous networks (HetNets) to enhance capacity requirements in high urban areas because of their favorable electromagnetic characteristics in interference management.

Qualcomm agrees with ComReg that the 3.6 GHz bands should be included in the upcoming spectrum award.

Sections 3.40 to 3.42: Degree of Harmonisation of the 700 MHz band

Global harmonisation of the 700 MHz is currently shaping around APT paired band plan, aka 3GPP Band 28. Many countries in Asia (Australia, Japan, Korea, India, Indonesia, Malaysia, Taiwan, Singapore etc.) and Latin America (Brazil, Venezuela, Chile, Mexico, Columbia, Ecuador, etc.) have taken action towards adoption of 3GPP Band 28.

Qualcomm believes that there is a large consensus in Europe to adopt the 703-733 MHz UL / 758-788 MHz DL as harmonized band plan for mobile and that the band

plan will provide significant benefits in terms of device availability and economies of scale.

733 – 736 MHz and 788-791 MHz for M2M

In addition, Qualcomm encourages ComReg to consider the adoption of 2x3 MHz in that band, namely 733 – 736 MHz and 788-791 MHz, for M2M applications, based on the rationale provided in our response to sections 3.53 to 3.57. Should such harmonisation occur, M2M applications would benefit from the considerable economies of scale driven by commercial mobile broadband LTE services to be deployed in the adjacent spectrum (703-733 MHz and 758-788 MHz). This option is currently under study in CEPT and the ECC should take a decision on such harmonization by end 2015. We invite ComReg to support this harmonization option at CEPT and EU levels.

Sections 3.43 to 3.46: Availability of 700 MHz band Spectrum

Based on previous experience of the 800 MHz release, Qualcomm shares the view from ComReg that any future release of the 700 MHz in UK would largely depend on the international context and coordination with neighbouring countries. 2018 seems to be a realistic timeframe to make this band available for mobile broadband operators and to benefit from the worldwide economies of scale.

Some countries in Europe (France, Germany) have announced plans to award the 700 MHz for mobile broadband earlier than this date.

It is not at this stage entirely clear at which date the 700 MHz band will be available across Europe, but the band plan and technical conditions to harmonise the band are the object of consensus in Europe. Qualcomm encourages ComReg:

- to adopt the technical conditions of access to the band which will provide a positive signal for the industry, both in Ireland and at European level,
- to study further the timeframe under which the band could become available in Ireland.

Sections 3.47 to 3.48: Propagation Characteristics of 700 MHz band

Qualcomm agrees with ComReg's assessment of the 700 MHz band propagation characteristics and notes that the joint allocation of the 1.4 GHz band and the 700 MHz band would enable a potential new entrant or an MNO without spectrum in the 900 or 800 MHz to fully benefit from the 1.4 GHz band.

Sections 3.49 to 3.52: Equipment Availability for the 700 MHz band

Qualcomm strongly supports the adoption of the 703-733 MHz UL / 758-788 MHz DL as European harmonized band plan.

Assuming such harmonization is successful, Qualcomm notes that the band is already standardized as 3GPP Band 28 and that Band 28 compatible terminals are available in markets outside of Europe. Qualcomm products support band 28.

Qualcomm fully expects that the band 28 compatible mobile device market penetration will be very high by the time the spectrum becomes available in Europe.

Sections 3.53 to 3.57: Suitability for Inclusion of 700 MHz band in spectrum award

Qualcomm agrees with ComReg's assessment that the 700 MHz band is highly complementary to other bands considered and that the 700 MHz band should be included in an upcoming spectrum award.

Qualcomm notes that both France and Germany have already announced plans to award the 700 MHz band in the short term, with availability of the band expected in the middle term (before 2020).

Transition plan

We believe that it is essential at this stage to define a transition plan which would ensure the availability of the 700MHz for mobile broadband while minimizing any impact on DTT viewers as well current as on current users of the UHF band. In particular, PMSE users in the 470-790MHz would benefit from an early decision on the transition plan so to have visibility on the future availability of spectrum and adapt

their technology to the commonly shared objective of releasing the 700MHz band for mobile broadband applications.

The key role of the 2x3MHz in the 700MHz band for M2M

3G/4G is the main driver for the growth and scalability of the IoE. LTE-Advanced is the next major milestone in the evolution of 4G, incorporating several enhancements, all of which will be beneficial for the roll-out of M2M applications and products. Leveraging carrier aggregation and hyper-dense HetNets to increase network capacities and data rates are one aspect. Leveraging the potential benefits of the use of part of the harmonized 700 MHz band at European level for M2M applications is another core one.

A 2x3 MHz in the 700 MHz band for M2M would offer a 24/7, national and European wide ubiquitous coverage; controlled QoS; high reliability (redundant network design) and strong penetration; a robust security (built-in security features used in government and financial sectors); extremely low power consumption; and finally scalability, as the lower total cost of ownership due to a large established ecosystem, leveraging existing mobile infrastructure and global standards enables seamless interoperability.

From a technology angle, LTE eMTC (evolved Machine Type Communication) will address the requirements of many M2M applications. LTE eMTC is part of the LTE Advanced evolution and is planned to be part of 3GPP Release 13. An important dimension of LTE eMTC is that it allows the coexistence between M2M applications and adjacent mobile services in the same band, leading to considerable economies of scale. This is to be combined with enhanced security elements, extended coverage and up to ten years battery power. LTE eMTC could be an ideal candidate for enabling M2M applications in the 2x3MHz of the 700MHz band.

As recently highlighted by the EC High Level Group report presented by Pascal Lamy, the 700MHz band provides the best opportunities for harmonized wireless applications across Europe. As the 700 MHz band becomes available across Europe, making available 2x3 MHz for M2M applications would appear to be the most cost-effective solution supported by industry. Given the requirements mentioned above, it

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would strongly benefit in particular the Smart Energy and the Smart Transportation sectors.

Sections 3.70 to 3.86: Bands to be considered in spectrum award

Qualcomm believes that additional spectrum in low and high bands is needed to meet the future demand for mobile broadband services by 2020 and therefore supports Option 3 proposed by ComReg to include in the spectrum award the 700 MHz, 1.4 GHz, 2.3 GHz, 2.6 GHz and 3.6 GHz.

The inclusion will enable optimal management of spectrum resource by offering alternatives to MNOs, including potential new entrants, in terms of:

- coverage bands [redacted],
- capacity bands [redacted],
- performance band [redacted]

Qualcomm agrees with ComReg's assessment that Option 3 is not only the best option for stakeholders, but will also deliver the best impact on competition and therefore benefit the most to the consumers.

Sections 4.4 to 4.11: The 2.6 GHz band plan

Noting that the majority of European countries have released the band in line with the primary band plan as set out in the EC decision 2008/477/EC, Qualcomm supports ComReg proposal to release the band in line with the primary band plan with no flexibility for altering the plan, which should mean greater availability of equipment for this frequency arrangement.

It is important to highlight that the European Commission decision 2008/477/CE was adopted based on the technical conclusions of the CEPT Report 19. This report focused exclusively on the interference scenarios from base station to base station. Neither the CEPT Report 19 nor the European Commission Decision 2008/477/CE take into account the interference and implementation constraints linked to terminals.

The ECC Report 131 has studied such constraints and identified technical conditions of access to the band for terminals.

The ECC Report 131 identifies some mobile station to mobile station interference issues at the border of each frequency blocks, especially at the FDD/TDD border but also between unsynchronized TDD blocks. The interference free coexistence of terminals in the band 2500-2690 MHz imposes severe emission restrictions at the FDD/TDD domains borders. These constraints go well beyond the 3GPP standards defined filtering capabilities of terminals and request additional filtering, in the form of specific RF components (RF filters). Qualcomm recommends ComReg to consider carefully these interference issues. It is critical for operators to ensure both an interference free environment but also the availability of mass market equipment, which can only occur through the adoption of single Europe-wide technical conditions of access to spectrum.

Furthermore following the conclusions of the CEPT report 19 and ECC Report 131, the 2570-2575 MHz and 2615-2620 MHz frequency blocks can only be used under very stringent technical restrictions. Furthermore, the emission limits defined to protect adjacent frequency blocks indicate that these two frequency blocks will correspond to the RF-filters transition bands of the equipment and therefore will be subject to severe interference. Such constraints raise major questions regarding the value of such bands, as well as the availability of equipment capable of operating in such bands. Furthermore, even if the above mentioned frequency blocks are used as guard bands, it is possible that this could not be enough to guarantee enough protection from interference and 10 MHz blocks might be needed.

Should the band is divided into two blocks of 25 MHz each, the exact amount of spectrum available to each MNO would need to take into account the guardband constraints at 2570 and 2620 MHz, noting that 5 MHz guard bands are unlikely to fully protect the systems. Furthermore, in order to avoid interference between the two TDD operators, either an additional guardband should be adopted or the two TDD MNOs should synchronise their networks.

Following these considerations, Qualcomm recommends to ComReg to assign 50 MHz of TDD spectrum in the 2.6 GHz band to only one operator.

Sections 4.12 to 4.17: The 2.3 GHz band plan

Qualcomm supports ComReg's proposal to adopt the band plan as set out by ECC DEC (14)02.

As in the case of the 2.6 GHz unpaired band, Qualcomm stresses that guard blocks or network synchronisation should be adopted to avoid interference between TDD operators.

Sections 4.18 to 4.23: The 1.4 GHz band plan

Qualcomm fully supports ComReg's proposal to adopt the band plan and technical condition harmonised at European level by ECC and EC.

Sections 4.24 to 4.30: The 3.6 GHz band plan

Qualcomm notes that the harmonized band plan for 3600-3800 MHz in ECC Decision 11(06) is TDD, with the understanding that TDD includes as one specific case SDL. Qualcomm further notes that while CEPT considers that SDL could be a specific case of TDD, the 3GPP considers SDL as a specific case of FDD. As such, Qualcomm underlines the risk that presenting the band plan as TDD would restrict the options of stakeholders further than what was proposed and agreed in CEPT.

As in the case of the 2.6 GHz unpaired band, Qualcomm stresses that guard blocks or network synchronisation should be adopted to avoid interference between TDD operators.

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Sections 4.31 to 4.35: The 700 MHz band plan

The full use of 3GPP Band 28 would not be appropriate for Europe as it overlaps with the EU 800 MHz band, aka 3GPP Band 20. However, the reuse of the lower duplexer (2x30MHz) currently implemented to support 3GPP Band 28 would maximise the economies of scale and facilitate roaming while being compatible with EU 800 MHz band (See Figure below).

Figure 1: Qualcomm proposal for optimal 700/800MHz band plan in Europe

In doing so, Europe can then leverage the best out of sub-1 GHz spectrum with an overall spectrum availability of 2x60 MHz in 700/800 MHz and with considerable harmonisation with other regions. In Region 1, the United Arab Emirates (UAE) Telecommunications Regulations Authority (TRA) has recently announced its plan to adopt this frequency arrangement for the 700/800 MHz as of 2015[3].

The adoption of the 703-733 MHz UL / 758-788 MHz DL as harmonized band plan for mobile in Europe is proposed by the draft CEPT Report 53 which should be finalized very soon. Qualcomm believes that there is a large consensus in Europe to adopt the 703-733 MHz UL / 758-788 MHz DL as harmonized band plan for mobile and that the band plan will provide significant benefits in terms of device availability and economies of scale.

In addition, Qualcomm encourages ComReg to consider the adoption of 2x3 MHz in that band, namely 733 – 736 MHz and 788-791 MHz, for M2M applications.

3 http://www.tra.gov.ae/news_UAE_TRA_ANNOUNCES_700_MHZ_BAND_PLAN_FOR_MOBILE_BROADBAND-514-1.php

Sections 4.40 to 4.43: Non-exclusive assignment of Spectrum

In order to respond to the traffic demand, Qualcomm believes that operators need to leverage all types of spectrum including:

- Traditionally exclusive licensed spectrum, for QoS critical applications and to reach coverage goals.
- LSA spectrum, where sharing and interference are controlled and predictable,
- Unlicenced spectrum, to access very large bandwidth on a local basis.

All three types of spectrum access methods are complementary.

However, Qualcomm argues that it is neither appropriate, nor supported by the market, to mix different spectrum access method in a given spectrum band. Mass market devices using unlicenced spectrum access typically operate in bands harmonized at worldwide level for such use. Furthermore, it may be challenging to avoid interference for unlicenced devices to mobile devices operating in spectrum licenced to an MNO.

Qualcomm recommend ComReg to perform a band per band assessment on whether it is desirable and recommended to allow the introduction of unlicenced devices in a band. In particular, the value of coverage bands such as 700 MHz and 1.4 GHz may be significantly degraded should unlicenced devices operation be allowed in the band.

11. Ripple Communications Ltd.: submission entitled "Submission to ComReg 14/101", dated 12 November 2014

November 12th, 2014

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Re Submissions to ComReg 14/101

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Dear Ms. Devey,

1 Introduction

Ripple Communications Limited ('Ripplecom') is a rapidly growing telecommunications operator providing solutions and services via radio and fibre optic networks. Headquartered in Limerick, Ripplecom has a staff compliment of 30 people servicing 6,000 customers. The Company is one of Ireland's largest suppliers of broadband services to the Department of Educations' primary school sector. In addition to Government contracts, Ripplecom provides wholesale and retail solutions to Corporate, SME and Residential customers across 25 counties.

The company has a focus on engineering excellence and is one of only two telecommunications providers in Ireland that has achieved the prestigious Engineers Ireland CPD Accredited Employer standard. Ripplecom has featured twice in the last three years in the Deloitte & Touche "Fast 50" technology awards.

With a shareholder base including the Irish Farmers Association (IFA) and Farmer Business Developments PLC, Ripplecom is focused on the development, deployment and delivery of high speed Internet solutions to businesses and communities in rural Ireland.

Ripplecom maintains 30 ComReg licensed Point to Point (PTP) links and has a further 9 Point to Multipoint (PTMP) licences on the Fixed Wireless Access Local Area (FWALA) 3.6GHz spectrum. This spectrum allocation is due to expire in 2017.

2 Spectrum Allocation to Support the National Broadband Plan (NBP)

Ripplecom is actively communicating with the Department of Energy, Communications and Natural Resources (DCENR) concerning the development of the NBP. Ripplecom has contributed to the DCENR **National Broadband Plan Call for Input 14/01**[i] process.

With the Next Generation Access (NGA) requirements set in the European Digital Agenda (EDA)[ii] and the recent DCENR National Broadband Plan Call for Input 14/01, is clear that the future broadband delivery requirement is 30 Mbps for 100% of citizens.

While increasing fibre connectivity to the citizens of Ireland will be the primary route to achieve these objectives, the probability that fibre will be deployed to every household / premises in Ireland within the next five years is remote.

In other jurisdictions, the delivery of NGA speeds has / is being achieved through a combination of fibre and wireless technologies. It is estimated in the United Kingdom (UK), that the cost of deploying superfast broadband to the last 10% of households is up to three times higher than supplying to the first two-thirds of the population[iii]. Considering the more dispersed pattern of the Irish rural population, this ratio may be even higher in Ireland. It is the opinion of Ripplecom that Fixed Wireless Access (FWA) can be a key element for the delivery of the NGA targets particularly in rural areas.

3 Number of Subscribers Utilising Fixed Wireless Technologies & Quality of Service Issues

ComReg reports that the number of subscribers utilising fixed wireless technology includes the FWALA 3.6, 10.5 and 26 GHz, spectrum. They also collect and report on the number of customers receiving a service on the unlicensed Short Range Device (SRD) bands of 2.4 Ghz and 5 GHz.

Ripplecom is of the view that numbers do not reflect the overall FWA picture as many Wireless Internet Service Providers (WISPs) do not report to ComReg at all. From our knowledge of the marketplace, there are over 60 WISPs providing services to at least 100,000 to 120,000 customers who are primarily rurally based.

As a result of the extensive deployment of service using these unlicensed bands, Quality of Service (QoS) due to interference is a constant issue. Ripplecom has built up a significant body of expertise, delivering broadband to rural Ireland both through FWALA licensed and 5GHz SRD band unlicensed spectrum networks. Looking to the future, in our opinion, it is vital that broadband delivery over a fixed wireless platform is achieved *exclusively* by utilising licensed spectrum network equipment where QoS is guaranteed.

4 Technical Suitability of 3.6 GHz for Rural FWA Services

The 3.6 GHz band is very well suited to rural fixed wireless deployments owing to its low susceptibility to attenuation resulting from precipitation. Reliable high speed connections can be provided at distances of up to 20 km. For this reason, the band is well suited to areas of low population density but only where there exists a clear line of sight to a high site from a large number of consumers. Given the propagation characteristics of 3.6 GHz, the band is less suitable for mobile telecommunications for the following reasons:

- 3.6 GHz has a worse non line of sight performance. This translates into a need for a higher number of Base Stations and higher costs for the initial network build and poorer rural coverage.
- 3.6 GHz has poor building penetration resulting in ineffective indoor coverage.
- 3.6 GHz is not yet proven although operators in Europe and Asia are currently deploying Long Term Evolution (LTE) networks.

5 Current FWALA Scheme

While the 3.6 GHz is very well suited for FWA, the current FWALA scheme is not adequate for NGA speeds. While the 28 MHz channels could be adapted to meet the NGA requirements as outlined in section 2 of this document, the 7 and 14 MHz channels currently available will not.

Coupled with the restricted channel size, a licence cessation date of July 31st 2017 was reconfirmed in document 10/55 in 2010. Given the expensive nature of the equipment, it was difficult to get the return on investment over a relatively short six year time horizon. Over the past few years, WISPs have been left with no option but to migrate subscribers from FWALA to the 5 GHz SRD band. While serving their customers' ever increasing bandwidth requirements, the QoS is compromised. This current spectrum award is an opportunity to provide the spectrum required for the delivery of NGA speeds and upgrade the QoS to existing customers of FWA Operators.

6 Spectrum Award

The consultation document entitled 'Spectrum award – 2.6 Ghz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands' is welcomed by Ripplecom as we believe the only long term sustainable business plan that can be adopted by WISPs, is one based on the utilisation of licensed spectrum to deliver QoS. We are of the opinion that the licensed spectrum granted in an award must be capable of delivering the minimum objective of the NBP.

6.1 *2.6, 2.3, 1.4 GHz and 700 MHz Bands*

Ripplecom understands that the 2.6 GHz band should mainly target end-user access to broadband communications[iv]. Therefore, it would appear to be best served as 8 blocks of 5 MHz from 2570-2620 MHz in a Time Division Duplex (TDD) configuration. In considering the need for end-user access to broadband communications, it would appear reasonable that the 1.4 GHz band be added to this spectrum auction. Ripplecom understands that the use of the 1452-1492 MHz band[v] is harmonised as a Supplemental Down-Link (DL). Ripplecom has reviewed the 2.3 GHz band and would comment that due to the poor quality 2.4 GHz Short Range Devices (SRD) that have been deployed in large numbers across premises all over the country, the spectrum analysis of the band in most areas from 2300-2412 MHz shows noise of greater than -70dBi. In regard to the 700 MHz band, the lower frequency level makes it ideal for mobile use, perhaps as two paired blocks as Frequency Division Duplex (FDD) or even as a single TDD Long Term Evolution (LTE) (TD-LTE) block.

6.2 3.6 GHz Band

Given that the award process addressed in this consultation process is likely to include 2.3 GHz (100MHz) and 1.4 GHz (40 MHz) in addition to 2.6 GHz (190 MHz) this will add a very significant amount of spectrum to that already utilised by mobile operators. Since the propagation characteristics for these bands make them better suited to wide area mobile deployments than the 3.6 GHz band, it is likely that these bands rather than 3.6 GHz would be used for rural deployments, with 3.6 GHz possibly being used for urban hot-spots and areas of very high population density.

To reserve all 400 MHz of the available spectrum at 3.6 GHz spectrum for national licences (a scenario which might result in spectrum being used in a limited number of urban deployments), would not, in in Ripplecom's view, be consistent with ComReg's obligation to make optimal use of spectrum for the benefit of all.

In addition the FWA Operators providing the service at present and who are capable of upgrading their networks when spectrum is released, must be given the opportunity to deliver the service to their customer base and hopefully to increase their scale of operations over time.

Therefore, Ripplecom believes that the 3.6 GHz band should be included in the new licensing framework but it is essential that a significant portion of this 3.6 GHz band (3.6 GHz to 3.8 GHz) is reserved for rurally focused WISPs to deliver NGA speeds. The 3.6 GHz band is currently the lowest licensable band available in Ireland for such applications and is thus ideal for providing service to CPEs, although a Line of Sight (LoS) path is still required. In summary, Ripplecom believes that frequencies in the range 3,600 to 3,800 MHz should be reserved principally for the provision of quality FWA broadband services to business and residential users, focusing on the small towns and rural areas of Ireland.

To deliver these speeds, WISPs will require a minimum of 20 MHz channels with the ability to increase to 40 MHz to cater for future needs. If allocations are made on this basis, progressive WISPs can invest in technologies like TD-LTE or LTE-lite to deliver to rural households and businesses.

Ripplecom believes that licences could be granted on a number of different scenarios including:

1 ***National 3.6 GHz licence***

Paragraphs 3.29 to 3.31 in document 14/101 deal with the availability of spectrum in the 3.6 GHz band. Notwithstanding the contents of Section 5.6, ComReg maintains that for the purposes of Chapter 3 dealing with the assessment of the suitability of whether or not to include additional frequency bands in the award process, any rights pertaining to the 3.6 GHz band would be available for award on a national basis.

With our shareholder base including Farmer Business Developments PLC and the IFA, Ripplecom is well positioned to operate such a national licence and source additional resources to roll out a NGA platform across its substantial current radio footprint and expand that footprint as demand arises. Ripplecom believes it would be possible to acquire a national licence under the circumstances described in the Consultation Document Section 5.6 (5.78) particularly where *'the price premium to be paid over a regional licence is sufficiently small'*.

Failing the granting of the award of a National licence to Ripplecom in its own right, we are willing to enter into arrangements with a number of other WISPs to form a legally binding partnership / limited liability company to ensure that the combined footprint of the entities would have near national coverage from start-up. A platform upgrade based on 3.6 GHz covering 26 counties could be undertaken in a very speedy fashion. This would ensure that in the context of national licences being awarded to larger service providers, real competition would exist across the 26 counties.

2 *Sub-national licence*

In Section 5.6 of document 14/101 it is stated that it may be appropriate to award a subset of the 3.6 GHz band on a regional or local basis.

Ripplecom believes that the awarding of a subset of the 3.6 GHz band on a regional or local basis is an absolute requirement. If sub-national licences are not introduced, the likely market price of national licences would be prohibitively high for those operators focusing on the provision of broadband to small towns and rural areas. In the event that regional operators are unable to acquire sub-national licences, there would be an immediate reduction in broadband options and an absence of equivalent replacement services for rural broadband users including schools, SMEs and home workers.

Ripplecom does not consider it appropriate to attempt a detailed award design within the remit of the current consultation process; however some of the key points that could be taken into account by ComReg are as follows:

- The regional licensing areas (RLA) need to be designed with care; geographical boundaries should be included on a vector map.
- Four possible / natural RLAs;
  - Borders – Counties Donegal, Leitrim, Cavan, Monaghan and Louth.
  - Connaught – less County Leitrim.
  - Leinster - less Dublin City.
  - Munster
- A goal would be to have three to four operators per RLA.
- Consideration should be given to the awarding of Licences to Operators at a local level (sub-region) who can demonstrate they are currently providing services in specific areas subject to the Operator fulfilling minimum requirements as set out in paragraph 7.3 below.
- Broadband services must be offered to residential and business consumers.
- 3.6 – 3.8 GHz should be available for licensing.
- Licensees in the Borders RLA would need to comply with an Ireland – UK coordination agreement.
- Sub-national operators in consultation with ComReg should develop a code of conduct and dispute resolution procedure.
- The cost of a licence should be affordable for companies wishing to provide rural broadband services.
- An operator may hold a maximum of three RLA licences in order not to obtain a national licence through consolidation and acquisition.

With its scale of operations, shareholder base and experience in delivering services to its customer base, Ripplecom would be well positioned to operate a sub-national licence.

7 Commercial Considerations

It is not considered appropriate to attempt to set out detailed commercial criteria in the awarding of spectrum. This is a matter for ComReg. However Ripplecom would like to input a number of key points of information that it believes should be taken into account when designing the spectrum award process including;

7.1 Exclusion from Auction

While it is essential that the 3.6 GHz band is included in the new licensing framework to facilitate proper planning of a network build-out and the raising of the necessary investment, Ripplecom is of the view that it should be excluded from the 2.6 GHz national auction and awarded on a different basis for the following reasons:

- Given their scale, WISPs cannot afford to go into an auction against international telecommunications companies / service providers with virtually limitless resources and hope to outbid them. The method of allocation of licensed spectrum of the 3.6 GHz to 3.8 GHz bands should shift from the companies with the deepest pockets who pay upfront fees, to those who provide services to a predetermined quality level at agreed rural locations, where the services are required.
- At present a 'digital divide' exists between urban and rural areas of the Ireland. This has been recognised by DCENR (The Minister for Communications has issued press releases concerning a €500m+ market intervention to provide broadband to rural areas). While understanding that this divide needs to be addressed, due recognition needs to be given to the numerous WISPs who have delivered services and 'filled the void' to rural communities for the past decade. These WISPs have invested significant monies and have infrastructure and site arrangements *in situ* at present. This infrastructure can be upgraded should spectrum be awarded, while the larger telecommunications companies, who have focused on the highly lucrative urban markets during this time period, have a limited localised presence.

7.2 Term of Spectrum Award

Appropriate licence duration for all public telecommunications licensees is required which, on one hand encourages investment and on the other hand, provides the regulator with sufficient powers to withdraw licences in certain circumstances and to decline renewal where spectrum efficiency can be improved.

A suitable commercial environment needs to be created where operators can raise the required investment for next generation equipment, introduce higher speeds and procure additional sites. A realistic licence duration of 15 to 20 years should provide this environment.

This timeframe creates the opportunity to invest in and upgrade the network with TD-LTE equipment thereby offering NGA speeds while at the same time securing a return on investment for investors / shareholders. Ripplecom is of the view that the granting of licences to *bona fide* FWA operators should be on the same commercial basis as the current FWALA licences.

7.3 Conditions Attaching to Licensed Spectrum Award

Ripplecom recommends that ComReg set out a number of conditions which would apply to companies who are awarded these licenses and which would need to be complied with, on an ongoing basis, to maintain the right to use the spectrum. This would ensure:

- compliance with regulatory rules (both technical and administrative).
- competency regarding the technical capability of the Company to operate in today's telecoms environment.
- capability regarding the provision of a level of service commensurate with the objectives of the NGA.

Ripplecom recommends that ComReg considered the following conditions that may apply to an award of spectrum:

1. Be registered with DCENR and ComReg as a telecommunications provider.
2. Following the acquisition of spectrum, be able to demonstrate that a minimum number of customers (number to be agreed) are being serviced within 12 months of the first allocation. This ensures that the allocated spectrum is being used for its intended purpose.
3. Maintain a residential customer base of at least 50% to ensure that the spectrum is not used solely to service higher paying Business Customers (which would result in rural customers remaining without broadband).
4. Be tax compliant and have up to date accounts files with Revenue.
5. Be of a scale to operate a network across an RLA.
6. Have a core telecommunications network in place with sufficient transit capacity and a connection to Internet Neutral EXchange association (INEX) for peering with other service and application providers.
7. Offer broadband and voice services.
8. Have the resources available or be able to demonstrate that the required resources can be raised in the marketplace to upgrade its current network to a licensed spectrum NGA platform within the next 18 to 24 months.
9. Have sufficient and appropriately qualified technical and operational staff commensurate with its customer base.
10. Fulfill all regulatory commitments including quarterly reporting to ComReg.
11. Have the ability/track record of providing wholesale services to other operators to ensure competition.

7.4 Link with the NBP

Assuming the above conditions are met, FWA Operators who deliver NGA broadband to specific rural areas could be refunded the cost of the provision of the service (e.g. the cost of the Customer Premises Equipment (CPE) plus some overhead) as a means of supporting the roll-out of the NGA.

Funded from the Government NBP intervention programme, this will support the roll-out of a quality NGA service to the hard-to-reach rural locations being serviced over the wireless platform. The deployment of this solution will invariably be capable of much faster delivery compared with a Fibre- to-the-Home (FTTH) plan, which at best, will take years to deploy if ever.

8 Conclusion

Ripplecom believes it is essential that the 3.6 GHz band is included in the new licensing framework and that a significant portion of this band (3.6 GHz – 3.8 GHz) is reserved for the deployment of NGA networks by WISPs who fulfil minimum operating requirements. The allocation of this spectrum, on a national and sub-national basis, can be accommodated and this would generate ample competition between Operators for the benefit of consumers while still preserving the commerciality of the business model required for Operators to earn a return on investment.

Allocation of spectrum to qualifying WISPs, who have 'filled the void' over the past 10 to 15 years in bringing broadband to rural communities, is very important. It recognises the contribution made by companies like Ripplecom, who form part of these rural communities. In addition a significant number of jobs and economic spend connected with these rurally based companies would be protected.

With our shareholder base including Farmer Business Developments PLC and the IFA, Ripplecom is well positioned to put in place additional resources to roll out a NGA platform across its substantial current radio footprint and expand that footprint as demand arises.

Ripplecom would like to extend its thanks to ComReg for the opportunity to respond to this consultation. Ripplecom is available for further consultation with ComReg if additional information or clarification is required.

Nothing in this document needs to be considered as restricted or confidential.

Yours sincerely,

John McDonnell

Managing Director

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i Ireland, Department of Communications, Energy and Natural Resources (2014). NBP-TL-0001: National Broadband Plan, Call for Input, On Key Aspects of the State-Led Intervention. Dublin: Department of Communications, Energy and Natural Resources.

ii European Union, European Commission. (2010). COM(2010) 245 final/2: A Digital Agenda for Europe. Brussels: European Commission.

iii United Kingdom, Department for Business, Innovation and Skills. (2010). Britain's Superfast Broadband Future. London: Department for Business, Innovation and Skills.

iv European Union, European Commission. (2008). 2008/477/EC: Decision on the harmonisation of the 2 500-2 690 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community. Brussels: European Commission.

v European Conference of Postal and Telecommunications Administrations. (2013). ECC Decision (13)03: The harmonised use of the frequency band 1452-1492 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL). Copenhagen: European Conference of Postal and Telecommunications Administrations.

12. RTÉ: submission entitled “RTÉ Response to Comreg Consultation - Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands”, received 19 November 2014

RTÉ RESPONSE TO

COMREG CONSULTATION

Spectrum award - 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

ComReg 14/101

RTÉ is the primary user of the UHF spectrum (700MHz band) under consideration in this consultation, and has been investing in and delivering national public service television using UHF spectrum since the 1970s. Today, RTÉ's free to air Digital Terrestrial Television (DTT) platform SAORVIEW is delivered exclusively over UHF spectrum - including the 700MHz band - and is entirely dependent on it. DTT in the UHF band provides universal, free to air access to public service media services that seek to inform, educate and entertain Irish citizens, and contributes significantly to media pluralism.

Removing the availability of the 700MHz band from broadcasting has the potential to affect every single SAORVIEW household (depending on the outcome of ongoing UHF re-planning), causing major disruption and cost to viewers and broadcaster alike, and inhibiting RTÉ's ability to carry out its public service obligations.

RTÉ previously responded in detail to the ComReg preliminary consultation on the future of the UHF band (ComReg doc. 14/13) outlining our concerns with the potential re-purposing of the 700MHz band from its current use for broadcasting (as referenced in section 3.44 of ComReg 14/101). RTÉ is generally pleased with ComReg's response to this consultation (ComReg 14/85) and is encouraged by ComReg's initiative in developing a Cost Benefit Analysis of the release of this spectrum. We look forward to its publication and participating further in that ongoing consultation process.

Furthermore RTÉ is pleased to have had the opportunity to respond to the DCENR's recent consultation on spectrum policy (as referenced in section 3.46 of ComReg 14/101) which also dealt specifically with the potential reallocation of the 700MHz band, and will hopefully lead to further clarity around the future of UHF spectrum for broadcasting.

The key issue which should be re-stated in this current consultation (14/101) on the auction process is to ensure that consideration is given to the cost impact of this change and adequate provision is made for compensation to RTÉ, SAORVIEW viewers and other effected parties for costs incurred and disruption, should the 700MHz band be re-allocated from broadcasting. In this regard:

1. A comprehensive and easily accessible compensation mechanism (for those effected by any works conducted on shared infrastructure to facilitate changes in the spectrum) needs to be implemented to minimise disruption to existing viewers[1], broadcast network operators, telecom services providers sharing the infrastructure, SAORVIEW license holders and affected broadcasters[2] (mainly SAORVIEW and FM broadcasters), in line with the RSPP (Articles 5 and 18) and considering the recommendations of the

[1] Disruption to viewers is likely to include: re-scans, receiver antenna re-alignment, receiver antenna replacement

[2] Disruption to broadcasters will include: significant network replacement, service disruption (including FM radio services during major UHF antenna works), maintaining brand value

chairman's report from the EC High Level Working Group on the future of the UHF band[3].

2. Appropriate protection, information and compensation needs to be in place for viewers whose reception equipment may be vulnerable to interference from mobile services in the 700MHz band as a result of the spectrum re-purposing.

3. Some consideration should be given to viewers whose reception equipment may not work due to the reallocation of channel frequencies as a result of the spectrum re-purposing. Many of these viewers have only recently replaced equipment due to the spectrum changes at ASO.

4. Appropriate protection and compensation needs to be in place for PMSE users of this spectrum.

5. A comprehensive communication plan needs to be put in place, particularly around viewers who will experience difficulty. This comprehensive communication plan should be appropriately compensated and should be managed by the party who will experience the greatest burden result of the spectrum re-purposing namely SAORVIEW.

RTÉ looks forward to ComReg's estimates of these costs from its Cost Benefit Analysis.

RTÉ anticipates that the most appropriate source of this compensation will be the direct proceeds of the spectrum auction. While it may need a policy decision from the DCENR to implement, this consultation should include consideration of compensation to existing users of spectrum as a central part of this award process. This will help ensure that potential bidders for the spectrum are fully aware of all issues and responsibilities that come with using this spectrum.

[3] The chairman's report of the EC High Level Group on the future of the UHF band states that terrestrial broadcasting will continue to be an important platform until 2030, recommending a review of terrestrial broadcasting and mobile broadband spectrum demands by 2025. https://ec.europa.eu/digital-agenda/en/news/report-results-work-high-level-group-future-use-uhf-band

13. Three Ireland (Hutchison) Limited: submission entitled "Spectrum Award – 2.6GHz (Also 700MHz, 1.4GHz, 2.3GHz, and 3.6GHz) -Response to Document 14/101 from Three", dated 14 November 2014

Spectrum Award – 2.6GHz

(Also 700MHz, 1.4GHz, 2.3GHz, and 3.6GHz)

Response to Document 14/101 from Three

14th November 2014

1. Introduction

ComReg and the mobile operators have just recently concluded the first Multi-Band Spectrum Auction (MBSA I) in Ireland. We all learned from that auction that the process of consultation, decision making, and execution takes considerable time and effort both for ComReg and interested bidders. Three welcomes the approach that ComReg seems to be taking this time around – to broaden its consideration to include all possible candidate bands from the beginning. This should allow a broad review of which bands should be awarded, and when.

We recognise that ComReg has already undertaken some work to present a fairly detailed proposal in its first consultation. It is hoped that all alternative suggestions and modifications which emerge through the consultation process will be considered, and that ComReg remains open to changing its current proposal as necessary.

While there are varying opinions on the exact rate of growth of mobile data traffic, it is widely accepted that it will be significant for a number of years to come, and that additional spectrum will need to be made available if that demand is to be met. There is a little less certainty regarding exactly when additional spectrum in the various bands will be required, and it is also unclear when the ecosystem will be in place to allow use of the emerging bands.

The expiry of current 2.6GHz licences in 2016 is a firm date that has provided a focus for ComReg's proposal – suggesting an assignment by the end of 2015. Three believes this is premature for the large multiband auction in ComReg's initial proposal as there is considerable uncertainty regarding the suitability of several of the bands under consideration. Mobile operators have just recently acquired spectrum in the MBSA I, under which significant up-front and annual payments are required. Operators are now investing in their networks so that they can use the spectrum acquired to deliver services. If they were required to again make such payments in the short-term, they would be deprived of funding to invest in these networks, and consumers would lose out.

All those who were involved will have benefited from the lessons learned in the MBSA I, and this has allowed ComReg to make a reasonably well progressed proposal in this, the first consultation. While some considerations are similar this time round, there are also several aspects of the proposal that Three believes are significantly different. We agree with some of the detail of ComReg's proposal and those decisions will make sense whenever the various bands are awarded. There are also aspects of the analysis that we disagree with, and **overall we believe it is premature to consider the multiband auction as proposed**. These points are explained in the following sections, which in general follow the format of ComReg's consultation document.

2. General Response

As stated above, there is a consensus of opinion to state that demand for mobile data will continue to grow at least in the short to medium term. ComReg's own quarterly report demonstrates the historical growth, and while there is consensus to say that growth will continue, there is some uncertainty about the rate of this growth. ComReg has quoted the Cisco Visual Networking Index as a reference, however there are several other reference sources including Ericsson[1], Neilson[2], and Red Mobile[3]. As yet, there is no equivalent of Moore's Law for data demand, however all of the above reports point to a continuing growth in demand for mobile data capacity.

While some gains in throughput will be made by improvements in technology, and re-engineering of networks, ultimately it will not be economically feasible to match the growth in demand by squeezing more throughput from existing spectrum assignments. Again, there are a number of studies available that try to identify the future demand for mobile spectrum, including from the USA, which decided in 2010 to make an additional 500 MHz of spectrum available; a report by Coleago for the GSMA in 2013 which concludes that about 2GHz of spectrum will be needed to meet demand from mobile networks; and a report by Analysys Mason for the NITA in Denmark which concluded that 1,700MHz of spectrum would be needed for broadband access by 2025, leaving a 600MHz shortfall.

Overall, the conclusion must be that more spectrum will be required for mobile access, though some uncertainty remains in relation to how much and when.

As discussed later, Three believes ComReg has identified the right list of candidate bands and welcomes the fact that ComReg is consulting on these early. It is important for operators to have visibility of the bands that are being considered for allocation as early as is possible; however there are a number of factors to take account of when considering the correct timing for release of spectrum.

It is important that Ireland does not fall behind competing countries in making spectrum available for broadband access, particularly mobile broadband. This is an area that has continued to innovate over the past decade, and shows no sign of slowing down. Much of the digital economy is now mobile, with digital leaders focusing on "mobile first" as a means to protect the future of their businesses. For a time, Europe was world-leading in manufacturing, deploying, and using mobile services. That lead has however been lost, and now the US is considerably ahead of Europe for mobile broadband connectivity and innovation, and as a consequence also for all associated benefits. With the deployment of 700MHz spectrum for LTE in

[1] http://www.ericsson.com/news/1561267
[2] http://www.nielsen.com/us/en/newswire/2011/average-u-s-smartphone-data-usage-up-89-as-cost-per-mb-goes-down-46.html
[3] http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf10253.html

2007, the US was able to jump ahead of Europe in LTE penetration and use. This leadership does not only affect the communications sector itself, but all of the associated businesses and services in the digital economy.

It is equally important to recognise that the market in Ireland is not big enough on its own to achieve the economies of scale necessary to proceed ahead of harmonised standards. In particular, mobile devices and networks are manufactured for a limited number of global markets, and Ireland is not sufficiently large to influence the specifications of devices and network equipment on its own. ComReg correctly follows European harmonised assignments and band plans where they are available. Where they are not available and already being adopted, it is necessary for some of the larger countries to have commenced their assignments so that there can be confidence in widespread availability of devices and equipment.

Ireland should not fall behind other European countries in the assignment of additional spectrum bands for mobile services. Equally, the market is too small to influence the global ecosystem, so Ireland cannot proceed ahead of other European countries. If ComReg offer particular bands for assignment before it is certain that they will be adopted generally, then this uncertainty will inhibit demand.

3. Bands for Award

ComReg has proposed to include the following bands in a multi-band spectrum auction:

- 700MHz
- 1.4GHz
- 2.3GHz
- 2.6GHz
- 3.6GHz

Three agrees that ComReg has identified the correct candidate bands for inclusion in this consultation. We recognise that ComReg is participating at the relevant European organisations which are identifying new harmonised bands for allocation to mobile. As described above though, getting the timing right is important, as it does not seem that Ireland can proceed ahead of the European consensus for any particular band. **As explained further in this document, Three does not believe it is appropriate to proceed with a multi-band auction for all of the above bands at this time.**

ComReg's timetable is being driven by the expiry of current licences in the 2.6GHz band in April 2016, with the aim of this consultation being to consider which additional bands should be assigned in the same process. At the present time, there

are significant disparities between the various bands listed above, which mean it would not be appropriate to include them all within a multi-band spectrum auction as currently proposed by ComReg. We believe it is likely that such an auction would fail. If we take a brief look at each band:

2.6GHz

We agree with ComReg that this band is suitable for award to mobile services. It was generally the first band to be awarded for LTE services in Europe, and there is a well-established device and network ecosystem. Mobile services could be deployed in this band relatively quickly following assignment. Its propagation characteristics mean this band is suitable for capacity provision, rather than coverage.

While previous consultations by ComReg have indicated there is interest in this band, it is unclear yet whether any existing operators have hit capacity constraints that will require deployment of additional capacity spectrum in the short term. ComReg's timetable for the proposed auction seems to be driven by the expiry of MMDS licences in April 2016 and a desire to have replacement licences in place before then.

700MHz

This spectrum is currently in use as part of the national Digital Terrestrial Television (DTT) plan for broadcasting, as is typically the case across Europe. Obviously, the broadcast networks will need to be re-tuned and the spectrum recovered before it can be re-purposed for use by mobile.

Three is aware that many broadcasters, including 2RN may not agree with the recovery of the 700MHz spectrum at this time so that it can be re-purposed for mobile use. It is just over two years since the last network re-configuration by 2RN was completed with analogue switch-off. Three (like any operator of a large network) can understand that 2RN will not welcome a seeming continuous requirement to re-design and re-tune its network, and that this will take both time and resource to plan and implement. The Department of Communications, Energy, and Natural Resources has issued a consultation document on this matter, and the policy decision arising from this matter is awaited.

Nevertheless, its propagation characteristics make this band attractive for use to provide mobile coverage. There is growing momentum across Europe to recover this spectrum from broadcasting and assign it to mobile. At this time, Germany has already stated its intention to auction this band in 2015, and as ComReg has pointed out, other work is in progress to produce harmonised band-plans and technical conditions.

Three believes this spectrum will be generally re-assigned for mobile use across Europe in the next few years, however the timing is uncertain. Former EU Commissioner Pascal Lamy chaired a High Level Group on the future of the UHF band in 2013, however he failed to reach agreement between the interest groups. His personal report to the European Commission recommends that the 700 MHz band should be reallocated to wireless broadband across Europe in a timeframe ranging between 2018 and 2022, though this report does not have any official status as yet.

ComReg is in the process of carrying out a cost-benefit analysis to facilitate the decision making process for this band. Although that analysis has not been completed yet, Three believes the 700MHz band will be licensed for mobile use in Ireland. It is currently uncertain when that is likely to be though. It is noted that the current DTT licences will not expire until 2019.

Given the above factors, it would seem unlikely that the 700MHz band will be available for mobile before 2019, and even that is dependent on DTT being re-tuned and the band cleared within that timeframe. Taking into account also that no other European country has licensed this band yet, and that equipment is not yet available, **it would be premature for Ireland to consider licensing the 700MHz band in Ireland for mobile in 2015**. Waiting until at least some of the larger EU countries have licensed this spectrum, band-plans and technical specifications are established, and the transition plan for release of the spectrum is known would remove uncertainty regarding this band. This would allow applicants a significantly greater ability to establish their demand and valuations at the time of an auction.

1.4GHz

Even though a number of European countries are moving towards licensing this band to be used as a supplemental downlink, none has done so already. Devices and equipment to use this band are not available at present, and there is no established experience of use of this band to indicate how useful it will be in practice or how it should be valued. While it is accepted that there is a general interest in making this band available to mobile, **Three believes it is premature to consider an auction process to award the 1.4GHz band at this time**.

2.3GHz

We note that this band has been available in Ireland for several years, and that internationally, it has also been a candidate band for mobile for several years. This band is in use in some countries outside of Europe already, so it is to be expected that at least some devices are capable of supporting it. Nevertheless, progress for this band has been slow within Europe. We note

that the ECC decision harmonising this band for mobile use has only recently been adopted, and that only some European countries have indicated that they will award the band for mobile services. **For these reasons, there remains some uncertainty at this time in relation to widespread take-up of this band**.

3.6GHz

This band is licensed and in operation already to provide fixed access. It is a large capacity band, however its propagation characteristics mean it would have limited value in Ireland for mobile services. With little or no mobile device inclusion this band stands in a different category to the others covered by ComReg's consultation and it **should not be included in the same award process**.

4. Which Bands When?

ComReg has proposed to proceed with an auction to award rights of use in the 2.6GHz band, and correctly has examined whether there are any other bands that should be considered for inclusion in the same auction. Three agrees that ComReg has identified the correct bands for consideration, however on analysing those bands Three does not agree that it would be appropriate to proceed with the multi-band auction as proposed at this time.

It is possible of course to hold a single auction which includes for sale different bands that have very different use and application and where the decision to buy spectrum in one band has no dependency on winning spectrum in one of the other bands. In this case, different bidders could participate in the auction bidding only on the spectrum that they are interested in, without affecting the bidding or sale of other bands that they have no interest in. Adding multiple bands to an auction adds to the complexity involved for the auctioneer and the bidders though, so unless there is a logical reason to group bands together in a single award process, it is better not to do so.

Bands should be grouped together into a single award process where there is a benefit to the bidders in doing so. ComReg and DotEcon have identified these cases in their documents - cases where the bands are compliments and a bidder would want to know they could buy both, also cases where they are substitutes so a bidder could switch between bands depending on how the pricing for each band is developing at any point during the auction.

In addition to just being compliments or substitutes, there are other factors that need to be taken into account when considering whether to include bands together in a multi-band auction. There needs to be a reasonable degree of consistency in knowledge of the utility and cost of use of each band in order to develop reliable

valuations. This is relevant for the auctioneer in deciding on the relative bidding eligibility and minimum price for each band also. It is critical for bidders to be able to develop reliable calculations of relative demand and valuation. **Mobile operators need spectrum to provide services and they invest in accordance with their business plan. They are not speculators and should not be expected to bid for spectrum where there is uncertainty regarding the factors that will influence their demand and valuations, or where the spectrum will not be available for use for some time**. In this circumstance it is bidders' different approaches to speculative bids that will determine the auction outcome rather than the utility or value they can generate from the spectrum. This could lead to an efficient operator losing out to a less efficient operator who is less risk averse, and this would be an inefficient auction outcome.

Large multi-band auctions also suffer if the bands are to be auctioned a long time before the spectrum can be used, or if there is a large spread in the time when different bands can be used. The type of auction proposed requires large upfront payments by bidders. If the spectrum bought cannot be brought into service soon after the auction, then this only serves to deprive operators of funding, which hampers their investment in services.

Decisions made in advance of the first multiband spectrum auction (MBSA I) were predicated on the basis of a potential new entrant to the market. This influenced several aspects of the auction, including the spectrum caps, minimum price benchmark, etc. There are currently three mobile access network operators, one core network operator, and four MVNOs (some of which will have an option to obtain spectrum). Given the stage of the market, it would seem unlikely that a wholly new entrant provider of mobile access networks will emerge, and it would be incorrect for ComReg to place too much weight in its decision-making process on this outcome.

ComReg's timetable for this auction is being driven primarily by the expiry of current MMDS licences in April 2016, which implies an auction would be completed in 2015. While Three considers that the mobile ecosystem is already in place for the 2.6GHz band, and that bidders will have available to them all of the information needed to participate in an auction for this band, the same does not apply to the other bands proposed for inclusion.

To recap:

- 700MHz – Three believes this band will be deployed for mobile in Ireland, however for the reasons discussed above; it would be premature to include it in the auction at this time. There is poor to no substitutability between 700MHz and 2.6GHz so this is not a significant consideration.

- 1.4GHz – Again, there is considerable uncertainty regarding this band at the present time. As it is to be used to provide additional capacity through supplemental downlink services it is not useable on its own, but only in conjunction with a duplex band. While it is a weak compliment to other bands, it is not believed that a decision to buy or not buy spectrum in other bands would be heavily influenced by lots won in this band (at best, the quantity bought might vary). Equally, as it cannot be used on its own, this spectrum is not a substitute for one of the duplex bands – at best it might influence the quantity of spectrum bought.

- 2.3GHz – This band is potentially a substitute for 2.6GHz. As explained above though, at the present time uncertainty regarding its adoption means it could not be considered a proper substitute. This should be clarified in time.

- 3.6GHz – Propagation characteristics and device availability mean this band is not a substitute for the others under consideration. Three does not believe it is a compliment either. As it is proposed to provide for regional licences, the structure of licences and lots within the auction will be different to that of the other bands. While ComReg was right to consider it, Three does not believe there is a strong enough argument for including this band in the same process as the other four.

Taking all of the above into consideration, Three does not agree that it is appropriate to proceed with the multiband spectrum auction as proposed by ComReg at this time. In the first place, we do not agree that the 3.6GHz band needs to be included in an auction with the other candidate bands. For the 1.4GHz and 2.3GHz bands there remains uncertainty as to the value of these bands for mobile, though this can be expected to be clarified in time. While Three believes the 700MHz band will be assigned for mobile in Ireland, it is premature to propose its inclusion in an auction in 2015.

This leaves ComReg with two options:

- **Option 1- proceed to auction the 2.6GHz on its own in advance of April 2016; or**
- **Option 2 - hold a multi-band auction at a later date when there is greater certainty in relation to 700MHz, 1.4GHz, and 2.3GHz**

The licensing of spectrum in the 3.6GHz band does not necessarily need to be tied to an auction of the other bands and could be proceeded with separately.

There is a practical reality that operators have just recently invested heavily in spectrum licences (€855[4]m) and are now investing in rolling out the networks to use it. Operators generally invest in spectrum so that they have the capacity to deliver services demanded by their customers. Investing in spectrum licences does not bring in any additional revenue and it is not the case that operators benefit by obtaining spectrum early unless they are capacity constrained, or the new spectrum allows the deployment of new technology. For this reason, the business case for buying further licences in the short term will be significantly weaker than for MBSA I. That business case will be further weakened if spectrum does not come available and usable for some time after the auction.

While both options above have merits, **Three believes Option 2 preferable**. Within one to two years there will be greater clarity regarding the suitability and availability of the multiple bands. This would necessitate a delay in relicensing of the 2.6GHz band, however that would also present an option to extend the current MMDS licences for an additional period which might ease the transition out of the band for existing subscribers. It would also allow for clarity to be obtained regarding the transition of DTT out of the 700MHz band.

ComReg's original consideration of the proposal against its statutory functions neglects consideration of the uncertainty that currently exists in relation to three of the bands. Taking this into account, either Option 1 or Option 2 above are as compliant as the MBSA II proposal with ComReg's functions and objectives. **ComReg should now expand its cost-benefit analysis to cover Option 2 above.**

5. Licence Conditions

Technical Conditions

ComReg has proposed a number of technical conditions that will apply to the bands when assigned. Notwithstanding our comments above regarding the appropriate timing for allocation, it is useful to consult on the technical conditions insofar as that is possible. Taking each band in turn:

- 700MHz – While ComReg should wait for the CEPT harmonised bandplan to be finalised, ComReg's proposal seems sensible for now.
- 1.4GHz – Three agrees with ComReg's proposal.
- 2.3GHz – At this time we would see no reason to demur from the bandplan proposed in the ECC Decision, and we await the EC harmonisation decision.
- 2.6GHz – ComReg propose to use the primary band plan without flexibility. While we have no strong objection to allowing some flexibility, on balance ComReg's proposal is acceptable for the reasons outlined. For this band (as for all), a 5MHz or 2x5MHz lot size is appropriate. In relation to the interface

[4] ComReg Press Release 15/11/2012

between TDD and FDD sub-bands, Three suggests that ComReg should make all blocks available for auction. If there are less TDD lots sold than are available, then the assignments should automatically be made from the unencumbered lots – i.e. only those in the centre of the TDD band are available for assignment. If there is demand for all of the TDD lots, then they should be made available for assignment with the restrictions applying to interface blocks as necessary.

- 3.6GHz – at this time ComReg's proposal, i.e. 72 TDD lots only is acceptable.

Service and Technology Neutral

ComReg propose that any licences that will be issued will be service and technology neutral. Three supports this proposal; it is consistent with the previous auction and relevant EC and CEPT Decisions.

Non-Exclusive Use

The licences issued as a result of this process should be consistent with those issued following MBSA I. While those licences were not exclusive, nevertheless licensees have bid for, won, and paid large fees in the expectation that they can operate their service nationally without restriction (other than those specified in the licence), and free from interference. The same expectation will apply to any spectrum awarded by auction in the future. Any other use of the spectrum must be on a non-interference and non-protected basis. In addition, ComReg must be of the opinion that any other use of the licensed spectrum will not impact upon the licensee.

Licence Duration

It is only possible to have continuous investment in networks and services where there are continuous licences. **Three believes that 'rolling' licences subject to five years notice of revocation after an initial term of 20 years are most appropriate for mobile spectrum bands**. Just as is the case for fixed term licences, this type of licence:

- promotes competition, spectrum efficiency and the internal market;
- is wholly compatible with the Common Regulatory Framework;
- ensures licence holders can continue to invest in the networks that use spectrum, confident that there is sufficient time remaining in their licence to obtain a return on that investment;
- provides a sufficiently flexible approach to address future co-ordinated approaches that may be taken to particular spectrum bands at an EU-wide level;

- ensures that there are no long-term barriers to a co-ordinated approach to the bands. This is particularly important where a co-ordinated approach is necessary to introduce new and innovative services to a band; and
- ensures that there can be a co-ordinated approach to bringing about the desired change without perverse incentives emerging for incumbent firms to hold out strategically with a view to gaining more rents.

There is no merit to the argument that fixed-term licences should be issued in order to be consistent with those issued in MBSA I. While consistency across licences is desirable, that is not the case where a particular licence attribute is incorrect. It is better to be inconsistent in order to have the correct condition, than to be consistent with the wrong one.

Notwithstanding the above position, where ComReg is to issue fixed term licences, Three agrees that a period of 20 years is appropriate.

We note ComReg's comments in paragraph 4.56 of the consultation document that there may be merit in maintaining a temporal separation between the future releases of spectrum previously released under the MBSA process on the one hand and that spectrum proposed for inclusion in this award process on the other, for the purposes of safeguarding business continuity and promoting competition. This same consideration also applies to the decision regarding which bands should be included together in a single multi-band auction, and further weakens the case for proceeding with the multi-band auction as proposed at this time.

Coverage and Roll-out

Radio spectrum that is suitable for providing mobile or broadband services is limited by both availability of the spectrum itself (there is a limit to the amount allocated) and usability (equipment must be readily available). Three agrees that when this spectrum is awarded, there should be a licence condition to ensure that it is actually used within a reasonable time; however any roll-out obligation must take into account practical considerations including the characteristics of the spectrum itself, and that it will most likely be integrated into networks that already use other bands.

The mobile spectrum bands above 1 GHz (1.4GHz, 2.3GHz, 2.6GHz) are primarily suitable for providing capacity rather than coverage. There should be either no coverage obligation attached to these bands, or a minimum one designed to ensure allocated spectrum is actually brought into use within a reasonable time.

The 700MHz band is suitable for providing coverage and will be used by existing operators together with existing 800MHz and 900MHz assignments (albeit with different technology at 900MHz) according their own requirements. Three accepts that there should be a coverage obligation associated with this band, and the difficulty is to have a condition that makes practical sense when taken in combination

with the existing Liberalised Use Licences. Three suggests that the following licence condition should be considered:

- For any licence awarded in the 700MHz band, there should be a roll-out obligation;
- That obligation should be to reach 70% population coverage on a stand-alone basis, or at the choice of the licensee the obligation can be combined with the coverage obligation in an existing Liberalised Use Licence such that the existing coverage obligation is increased by 20%, i.e. the effect of combining the coverage obligations would be to raise the 70% target in the Liberalised Use Licence to 90%.

The roll-out period of 3 years would seem reasonable to apply to the above coverage targets.

Voice Call Standards

ComReg proposes in paragraph 7.30 that all non-VOIP voice call services provided to a licensee's customers should be captured by a quality of service obligation. It is difficult to see how this is to be regulated in practice, as any voice service provided over an LTE network will be VoIP. ComReg needs to further break-down the definition of what service should be categorised as falling within this obligation. Presumably it is if the service falls in the same market as existing "native" voice services and not in the same market as over-the-top voice services which are provided on a best effort basis only. If a quality of service obligation is to be imposed, then this voice service will need to take priority for network capacity over other services, including over-the-top voice services.

Cessation of a Technology

Three can agree with a licence condition to notify ComReg in advance of cessation of a system, as is required under the current Liberalised Use Licences. This requirement is specified in Regulation 12 of SI 251 of 2012. It is not clear that ComReg intends to apply the same condition in this case, or if something broader in scope is anticipated. This should be clarified.

6. Award Type and Format

Three notes ComReg's consideration of the mechanism for award of the spectrum, and the two main methods have been examined – Administrative Assignment and Auction. It is correct to say that early assignments were mostly some form of administrative process, and that globally, various forms of auction have become the norm for mobile spectrum awards. We do not accept that an auction is automatically

the best assignment method in all cases, and even in cases where an auction is appropriate, it can only deliver the correct outcome where the specific auction mechanism, rules, and conditions are appropriate.

In summary, the basis for using an auction is that bidders who are most efficient and can generate greatest value from the spectrum will have the highest valuation and so will emerge as the buyer of the spectrum in an auction. Ideally the spectrum will be bought at the minimum price necessary, leaving maximum funds for investment in the services.

This is all-good-and-well in theory, however it is dependent on all bidders bidding in a straightforward manner according to their valuations; on all bidders having equally good information to calculate their valuations; and on the auction rules permitting this straightforward bidding. In reality, auctions are never that straightforward as gaming behaviour; differences in bidder valuation methods; approaches to risk-taking; and auction rules (bidding rules, spectrum caps, minimum prices, eligibility, etc.) all can have the effect to change the auction outcome. **If an auction is to be used, then it can only deliver the correct outcome if all of the above impacts are correctly addressed, otherwise this method is no better than an administrative assignment in meeting ComReg's objectives**.

Auction Mechanism

ComReg has considered the following main variants of auction mechanism:

- simultaneous multiple-round ascending (SMRA) auction;
- simple clock auction (SCA);
- combinatorial clock auction (CCA); and
- sealed-bid combinatorial (SBC) auction formats.

ComReg has also outlined the factors below that should be taken into account if an auction is to deliver the correct result.

Common value uncertainty

We agree that there will be considerable uncertainty regarding the valuations of the various spectrum bands, and that this could lead to an inefficient outcome. The auction mechanism and transparency rules must allow for price discovery.

Collusion and strategic demand reduction

This factor has been given disproportionate weight by ComReg in developing its proposals, just as was the case in advance of MBSA I. No particular evidence has been presented to show why a spectrum auction in Ireland would be susceptible to

collusion. When designing the first auction, ComReg placed great weight on the need to prevent collusion in the auction mechanism and rules, whereas in practice, the evidence of the first auction shows that this simply did not occur.

Placing too much weight on prevention of collusion is a problem if it requires a trade-off against other aspects of the auction, e.g. lack of transparency which inhibits price discovery, and minimum price which if set too high chokes off efficient demand and leaves spectrum unsold[5].

Strategic demand reduction is also presented as a risk factor, however DotEcon has failed to show any significant likelihood of this happening or consequential inefficiency in use of the assigned spectrum. It is noted that in the example presented by DotEcon the same quantity of spectrum is assigned for use. The most significant outcome from a bidder reducing demand would seem to be that overall auction revenue might be reduced; however **it is noted that maximising auction revenue is not one of ComReg's statutory objectives or functions**. As a result, it should not be given significant weighting in designing the auction process, particularly if this comes at the risk of compromising some other facet of the auction.

Substitution risks;
Three agrees this is a factor to be considered, however as already stated, at this time, several of the bands would not be regarded as good substitutes.

Aggregation risks
Given the large quantity of spectrum being offered by ComReg, aggregation should not be a huge concern.

Complexity
The auction should not be so complex as to make it difficult for bidders to participate and know the outcome of their bidding at any point in the process. While existing mobile operators have already participated in one auction, and can be expected to have resources to deal with reasonable complexity in an auction, this might not be equally true of all bidders interested in all bands. In particular, some bidders who would be interested in the 3.6GHz band could be placed at a disadvantage if the mechanism and rules are so complex that it is difficult to execute their bidding strategy. As stated above, Three does not believe there is sufficient substitutability or complementarity to include this band with the others.

[5] For example, in 2013, ComReg offered three lots of 1800MHz spectrum for award with a minimum price that was derived from the Conservative Market Value benchmark in MBSA I. The spectrum remains unsold (Document 14/01). Also in August 2006, ComReg opened an award process for licences in the 26GHz band with a reserve price per lot of €1m. No lots sold, however in a subsequent award with a minimum price of €100,000 several lots were sold and brought into service.

Gaming and Price Driving

ComReg has neglected to give due consideration to this factor which could equally affect the auction outcome. Gaming within an auction is the factor that presents the highest risk of an inefficient outcome. It can affect how many lots are obtained by each bidder and also the price paid, so can lead to an inefficient outcome.

The MBSA I was a Combinatorial Clock auction with a second price rule. DotEcon has explained that in theory a combinatorial clock auction should encourage bidders to bid in a straightforward, honest manner according to their valuations; however this is theoretical only. [redacted] **This must be prevented if an auction is to deliver an efficient outcome**.

Spectrum Caps

In general, Three accepts that within an award process it can be helpful to have spectrum caps if there is a fear that any one bidder or a small number of bidders together stands to obtain a disproportionate quantity of the spectrum available, and that this would have a detrimental impact on competition in the communications markets. The same might apply to a particular band within an auction if a distribution of spectrum among bidders was deemed to be a critical objective of the award.

We caution however that spectrum caps can have a negative effect on the operation of an auction. They are only of use if they prevent bidders from placing bids that they would otherwise have placed, so they artificially limit bidding for different quantities according to valuation. Given that an efficient auction is designed to award spectrum to the most efficient bidder, this can undermine the fundamental reason for using an auction in the first place.

Spectrum caps can have the greatest impact on auction progress and outcome where there is a relatively small number of lots on offer. In this case a decision as to whether to raise or lower a cap by one lot can be the most significant constraint on bidder behaviour and the auction outcome. Placing tight caps in this circumstance gives a result that is more akin to an administrative assignment than an open auction.

Where spectrum caps are used, they should apply only within the auction itself (i.e. they should not be used in any way to imply any long term decision about distribution of spectrum among licensees), otherwise they can serve to inhibit free movement of

spectrum long after their intended effect. ComReg should make it clear that any spectrum cap applied is relevant only for the duration of the award process itself.

ComReg needs to be particularly careful when designing the planned auction that the rules do not in any way discriminate against any one applicant. This would be the case if one applicant was more restricted in their freedom to place bids than other applicants. Any such restriction would need to be justified by reference to the impact it would have on downstream market competition.

Three does not agree that ComReg should take into account any spectrum holdings outside of the bands to be included in the auction itself, as this would mean that bidder behaviour is restricted by factors outside of their valuation for the spectrum on offer. In the case of the 700MHz band, **it would be fundamentally unfair to impose a price-cap that includes all existing sub-1GHz assignments**. While 700MHz and 800MHz spectrum can be expected to be substitutable, this does not apply to the same extent between 700MHz and 900MHz. It would be incorrect for ComReg to simply include all three bands together in a single sub-1GHz cap.

Apart from consideration of whether the 900MHz band is a substitute for 700MHz spectrum, ComReg is aware that since acquiring O2 Ireland, **Three currently holds one additional lot of 900MHz spectrum when compared to its main competitors, however that one additional lot of spectrum is encumbered in that it must be made available if required by an MVNO operator within a period of 10 years**. In effect, there is no certainty that that one lot will be available to Three throughout most of the licence term.

Further, if one bidder in the auction is restricted relative to the other bidders, within a CCA auction of the type proposed by ComReg this places the restricted bidder at a disadvantage within the auction relative to other bidders. This is because they cannot express a value for the same quantity of lots, so the price-setting mechanism within the auction does not treat all bidders equally. This would be fundamentally unfair and would have a discriminatory effect.

Auction Types

Having considered these factors, ComReg then makes some preliminary decisions regarding the auction mechanism for the proposed multiband auction:

- Sealed-bid Combinatorial – Three agrees with ComReg that this auction method is unsuitable. Common value uncertainty will be significant for the bands proposed, and the SBC does not allow price discovery.
- Simple Clock – ComReg discounts this method heavily on the basis that it could be susceptible to strategic demand reduction, however as explained above, Three does not agree that this is a consideration that should be given too much weight.

- Simultaneous Multi-round Ascending – Three disagrees with ComReg regarding the merits of this auction type. It provides good price discovery, and allows bidders to know how much they will pay if any bid is successful. Three does not agree with ComReg that it should be discounted because it is open to strategic price reduction, and believes ComReg has given too much weighting to this concern. This auction type can be modified with the activity rules to give an efficient outcome.
- Combinatorial Clock Auction – ComReg has formed a preliminary view that a CCA auction is most suited as a mechanism to award spectrum in the bands under consideration. [redacted]

  This susceptibility completely undermines the CCA as a means to deliver an efficient outcome, and so is contrary to ComReg's statutory objectives.

[redacted] **One rule that ComReg should implement to help mitigate such behaviour is to require bidders to periodically place deposits with ComReg to 100% of the value of their highest bid made at that time. ComReg should also ensure that such a deposit call for 100% of the highest bid placed by each bidder in the supplementary round is made prior to running the winner and price determination. This deposit requirement and its triggers should be made clear to all bidders in advance, so that they can have cash prepared to match their own bidding valuations. Applicants who bid genuinely according to their valuations should have no difficulty with this requirement, as they must be prepared to pay up to the value of their bids if those bids are successful.**

7. Fees

Minimum Price

Three disagrees fundamentally with the approach taken by ComReg in relation to setting the minimum price for the auction proposed – to set minimum prices at the level of conservative market value based on benchmarking. ComReg's reasoning appears to be to avoid strategic demand reduction on the part of bidders, to avoid speculative acquisition, and to avoid selling spectrum below its "real economic value". Evidence from MBSA I shows that ComReg's concern regarding strategic demand reduction is unfounded. Given the quantity of spectrum coming available, there is little scope for speculative acquisition. This would be a high risk strategy, with a significant risk of being loss making. Three does not see that it should be a factor in setting the minimum price.

The concern regarding selling spectrum at a price below real economic value requires further explanation from ComReg. ComReg's statutory objective is to ensure efficient use of the radio spectrum. If there is a user who is willing to use the spectrum, and pay a licence fee to do so, then they should be permitted to do so. Utilisation of spectrum at even a low licence fee is more efficient than holding it unused. ComReg needs to take into account that spectrum trading is possible, so if a higher value use emerges, then there will be an incentive and mechanism for both parties to complete the transfer to the higher value user. **If ComReg is to restrict access to spectrum on the basis that licence fees fall below the "real economic value", then a definition of this value must be provided**.

There is uncertainty as to the value of the spectrum to applicants, otherwise an auction would not be required. Benchmarking can at best provide a rough-guide to the expected valuations for the spectrum to be sold, averaged across all successful bidders. There is a significant margin of error in this method. If ComReg is to set the minimum price approaching this conservative market value, there is a likelihood that this minimum price will choke-off demand. We have already seen this effect in the 1800MHz band and the 26GHz band in Ireland.

Setting the minimum price below the benchmark value presents little or no down-side for ComReg – the auction itself will ensure that final prices rise to that necessary to clear the market. Given this, ComReg should not risk choking demand by setting the minimum price at a level approaching the benchmark price, but instead should set the minimum price substantially below that level. **It is only necessary for ComReg to deter frivolous bidders in the auction, and Three believes that can be achieved at a level of approximately 10% of the benchmark price**.

Benchmarking

The use of benchmarking to determine conservative market values raises some difficult challenges at this time. In the first place, benchmarks are unreliable, as they cannot reflect all of the local conditions that will impact on bidding at a particular time. In addition, apart from the 2.6GHz band there is little reliable data on which to base a benchmark. For 700MHz there has been no auction in Europe yet, so any benchmark will tend to be dominated by data for other sub-1GHz bands. The circumstances under which the 800MHz band was auctioned were different to that which will apply to 700MHz (it was the first LTE coverage band to come available), and will tend to over-estimate the 700MHz valuation.

There is no reliable benchmark data available for the 1.4GHz, 2.3GHz, or 3.6GHz bands. While it is proposed to set the minimum price for these bands relative to the 2.6GHz band, there is little basis for saying this can be done accurately. ComReg needs to state specifically how this is to be achieved and what factors will be taken into consideration.

Overall, Three has significant concerns that the use of benchmarking is prone to error and believes **ComReg should have DotEcon indicate the margin of error that can be achieved for each band**.

Subject to the above comments regarding minimum price, Three agrees that the split between the upfront and annual fees is appropriate at approximately 50/50.

End

14. Viatel: submission entitled "Response to Consultation 14/101 -Spectrum award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands", dated November 2014

www.viatel.com

Response to Consultation 14/101

ComReg

Spectrum award – 2.6 GHz band with possible inclusion of 700 MHz, 1.4, 2.3 and 3.6 GHz bands

November 2014

1 / 10.1 GHz band spectrum opening – (section 2.48)

It is extremely frustrating to read in ComReg's report that the 10.1 GHz band was not released due to "very little interest". Back in the years 2008-2009 and one multiple occasions since, The Digiweb Group (from which Viatel is part of) actively engaged with the Telecom Regulator raising its interest in using the 10-10.154 GHz spectrum in order to deliver broadband services. Unfortunately, in ComReg's view, one serious expression of interest is not enough and therefore considered there was "very little interest". Five years later, this opportunity window is now receding and the band has never been used. ComReg has therefore failed to reach its goals of promoting competition, contributing to the development of the internal market and making effective use of spectrum.

In future, we urge ComReg to change its view if such a situation arises once again. Available spectrum attracting "very low interest" should not be locked out from potential use. We advise ComReg to keep a record of all vacant spectrum similarly to what is done by the Norwegian Telecom Watchdog [1]. Should an operator raise its interest, such expression should be disclosed publicly by ComReg for two months. If several interests are made following this two months notice, an auction can therefore be arranged. If no other interest is filed by the regulator, the spectrum should then be licensed on a first-come first-served basis.

2 / "Spectrum for Award" – Option 3 – (section 3.2.2)

Viatel fully agrees that the Option 3 is the Preferred Option. This provides more certainty for the stakeholders as it will allow them to consider all of the spectrum bands in order to fulfil their network's capacity and coverage requirements over the next years. Moreover, the fact of providing the largest pool of spectrum in addition to the introduction of capping should facilitate the emergence of new entrants in the market. Viatel/Digiweb is an active stakeholder in the Irish market through its wireless operations in the 10.5 GHz and 3.6 GHz FWALA bands. The forthcoming auction will be critical in order to safeguard and expand our wireless operations. It's in our best interest to see the largest pool of spectrum bands available in the auction.

3 / Industry stakeholders – Consider Indigenous Operators (section 3.65 & 3.177)

We acknowledge that ComReg is seeking to consider all the different industry stakeholders in its review (see section 3.65) and attempt in some cases to take into consideration some of their concerns (section 5.6). However, those statements strongly collide with other sections especially regarding the reserve prices and coverage requirements. In section 3.177 and 3.175, ComRegs states the need to open-up further the Internal Market in order to facilitate the emergence of pan-European services. While we do appreciate those are guidelines provided by the European Commission, we'd like to note that the Irish Telecommunications Market is already exceptionally well composed of international players such as UPC, Vodafone, BT or Hutchinson Whampoa. In its drafting, ComReg should also attempt to facilitate the

[1] http://eng.npt.no/technical/frequency-management/frequency-licenses/vacant-frequencies/_attachment/8060?_ts=14974dc470b

emergence of indigenous telecommunications operators. Very early in the document, ComReg rightly noted that various types of stakeholders compose the Irish market place. The telecom regulator should therefore not only align reserve price and coverage requirement based on the strategic group availing of the largest funds. If so, it will de facto prevent the further emergence of home-grown telecommunications players.

4 / Competition caps & new entry – (section 5.5.1)

We strongly agree that ComReg should leave the door open for the emergence of a new entrant in the market. A mix of coverage and capacity bands should therefore be set aside for a new entrant, only in a first round. Should no new entrant express any interest, ComReg could organize a second round where all current players could acquire the spectrum. We also fully agree with the set-up of competition caps in order to limit the dominance of some player's spending power. At the exclusion of the spectrum set-up for a new MNO entrant (including capacity and coverage bands), the competition caps should facilitate the allocation of the 2.6 GHz and 2.3 GHz band across at least 4 players, and the 3.6 GHz band across greater than 5-6 players. This should facilitate the emergence of new entrants notably coming from the FWALA market.

5 / Sub-national licences at 3.6 GHz – (section 5.6)

We agree that a subset of the 3.6 GHz band should be awarded on a regional or local basis. The 3.6 GHz band will be clearly the least interesting band for the MNOs as its propagation characteristics is weak, as well as due to the shortage of devices available (section 3.33). Moreover, this band is "brownfield" and many local FWALA operators would wish to retain some spectrum holding in order to maintain their operations (even though it is highly unlikely that they will receive the same spectrum, which would then require investing in a spectrum migration which may well break-up their business model). Nevertheless, we believe it would be appropriate to set aside a total of 100MHz. It should be noted that the MNOs will probably not require the 3.6 GHz band outside of the very dense urban areas located in the 5 cities of Ireland. Also, ComReg could potentially consider splitting geographically the band across the full spectrum as it is unlikely the MNO will require the band in the remote, rural and suburban regions where the FWALA scheme models work the best. Availing of the full spectrum could potentially also allows those rural FWALA operators to keep their business intact.

6 / Benchmarking – (section 6.2.4)

We absolutely disagree that ComReg should set minimum prices for different capacity bands by reference to the 2.6 GHz band. While this assumption may work for the bands below 2.6 GHz (2.3 GHz and 1.4 GHz), the lower propagation characteristics of the 3.6 GHz as well as the low numbers of LTE handsets available in the band make it of considerably lower value that the 2.6 GHz band.

Complete clarity should be disclosed when calculated the reserve price on the capacity bands. We'd be grateful if ComReg could include in its next consultation its proposed reserved price as well as the full workings done in order to calculate this value.

7 / coverage requirements

We disagree on setting coverage requirements for the capacity bands (therefore at the exception of the 700 MHz) as this spectrum won't be use to achieved coverage but instead in order to meet specific demand in very dense urban areas. Establishing a coverage requirement is therefore off topic in our mind.

8 / Agreements

Viatel fully agrees with ComReg recommendations in:

1. Using CCA auction with second pricing rule,
2. Being technology neutral,
3. Setting a spectrum duration between 15 and 20 years,
4. Making sure those bands are fully harmonized at EU levels,

15. Vodafone Ireland Limited: submission entitled "Vodafone Response to ComReg 14/101", dated 14 November 2014

Vodafone Response to Comreg 14/101

14 Nov 2014

Vodafone Response to Comreg 14/101

Vodafone welcome the opportunity to comment on ComReg's document discussing a future Spectrum award.

We would like to make some key points in overview of the mobile market in Ireland and in addition we have detailed comments on sections of ComReg's documents 14/101

Key Points

Current spectrum allocation in the Irish market

Vodafone have clearly indicated to Comreg our strongly held position that the current allocations of spectrum to mobile operators in the Irish market is inefficient, and must be formally reviewed by Comreg post the merger of Hutchison and Telefonica/O2. We believe that ComReg have both powers and obligations under statute to formally and urgently review the new spectrum allocations, given the seismic change in holdings post the merger.

Our position on the matters under discussion in this document are therefore strictly without prejudice to the above position and to Vodafone's position in the current legal proceedings before the High Court. While the allocation of further spectrum may, at some future date, possibly result in a change to relative allocation of mobile operators this does not remove the current urgent requirement that ComReg carry out a review of the post-merger allocations to ensure an effective and efficient use of spectrum in the Irish market.

Cost of additional spectrum

As consumers are using increasing amounts of data services, mobile technology is offering increasingly higher speeds through wider band carriers and carrier aggregation, and devices are becoming increasingly richer in their use of data and HD video. Operators need more and more spectrum to fulfil their customers' needs. ARPUs are not moving in line with this additional demand. Therefore, as spectrum volumes increase, unit costs for spectrum must come down – if they do not, the mobile sector will not be able to invest and benefits to consumers will stagnate.

A planned Award Process.

The outcome of ComReg's consideration in this document is to favour a large auction including all five bands under discussion (2.6GHz,700MHz, 1.4, 2.3, and 3.6GHz).

There is considerable uncertainty in timing of availability of a number of the bands under consideration and uncertainty in the timing of network and terminal support. Therefore there is a risk that a large auction could be considerably delayed while these uncertainties are resolved. There is also very significant uncertainty in the value of some of these bands.

Taking these factors into account , together with our desire to have a more phased spending on spectrum, Vodafone would favour an auction design with a lower number of bands being simultaneously auctioned. An additional auction, or auctions, at a planned later date could award the other bands. The extra overhead imposed on Comreg and Operators by holding additional award processes would be compensated for by having significantly more simple auctions at more predictable times. We would ask that Comreg publish a work programme for future auctions setting out a quarter by quarter program over the next number of years. This would help operators plan resources and approvals and give more regulatory certainty to the market.

Comments on Document 14/101

The following text contains comments on aspects of ComReg14/101. The text follows the heading in the Comreg document. References to pXXX and sXXX are to the numbered paragraphs and sections in ComReg's document.

The bands now being considered for release.

2.6 GHz band

2.6 GHz spectrum is useful for mobile operators but not a direct replacement for 1800MHz spectrum as lower propagation at higher frequency will restrict use to more densely population density areas. This band is a commonly used standard across Europe. There will therefore be a high availability of devices – this is an important consideration as the scale of the Irish market is not large enough to significantly influence the production of devices.

In line with the EC 2.6GHz decision quoted in p2.9 this band should now be targeted at supporting wireless broadband services.

700MHz band

As noted in p 3.41, Europe has already begun its preparations for the implementation of 700MHz but a number of factors may delay its implementation in Ireland.
The finalisation of channel plans may have to await the publication of Report B.

There is certainly a strong case for using 700MHz in Ireland, particularly to support rural broadband. In the longer term is now appears reasonably certain that this will become a standard usage throughout Europe and therefore be supported by terminal suppliers.

The early release of this spectrum from DTT to mobile applications is certainly of interest and we continue to support the process underway with the Cost-benefit analysis referred to in p3.44.

While these processes are useful the timing of completion of a possible reallocation of spectrum from DTT to mobiles remains uncertain. The conclusion and implementation of an agreement with broadcasters on a move of DTT spectrum allocation in Ireland may take considerable time.

1.4 GHz band

Vodafone are aware of the work being done to harmonise the usage of the 1.4GHz band across Europe. We agree that the most likely application that this will be used for will be as a supplementary downlink for other bands.

The timing of development of implemented services and application in terminals remains uncertain and also there will be difference in propagation characteristics between this band and the band it may operate with in SDL mode.

These factors will make it difficult to produce detailed plans of its application at this time and hence it is difficult to value.

The timing and support by terminal manufactures remains uncertain.

2.3 GHz band

The band is likely to be harmonised within CEPT.

We agree the propagation characteristics will be similar to the 2.6 GHz band.

This band appears however to have strong support among manufacturers of infrastructure and terminals, and is widely used in Asian markets.

3.6 GHz band.

Vodafone are aware that this band has been harmonised under EC Decision 2014/276/EU.

Our view is that this band is not a substitute for the 2.6 GHz band or the other bands included in this consultation document. The likely primary applications are FWA and non-line of site transmission links to small cells applications for small cells.

The propagation characteristics at 3.6GHz make this spectrum significantly less suitable for true mobile applications. Antenna-positioning or the use of external antenna can be used to circumvent the poor propagation characteristics when using a FWA application or in a transmission application for small cells.

There may be future mobile applications, possibly for small cells but this remains uncertain.

p3.34 recognises that this band may not be fully substitutable with the 2.6GHz band. This is a view Vodafone would strongly agree with.

Chapter 3 Assessment of the suitability of additional bands to the process.

1.4 GHz

The harmonisation of this band will happen later than for other bands in the group being considered. The availability of terminals will also come later than for 2.6 and 2.3GHz bands.

As this band will operate in SDL mode this spectrum is not a straightforward substitute for paired 2.6GHz spectrum but it may be possible to calculate its equivalence with unpaired spectrum.

Given the later availability of terminals to support this band and the consequent uncertain value our preference is that this band is not included in the award process with 2.6GHz spectrum.

2.3GHz

The standardisation for this band is more mature and there appears to be strong terminal support for this band, particularly in Asian markets.

It appears that this band will be useful at an earlier date than 1.4GHz or 3.6 GHz bands and is a better candidate for inclusion in an award process with 2.6GHz spectrum.

3.6 GHz

We note the various factors discussed in p 3.26 to 3.33 on the suitability of including 3.6GHz spectrum in an award process with 2.6GHz spectrum.

Vodafone's recommendation is that this band is not included in this process.

Key factors in this view are :

- Significant Differences in propagation
- Potential 3.6Ghz applications other than mobile

- Potential non-national licence at 3.6GHz.

The net effect of these differences that there is only a very weak substitutability between these two bands and a weak case for common demand with other bands.

700MHz band

The long term attractiveness of the 700MHz for nationwide coverage is agreed.

The key issues will be around the timing of availably of the spectrum and whether the uncertainty in the timescales required to agree a required move of DTT services could delay a 2.6GHz award process.

The benefit of adding this band to the award process needs to be balanced with the possible delays to an auction.

p3.1.5 Outcome of the preliminary assessment

P3.58 Vodafone believe that the arguments for including 3.6GHz in the same award process are very weak. There remain significant timing uncertainties around the availability of 700MHz and the application of 1.4GHz.

In order to reduce complexity, and uncertainty in values, we would favour reducing the number of bands being included in an award process.

S 3.2 Comments on Draft RIA on inclusion of additional bands.

There appear to be some issues that have not been taken into consideration in the RIA.

- Auctioning large tracts of new spectrum with uncertainty in value creates considerable uncertainty in the mobile market, affecting the value of sunk and planned investments
- An auction for a large tranche of spectrum will take considerable cash from existing operators – affecting ability to make future investment in network.
- Impact on competition is considered in the abstract, a review of current spectrum allocation and the effect of current allocations would need to be completed before a real assessment of the impact of further allocations could be properly assessed.

p3.92 mentions new entry: reservation of spectrum for a new entry may only serve to drive prices up for existing operators or leave spectrum unused. Added cost, delay to the auction process or significant added complexity in order to facilitate a new operator may not have a net consumer benefit.

p3.75 the assumption that 3.6GHz band will be made available on a nationwide basis is a significant assumption – affecting the outcome of the RIA.

p3.105 Comreg's assessment that industry stakeholders would prefer the inclusion of all Capacity bands in the award process is incorrect. Vodafone's view is that, on balance, it would be better to divide the award of spectrum into smaller groups. This would considerably reduce complexity and uncertainty in value.

P3.111 the assessment of competition should include a review of current allocation of spectrum in the mobile market.

Chapter 4 Band Plans

The band plans suggested in Comreg 14/101 are largely non-controversial. In general Vodafone strongly favour the use of band plans that are used broadly across Europe, and where possible used worldwide. This will support the availability of devices and development of services.

We agree with the principle of technology and service neutrality (4.2)

Section 4.1.1

2.6 GHz band	We favour the primary band plan described in p 4.6
2.3 GHz band	band plan agreed as per 4.17
1.4 GHz band	band plan agreed as per 4.23
3.6 GHz band	We favour making the entire band available on a TDD basis as per p4.26. This will be the most efficient long term solution even if the band has mixed applications or regional licences.
700 MHz band	The band plan described in 4.33, Report A, appears to be the plan that will become the EC standard. We assume that an award process will reflect any changes that are made before an award process.

Technology and Service neutrality

We agree with the principle of a technology and service neutral approach to the licencing of the bands as per p4.39.

Licence Duration

A number of arguments are presented by Comreg for spectrum licence of finite duration. Vodafone believe that Comreg should strongly support Infrastructure Competition among operators. To support this objective Comreg should make the licences of long or infinite duration. If Comreg are minded to make the licence of finite duration then we would suggest duration of 25 years.

Co-termination

As discussed elsewhere we favour a more gradual release of the spectrum bands under discussion in the document. The licences could then terminate different times. The arguments discussed in 4.56 supporting separate end dates for these band and the MBSA bands could equally be applied to support multiple terminate dates for the bands under discussion.

We would agree with the view expressed in 4.58 that co-termination with MBSA is not appropriate for these frequency bands.

Chapter 5 Award type and Format

Auctions

Vodafone agree that an auction process is the most appropriate mechanism to award rights of use for spectrum. A well designed auction should provide a transparent process in which the winners are incentivised to build and operate services in order to earn a return on investment. This provides the best outcome for consumers.

An overly complex auction design risks highly unpredictable outcomes that can have significant affects in stifling investment by operators or leaving spectrum unused.

Common Value Uncertainty

Section 5.1.1 discusses common value uncertainty. We agree with the points presented in section 5.8 arguing that there is significant common value uncertainty in the proposed award process. As we stated in our opening remarks consumers are using increasing amounts of data and more spectrum is required to satisfy their needs. ARPUs are not increasing proportionally. Therefore, as spectrum volumes increase, the value of the additional spectrum will be reduced.

There is extensive discussion of in Chapter 5 of risks that may arise. We wish to comment on some of these risks

Common Value uncertainty in capacity bands

For capacity bands there is significant uncertainty in the future value of these bands. The uncertainty in the timing of their availability and the terminal support adds to this uncertainty. We believe that designing an auction where all of the capacity bands under discussion are auctioned at the same time will increase this uncertainty.

Reducing the number of bands being auctioned simultaneously and releasing the other bands at later dates would reduce this uncertainty.

Collusion

The evidence from other auctions around Europe would not appear to point to collusion being a significant risk. P5.17 mentions the risk of providing too much information to bidders in the auction. There is evidence from other countries where open bidding was used, for example, Germany and Italy , that the prices paid for spectrum are in line with other countries (measured in €/ MHz / pop.).

Competitive Price Setting

This risk was not mentioned by Comreg. Vodafone's experience in other countries is that as operators become ever more experienced with CCAs, they do more and more competitive price-setting, driving up the cost of spectrum. This is especially a risk with weak spectrum caps. We believe that this had a significant affect in auctions that took place in Netherlands and Austria.

Complexity

The MBSA auction that took place in Ireland was extremely complex. We understand that much of the complexity was due to the two Time Slots and the Liberalised / Non-Liberalised structure of choices. If Comreg proceed to auction 5 bands simultaneously it will make the resultant auction very complex as the number of possible combinations of allocations would be extremely large. The auction would be made more simple by auctioning fewer bands.

Vodafone's preferred Auction Format.

Vodafone's preferred auction methods are to use a either a CCA or SMRA, provided the rules are fair, not too contrived, and the reserve prices and spectrum caps are reasonable. Artificially high reserve prices and no (or weak) spectrum caps would create problems for these auction formats.

Our first preference is to use an SMRA, partly for the greater transparency and certainty about what bidders are going to win, but also because they create less risk of "price setting" behaviour by incumbents against each other. As operators have become ever more experienced with CCAs, they do more competitive price-setting, and the results get more and more expensive. This is especially a risk with weak spectrum caps.

Whichever format is used we are keen that the auction is less complex than the previous MBSA.

If ComReg decide on using a CCA again, we would encourage them to keep to a more standard design.

Spectrum Caps

Vodafone strongly believe that it will be appropriate to apply spectrum caps in the forthcoming award process (or processes).

We agree with the arguments presented p5.68 that caps should be set so as to avoid extremely asymmetric award outcomes.

Our position remains that the current extremely asymmetric allocations in the market should be addressed pre a new award process. Any new award process should take into account the total allocations that operators hold at the time of auction.

The design of caps should also take into account the differences between the various bands.

Spectrum sub 1GHz has particular value in delivering nationwide coverage and it is more difficult to substitute demand in this band with other bands. A cap on sub 1Ghz spectrum should be designed to avoid an extremely asymmetric award and help address existing asymmetries; it could also allow for a new entrant to acquire a single block (if they have not already done so prior to the auction) without the need to specifically reserve spectrum.

The main paired capacity bands could then be considered together, we suggest applying a cap to total allocation in 1.8GHz + 2.1GHz, +2.6GHz bands, as these band are highly substitutable.

As the 3.6 GHz has different applications is should be treated separately, with a separate cap if required, but the issues around regional./national licences would need to be decided first. Similarly, the 1.4 and 2.3 bands could have specific caps or possibly a joint cap between them.

To answer the specific questions posed in p5.74

i. a number of separate spectrum caps should be applied to the holding of spectrum;

1. A sub-1GHz cap, as this spectrum is key for nationwide coverage,
2. A cap for total holdings in the main capacity bands (1.8+2.1+2.6 GHz bands),
3. Specific caps for the other spectrum bands (3.6, 2.3, 1.4 GHz bands).

ii. any caps set should include current spectrum holdings of bidders taking part in the award process.

Chapter 6 Fees

Approach to setting fees

The principle of setting spectrum access fees, usage fee, and minimum price is understood.

The minimum price chosen should be conservatively low. As per our opening remarks, increased volumes of spectrum will lower the price per bit for customers and also lower the real value of spectrum. There is greater national gain in having the spectrum made available to customers through services offered by operators than in increasing the purchase price of spectrum. Increased cost of spectrum will lower investment in Networks.

A business modelling approach (p6.2.3) would be unnecessarily complex as very significant and possibly contentious assumptions would have to be made.

Comreg argue in p6.36 that a minimum price should ensure spectrum is not sold in the event of a lack of short term demand. We would argue conversely that minimum prices should not be set using high prices that occurred in some other countries due to artificial spectrum shortage.

The minimum price should then be set a discount to a simple benchmark of prices in other counties. This would take account of issues such as higher costs of sites in Ireland.

In the absence of benchmarking values (p6.51) the price for capacity bands other than 2.6GHz should considerably lower than the minimum price for this band to reflect their lower usefulness.

Chapter 7 Licence Conditions.

Vodafone agree that the reasoning and justification for applying coverage and roll-out obligations still hold and are valid in respect of this award process (p 7.13)

In particular there is value for consumers in attaching coverage requirements to the 700MHz band. This band is particularly useful in providing services to rural areas.

We would agree with roll-out conditions proposed for 700MHz band in p7.21.

There may value in setting rollout conditions in parts of the 3.6GHz band if this is going to be used for FWA. A combination of these rollout conditions and possible regional variations would make an auction very complex and we would again recommend not auctioning this band with the 2.6 GHz band.