Commission for
Communications Regulation

Consultation 15/70 on Proposed 3.6 GHz Band Spectrum Award

Non-confidential submissions received

Submissions to Consultation Document 15/70

Reference: ComReg 15/106

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Content

1 Airwave Internet

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WIRELESS INTERNET SERVICE PROVIDER

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26 August 2015

Response to ComReg 15/70 – Consultation on Proposed 3.6Ghz Band Spectrum Award

Mr Joesph Coughlan
Commission for Communication Regulation
Irish Life Centre
Abbey Street
Dublin 1

Dear Mr. Coughlan,

Airwave is an Internet services provider that specializes in providing solutions via a fixed wireless delivery platform. We were founded in 2005 to serve a need for quality broadband connectivity in the Cork area and currently deliver to a mixture of residential and commercial customers throughout approximately half of county cork

We are a member of the ISPAI and its WISP sub-group. We would regard ourselves as a regional WISP serving a local area with a mixture of technologies. Due to our size and the scale of our network, we have not participated in previous spectrum awards. We do not have the resources to provide extensive technical arguments but instead can offer a real world opinion on same.

Auction process

All spectrum is valuable but the 3.6ghz band in particular is ideal for FWA and the delivery of broadband services. It could be argued that ComReg's mandate should prioritize the use of this band to actively deliver broadband services to rural areas – in other words, it is not enough just to generate income from this spectrum – ComReg should see to ensure it is used for broadband.

ComReg could point to poor take-up of existing 3.6ghz licenses, but due to the poor management of same, the uncertainty relating to its future and the relative good performance of unlicensed bands – operators did not see a good business case for investing in 3.6ghz spectrum before now.

The need for increased bandwidth, congestion on unlicensed bands and the forthcoming NBP process mean that the 'game has changed' and ComReg should therefore make every effort to ensure existing operators can build a business case in delivering next generation services in rural Ireland.
This is very much in the national interest.

A significant amount of the spectrum allocation *must* be allocated to FWA operators with of course stringent clauses to ensure the spectrum is used. Large ISP (MNO's) with deep pockets cannot be allowed to purchase spectrum for 'hotspot' type deployments in towns.

Award

The regions as described cut the country into large areas – in our case, the area is Munster. Any existing FWA operator would find it difficult to deploy into the entire area, so a mechanism of sub-letting must be envisioned.

In practical terms, should the spectrum be allocated to one MNO and one FWA (for example) then it may not be possible for a second FWA to purchase a channel. Both FWA operators may not be directly competing due to over lapping or adjacent coverage areas.

Therefore, every effort should be made to ensure a duopoly does not occur and that at least two FWA spectrum awards are made in each area to ensure active and reasonable sub-letting of channels.

In order to ensure that the spectrum is actually used, and to involve the smaller FWA operators, the license holder should be obliged to sub-let channels that are not being used within a reasonable time-frame. The cost of sub-letting must be regulated (based on the initial cost of spectrum) in order to avoid opportunism.
ComReg must involve itself in this process in order to ensure that unused spectrum is sub-let to smaller operators at a reasonable cost

Has ComReg put any thought into how this sub-letting will work ? The license holder will have ultimate responsibility for his spectrum, but disputes will arise if for example technical issues arise ?

License Duration

We would propose an award of no more than 100Mhz per operator with further spectrum available if it can be shown the initial spectrum is used and more is required.

Airwave would consider a 15 year license duration to be short – 20 years would be better. Migration from existing unlicensed networks will take time and it would not be practical (or affordable) to so immediately.
Irrespective of how long the license duration is, ComReg should undertake to ensure a new process is completed 5 years before the end of the current license in order to give clarity and enable operators to make decisions.

Pricing

Our initial reaction to the proposed pricing on a cost per head of population was positive. The lower cost in rural areas acknowledges the higher cost in serving a large rural area with a small population. However, the pricing assumes that the entire area can be covered from a base station and that all within the catchment area can be customers.

Presently, the broadband market is very competitive with several fixed line companies offering fibre based services can deliver very high speeds in built-up areas. Furthermore, recent proposals to grant-aid the extension of these networks into rural areas, mean that the traditional base of FWA operators is being eroded.

Any FWA operator looking to bid for 3.6ghz spectrum must will dismiss towns within the catchment area as being ultra competitive (if not now certainly within the lifetime of the license). Secondly, they will look at the coverage area from their base station and realise that complete coverage of the line-of-sight diameter is not practical.

Therefore, the cost per actual potential customer is much higher than the €0.015 proposed for rural areas.
Furthermore, the applicant is required to pay 50% upfront which is a very large capex investment for any company. In fact, it is likely to be impossible for any company to fund this without seeking external investment.

A 25/75 split would encourage smaller FWA operators to get involve in the process.

Regards,

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2 Aptus Ltd

28th August 2015

Mr Joseph Coughlan
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Email marketframeworkconsult@comreg.ie

Re Submissions to ComReg 15/70: – Aptus Ltd

Dear Mr Coughlan,

Aptus Ltd would like to make the following reply in terms of consultation ComReg15/70

Chapter 2 Background

Aptus Ltd agrees with the point **2.20** *"The FWALA licensing framework has helped facilitate the provision of wireless broadband (WBB) services across Ireland and has been particularly beneficial for the provision of these services in small towns and rural areas."* But disagrees with point **2.25** that the *"FWALA services reached their peak subscriber numbers of circa 121,000 in 2008 and have been declining steadily since. The reduction in subscriber numbers may be due to increased competition from mobile broadband services and an increase in the availability of fixed line broadband, particularly in rural areas."* Aptus disagrees that the drop in FWALA subscribers to 27,302 today from it height of 121,000 subscribers is totally due to the reasons outlined above,(1) competition from mobile broadband and (2) an increase in the availability for fixed line broadband Aptus ltd believe that had circumstances been different then the figures for FWALA subscribers today would be significantly higher that 27,302. From a recent survey carried out by the ISPAI of its wireless ISP members it was indicated that from the 34 companies who replied to the survey that cira 74,000 customer were services by fixed wireless technology but it should be noted that there are in excess of 60 wireless ISPs currently operating in Ireland (not all of which are members of the ISPAI) and we believe that from extrapolation that it would be fair to say that there are well in excess of 100,000 customers receiving broadband services via fixed wireless technology from wireless ISP's today. Aptus ltd believe that should the situation have been difference in relation to the uncertainty in the 3.6Ghz spectrum between 2010 and today then a significantly larger proportion of the circa 100,000 fixed wireless broadband customers would be serviced using 3.6Ghz technology. While Aptus ltd cannot speak for other wireless ISPs from its own prospective it would certainly have had a large proportion of its network service on the 3.6Ghz ban should that have been more certainty around the 3.6Ghz spectrum. It is also important to note that the majority of these circa 100,000 fixed wireless customers are based in rural areas and small towns were very often both mobile broadband and fixed line broadband solutions are poor or non-existent

Chapter 3 The Draft Regulator Impact Assessment

Aptus Ltd agrees with the preliminary view of Comreg that the 3.6Ghz bands should be assigned by way of auction with no other bands included in the auction.

Aptus Ltd is of the opinion that due consideration should be giving to the terms of the auction and the allocation of spectrum so as not to disadvantage rural areas. It is the belief of Aptus ltd that the interest of the state are best service by ensuring that spectrum is made available to rural areas and that condition are applied where possible to ensure that rural areas of Ireland are services by this spectrum. Aptus ltd believe the 3.6Ghz spectrum is an ideal spectrum for the delivery of high speed high capacity fixed wireless broadband to rural areas but at the same time it would be much more profitable for the winning bidder for the spectrum if they were to use the spectrum for the deployment of the infrastructure in more densely populated areas and ignore the needs of rural communities. The DCENR is currently working on its NBP to ensure the delivery of NGA broadband across Ireland. Aptus ltd believe that if 3.6Ghz Spectrum can be made available at a reasonable price with specific condition to ensure available of the spectrum for use in rural areas then it would encourage investment by the private sector in NGA broadband infrastructure for rural areas and significantly reduce the sum of money required to be spend by the government in it broadband intervention program (NBP).

Urban and densely populate areas currently have and will always have many differ options to high speed , high capacity broadband and therefore Aptus Ltd believer that they should not be excluded from access to the 3.6Ghz spectrum but their access to 3.6Ghz spectrum should be worked around access given to the rural areas who may have no other option for broadband.

Chapter 4 Key Aspects of the Proposed Award Spectrum

Aptus ltd agrees that the band plan for 3400 – 3600 Mhz sub-band should be TDD. There are many advantage to TDD and with synchronisation great frequency efficiencies can be achieved.

Aptus ltd agrees with the regions identified in option 2 should be used for the award process

Aptus ltd agrees with a long license duration but feel that in light of the fact that the DCENR are running the NBP over a 20 year period that it would be more appropriate to align the duration of the 3.6Ghz spectrum license with the 20 year NBP of the government.

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Chapter 5 Award Type and Format

Aptus Ltd agrees that a single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz

Aptus Ltd agrees that Sixty five (65) frequency-generic lots of 5 MHz each should be adopted for frequencies between 3475 MHz – 3800 MHz

Aptus Ltd agrees that a competition cap should be set, while Aptus Ltd will not comment on the cap for urban areas it believe that for the 4 regions the cap should be in the region of 100Mhz. Aptus Ltd believe that with synchronization and efficient use of spectrum and proper planning that 100Mhz will facilitate the delivery high speed and high capacity broadband to rural areas. Which at the same time ensuring that a minimum of 3-4 operators will have access to spectrum? With 3-4 operator in a region it will encourage competitor, put upward pressure on the package offered by those operators and give opportunity for greater coverage for rural areas.

Aptus Ltd believes that the minimum price should be set and while Aptus Ltd will not comment on the minimum price for urban areas it believe that a price between €0.015 and €0.025 per Mhz per capita in too high for two reason

1. For the delivery of broadband via fixed wireless technology using the 3.6Ghz spectrum in rural areas the areas with pockets of dense populations (towns) will already have access to broadband via FTTX and for that reason will not be a target customer of the winning bidder.
2. For the delivery of broadband via fixed wireless technology using the 3.6Ghz spectrum a customer will typically be either a home or business and if we are to take the example of a home then we are looking at approx. 2.5 persons per home ie 1 subscription /2.5 persons instead of 1 subscription / person that you might achieve with a mobile service.

Aptus Ltd feel the a splint of 50/50 between SAF and SUF is a little high for the SAF component and fell that a 25/75 SAF / SUF splint would be a better options and give smaller Wireless ISPs a better chance to compete in the auction for spectrum, who are essentially the operators who are currently providing services to broadband users in rural Ireland.

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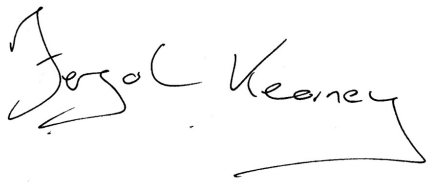
Chapter 6 Licence Conditions

Aptus Ltd believe that a default TDD frame Structure based on TD-LTE configuration 2 (3:1) should not be applied to incentivise internet synchronisation. Aptus believe that Synchronization should be encouraged but that are other synchronization solutions in the market place that operate equally if not more effective as TD-LTE and therefore should enough operators subscribe to a different synchronisation solution then that should be acceptable also. One example of this is Cambium Networks PMP450

Yours sincerely,

Fergal Kearney
Aptus Ltd



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3 BBnet

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27 Aug 2015

Mr. Joseph Coughlan
Commission for Communications Regulation
Irish Life Centre
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Submission on Comreg 15/70 from BBnet.

BBnet is an authorized provider of telecommunications services, employing 10 people. BBnet provide services to approximately 3,000 customers. We have been providing broadband services (primarily) in rural Munster for 10 years. We have previously enquired about acquiring 3.6ghz spectrum, but decided against it on grounds of questionable ROI, given the licence expiry deadline of July 2017. Our inputs on Comreg 15/70, are summarized below:

As a regional ISP, we do not have any experience of the auction process being described in the document. Accordingly, we do not feel qualified to comment on the merits, or otherwise of such a process – other than to say an auction process will inevitably favour larger operator with bigger budgets, who can afford to sit on the licences and only roll out limited services (at best). In the interests of fairness to all operators, rigorous steps need to be taken to ensure that this cannot happen.

Section 3: Draft Regulatory Impact Assessment (RIA)
"ComReg is of the preliminary view that the 3.6 GHz band should be assigned by way of auction with no other bands included in the auction".

There are a number of reasons why we propose that a *portion* of the spectrum in rural areas should be designated as primarily for FWA where operators have expressed an interest in rollout of NGA equipment.

1. The relatively large amount of available spectrum.

2. The national interest to deliver NGA broadband to as many rural premises as possible in the shortest timeframe and the lowest impact to the taxpayer.

3. The history of service provision by FWA providers. We contend that had it not been for ComReg decision 10/29 or had ComReg provided a much earlier consultation on the 3.6Ghz spectrum then there would have been significantly greater investment in licensed FWA with significantly more competition and subscribers connected in rural areas. By ensuring adequate spectrum is made available (at a reasonable price) in large areas ComReg can encourage investment in the sector which may significantly reduce the dependence on state subsidy in the NBP.

In the opinion of BBnet, it is inappropriate to award a significant amount of spectrum via an auction process to authorized operators for use solely as capacity spectrum in hotspots in the larger towns within the rural regions. These towns will soon be well served by fixed line services from Eircom and SIRO. Due consideration must be given to the national interest in delivering NGA access to as many rural locations as possible with the least impact to the taxpayer. Requirements for in-building capacity spectrum by MNOs could and should be met through an obligatory system of sub-leasing of spectrum for these purposes. We extend this point to highlight that it should not be permitted to acquire spectrum on the basis of the *potential* for future use and that any award should be based on presentation of clear evidence of concrete rollout plans. In meeting its statutory obligations, Comreg must ensure that these plans are real and substantiated.

Section 4: Key aspects of the Proposed Award Spectrum.

The band plan will be TDD, 1x 25MHz slot and 65x 5MHz slots.
Regions will be established in line with the principles established by ComReg. (Option. 2)
A license duration of 15 years should apply to the 3.6GHz band.

BBnet support the option 2 boundaries. But, we believe that it is imperative that an efficient process for spectrum trading be created alongside this process. There are many well established smaller/medium size WISP's, who are interested in using 3.6ghz to deliver NGA services, especially in rural areas. In practical terms, spectrum trading is the only way in which this can happen. The pricing model for such trading needs to be clearly set out and transparent.

BBnet believe that the license duration should be 20 years, to bring it into line with the proposed NBP award and to give greater investment certainty to operators.

Section 5: Award Type and Format

A cap of 150-250Mhz per operator should apply
The minimum price should be apportioned on a 50/50 basis (SAF and SUF).
Minimum price range of between €0.015 and €0.025 per MHZ per capita.

BBnet strongly support the following ComReg proposals:
1. That the 3.6Ghz band is assigned with no other bands included in the process.
2. That the region model (option 2) proposed by ComReg is appropriate.

3. That a cap should apply. We recommend a cap of 100Mhz in an initial phase (perhaps 2 years) with opportunities to acquire additional spectrum provided defined criteria (to be developed) are met. We propose that these should include at least the number of subscribers connected in a given license region.
5. That rollout obligations should apply to successful bidders and failure to comply within specified timeframes should result in loss of access rights to spectrum.

Minimum Pricing.

The economies involved in fixed wireless networks are significantly different from those of MNOs as is clearly understood by ComReg. ComReg appear to acknowledge this in the proposed pricing model where a minimum price of €0.015 is proposed for rural regions vs. €0.025 for urban. However this does not go far enough. Given the national interest, it would seem appropriate that a much reduced SAF (up-front payment) should apply to operators who indicate an intension to deliver NGA services in rural areas. ComReg can easily ensure the legitimacy of such operators by specifying rollout obligations.
Setting the minimum price of a region based on an assumption of full coverage of the population within that region is false. The population covered is more accurately determined by an analysis of coverage from known mast sites.

In deriving the minimum price, the population numbers that may be potential customers for FWA in rural areas should exclude the population of larger towns where there is access to fibre or cable technologies or where access to fibre is planned to be available in the near term. Indeed given the recent announcement by Eircom and the proposals of the NBP the subscriber base that may be connected by NGA FWA is likely to reduce significantly between now and 2020. All of this would greatly reduce the population number used to determine the minimum price point.

Finally, we contend that rather than a 50/50 split of the SAF vs. SUF that a 25/75 split would encourage more participation by existing smaller companies and new entrants. The price at which 3.6ghz licences will be acquired at, will greatly affect the price at which NGA services can be delivered at. To ensure competitively priced and affordable FWA services, and to promote competition (a comreg statutory obligation) especially in rural areas, it is imperative that SAF & SUF payments are kept to a minimum.

Yours Sincerely,

B O'Halloran

_____
Barry O'Halloran.
Managing Director.

4 Carnsore Broadband

carnsorebroadband
Fibre Powered Broadband for Wexford

Response from Carnsore Broadband regarding the Submissions to ComReg 15/70

Dated 27 August 2015

For the attention of Mr. Joseph Coughlan Commission for Communications Regulation Irish Life Centre Abbey Street Freepost Dublin 1 Ireland Email: marketframeworkconsult@comreg.ie

The following are the main points of concern:

- **Section 3: Draft Regulatory Impact Assessment (RIA)**

We propose that a portion of the spectrum in rural areas should be designated as primarily for FWA operators for the following reasons:

1—There is a relatively large amount of spectrum available which would enable FWA operators to deliver NGA broadband services as specified by the National Broadband Plan .

2---If Comreg make available adequate spectrum to FWA operators at a low or no cost Comreg can encourage investment for the sector to deliver NGA .This in turn would reduce the dependency on state subsidised NBP rollout.

- **Section 5: Award type and format**

We agree with the ComReg proposal that a long term licence is appropriate however perhaps a minimum of 20 years would be better. This licence should be reviewed well in advance of the end of the licencing period and the 3.6Ghz band should be assigned separately from the other bands.

- **Minimum Pricing**

We feel that a low cost or no cost solution should be made available for FWA operators to allow NGA services to be provided by them. FWA operators have been supplying broadband to rural communities for the past 10 years, and it would be inappropriate and also not in the national interest for larger operators to be given a competitive advantage over smaller ISP's.

The pricing guidelines set out by ComReg do not take into account that in the future (as defined by the NBP) a large number of households / businesses will be able access high speed broadband by fibre or cable technologies. This would reduce the number of subscribers to wireless services, and the minimum pricing should reflect this.

5 Digital forge

Annex 7: Consultation Questions

General submission concern

Just to make Comreg aware that Digitalforge does not have a large department dedicated to responding to Comreg's detailed consultation papers. We are disadvantaged by not having had experience of previous auction processes nor access to technical expertise in assessing the relative merits, advantages and disadvantages of the alternative auction processes outlined. ComReg should bear this in mind when weighing up the responses received and deciding on the options available to it in the final design of the allocation process and in designing the rules that should apply.

A7.1 Chapter 4 Consultation Questions

Do you agree with ComReg's preliminary views set out in Chapter 4 and in particular, that

The band plan for the 3 400-3 600 MHz sub-band should be TDD (in line with the preference expressed in the 3.6 GHz EC Decision)

Digitalforge agree with Comreg in that the 3.6 MHz band should be TDD

Regions should be established in line with the principles identified by ComReg;

I disagree, we are a small fixed Wireless operator based in County Cork and the region's proposed and in turn the pricing structure put us out of contention to obtain the licenses dues to cost. This can either be rectified by reducing the licence fees or make the regions smaller.

The regions identified in Option 2 should be used for the proposed award;

disagree

A licence duration of 15 years should apply to the 3.6 GHz band.

Disagree, I would prefer a duration of 20 years in order to have security of my investment and ensuring that the customers have security of service. A consultation on existing 3.6GHz licenses at least 5 years before the termination date of such licenses should be performed so that operators can make appropriate business decisions and preparations for any potential changes

A7.2 Chapter 5 Consultation Questions

Do you agree with ComReg's preliminary views set out in Chapter 5 and, in particular, that:

• A combinatorial clock auction is the preferred auction format;

It is in our opinion inappropriate to award a significant amount of spectrum via an auction process to MNOs for use solely as capacity spectrum in hotspots in the larger towns within the rural regions. Due consideration must be given to the national interest in delivering NGA access to as many rural locations as possible with the least impact to the taxpayer. Requirements for in-building capacity spectrum by MNOs could and should be met through an obligatory system of sub-leasing of spectrum for these purposes. We extend this point to highlight that it should not be permitted to acquire spectrum on the basis of the *potential* for future use and that any award should be based on

presentation of clear evidence of concrete rollout plans. In meeting its statutory obligations Comreg must ensure that these plans are real and substantiated.

• A single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz;

Agree

• A competition cap should be set and, further, that such a cap be within the range of 150 MHz to 250 MHz. Comreg is mindful of the alternative uses to which this spectrum can be put and the potential impacts this can have on competitive dynamics in the relevant market concerned (for example fixed of mobile). Accordingly, Comreg welcomes input on any other factors which should be taken into account when establishing the level of any competition cap;

To ensure adequate competition and to curtail spectrum hoarding, a spectrum limit of 100MHz per operator per region for an initial period should be adopted. Rollout conditions may be specified such that if operators fail to meet required targets (as reported to ComReg) that they may lose their entitlement to some of all of the awarded spectrum

Benchmarking be used as the approach by which to determine a conservative minimum price;

• the minimum price should be apportioned on a 50/50 basis between an up-front payment (SAF) and ongoing annual payments subject to CPI index linking (SUFs);

We contend that rather than a 50/50 split of the SAF vs. SUF that a 25/75 split would encourage more participation by existing smaller companies and new entrants.

• the range €0.015 to €0.025 per MHz per capita is appropriate for the setting of the minimum price, with the higher end of the range applying to urban areas and the lower end applying to regions that do not have specific urban areas identified.

The economies involved in fixed wireless networks are significantly different from those of MNOs as is clearly understood by ComReg. ComReg acknowledges this in the proposed pricing model where a minimum price of €0.015 is proposed for rural regions vs. €0.025 for urban. However this does not go far enough. Given the national interest, it would seem appropriate that a much reduced SAF (up-front payment) should apply to operators who indicate an intension to deliver NGA services in rural areas. ComReg can easily ensure the legitimacy of such operators by specifying rollout obligations.

Setting the minimum price of a region based on an assumption of full coverage of the population within that region is false. The population covered is more accurately determined by an analysis of coverage from known mast sites.

ComReg report that there are 120-170 BS currently in the rural regions, each with an FWALA service area of 314km^2. This gives a total coverage area of approx. 45,000 km^2. However many of these BS are in close proximity to each other so the real coverage is likely less than 30,000km^2, less than 40% of the area of the country. Although it may be possible to develop new high sites these are likely to be of lesser economic value in connecting additional subscribers. In addition, although the population density is likely greater in the existing FWALA coverage areas, due to the LOS nature of 3.6Ghz it is also clear that fixed wireless can connect to significantly less than 100% of premises in these coverage areas.

In deriving the minimum price, the population numbers that may be potential customers for FWA in rural areas should exclude the population of larger towns where there is access to fibre or cable

technologies or where access to fibre is planned to be available in the near term. Indeed given the recent announcement by Eircom and the proposals of the NBP the subscriber base that may be connected by NGA FWA is likely to reduce significantly between now and 2020. All of this would greatly reduce the population number used to determine the minimum price point.

Chapter 6 Consultation Questions

Do you agree with ComReg's preliminary views set out in Chapter 6 and, in particular, that:

• The band should be released on a service- and technology-neutral basis;

Agree

• Rights of use in the band should be awarded on a non-exclusive basis;

• An obligation to notify of the termination of a technology should apply;

Agree

• a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region;

Agree

• a quality of service obligation should apply in relation to each of network availability and voice call standards;

Agree

6 Eircom/Meteor

eircom Group

Response to ComReg Consultation Paper:

Consultation on Proposed 3.6 GHz Band Spectrum Award

ComReg Document 15/70

28 August 2015

DOCUMENT CONTROL

Document name	eircom Group Response to ComReg Consultation Paper 15/70
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The comments submitted to this consultation are those of Meteor Mobile Communications Ltd. (MMC) and eircom Ltd (eircom) collectively referred to as eircom Group.

Responses to Consultation

eircom welcomes the opportunity to contribute to ComReg's proposals for the award of the 3.6 GHz band. We generally agree with ComReg that it is appropriate to proceed with an award solely focussed on the 3.6 GHz band. This strikes the right balance between developing national policy in respect of the 700 MHz band and release of the 3.6 GHz band where there is already established demand and which is likely to be of significant interest to mobile and fixed operators for the provision of wireless broadband services.

Do you agree with ComReg's preliminary views set out in Chapter 4 and, in particular, that:

- ***the band plan for the 3 400-3 600 MHz sub-band should be TDD (in line with the preference expressed in the 3.6 GHz EC Decision);***

eircom agrees that the band plan should align with the EC Decision. This will ensure that users in the band in Ireland will benefit from a rich equipment ecosystem that we expect will evolve from the widespread exploitation of this spectrum on a harmonised basis.

We note that part of the band 3 435 – 3 475 MHz is currently in use for unspecified State services and that ComReg is in ongoing discussions with the relevant State body. We believe it would be beneficial if all of the band could be made available without restriction. eircom requests that ComReg undertakes analysis that identifies the cost / benefit of the continued State use of this spectrum and that the outcome of this analysis be published alongside ComReg's final decision regarding this spectrum.

If State services are to continue to be used then we would agree that the spectrum below the frequency of the State services should be released as a single 25 MHz block. eircom welcomes ComReg's commitment[1] to further clarify whether the existence of the State services may impact on the right of adjacent users to use spectrum won in the award process.

- ***regions should be established in line with the principles identified by ComReg;***

ComReg proposes five principles[2]:

"*1. There should a small number of regions (i.e. between circa five to nine regions) including the major cities to provide a balance between allowing bidders flexibility to obtain spectrum licences in an appropriately-sized area and limiting auction complexity.*

2. Use established boundaries for the identification of borders between regions e.g. County boundaries and/or County council boundaries.

3. Minimise the instances of tri-lateral agreements occurring between operators at boundaries between regions.

4. Eliminate, as far as practicable, the instances where a city region is adjacent to two other regions.

5. By extension, facilitate the potential for each regional operator to acquire both a city and surrounding rural region."

[1] As expressed in Footnote 49, page 63 of ComReg 15/70
[2] Paragraph 4.92, ComReg 15/70

eircom has considered ComReg's proposed principles and agrees that they are fit for purpose. In particular we agree with ComReg[3] that "*In considering the number of regional areas to be awarded … there is a balance to be struck between allowing bidders flexibility to obtain spectrum licences in an appropriately sized geographic area, and the complexity of the auction mechanism*." This is captured in principle 1 and we also agree that the number of and the design of regions should be such to minimise the complexity of coordination between users at the borders. The inclusion of cities separately recognises that use in cities may differ from use in other areas.

- ***the regions identified in Option 2 should be used for the proposed award; and***

eircom considers that Option 2 is preferable to Option 1. eircom fully agrees that there should be five urban regions and four rural regions. In principle we have no objections to the definition of each of these regions in terms of areas covered.

- ***a licence duration of 15 years should apply to the 3.6 GHz band.***

eircom's position on licence duration remains as set out in section 7 of our response to ComReg 14/101 that indefinite licences are optimal to encourage continual investment. As noted in that response even if finite licences are adopted there are practical considerations that must be considered when setting finite licence durations: "*A minimum term of 15 years, assuming commencement date of April 2016, would mean that the licences could become 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*." eircom is therefore disappointed that ComReg is proposing the licence duration should be 15 years.

ComReg seeks to justify its position with two observations at paragraph 4.145 of the consultation document. ComReg's first observation notes that "*an asset life of 8 years is used for the vast majority of the mobile elements. … ComReg observes that this asset life may be equally applicable to future fixed deployments in the band. Accordingly, a 15 year duration would allow potential licensees a generously sufficient period of time to obtain a return on its investment considering this asset life.*" It is not clear to us how an asset life of 8 years in any way supports ComReg's proposal for a 15 year licence duration. The physical life of an asset is not the important determinant even if the period ComReg suggests is correct, which we submit it is not, it is the period over which the investment in the asset is recovered economically. If we assume that the physical life and the investment recovery period are aligned at 8 years then it would be clear that a rationale investor would cease to invest in new equipment after year 7 of the licence.

ComReg's second observation is equally concerning. "*The on-going developments in the 3.6 GHz band that could over time change the attractiveness of this band to certain services and the demand for spectrum in this band. This may mean that the primary spectrum outcomes derived from this award process may not be the most optimal outcomes in the future. While market mechanisms, such as spectrum transfers and leasing, have the potential to address any such concerns, ComReg observes that a duration towards the lower end of the 15 to 20 year range would further mitigate the risk of sub-optimal outcomes in the longer term*." In effect ComReg is saying that it has no faith in market mechanisms to determine the efficient use of spectrum. This of itself is not justification for a finite licence duration and certainly not a proposal for a duration of 15 years. eircom has previously proposed indefinite licence durations with the potential for licences to be revoked. As noted

[3] Paragraph 4.68, ComReg 15/70

in our response to ComReg 14/101, "*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*." We remain of the view that ComReg has not presented sufficient justification for its licence duration proposal of 15 years. ComReg has maintained an entirely arbitrary approach to licence duration which contradicts ComReg's own reasoning. ComReg's observations regarding asset lives and uncertainty regarding future use of the band in fact point towards a requirement for a shorter licence duration in respect of the 3.6 GHz band. If ComReg is to be consistent with its own reasoning then the duration of 3.6GHz licences should be in the region of 7 to 10 years.

Do you agree with ComReg's preliminary views set out in Chapter 5 and, in particular, that:

- ***a combinatorial clock auction is the preferred auction format;***

eircom agrees that a combinatorial clock auction is the preferred auction format for the reasons outlined in the consultation document.

- ***a single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz;***

As noted above if State services are to continue to be used then we would agree that the spectrum below the frequency of the State services should be released as a single 25 MHz block.

- ***Sixty five (65) frequency-generic lots of 5 MHz each should be adopted for frequencies between 3475 MHz – 3800 MHz;***

eircom agrees that frequency generic lots of 5 MHz may be appropriate as this is the minimum size of the building blocks for service delivery. However it is unlikely that a service could be meaningful delivered on less than 20MHz. The complexity of the award process can be simplified somewhat if the number of lots is reduced. Consequently we believe there is merit in consideration being given to lot sizes of 20 MHz for the frequency generic lots.

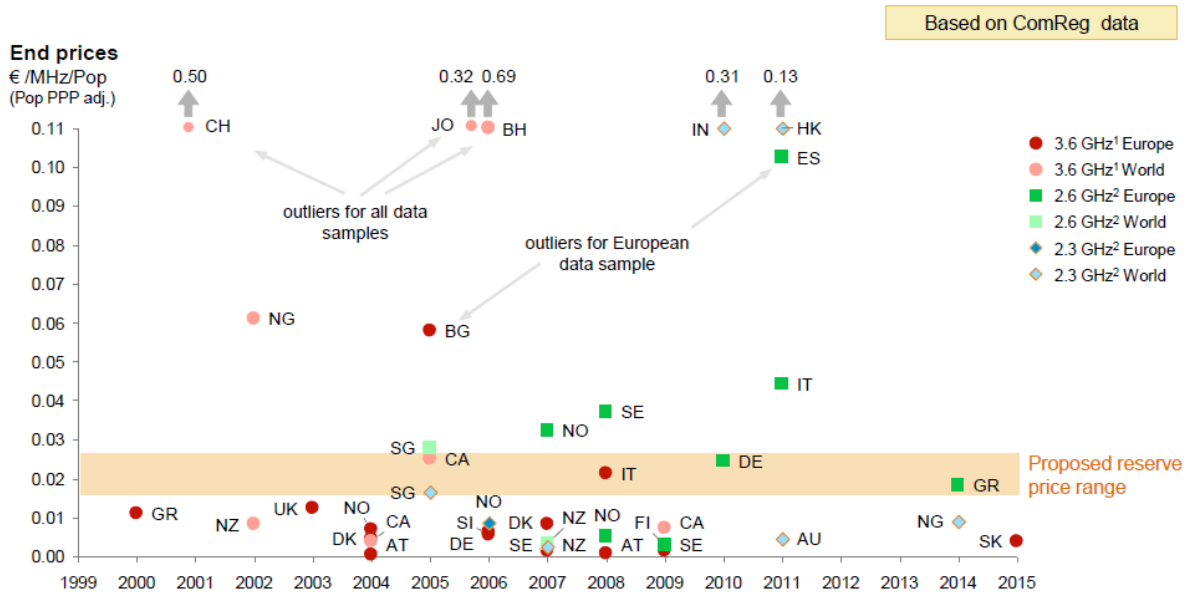
- ***a competition cap should be set and, further, that such a cap be within the range of 150 MHz to 250 MHz. ComReg is mindful of the alternative uses to which this spectrum can be put and the potential impacts this can have on competitive dynamics in the relevant market concerned (for example fixed of mobile). Accordingly, ComReg welcomes input on any other factors which should be taken into account when establishing the level of any competition cap;***

eircom notes the analysis set out in the consultation document that the competition cap should be set in the range of 150 MHz to 250 MHz. In our view a cap in the region of 250 MHz is too loose. This could lead to an extremely asymmetric outcome with two parties able to acquire all of the spectrum to the detriment of promoting a competitive playing field with a reasonable number of capable players. Competition between the two parties would also be distorted if one entity acquired spectrum to the cap of 250MHz leaving 100MHz for the other party. This asymmetry would give substantial advantages to the operator with the significantly larger assignment that cannot be replicated in terms of quality of service offered and cost of network rollout. . In our view the cap is better set in the range of 150 MHz to 200 MHz.

- ***benchmarking be used as the approach by which to determine a conservative minimum price;***
- ***the minimum price should be apportioned on a 50/50 basis between an up-front payment (SAF) and ongoing annual payments subject to CPI index linking (SUFs); and***
- ***the range €0.015 to €0.025 per MHz per capita is appropriate for the setting of the minimum price, with the higher end of the range applying to urban areas and the lower end applying to regions that do not have specific urban areas identified.***
- ***the population of each of the regions under Option 2 should be adjusted to take account of the commuter flows between the five identified cities and the other applicable regions.***

eircom will address all the questions regarding spectrum pricing together. As noted in the consultation document there are a number of approaches that can be used to inform the setting of minimum prices. eircom acknowledges that benchmarking can be used as one such approach. We also agree with ComReg's stated intent that the minimum price should be established on a conservative basis. However there are a number of reasons why we do not believe that ComReg's proposals are conservative or equitable and as such ComReg's proposals risk distorting the efficiency of the award process.

The data presented by ComReg seems inappropriate to estimate the market value for 3.6 GHz licences in Ireland. The 3.6 GHz data is mostly very old and the 2.6GHz data is not comparable because the band has much better propagation characteristics and a wider application range, as well as a much larger equipment ecosystem. It should also be noted that non-European data is not comparable because the spectrum situation in these countries is often very different from Europe (higher scarcity). Even if one accepts the data points chosen by ComReg, the approach to calculating an average appears to be skewed upwards.



This calls into question the range of €0.015 to €0.025 proposed by ComReg. We do not consider these to be conservative estimates.

ComReg proposes to use the lower end of the range to calculate prices for the rural regions and the upper end of the range to calculate prices for the urban regions. In eircom's view this is done in an entirely arbitrary way which is indeed reflected in the way ComReg

describes its proposal[4] "*Dotecon observes that there are no simple means to relate population density to unit costs and hence to spectrum valuations. This is made more difficult because this population cost relationship is likely to vary across different operators and uses. However, DotEcon adjust for this effect by using a higher price per MHz per capita, within the conservative range, when calculating the minimum price for regions with a high population density*." eircom believes that a single price per MHz per capita should be used. This reflects the greater current demand for this spectrum outside urban areas.

eircom also questions the justification for adjusting the regional population figures for commuting patterns. A population adjustment of this nature is questionable in any event as such patterns change (indeed this is one of the likely effects of the NBP) however what ComReg is proposing in the context of the 3.6 GHz spectrum appears to us to run against the principle of technology and service neutrality. In effect ComReg is making an adjustment assuming that the spectrum will be used for mobile purposes. However the 3.6 GHz spectrum can be used for fixed and mobile uses and ComReg's adjustment has the potential effect of creating a higher price per MHz per capita capable of being served by fixed services. The proposal to adjust for commuter flows should be dropped.

Do you agree with ComReg's preliminary views set out in Chapter 6 and, in particular, that:

- ***the band should be released on a service- and technology-neutral basis;***
- ***rights of use in the band should be awarded on a non-exclusive basis;***

eircom agrees.

- ***an obligation to notify of the termination of a technology should apply;***

eircom has no objection to such an obligation on the understanding that the obligation will be "*substantively the same terms as that imposed on Liberalised Use Licences issued under S.I 251 of 2012*"[5].

- ***a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region;***

eircom agrees that it is appropriate to define rollout obligations in terms of minimum coverage requirements to encourage the efficient use of the spectrum. ComReg proposes to define the rollout obligation in terms of the number of transmitters in each region. This is a novel approach moving away from the established form of coverage obligations expressed in terms of population to be covered. ComReg proposes to express the coverage obligation by reference to existing use of the spectrum by FWA operators with between 15-25 network controlled sites in at least 3 to 5 Counties of rural regions, 15-25 sites in Dublin, and 2-4 sites in the other urban regions. It is not clear to us that one size of coverage obligation will be appropriate for all users and to guard against the risk of hoarding. In particular, if ComReg sets the spectrum cap in the region of 200 to 250 MHz this is a substantial quantity of spectrum and it may be appropriate to express a more substantial rollout obligation to guard against hoarding of the spectrum. As such eircom believes that a sliding scale coverage obligation should be established such that the number of sites proposed by ComReg applies for spectrum holdings of 100 MHz or less. The scale should then move up

[4] Paragraph 5.139, ComReg 15/70
[5] Paragraph 6.22, ComReg 15/70

proportionally such that the number of sites required for the largest holdings (e.g. in the region of 200 to 250 MHz) is set at four times the basic level. eircom's proposed approach is consistent with ComReg's proposals in respect of specifying minimum base station requirements by reference to the size of the spectrum holding.

eircom agrees with ComReg's view that a rollout period between 3 to 5 years is appropriate. We also agree that the coverage obligation of a national or multi-region licence should be expressed as the aggregate of the relevant regional licences.

- ***a quality of service obligation should apply in relation to each of network availability and voice call standards;***
- ***licensees should internalise guard-bands as spectrum should be assigned without guard-bands; a default TDD frame-structure based on TD-LTE configuration 2 (3:1) should be applied to incentivise inter-network synchronisation;***
- ***a permissive BEM should apply to synchronised networks and a restrictive BEM should apply to unsynchronised networks;***
- ***the terminal station in block power limit set out in the 3.6 GHz EC Decision should be relaxed for fixed outdoor installations;***
- ***at regional borders a coordination threshold should apply to allow for bilateral/multilateral co-existence agreements; and***
- ***where agreement in cross-border coordination fails to be met, the coordination threshold limit should be set as a binding licence condition***.

eircom agrees with the technical proposals.

Do you agree with ComReg's preliminary views set out in Chapter 7 and, in particular, with the following proposals:

- ***Transition Proposal 1: the formulation of a transition plan for the 3.6 GHz band***;

ComReg's proposals in respect of the principles to underpin the formulation of a transition plan are in line with those previously applied for the MBSA in 2012. eircom was a participant in the MBSA transition plan for timeslice 1 and timeslice 2 and notes that both transition phases completed satisfactorily. As such we can see no reason why the principles should not be appropriate for any transition activities arising from the 3.6 GHz award process.

We note ComReg's comments regarding the potential for market forces to assist in resolving transitional issues and look forward to ComReg's proposals in respect of establishing a framework for spectrum leasing. We believe that a spectrum leasing framework should be designed to encourage market led solutions and as noted by ComReg such features could include allowing the use of leased spectrum to count towards the lessor's coverage for the purpose of assessing compliance with coverage obligations.

- ***Transition Proposal 2: the Transition Protected Licence; and***

ComReg proposes to allow the issuance of Transition Protected Licences to existing licensees, if necessary, to allow completion of transition activities beyond the expiry date of the existing licences. At this stage we cannot predict how complex the transition arrangements will be. There may be a requirement for a number of licensees to undertake sequential works to facilitate a transition. If the transition arrangements are complex it may be necessary for the activity to run beyond the expiry dates of the existing licences. As such

we agree with ComReg's proposal to facilitate the process allowing for Transition Protected Licences. Clearly it will be necessary to ensure that the duration of such licences is the minimum necessary period reasonably required to undertake and complete transition activities. ComReg proposes that the terms and conditions of the Transition Protected Licences should be the same as existing licences with the exception of the duration and potentially amendment to frequency assignments. In eircom's view consideration should also be given to amending the licence fees. Increased licence fees would incentivise the timely completion of the transition activities.

- ***Transition Proposal 3: the Transition Unprotected Licence.***

ComReg proposes to introduce Transition Unprotected Licences which would allow any existing licensee who fails to acquire sufficient rights in the 3.6 GHz award process, to continue to provide service to end users until such time as an alternative means of supply has been established. Alternative means of supply could be from a successful 3.6 GHz operator or an alternative technology, such as fibre, delivering fixed broadband to the area. eircom agrees there is merit in such licences to maximise the benefits to end users.

eircom agrees with ComReg[6] "*that any regulatory mechanism proposed must not provide perverse incentives for the Existing Licensees in terms of the nature and extent of their participation in the proposed award or in terms of coming to a market-based resolution of the transition scenario identified*." eircom supports the concept of Transition Unprotected Licences provided the following fundamental principles are maintained:

- Transition Unprotected Licences may only be applied for by existing licensees who have participated in the 3.6 GHz award process and failed to acquire sufficient spectrum to maintain an existing fixed wireless broadband service.
- The existing licensee is the sole provider of fixed broadband services in the area. If there are one or more alternative suppliers in the area then we do not believe there is a basis to justify the issuance of a Transition Unprotected Licence.
- The licences should be of a reasonably short duration and in this regard we agree with ComReg that a maximum term in the region of 2 to 5 years is appropriate.
- The licences should be terminated rapidly following deployment of alternative means of supply of fixed broadband to the area from a successful 3.6 GHz operator or an alternative technology, such as fibre. This termination could occur at any time during the maximum term of the Transition Unprotected Licence.
- The frequency assigned under the Transition Unprotected Licences should be the same as under the existing licence. This is option 1 proposed by ComReg in paragraph 7.65. However we note that ComReg does not appear to fully support option 1 because the existing frequencies may not be available if "*the new licensee has launched services*". ComReg's position appears to contradict the fundamental objective of the Transition Unprotected Licences to ensure that end users have a service of last resort. If the new licensee has launched services then there can be no justification for a Transition Unprotected Licence to be issued. We do not agree with option 2 which would allow an existing licensee to select an alternative frequency assignment for this reason. If the existing frequency assignment is not available there is no justification for a licence to be issued.
- On the issue of licence fees ComReg presents three options comprising, using existing fees, using existing fees updated for CPI, using fees based on the

[6] Paragraph 7.58, ComReg 15/70

outcome of the award process. ComReg indicates a preference for the second option, using existing fees updated for CPI. Whilst this is preferable to the option of using existing fees, eircom believes that basing the fees on the outcome of the award process is the only justifiable approach as it is based on the market's view of the economic value of the spectrum. This holds irrespective of whether the Transition Unprotected Licences contain liberalised rights of use or not.

Other Matters Not Addressed in the Consultation Paper

There are a number of important matters related to the design of a spectrum award process that interested parties should have sight of and the opportunity to comment on. Such matters include, but are not limited to, qualification criteria that will apply to enter the award process, policy in respect of Deposits during the qualification and the auction phases, eligibility rules for round activity, rules for bidders in respect of confidentiality, policy for price increments during the auction process, rules for the derivation of final prices, the maximum permissible number of supplementary round bids etc. eircom looks forward to a subsequent consultation on these important matters which we expect will inform the Information Memorandum for the 3.6 GHz award process.

Project Timeline

ComReg indicates in this consultation paper its intention to issue its response to the consultation by the end of 2015. ComReg further states[7] that it "*cannot provide further clarity on the overall timelines at this juncture, as this will depend on the nature of responses received among other things, ComReg would reiterate that it remains conscious of the expiry of existing 3.6 GHz licences in July 2017 and is working towards providing clarity on the future of the 3.6 GHz band as far as possible in advance of this date*." As ComReg and some interested parties with previous experience of the MBSA in 2012 will be aware there is a significant amount of preparation required for interested parties to effectively participate in an award process. This includes developing a clear understanding of the rules expressed in the Information Memorandum including participation in one or more mock auctions and preparatory activities such as creating a secure bidding room. Interested parties require a reasonable view of timelines in order to effectively prepare. As it stands ComReg has indicated that a response to the consultation will issue by the end of 2015 and the award process will conclude as far as possible in advance of July 2017. We appreciate that ComReg cannot be definitive at this time on specific dates for the award process but interested parties do need some indication as to when to expect major milestones to occur. eircom requests that ComReg publishes a high level project plan for the 3.6 GHz award process.

[7] Paragraph 8.8, ComReg 15/70

7 Eurona Ireland

Eurona Ireland submission on Proposed 3.6GHz Band Spectrum Award (ComReg 15/17)

Section 3 Draft Regulatory Impact Assessment (RIA)

We agree with the ComReg proposal that the 3.6ghz band be auctioned separately to the grouping of other bands such as 700mhz, 1.4ghz and 2.3ghz.
We support the ComReg proposal that the 3.6 GHz band alone is included in the proposed auction, and no other bands are included in the process.
We also propose the following:

- A larger proportion of the spectrum be used for the delivery of LTE / FWA. There is currently a requirement for licensed spectrum by WISPS in Ireland, as attributed to the fact that a large proportion of the current FWA subscriber base is supported by non-licensed technology. 3.6ghz is not ideal for delivery of mobile services, as demonstrated by the lack of band enabled mobile devices (GSA Report April 2015) and limitations on services such as download caps. ComReg also proposes to release additional spectrum, which is ideal for mobile services.

- A report undertaking the impact of the 3.6ghz band on the national broadband plan currently proposed by the DCNR. It is our view that a cross department report such as this could identify savings, reduce the dependence on state subsidy for the NBP and alleviate the burden on the taxpayer.

- Spectrum should not be allocated to operators on a " future-plans " basis and operators must show short term and medium term plans to utilise the spectrum to its capacity, and eliminate the current pervasiveness of spectrum-hoarding.

Section 4/5 Proposed Award Spectrum, Award Type and Format.

We broadly agree with the plans by ComReg to divide the spectrum allocation into the regions as proposed.

We believe that the license duration should be extended from the proposed 15 to 20 years, and be primarily used for LTE-TDD. This would encourage more long-term large scale investment. Furthermore, a review of the assigned spectrum should be undertaken every 5 years to ensure efficient use of the spectrum and the delivery of services to end users. Prior

to expiration of the license, a consultation should be undertaken with the stakeholders at least 5 years before the next award of the spectrum.
We submit a proposal that the period should be extended for a further 10 years, subject t performance conditions. This would enable stakeholders to undertake future directions, investment plans and preparations for any technology upgrading or business changes.

We submit that a cap of 100MHz should apply, in order to diffuse a situation where potentially only two operators in a particular region may collude to stifle competition in that region.

We submit that in order to have a manageable block of apportioned spectrum, that blocks are not of less than 50MHz.

We submit that rollout obligations, to counteract spectrum hoarding, should apply to successful bidders, and failure to comply within specified timeframes should result in loss of access rights to spectrum.

We submit that the proposed minimum pricing is set too high. We believe it is not in the interest of rural subscribers to have the minimum pricing set at this level, given that the providers will in all likelihood have to compete with the proposed subsidised NBP.
Whilst the proposal to base minimum pricing on population may provide simplicity and clarity, we submit a possible alternative may take into consideration the relative affluence / purchasing power of one region over another.
Naturally demand will set its own level, however, setting an initial high limit may prevent many potential bidders from participating.
We submit it would be preferential to alter the payment split to reflect an initial 40% SAF, as opposed to the ComReg proposal of 50%, as this would encourage competition on the basis of lower initial Capex requirements.
The pricing structure is based on the upper end of the scale. Moreover, the cost basis on the assumption of population-coverage is a problematic model to follow. 3.6ghz cannot provide 100% population coverage due to its propagation characteristics. ComReg could estimate a more realistic population coverage by excluding areas that have access to NGA technologies such as fibre or cable modem access. Furthermore, the market size will be reduced even further by inclusion of the recent announcements by Eircom, SIRO and **the** DCENR.

Section 6 License Conditions

Subject to interference conditions being met, there should be an obligation on license holders to sub-lease (at viable commercial rates) to other operators in areas where they not plan to provide coverage within a specified time limit. The pricing model should be determined in advance of the spectrum award process.

The obligation to sub-lease spectrum should also apply in situations where a transmitter in one region may be used by another operator to serve a population in an adjacent region, where it can be

shown, to the satisfaction of ComReg, that the leasee's frequency plan does not impact on the main operator.

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8 Joint FWA 4 Operators

Joint response received from four FWALA Operators listed below:

- Lightnet
- permaNET
- Ripplecom
- WestNet

Lightnet, permaNET, Ripplecom & WestNet

Joint Response to the Consultation Paper entitled Consultation on Proposed 3.6 GHz Band Spectrum Award. ComReg 15/70

We would initially point out that in terms of submitting responses to this detailed consultation that unlike the large MNO companies, small FWA companies are disadvantaged by not having had experience of previous auction processes nor access to technical expertise in assessing the relative merits, advantages and disadvantages of the alternative auction processes outlined. ComReg should bear this in mind when weighing up the responses received and deciding on the options available to it in the final design of the allocation process and in designing the rules that should apply.

Section 3: Draft Regulatory Impact Assessment (RIA)

" ComReg is of the preliminary view that the 3.6 GHz band should be assigned by way of auction with no other bands included in the auction".

There are a number of reasons why we propose that a *portion* of the spectrum in rural areas should be designated as primarily for FWA where operators have expressed an interest in rollout of NGA equipment.

1. The relatively large amount of available spectrum.

2. The national interest to deliver NGA broadband to as many rural premises as possible in the shortest timeframe and the lowest impact to the taxpayer.

3. The history of service provision by FWA providers. We contend that had it not been for ComReg decision 10/29 or had ComReg provided a much earlier consultation on the 3.6Ghz spectrum then there would have been significantly greater investment in licensed FWA with significantly more competition and subscribers connected in rural areas. As it is, more that 60% of the known 74,000 FWA subscribers in Ireland are connected using license exempt equipment, largely for this reason. By ensuring adequate spectrum is made available (at a reasonable price) in large areas ComReg can encourage investment in the sector which may significantly reduce the dependence on state subsidy in the NBP.

4. Typically the amount of spectrum required to deliver competitive mobile services is significantly less that the spectrum required to deliver competitive fixed services as the expectation of the consumer is that the mobile service will involve a (relatively low) usage cap typically less than 20GB, whereas the expectation for fixed service is that there is no cap - or a relatively high one (200GB). In addition there is a stated intension to release other spectrum bands in the near future (2.3 and 2.6GHz) that are better suited to Mobile services and therefore likely to be economically out of reach for FWA providers.

It is in our opinion inappropriate to award a significant amount of spectrum via an auction process to MNOs for use solely as capacity spectrum in hotspots in the larger towns within the rural regions. Due consideration must be given to the national interest in delivering NGA access to as many rural locations as possible with the least impact to the taxpayer. Requirements for in-building capacity spectrum by MNOs could and should be met through an obligatory system of sub leasing of spectrum for these purposes. We extend this point to highlight that it should not be permitted to acquire spectrum on the basis of the *potential* for future use and that any award should be based on presentation of clear

evidence of concrete rollout plans. In meeting its statutory obligations Comreg must ensure that these plans are real and substantiated.

Section 4: Key aspects of the Proposed Award Spectrum.

The band plan will be TDD, 1x 25MHz slot and 65x 5MHz slots.

Regions will be established in line with the principles established by ComReg. (Option. 2)

A license duration of 15 years should apply to the 3.6GHz band.

Section 5: Award Type and Format

A cap of 150-250Mhz per operator should apply

The minimum price should be apportioned on a 50/50 basis (SAF and SUF).

Minimum price range of between €0.015 and €0.025 per MHZ per capita.

For the reasons already outlined above and in our response to 14/101 we are supportive of the following ComReg proposals

1. That the 3.6Ghz band is assigned with no other bands included in the process.

2. That the region model (option 2) proposed by ComReg is appropriate.

One potential issue that has been identified with the option 2 region model proposed is where a transmitter is located in one region whose target coverage area is in another region, e.g. a transmitter in a urban region which has extensive rural coverage. A potential solution is in obligatory sub-leasing of spectrum discussed under section 6 response below.

3. That a long license duration (we suggest a minimum of 20 years) is appropriate.

4. That a cap should apply. We recommend a cap of 100Mhz in an initial phase (perhaps 2 years) with opportunities to acquire additional spectrum provided defined criteria (to be developed) are met. We propose that these should include at least the number of subscribers connected in a given license region.

5. That rollout obligations should apply to successful bidders and failure to comply within specified timeframes should result in loss of access rights to spectrum.

Minimum Pricing.

The economies involved in fixed wireless networks are significantly different from those of MNOs as is clearly understood by ComReg. Comreg appear to acknowledge this in the proposed pricing model where a minimum price of €0.015 is proposed for rural regions vs. €0.025 for urban. However this does not go far enough. Given the national interest, it would seem appropriate that a much reduced SAF (up-

front payment) should apply to operators who indicate an intension to deliver NGA services in rural areas. ComReg can easily ensure the legitimacy of such operators by specifying rollout obligations.

Setting the minimum price of a region based on an assumption of full coverage of the population within that region is false. The population covered is more accurately determined by an analysis of coverage from known mast sites.

ComReg report that there are 120-170 BS currently in the rural regions, each with an FWALA service area of 314km^2. This gives a total coverage area of approx 45,000 km^2. However many of these BS are in close proximity to each other so the real coverage is likely less than 30,000km^2, less than 40% of the area of the country. Although it may be possible to develop new high sites these are likely to be of lesser economic value in connecting additional subscribers. In addition, although the population density is likely greater in the existing FWALA coverage areas, due to the LoS nature of 3.6Ghz it is also clear that fixed wireless can connect to significantly less than 100% of premises in these coverage areas.

In deriving the minimum price, the population numbers that may be potential customers for FWA in rural areas should exclude the population of larger towns where there is access to fibre or cable technologies or where access to fibre is planned to be available in the near term. Indeed given the recent announcement by Eircom and the proposals of the NBP the subscriber base that may be connected by NGA FWA is likely to reduce significantly between now and 2020. All of this would greatly reduce the population number used to determine the minimum price point.

Finally, we contend that rather than a 50/50 split of the SAF vs. SUF that a 25/75 split would encourage more participation by existing smaller companies and new entrants.

Spectrum Limit.

To ensure adequate competition and to curtail spectrum hoarding, a spectrum limit of 100MHz per operator per region for an initial period should be adopted. Rollout conditions may be specified such that if operators fail to meet required targets (as reported to ComReg) that they may lose their entitlement to some of all of the awarded spectrum.

License Duration.

There should be a provision to extend the license duration to 20 years. We agree with DotEcon's comment that "spectrum use typically requires long-term, large-scale investments". To provide for business continuity and ongoing network investments there has to be an option for the regulator to extend licenses beyond the proposed 15 or 20 years. Irrespective of the initial license duration if a license were to terminate with the next 5-7 years there would be no incentive to continue to invest in the network. This has been apparent from the lack of investment in FWALA. The regulator should furthermore provide a commitment to conduct a consultation and issue a decision on existing 3.6GHz licenses at least 5 years before the termination date of such licenses so that operators can make appropriate business decisions and preparations for any potential changes.

Section 6: License Conditions

Subject to interference conditions being met, there should be an obligation on license holders to provide spectrum to other (possibly smaller) operators in areas where they do not plan to provide coverage within specified time limits. As stated earlier, there should also be an obligation on FWA license holders in large rural areas to sub-license spectrum for in-building capacity spectrum in urban hot spots. The pricing model for such sub-leasing should be determined in advance of the spectrum award process but we propose that the pricing should be based on a similar population model as ComReg propose and should discourage opportunism.

The obligation to sub-lease spectrum should also apply in situations where a transmitter in one region may be used by another operator to serve a population in an adjacent region. Provided that the requesting operator can demonstrate to ComReg's satisfaction that their frequency plan does not impact on the requested operator then there should be an obligation to sub-lease the requested spectrum.

Section 7: Transitional Issues

It is presumed that under a transition license (protected or unprotected) that an operator will be authorized to continue to provide services using the current FWALA band plan, equipment and conditions of use.

In the case of the transition unprotected license it is assumed that the operator would be protected from interference by unlicensed transmission and that the operator could continue to avail of ComReg's compliance resources to investigate and resolve any such issues.

In setting out its proposals for Transition Plans and timelines ComReg has made reference to the MBSA process. However we would point out that transition issues for Fixed wireless services are significantly different to mobile services. In the case of mobile services it may be presumed that the CPE devices (handsets) will incrementally be changed by the subscriber base over time to avail of the new services or bandwidth provided by the operator. In the case of FWA truck rolls may be required to each subscriber premises. In a situation where an operator is planning to upgrade equipment in a certain sector and where there may be several hundred subscribers in that sector then in order to provide continuity of service the operator would have to

1. Upgrade the BS with the new equipment, transmitting in alternative "turning space" spectrum.

2. Implement a plan to replace equipment at each CPE premises, requiring truck rolls to each location

3. Once all CPE equipment had been replaced then turn off the "old" BS transmitter for that sector and retune the "new" BS equipment to the final frequency assignment.

4. The operator would have to continue steps 1-3 for all other sector transmitters at the BS.

Given all of this it is likely that the timeframes involved would not be equivalent to those in the MBSA process.

Under the terms of the Transition Unprotected License we suggest that the specific frequency assignment is a matter that should be arbitrated by ComReg on a case by case basis prior to the license issue. There are significant differences in the frequency agility of 3.6GHz equipment. An existing licensee may have deployed equipment with customers which may have a fixed range of operation within a 30 or 40MHz section of band, whereas much of the NGA equipment that would likely be deployed under a new license is capable of operating in any contiguous block of the proposed frequency plan, in 5, 10, 20, 40MHz or higher bandwidths.

Given the national interest in providing high speed wireless services to the maximum number of rural consumers, and in terms of maximising competition in the market, it seems contradictory that on the one hand DCENR is proposing to provide state aid to provide fibre services to each premises, whereas ComReg is proposing to increase FWALA fees. As a result we would advocate that there should be no fee increase for transition unprotected FWALA licenses.

Regarding the duration of a Transition Unprotected license our view is that this should not necessarily have a maximum term. ComReg should allow flexibility in this regard and determine when and if a license should be terminated based on market conditions. We suggest that a licensee operating under a transition unprotected license should be given a minimum of 18 months notice of the termination of the license in order to minimise consumer disruption and to allow for transition arrangements for those consumers to alternative provider(s).

9 KerNet Broadband

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27 Aug 2015

Mr. Joseph Coughlan

Commission for Communications Regulation

Irish Life Centre

Abbey Street

Dublin 1

Submission on Comreg 15/70 from KerNet Broadband.

KerNet Broadband is a small, locally based ISP serving the geographical area of the eastern part of County Kerry and crossing into the North Cork and South West Limerick. It is in existence with the last ten years and our customer base is mainly in rural based communities.

In consideration of this, we wish to point out in this submission to ComReg that the Consultation should make serious allowance for;

1) The sparsely populated areas and mountainous terrain that KerNet covers.
2) That KerNet Broadband has no experience of previous license auction processes and the technicalities of the course it would take.

Section 3: Draft Regulatory Impact Assessment (RIA)

Reasons why KerNet propose that a portion of the spectrum in rural areas should be designated as primarily for FWA where operators have expressed an interest in rollout of NGA equipment.

1) The relatively large amount of available spectrum.

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2) The national interest to deliver NGA broadband to as many rural premises as possible in the shortest timeframe and the lowest impact to the taxpayer.

3) The history of service provision by FWA providers. We contend that had it not been for ComReg decision 10/29 or had ComReg provided a much earlier consultation on the 3.6Ghz spectrum then there would have been significantly greater investment in licensed FWA with significantly more competition and subscribers connected in rural areas. As it is, more that 60% of the known 74,000 FWA subscribers in Ireland are connected using license exempt equipment, largely for this reason. By ensuring adequate spectrum is made available (at a reasonable price) in large areas ComReg can encourage investment in the sector which may significantly reduce the dependence on state subsidy in the NBP.

4) Typically the amount of spectrum required to deliver competitive mobile services is significantly less that the spectrum required to deliver competitive fixed services as the expectation of the consumer is that the mobile service will involve a (relatively low) usage cap typically less than 20GB, whereas the expectation for fixed service is that there is no cap - or a relatively high one (200GB). In addition there is a stated intension to release other spectrum bands in the near future (2.3 and 2.6GHz) that are better suited to Mobile services and therefore likely to be economically out of reach for FWA providers.

In the opinion of KerNet, it is inappropriate to award a significant amount of spectrum via an auction process to authorized operators for use solely as capacity spectrum in hotspots in the larger towns within the rural regions. These towns will soon be well served by fixed line services from Eircom and SIRO. Due consideration must be given to the national interest in delivering NGA access to as many rural locations as possible with the least impact to the taxpayer. Requirements for in-building capacity spectrum by MNOs could and should be met through an obligatory system of sub-leasing of spectrum for these purposes. We extend this point to highlight that it should not be permitted to acquire spectrum on the basis of the potential for future use and that any award should be based on presentation of clear evidence of concrete rollout plans. In meeting its statutory obligations, Comreg must ensure that these plans are real and substantiated.

Section 4: Key aspects of the Proposed Award Spectrum.

The band plan will be TDD, 1x 25MHz slot and 65x 5MHz slots.

Regions will be established in line with the principles established by ComReg. (Option. 2)

License duration of 15 years should apply to the 3.6GHz band.

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KerNet support the option 2 boundaries. But, we believe that it is imperative that an efficient process for spectrum trading be created alongside this process. There are many well established smaller/medium size WISP's, who are interested in using 3.6ghz to deliver NGA services, especially in rural areas. In practical terms, spectrum trading is the only way in which this can happen. The pricing model for such trading needs to be clearly set out and transparent.

KerNet believe that the license duration should be 20 years, to bring it into line with the proposed NBP award and to give greater investment certainty to operators.

Section 5: Award Type and Format

A cap of 150-250 MHz per operator should apply

The minimum price should be apportioned on a 50/50 basis (SAF and SUF).

Minimum price range of between €0.015 and €0.025 per MHZ per capita.

KerNet support the following ComReg proposals:

1. That the 3.6 GHz band is assigned with no other bands included in the process.

2. That the region model (option 2) proposed by ComReg is appropriate.

3. That a cap should apply. We recommend a cap of 100Mhz in an initial phase (perhaps 2 years) with opportunities to acquire additional spectrum provided defined criteria (to be developed) are met. We propose that these should include at least the number of subscribers connected in a given license region.

5. That rollout obligations should apply to successful bidders and failure to comply within specified timeframes should result in loss of access rights to spectrum.

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Minimum Pricing.

The economies involved in fixed wireless networks are significantly different from those of MNOs as is clearly understood by ComReg. ComReg appear to acknowledge this in the proposed pricing model where a minimum price of €0.015 is proposed for rural regions vs. €0.025 for urban. However this does not go far enough. Given the national interest, it would seem appropriate that a much reduced SAF should apply to operators who indicate an intension to deliver NGA services in rural areas. ComReg can easily ensure the legitimacy of such operators by specifying rollout obligations.

Setting the minimum price of a region based on an assumption of full coverage of the population within that region is false. The population covered is more accurately determined by an analysis of coverage from known mast sites.

In deriving the minimum price, the population numbers that may be potential customers for FWA in rural areas should exclude the population of larger towns where there is access to fibre or cable technologies or where access to fibre is planned to be available in the near term. Indeed given the recent announcement by Eircom and the proposals of the NBP the subscriber base that may be connected by NGA FWA is likely to reduce significantly between now and 2020. All of this would greatly reduce the population number used to determine the minimum price point.

Finally, we contend that rather than a 50/50 split of the SAF vs. SUF that a 25/75 split would encourage more participation by existing smaller companies and new entrants. The price at which 3.6 GHz licences will be acquired at, will greatly affect the price at which NGA services can be delivered at. To ensure competitively priced and affordable FWA services, and to promote competition (a comreg statutory obligation) especially in rural areas, it is imperative that SAF & SUF payments are kept to a minimum.

Section 6: License Conditions

Subject to interference conditions being met, there should be an obligation on license holders to provide spectrum to other smaller operators in areas where they do not plan to provide coverage within specified time limits. The pricing model for such sub-leasing should be determined in advance of the spectrum award process but we propose that the pricing should be based on a similar population model as ComReg propose and should discourage opportunism.

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The obligation to sub-lease spectrum should also apply in situations where a transmitter in one region may be used by another operator to serve a population in an adjacent region. Provided that the requesting operator can demonstrate to ComReg's satisfaction that their frequency plan does not impact on the requested operator then there should be an obligation to sub-lease the requested spectrum.

Conclusion

KerNet Broadband wish to re-iterate our opening remarks in relation to our opinion that ComReg should make serious allowance for an ISP operating in the rural area and inexperience in licence action processes.

Please note that this submission is of non-confidential status.

Yours Sincerely,

Daniel Kerin

Network Development

10 Munster Wireless Ltd

Munster Wireless Ltd. The Mill, 1 Bridge St., Cahir, Co. Tipperary, Ireland. www.munsterwireless.com - info@munsterwireless.com - +353 527442814

28th Aug 2015

Commission for Communications Regulation,
Block DEF,
Abbey Court,
Irish Life Centre,
Lower Abbey Street,
Dublin 1,
D01 W2H4

Consultation on Proposed 3.6GHz Band Spectrum Award

The following are the views of Munster Wireless Ltd. on the proposed 3.6GHz band spectrum award:

- Auctioning spectrum to highest bidder is cost prohibitive to smaller providers.
- The cost of spectrum must be passed to the end user.
- The coverage area of licenses is too large for small providers.
- Subletting of spectrum will be cost prohibitive to small providers.
- While setting the minimum price high to encourage the use of spectrum may be effective for the large providers it will put it out of reach for the smaller ones.
- Making a third of the available spectrum available to existing fixed wireless providers at a minimal price and in smaller coverage areas will benefit the consumer and promote competition while allowing the state to maximize returns on the remaining spectrum.

Yours sincerely,

Pat Fitzgerald
Munster Wireless Ltd.

11 Net1 Ltd

Net1.ie
Delivering Broadband Internet

Mr. Joseph Coughlan
Commission for Communications Regulation
Irish Life Centre
Abbey Street
Freepost
Dublin 1
Ireland

28'th August 2015
Consultation on Proposed 3.6 GHz Band Spectrum Award 15/70

Dear Sirs,
We submit our comments as follows
4.5 Chapter 4 Consultation Question
Net1 Ltd Response

- Net1 agrees that regions should be established in line with the principles identified by ComReg in order to allow a single operator or group of operators to achieve a significant critical financial & administrative mass to allow them to join the competition in order to submit a viable bid/proposal for spectrum thereby delivering increased competition for services in rural areas.
- Net1 agrees the Option 2 should be used.
- Net1 agrees that • a licence duration of 15 years should apply to the 3.6GHz band in order to make it economically viable for an operator to achieve a return on investment and provide enough time for finances to be raised to upgrade of equipment to second or third generation of FWA for enhanced services to customers

5.10 Chapter 5 Consultation Question 5.146
Do you agree with ComReg's preliminary views set out in Chapter 5 and, in particular, that:
Net1 disagrees that a • a combinatorial clock auction is the preferred auction format; should be used, because achieving the highest price for the permit to use the section of spectrum will not serve the best interests of the rural sparsely populated community. Whereas a beauty contest between bidders for permit to use blocks of spectrum for a fixed price will produce the winners who undertake to deliver the best services at increased competition in the market in areas which have been deemed by DCENR consultants as having a "Failed Market". Clawback & penalties could be included in the process in order to ensure bidders undertakings in these poorly served rural areas are actually delivered . Whereas the combinatorial clock auction suggested above will deliver an expensive license for which the operator must claw back the bidding cost from the customers which is not a suitable method to deliver market competition in areas where there is currently a "Failed Market". Net1 Ltd feels that Comreg has underestimated the numbers of existing customers currently using FWA services currently being delivered via 3.6Ghz spectrum, and also has underestimated the significantly larger number of FWA customers currently receiving their Broadband Services in the ISM band FWA (which we belive is over 160,000 customers in the recent census taken by ISPAI Wireless Working Group and the population is rapidly increasing due to demand) who need to be moved to a more reliable licensed platform

6.8 Chapter 6 Consultation Question 6.142
Do you agree with ComReg's preliminary views set out in Chapter 6 and, in particular, that:

- Net1 Ltd agree that the band should be released on a service- and technology-neutral basis in order to provide for the possibility of technology upgrades during the life of the license period to deliver improved services for customers.; •
- Net1 Ltd agree rights of use in the band should be awarded on a non-exclusive basis; •
- Net1 Ltd agree that there should be an obligation to notify of the termination of a technology should apply in order to protect the best interests of the customer for the duration of the license.
- Net1 agree that a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region in the best interests of actually delivering in a short time after license award the Next Generation Superfast Fixed Wireless broadband Services for customers
- Net1 agree that a quality of service obligation should apply in relation to each of network availability and voice call standards in the best interests of delivering Customers satisfaction throughout the life of the license permit.
- Net1 Ltd agree that at regional borders a coordination threshold should apply to allow for bilateral/multilateral co-existence agreements; and • where agreement in cross-border coordination fails to be met, the coordination threshold limit should be set as a binding licence condition. In the best interests of delivering a reliable customer service.

Yours faithfully

Andrew mckeever

12 Premier Broadband Ltd

PREMIER Broadband

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Thursday, 27 August 2015

Commission for Communications Regulation,
Block DEF,
Abbey Court,
Irish Life Centre,
Lower Abbey Street,
Dublin 1,
D01 W2H4

RE: Consultation on proposed 3.6 GHz band award

Premier Data Networks LTD (Trading as Premier Broadband and Alphawave Communications), established in 2005 was setup under the Government's National Broadband Scheme to provide rural broadband services. We provide services in Counties Waterford, Wexford, Kilkenny, Carlow, Cork and Tipperary and serve business and residential users ranging from schools to large businesses. Premier is a member of the ISPAI and is an active member of the ISPAI Wireless Sub Group.

Spectrum delegation towards FWA and NBP

We agree with Comreg's proposal that the 3.6ghz band be auctioned separately to the grouping of other bands such as 700mhz, 1.4ghz and 2.3ghz. We also propose the following.

- *A larger proportion of the spectrum be used for the delivery of FWA:*

There is currently a requirement for licensed spectrum by WISPS in Ireland, as demonstrated by the fact that a large proportion of the current FWA subscriber base is supported by non-licensed technology. 3.6ghz is not ideal for delivery of mobile services, as seen by the lack of band enabled mobile devices (GSA Report April 2015) and limitations on services such as download caps. Comreg also proposes to release additional spectrum which is ideal for mobile services.

- *A report undertaking the impact of the 3.6ghz band on the national broadband plan currently proposed by the DCENR:*

It is our view that a cross department report such as this could identify savings ,reduce the dependence on state subsidy for the NBP and alleviate the burden on the taxpayer.

- Spectrum should not be allocated to operators on a "future plans" basis and operators must show short term plans to utilise the spectrum to its capacity.

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Regions

We broadly agree with the plans by Comreg to divide the spectrum allocation into regions.

Licence Duration and Type

We agree that the license duration should be approximately 15 years and be primarily used for LTE-TDD. Furthermore, a review of the assigned spectrum should be undertaken every 5 years to ensure efficient use and the delivery of services to end users. Upon expiration of the license a consultation should be undertaken with the stakeholders at least 5 years before the next award of the spectrum. This would enable stakeholders to undertake future directions and preparations for any technology upgrades or business changes.

Spectrum Allocation Limits and Withdrawal of Spectrum

It is quite difficult for WISPs who wish to invest in licenced communications infrastructure and grow their customer base due to a number of problems with the previous spectrum award. We would propose that Comreg limit the amount of spectrum given to any individual operator to 100mhz for the following reasons.

- Spectrum Hoarding
- Under Utilisation by operators
- *Demonstration of Rollout*: An initial phase of 18 – 24 months should be considered to allow an operator to meet a defined set of milestones which will allow additional release of spectrum. This will ensure the spectrum is utilised and the operator is performing in a defined area.

It is our view that operators that clearly demonstrate that they are failing to deliver services to the market, in terms of the number of base stations (leased or owned) and the number of customers, should lose access rights to the allocated spectrum.

Minimum Pricing

We would not agree to the minimum price structure as proposed by Dotecon document (15/72) and believe the cost should be significantly less due to the following reasons.

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- The average pricing model by countries that previously auctioned off the spectrum was based on a significantly reduced availably of NGA access. Since these auctions have taken place, access technologies such as fibre and cable have increased significantly, reducing the market size for licensed spectrum services.

- The pricing does not take into consideration the NBP. Setting the minimum pricing too high would prevent smaller operators from participating in the auction process.

- The pricing structure is based on the upper end of the scale. Additionally, basing the cost on an assumption of population coverage is a problematic model to follow. 3.6ghz cannot, and never will, provide 100% population coverage due to its poor propagation characteristics. Comreg should estimate a more realistic population coverage by excluding areas that have access to NGA technologies such as fibre or cable modem access. Furthermore, the market size will be reduced even further by inclusion of the recent announcements by Eircom, SIRO and the DCNR.

- We refer to our previous suggestion that the spectrum could indeed provide a social dividend to the population, significantly reducing the cost of the NBP and the burden on the taxpayer if priced correctly. One solution is to introduce a low cost 100mhz section of the spectrum that would allow unlicensed operators to compete and migrate to NGA/LTE based products.

License Conditions

We believe that the conditions of the license are the most important aspect of the ward prices. The winners of the spectrum must meet the conditions in relation to interference, deployment of base stations and utilisation. Holders should be obliged, as part of the contract, to sublease the spectrum to smaller operators if they do not have concreate plans to roll out NGA services in an area. The cost and mark-up of spectrum should also be defined by Comreg /regulator as part of the award process and should not be prohibitive in allowing smaller operators gain access to the spectrum.

Yours Sincerely,

Niall Clancy
Premier Data Networks LTD.

13 Rapid Broadband Ltd

Response to Consultation 15/70
on
Commission for Communications Regulation
10 July 2015
Consultation on Proposed 3.6 Ghz Band Spectrum Award

28 August 2015

Mr. Joseph Coughlan
Commission for Communications Regulation
Irish Life Centre
Abbey Street
Freepost
Dublin 1
Ireland
Email: marketframeworkconsult@comreg.ie

Dear Sir,
Please find attached Rapid Broadband Ltd. submission in relation to the 15/70 consultation. In summary, Rapid Broadband feels that the 3.6 GHz Band award process should be dealt with separately from other frequencies. Rapid Broadband feels that Fixed Wireless operators have provided an important service to rural and small urban communities across Ireland for many years and that the 3.6 GHz band is the best opportunity that we and other operators have to continue to provide this local and important service. Rapid Broadband has extensive local knowledge as well as the short range infrastructure and sites that will allow us to provide high speed broadband as part of the National Broadband Plan, but it is critical that the 3.6 GHz spectrum be available.

Care must be taken to ensure that the spectrum is not awarded to large operators for use purely for capacity planning or for anticompetitive reasons. If large ranges of spectrum are awarded to MNO's then it is incumbent on Comreg to ensure that the frequencies are used and that a system for sub-leasing the frequencies at commercially viable rates is mandated.

Ref	Topic	Comment
2.17	Background	We strongly agree with the majority opinion that the 3.6 Ghz band awarded as part of a separate award process. This will allow smaller operators to compete on a regional basis with SNO
2.26	FWALA	Looking at the overall numbers of FWA customers in Ireland gives the impression that numbers are dropping steadily over time. That however does not properly show how the numbers are steady or increasing in rural areas. A map showing the areas serviced by each FWA and their % growth or decline would be more accurate as it would remove the very significant drop in urban wireless users over the last 5 years.
3.82	Auctions	A pure financial auction is not the best approach to dealing with the assignment of frequencies that will be used to deliver short range services. A more considered approach that takes into account ability to implement, existing infrastructure and likelihood of utilisation should be used.
3.87		Rapid Broadband feels that option 2 is more suitable

3.91		Rapid Broadband agrees with the sentiment that some of the band should be reserved for TDD based provision of broadband in rural and small urban areas.
3.130		If indeed Comreg goes ahead with option 1 and the award of the spectrum through an auction process, it must ensure that existing and new FWA operators can bid on the frequencies for their areas of commercial interest
4.64	Regional Licences	Rapid Broadband agrees that licences should be awarded for particular regional areas
4.94		Rapid broadband feels that the very limited number of regions suggested will be unworkable. Including all of Munster into one region (except for Cork and Limerick cities) guarantees that no FWA will be in a position to bid. How would Comreg deal with multiple WISP bidding together for a region? Would this be considered anticompetitive ?
4.147	Questions	Rapid Broadband largely agrees with these points with a caveat around how regional licences will be sublicensed to smaller operators.
5.120	Pricing	Care should be taken when looking at the minimum price for the spectrum to consider the low population density of many of the regions. Care should also be taken to exclude from the population numbers, the populations of the larger towns that have or will have access to fibre based broadband

Regards

Micheal Twomey,
Rapid Broadband Ltd.,
Rosscarbery,
Co. Cork

14 Real Broadband Ltd

REAL BROADBAND Ltd.

4 James St, Tralee, Co. Kerry. Tel 066 7180298

August 28th, 2015

Mr Joseph Coughlan
Commission for Communication Regulation
Irish Life Centre
Abbey Street
Dublin 1

Dear Sir

Please accept the information below for inclusion in your consultation 15-70

There is a lot of interest in the spectrum being offered from smaller regional providers for whom their service area is more in keeping with their region rather than the province that they are from. It is our view that the proposed licensing scheme is heavily weighed towards a few large providers acquiring spectrum nationwide or per province.
I would propose that Comreg change the proposed licensing scheme to facilitate the smaller operators either by allocating some of the spectrum on a more localised basis to accommodate all the interests.

Additionally the auction process requires a Masters Degree or above to understand how this works, most likely bidders are likely to be bidding against themselves because of a lack of understanding in the bidding process/method.

As one of the previous FWALA licence holders the limited duration of the licence with no obvious continuation path being available was of concern, we would propose that 5 years before the end of a licensing scheme that its replacement is decided on.

We like to see licence duration of 20 years, with provision that spectrum hoarding is not possible.

In the licence conditions we would like an obligation on large providers to sub-licence unused spectrum in an area at an affordable rate in keeping with costs.

Yours sincerely

Edmond Diggin
Director

15 Ripplecom

August 27th, 2015

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Re Submissions to ComReg 15/70

Email: marketframeworkconsult@comreg.ie

Dear Mr Coughlan,

1 Introduction

I refer to your Call for Input entitled 'Consultation on Proposed 3.6 GHz Band Spectrum Award'.

At the outset, Ripplecom welcomes the publication of this document and the overall direction of the document is in line with Ripplecom's view that the 3.6 GHz band should be separated out from the other spectrum bands. In the 14/101 submission, Ripplecom was of the view that 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 and beyond 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. Ripplecom has undertaken trials of Next Generation Access (NGA) through wireless technology operating on licensed 3.6 GHz technology. The results are well in excess of the minimum speeds set out in the National Broadband Plan (NBP) which illustrates that this band is ideal for high speed rural broadband connectivity (see attached report on trial in Clonmel).

2 ComReg and NBP Processes

While understanding that ComReg operates independently and is the independent Regulator of the Telecommunications marketplace, Ripplecom is concerned that only passing references are made in this document to the NBP. The Department of Communications, Energy and Natural Resources (DCENR) are planning for an unprecedented market intervention in the rural marketplace. DCENR have published documentation which sets out that the NBP programme in its current guise will impact 700,000 residences in 96% of the landmass of Ireland. Given the manner in which the market has developed, it would have been assumed that any intervention of this scale would be undertaken with the Regulator involved in the process and after relevant spectrum licensing events had been decided upon.

However two processes, one by DCENR and the other by ComReg seems to be running in parallel with little or no correlation between them. Wireless operators are confused by this approach. We recommend that ComReg and DCENR should streamline their respective processes, with ComReg completing the spectrum allocation process first, then DCENR receiving plans from Wireless Operators for the commercial build-out of NGA networks and finally reviewing the mapping process to see where State intervention may be required under an NBP style arrangement.

3 The Auction Process

From a policy perspective, it is difficult to understand how ComReg can be discussing the type of auction it is going to undertake for spectrum allocation while at the same time DCENR maintains there is market failure. DCENR are planning a massive intervention in the marketplace – affecting over 700,000 premises spread across 96% of the land mass of the country. An underlying assumption of auctions in spectrum allocation is that there is a functioning competitive market within which the auction can be conducted. Both DCENR and the Minister for Communications clearly believe this is not the case.

The document 15/70 sets out its reasons why one type of auction process is favoured over other types. From a Ripplecom viewpoint (and this probably applies to all the WISP companies) we have no expertise in determining the benefits of one auction process over another and neither have we any understanding of the best way of being granted spectrum through an auction process. Auction processes usually come down to the 'size of the pocket' of that organisation. In our contribution to the consultation document 14/101, Ripplecom anticipated this issue arising and to summarise again the points made by Ripplecom against an auction process:

- Given their scale, WISPs cannot afford to go into an auction against large multinational telecommunications carriers and service providers with virtually limitless resources and hope to outbid them. The method of allocation of licensed spectrum of the 3.6 GHz band 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 over the past 15 years. These WISPs have invested significant capital and have infrastructure and site arrangements *in situ* at present. This infrastructure can quickly 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 rural focus.

We believe that the ComReg 15/70 consultation has not taken these two critical points into account and we are of the view that an auction process is not the way to proceed at this point.

In our view an administrative allocation of some of this Band will be more appropriate. Ripplecom is of the view that a *portion* of the spectrum in rural areas should be designated primarily for FWA, where operators have expressed an interest in rollout of NGA equipment.

Various factors supporting this approach are outlined below:

- The relatively large amount of available spectrum.
- The national interest to deliver NGA broadband to as many rural premises as possible in the shortest timeframe and at the lowest impact to the taxpayer.
- The history of service provision by FWA providers. We contend that had it not been for ComReg decision 10/29 or had ComReg provided a much earlier consultation on the 3.6GHz spectrum then there would have been significantly greater investment in licensed FWA with significantly more competition and subscribers connected in rural areas. As it is, more that 60% of the known 74,000 WISP subscribers in Ireland are connected using license exempt equipment, largely for this reason. By ensuring adequate spectrum is made available (at a reasonable price) in large areas ComReg, can encourage investment in the sector which may significantly reduce the dependence on state subsidy in the NBP.
- Typically, the amount of spectrum required to deliver competitive mobile services is significantly less that the spectrum required to deliver competitive fixed services. The expectation of the consumer is that the mobile service will involve a relatively low usage cap (typically less than 30GB), whereas the expectation for fixed service is that there is no cap - or a relatively high one (e.g. 200GB). In addition, there is a stated intention to release other spectrum bands in the near future (2.3 and 2.6GHz) that are better suited to Mobile services and therefore likely to be economically out of reach for FWA providers.

Therefore, Ripplecom is of the view that it is inappropriate to award a significant amount of spectrum via an auction process to MNOs for use solely as capacity spectrum in hotspots in the larger towns within the rural regions. Due consideration must be given to the national interest in delivering NGA access to as many rural locations as possible, with the least impact to the taxpayer. Requirements for in-building capacity spectrum by MNOs could and should be met through an obligatory system of sub-leasing of spectrum for these purposes. We extend this point to highlight that it should not be permitted to acquire spectrum on the basis of the *potential* for future use and that any award should be based on presentation of clear evidence of concrete rollout plans. In meeting its statutory obligations, ComReg must ensure that these plans are real and substantiated.

It is for this reason that Ripplecom made further suggestions in its reply of 14/101 which again need to be reiterated – extract from 14/101;

> '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 NBP.
>
> 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 filed 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 both 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.'

4 Commentary on Plum Consulting Report

In section 5.74 of Comreg 15/70, an assertion is made that, based on responses to the earlier 14/101 paper, use of the 3.6 GHz band is likely to migrate towards the deployment of LTE Technology. Then in section 5.75 a Plum consulting report on "Analysis of the potential spectrum requirements for NGA services" released as Comreg document 15/75, is referenced in justifying a minimum cap level of 100MHz on the grounds that this would be required to provide NGA speeds (i.e. 30Mbps download). Ripplecom disagrees with both the above conclusions. Many WISPS including Ripplecom work with proprietary technology vendors and intend to continue doing so in the future. There is certainly no consensus within the WISP community that LTE Advanced technology is the only way to go for this spectrum. We also wish to highlight the fact that the 15/75 document was highly biased towards LTE Advanced technology which flies in the face of the goal to ensure technology neutrality in the spectrum usage.

Ripplecom engaged with our partners Cambium networks who develop proprietary wireless technology suitable delivering broadband services in the 3.6 GHz band. They studied the 15/75 document and prepared a comparison document with their own latest comparable product which we have included with this submission (cf. PlumLTEvsPMP450_0v4.pdf). Their analysis indicated that their current product could provide up to 30% more spectral efficiency than the LTE Advanced technology presented in the Plum report using similar assumptions. This in turn could lead to delivery of NGA services to significant percentages of the rural population with considerably less than 100MHz of bandwidth.

Ripplecom attaches a Cambium report entitled 'Comments on Comreg 15/75 LTE-A vs PMP450' to support our arguments.

5 Responses to Specific Issues Raised

The 15/70 Consultation asked for responses to specific consultation questions and below are Ripplecom's response to each of these questions:

4.5 Chapter 4 Consultation Questions	**Ripplecom Response**
Do you agree with ComReg's preliminary views set out in Chapter 4 and, in particular, that:	
• the band plan for the 3 400-3 600 MHz sub-band should be TDD (in line with the preference expressed in the 3.6 GHz EC Decision);	Yes – The 3.6 GHz band should be TDD
• regions should be established in line with the principles identified by ComReg	The region model (option 2) proposed by ComReg is appropriate. We would strongly recommend that Comreg shares region map this with DCENR so they can correlate NBP lots with these region boundaries.
• the regions identified in Option 2 should be used for the proposed award	Again, yes if these regions are correlated with NBP award
• a licence duration of 15 years should apply to the 3.6GHz band.	No. We believe the duration should be at least the same as the proposed duration of the NBP contract which is currently 20 years. Having a licence duration less than NBP contract duration could effectively prevent the 3.6 GHz band from being used as part of any NBP tender submission.

5.10 Chapter 5 Consultation Question	**Ripplecom Response**
5.146 Do you agree with ComReg's preliminary views set out in Chapter 5 and, in particular, that:	
• a combinatorial clock auction is the preferred auction format	Ripplecom has no prior experience of the differing auction formats. However from reading about the CCA process, it would seem to strongly favour larger companies trying to outbid smaller ones. Furthermore as set out above, Ripplecom is of the view that given that DCENR are actively pursuing massive intervention in the marketplace through the NBP, it is difficult to understand how ComReg is following an auction strategy for spectrum when this strategy assumes a functioning competitive marketplace, which is obviously not the case.
• a single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz;	Ripplecom understands the logic of this recommendation but have no particular opinion either way.

• Sixty five (65) frequency-generic lots of 5 MHz each should be adopted for frequencies between 3475 MHz – 3800 MHz;	Ripplecom would prefer a minimum lot size of 20 MHz is used. This would enable 16 lots of 20MHz be auctioned.
• a competition cap should be set and, further, that such a cap be within the range of 150 MHz to 250 MHz. ComReg is mindful of the alternative uses to which this spectrum can be put and the potential impacts this can have on competitive dynamics in the relevant market concerned (for example fixed of mobile). Accordingly, ComReg welcomes input on any other factors which should be taken into account when establishing the level of any competition cap;	Ripplecom suggests that a cap of 100MHzshould apply, particularly for the first 2 to 3 years and thereafter the opportunity to acquire additional spectrum would be dependent on the Operator achieving defined targets. Criteria might include network performance, number of subscribers connected etc. Rollout obligations should apply to successful bidders and failure to comply within specified timeframes should result in loss of access rights to spectrum
• benchmarking be used as the approach by which to determine a conservative minimum price;	Ripplecom is of the view that because the Irish situation is unique in Europe both in terms of the distribution of our rural population and the proposed government intervention via NBP, benchmarking should not apply in this case. The latter in particular skews the market considerably in Ireland so international benchmarks on 3.6GHz spectrum pricing cannot be applied. Furthermore failure to invest by previous governments has led to a large number of relatively small privately owned FWA operators in Ireland today who cannot afford international market rates for 3.6GHz spectrum.
• the minimum price should be apportioned on a 50/50 basis between an up-front payment (SAF) and ongoing annual payments subject to CPI index linking (SUFs);	Ripplecom is of the view that the 50/50 (SAF/SUF) is not appropriate. Given the financial position of many of the smaller players, it is more in keeping to align payments for the use of spectrum with the related income received from customers using the spectrum. Therefore Ripplecom is of the view that a split of 20/80 (SAF/SUF) is more appropriate.
• the range €0.015 to €0.025 per MHz per capita is appropriate for the setting of the minimum price, with the higher end of the range applying to urban areas and the lower end applying to regions that do not have specific urban areas identified.	Ripplecom is of the view that the economies involved in fixed wireless networks are significantly different from those of MNOs. The proposed pricing structure by Comreg appear to acknowledge this where a minimum price of €0.015 is proposed for rural regions vs. €0.025 for urban. However this does not go far enough. Given that DCENR are proposing massive Government

	intervention due to perceived 'market failure' it would seem appropriate in the national interest, to reduce the SAF (up-front payment) to operators who indicate an intention and ability to deliver NGA services in rural areas. ComReg can easily ensure the legitimacy of such operators by specifying rollout obligations. Setting the minimum price of a region based on an assumption of full coverage of the population within that region is false. The population covered is more accurately determined by an analysis of coverage from known mast sites. ComReg report that there are 120-170 BS currently in the rural regions, each with an FWALA service area of 314km^2. This gives a total coverage area of approx 45,000 km^2. However many of these BS are in close proximity to each other so the real coverage is likely less than 30,000km^2, less than 40% of the area of the country. It may be possible to develop new high sites but these are likely to be of lesser economic value in connecting additional subscribers. In addition, although the population density is likely greater in the existing FWALA coverage areas, due to the LoS nature of 3.6GHz it is also clear that fixed wireless can connect to significantly less than 100% of premises in these coverage areas. In deriving the minimum price, the population numbers that may be potential customers for FWA in rural areas should exclude the population of larger towns where there is access to fibre or cable technologies or where access to fibre is planned to be available in the near term. Indeed given the recent announcement by Eircom and the proposals of the NBP, the subscriber base that may be connected by NGA FWA is likely to reduce significantly between now and 2020. All of this would greatly reduce the population number used to determine the minimum price point.
• the population of each of the regions under Option 2 should be adjusted to take account of the commuter flows between the five identified cities and the other applicable regions.	Ripplecom's view of population numbers as a means of setting prices has been set out in the point above.

6.8 Chapter 6 Consultation Question	Ripplecom Response
6.142 Do you agree with ComReg's preliminary views set out in Chapter 6 and, in particular, that:	
• the band should be released on a service- and technology-neutral basis	Yes, Ripplecom supports this general principle. Ripplecom notes that Comreg 15/75 report from Plum Consulting released in conjunction with Comreg 15/70 seemed to be strongly biased towards exclusive use of LTE-TDD technology for this band. Apart from the fact that this seems to go against the technology neutral principle, Ripplecom has received analysis from a vendor of proprietary wireless technology to indicate that their solutions may be more spectrally efficient than LTE-Advanced.
• rights of use in the band should be awarded on a non-exclusive basis;	Yes, Ripplecom supports the rights of use should be awarded on a non-exclusive basis subject to interference conditions being met.
• an obligation to notify of the termination of a technology should apply	Yes, Ripplecom supports the obligation to notify of the termination of a technology and suggest that a six months obligation should apply at a minimum.
• a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region	Yes in principle, Ripplecom agrees with this proposal but would need to see more details of this exact proposal. Where rollout obligations are not being met, either the licence could be withdrawn or the licensee may be obligated to sub-licence to Operators who will roll-out. Also the term "base station" needs to specifically exclude Small Cells (aka Femto Cells) which although are technically base stations but which provide little or no outdoor coverage. Any MNO could quickly deploy hundreds of Small Cells in a region at very little cost to meet this obligation. However only a tiny minority of the population in that region would benefit.
• a quality of service obligation should apply in relation to each of network availability and voice call standards;	Yes but it should not be more onerous than NBP requirements
• licensees should internalise guard-bands as spectrum should be assigned without guard-bands;	Yes Ripplecom agrees with this point

• a default TDD frame-structure based on TD-LTE configuration 2 (3:1) should be applied to incentivise inter-network synchronisation;	While Ripplecom agrees in principle with encouraging inter-network synchronisation, we also feel strongly that nothing should be enforced that places non LTE solutions at a disadvantage to LTE based solutions. Allowance should also be made for customers (e.g. businesses) that may require synchronous services (i.e. equal DL and UL bandwidth)
• a permissive BEM should apply to synchronised networks and a restrictive BEM should apply to unsynchronised networks;	Yes, Ripplecom agrees with this point
• the terminal station in block power limit set out in the 3.6 GHz EC Decision should be relaxed for fixed outdoor installations;	Yes Ripplecom agrees with this point
• at regional borders a coordination threshold should apply to allow for bilateral/multilateral co-existence agreements;	Yes Ripplecom agrees with this point
• where agreement in cross-border coordination fails to be met, the coordination threshold limit should be set as a binding licence condition.	Yes Ripplecom agrees with this point

7.4 Chapter 7 Consultation Question	**Ripplecom Response**
7.74 Do you agree with ComReg's preliminary views set out in Chapter 7 and, in particular, with the following proposals:	
Transition Proposal 1: the formulation of a transition plan for the 3.6 GHz band;	Ripplecom supports the proposal that all existing licensees are involved in the process to determine a 3.6 GHz transition plan.
Transition Proposal 2: the Transition Protected Licence;	Yes. It is presumed that under a transition license (protected or unprotected) that an operator will be authorized to continue to

	provide services using the current FWALA band plan, equipment and conditions of use.
Transition Proposal 3: the Transition Unprotected Licence	It is presumed that under a transition license (protected or unprotected) that an operator will be authorized to continue to provide services using the current FWALA band plan, equipment and conditions of use. In the case of the transition unprotected license it is assumed that the operator would be protected from interference by unlicensed transmission and that the operator could continue to avail of ComReg's compliance resources to investigate and resolve any such issues. Under the terms of the Transition Unprotected License we suggest that the specific frequency assignment is a matter that should be arbitrated by ComReg on a case by case basis prior to the license issue. There are significant differences in the frequency agility of 3.6GHz equipment. An existing licensee may have deployed equipment with customers which may have a fixed range of operation within a 30 or 40MHz section of band, whereas much of the NGA equipment that would likely be deployed under a new license is capable of operating in any contiguous block of the proposed frequency plan, in 5, 10, 20, 40MHz or higher bandwidths. Regarding the duration of a Transition Unprotected license our view is that this should not necessarily have a maximum term. ComReg should allow flexibility in this regard and determine when and if a license should be terminated based on market conditions. We suggest that a licensee operating under a transition unprotected license should be given a minimum of 18 months notice of the termination of the license in order to minimise consumer disruption and to allow for transition arrangements for those consumers to alternative provider(s). Given the national interest in providing high speed wireless services to the maximum number of rural consumers, and in terms of maximising competition in the market, it seems contradictory that on the one hand DCENR is proposing to provide state aid to provide fibre

	services to each premises, whereas ComReg is proposing to increase FWALA fees. As a result we would advocate that there should be no fee increase for transition unprotected FWALA licenses.
Please provide a detailed explanation of your views, with supporting material, having regard to ComReg's statutory functions, objectives and duties.	In setting out its proposals for Transition Plans and timelines ComReg has made reference to the MBSA process. However we would point out that transition issues for Fixed wireless services are significantly different to mobile services. In the case of mobile services it may be presumed that the CPE devices (handsets) will incrementally be changed by the subscriber base over time to avail of the new services or bandwidth provided by the operator. In the case of FWA truck rolls may be required to each subscriber premises. In a situation where an operator is planning to upgrade equipment in a certain sector and where there may be several hundred subscribers in that sector then in order to provide continuity of service the operator would have to 1. Upgrade the BS with the new equipment, transmitting in alternative "turning space" spectrum. 2. Implement a plan to replace equipment at each CPE premises, requiring truck rolls to each location 3. Once all CPE equipment had been replaced then turn off the "old" BS transmitter for that sector and retune the "new" BS equipment to the final frequency assignment. 4. The operator would have to continue steps 1-3 for all other sector transmitters at the BS. Given all of this it is likely that the timeframes involved would not be equivalent to those in the MBSA process.

6 Conclusion

Ripplecom believes that this consultation process is very important to maintain competition in the broadband marketplace in Ireland.

WISP companies have serviced the rural market for the past 15 years and have filled a void left by the bigger telecommunication companies. Depending on the outcome of the 3.6 GHz spectrum award, Ireland could have a vibrant competitive marketplace with smaller companies providing NGA standard service which fulfils one of the objectives of both ComReg and the State (i.e. to have active competition in the marketplace). This localised service will provide competition to the big players. On the other hand, if the 3.6GHz is auctioned to the highest bidder and with the focus of DCENR apparently on awarding national contracts to a company or companies who have the ability to roll out fibre based connections to over 700,000 rurally based premises over a 3 to 3.5 year period, competition in the marketplace will be much diminished.

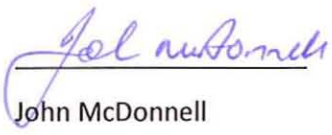
In the current consultation documents, 15/70, ComReg are focused on running an auction for the allocation of 3.6 GHz spectrum. An underlying assumption of auctions in spectrum allocation is that there is a functioning competitive marketplace. However, the basis of the DCENR NBP process, is that there is market failure in a very large area of the map and that the Government must intervene in this marketplace to ensure that adequate capital is invested to bring services up to a minimum standard by 2020.

In addition given the national interest in providing high speed wireless services to the maximum number of rural consumers and in terms of maximising competition in the market, it seems contradictory that on the one hand DCENR is proposing to provide state aid to provide fibre services to each premises, whereas ComReg is proposing to increase FWALA fees. As a result we would advocate that there should be no fee increase for transition unprotected FWALA licenses.

Ripplecom is of the view that the approach by the two processes is inconsistent and re-iterate our view that ComReg should complete the spectrum allocation firstly before the NBP is finalised.

Please acknowledge receipt of this submission via email.

Yours sincerely,



John McDonnell

Managing Director

Cambium Networks

Comments on Comreg 15/75 LTE-A vs PMP450

N. J. R. King

August 27, 2015

Ref: PMP-1154/NJRK

Version: 0.4

Abstract — Computes the efficiency of LTE-A vs PMP450 using the Plum Report Comreg 15/75 as a basis.

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Version	Date	Change	Author
0.4	2015-08-27	Incorporate review comments from Mark Thomas.	Nigel King
0.3	2015-08-27	Corrected some typos, clarified section numbers and provided a conclusion.	Nigel King

Contents

1 Introduction

Plum produced a report ComReg 15/75 for Commission for Communications Regulation of Ireland to assist the Spectrum Award Process for 3.6GHz. They used LTE-A as an example of modern efficient wireless technology. This Document compares the number of users which a base station can support for LTE-A, with the number of users which a base station can support for PMP450 using section 3 of the Comreg document as a basis.

This document does not comment on the conclusions of the Comreg Report.

2 Comments on ComReg 15/75 Section 3

In this section I prefix the section numbers and titles from the Plum report with P. Section 3 of Plum performs the main analysis for LTE-A. I compare the Plum analysis with the same analysis for PMP450.

P.3.1 Introduction

No comment.

P.3.2 Quantifying the available bit rates

The same factors apply for the consideration of PMP450.

P.3.2.1 Path Loss

Both LTE-A and PMP450 use Adaptive Coding and Modulation (CQI.MCS) to maximise the data throughput (in bits per second or bps), depending upon the signal to noise ratio of the received signal, which in turn depends on the quality of the radio link.

Modulation	**Spectral Efficiency**	**LTE-A**	**PMP450**
QPSK	**2bps per Hz**	Available	Available
16QAM	**4bps per Hz**	Available	Available
64QAM	**6bps per Hz**	Available	Available
256QAM	**8bps per Hz**	Not Available	Available

Table 1 Modulations used by technology.

The coding rates for LTE-A vary from 1/8 to 4/5. The coding rates for PMP450 are 72/92 for data and 36/92 for control.

The values of spectrum efficiency for LTE-A vary from 0.15 to over 5 bps per Hz. The values for PMP450 vary from 0.25 to over 6 bps per Hz.

The system selects an appropriate Modulation and Code Rate (CQI/MCS) for the communication in LTE-A there are 15 CQI, in PMP450 there are 4 MCS for data. The selection of MCS is very fast in PMP450 and is based upon fragment success.

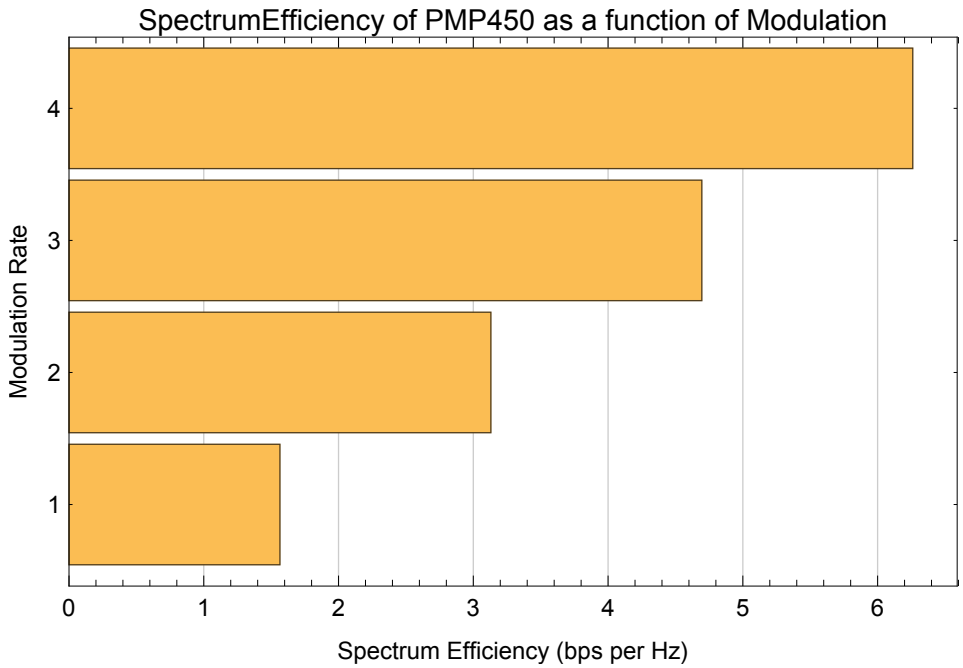

Figure 1 Spectrum Efficiency of PMP450 as a function of Modulation

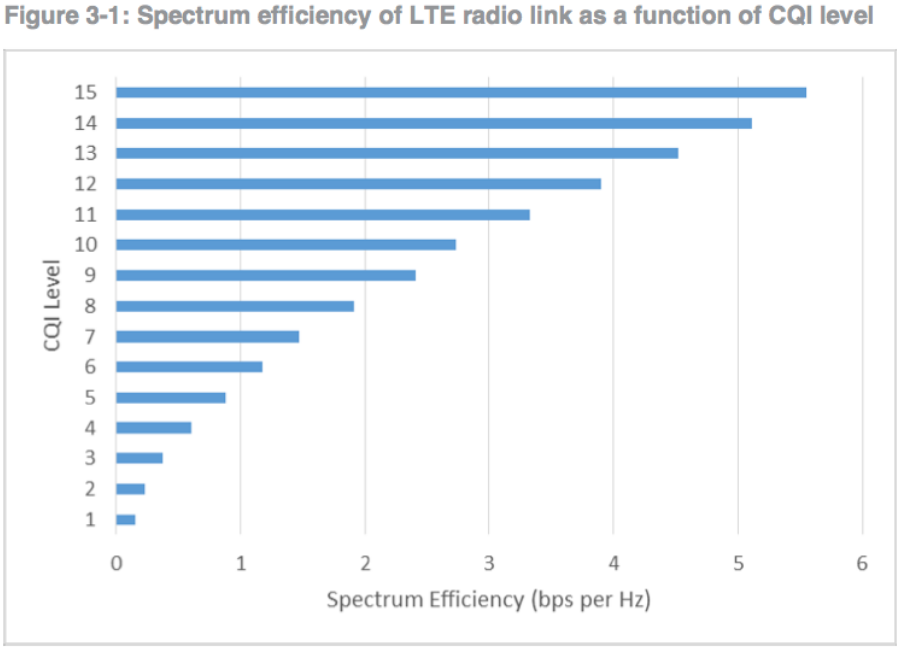

Figure 2 Spectrum Efficiency of LTE-A as a function of Modulation (From Plum)

P.3.2.2 Channel Width

LTE-A allows for 1.4, 3, 5, 10, 15 and 20MHz with the latest version of the standard enabling bandwidth up to 100MHz.

PMP450 has 5, 7, 10 and 20MHz bandwidths with the latest hardware capable of 40MHz bandwidth.

P.3.2.2 Split between uplink and downlink traffic

LTE-A supports 1:3, 3:5, 1:1, 2:1, 3:1, 7:2 and 8:1.

PMP450 in 20MHz bandwidth supports almost any ratio from a total 81 data symbols depending upon maximum cell range, thus at short cell range 4/77 through to 77:4 are supported.

P.3.2.4 Base station and CPE antenna characteristics

The LTE-A assumption is that there are 4 sectors using one frequency, I am surprised by the assertion that antenna discrimination allows frequency reuse in the adjacent sector. On the boundary between two sectors the interference equals the signal and so the maximum spectrum efficiency that may be used is about 0.5 for the best coding. And so, the reuse does not increase capacity accordingly for LTE-A. Section 3 addresses this point.

For PMP450 and a quad-sectored site, one can use two frequencies only in an ABAB configuration. A tri-sectored site needs 3 frequencies and a hex sectored site needs 3 frequencies in an ABCABC configuration. These options are fully available in the PMP450 system.

Figure 3 shows the response of a high quality sector antenna that may be used for 120° or 90° base sites.

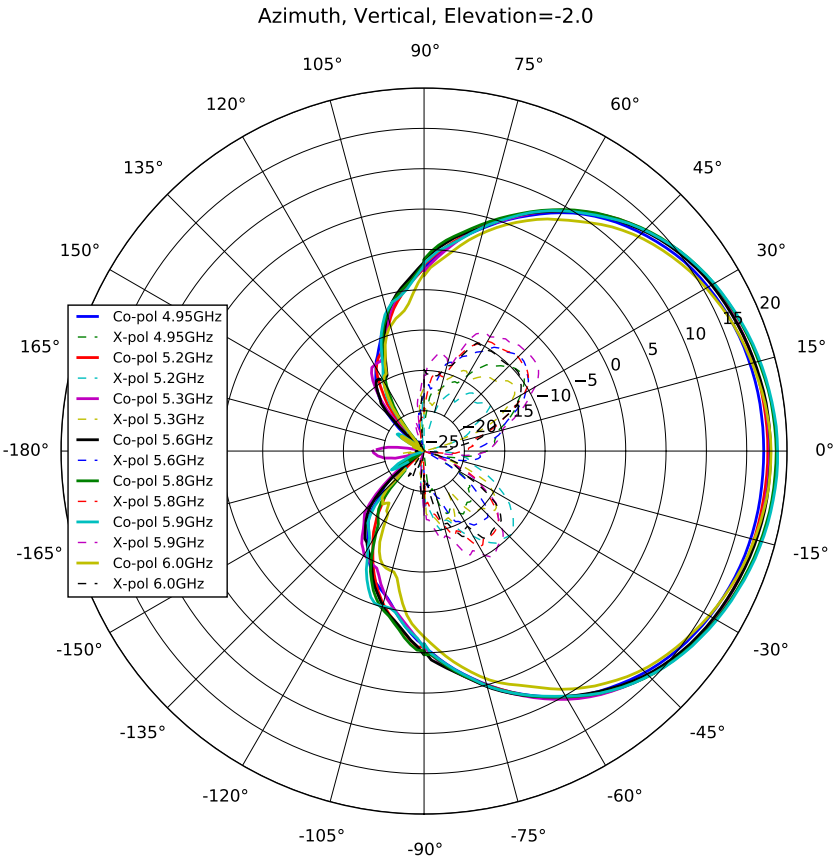

Figure 3 A High Quality Sector Antenna

P.3.2.5 Impact of MIMO deployment

In the PMP450 system the use of 2×2 MIMO doubles the the throughput. The system has available to any particular path the use of the paths separately or together. Separately doubles the throughput while together provides very significant diversity gain. This fact is proven in many deployments.

I note by contrast that the use of 2×2 MIMO in LTE-A only claims 50% increase in throughput.

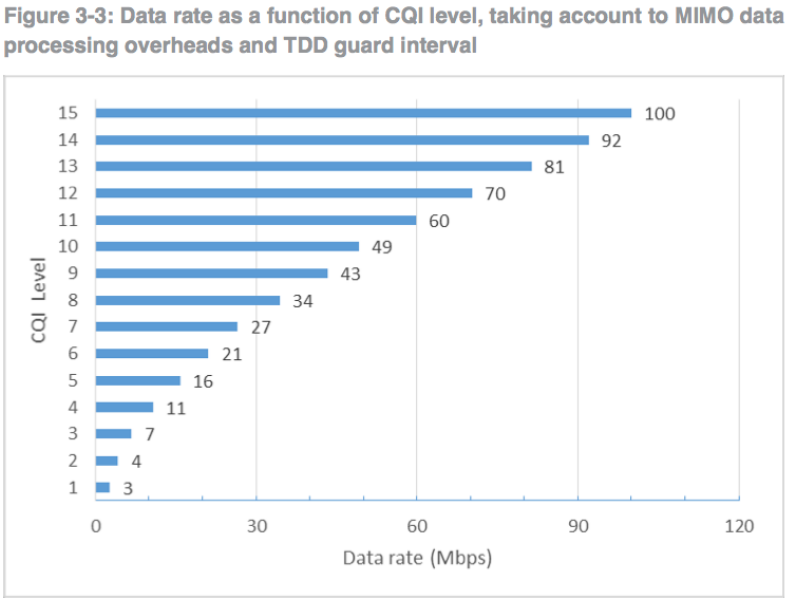

Figure 4 LTE Data rate as a function of CQI level, taking account to MIMO data rate, signal processing overheads and TDD guard interval (from Plum)

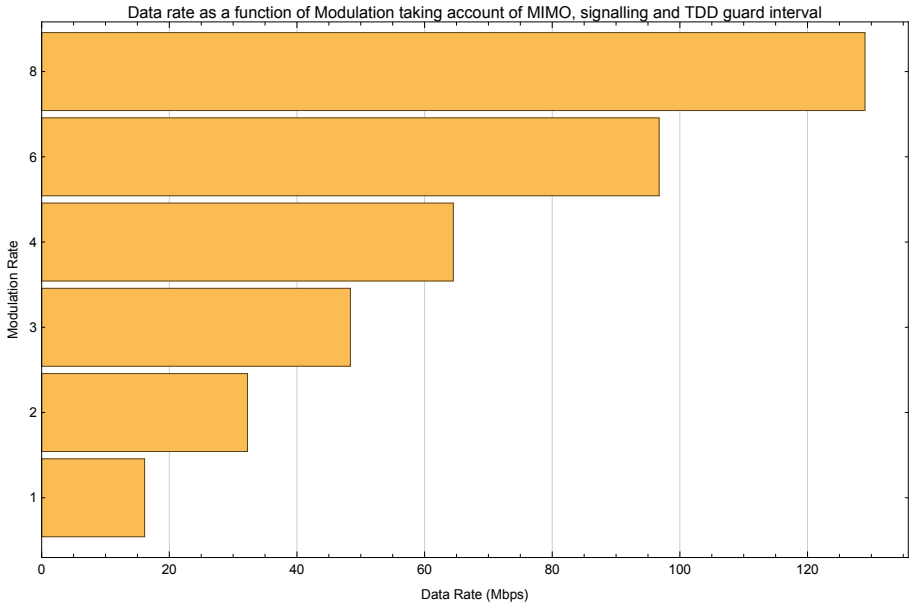

Figure 5 PMP450 Data rate as a function of MCS level, taking account of MIMO, signalling and TDD guard interval

P.3.2.6 Network Planning Considerations

The reference is incorrect and should be ITU-R P.1410-07.

For PMP450;

- 80% of connections achieve 129 Mbps / 20 MHz (based on highest modulation of 8)
- 20% of connections achieve at least 32 Mbps / 20 MHz (based on minimum modulation level of 2)
- Overall throughput spectrum efficiency = (0.8x129 + 0.2x32) = 109 Mbps / 20 MHz.

While LTE-A achieves:

- 80% of connections achieve 100 Mbps / 20 MHz (based on highest CQI level 15)
- 20% of connections achieve at least 34 Mbps / 20 MHz (based on minimum CQI level of 8)
- Overall throughput spectrum efficiency = (0.8x100 + 0.2x34) = 87 Mbps / 20 MHz.

P.3.2.7 Estimating Base Station Throughput and Capacity

As stated in the previous section the four-sectored LTE-A base station will not achieve 4×87=358Mbps because of the inter-sector interference has not been accounted for. I will work out an expected number using the antenna characteristic in figure 3. It will be greater than 2×87=179Mbps and less than 358Mbps. I have done this in section 3

PMP450 uses a frequency use of ABAB on a four sectored site and so we are able to give a value of 2×109=218Mbps per 20MHz bandwidth. 436Mbps for the base station but using a total of 40MHz of spectrum.

The number of users for the quad-sectored base station is 436/(30/8)=116 using 40MHz of spectrum.

I do not agree with the LTE-A number of users in this section because it takes no account of the inability to create adjacent sectors which have no interference when using the same frequency. The next section 3 recomputes the capacity of an LTE quad sectored base station.

3 LTE Spectral Efficiency in a Quad Sectored Site

Taking the antenna of figure 3 and published theoretical data for LTE in table 2

CQI Index	Modulation	Code Rate × 1024	Efficiency	SNR@10^{-2} BLER (dB)
1	QPSK	78	0.1523	-6.0
2	QPSK	120	0.2344	-4.0
3	QPSK	193	0.3770	-2.5
4	QPSK	308	0.6016	-1.0
5	QPSK	449	0.8770	1.5
6	QPSK	602	1.1758	3.0
7	16QAM	378	1.4766	5.5
8	16QAM	490	1.9141	7.0
9	16QAM	616	2.4063	9.0
10	64QAM	466	2.7305	11.0
11	64QAM	567	3.3223	12.7
12	64QAM	666	3.9023	14.5
13	64QAM	772	4.5234	16.5
14	64QAM	873	5.1152	17.0
15	64QAM	948	5.5547	21.0

Table 2 Published data for efficiency and SNR by CQI

The antenna theoretical polar gain characteristic for a quad sectored site diagram is in figure 6. You will note that each lobe is quite similar to the measured polar pattern in figure 4.

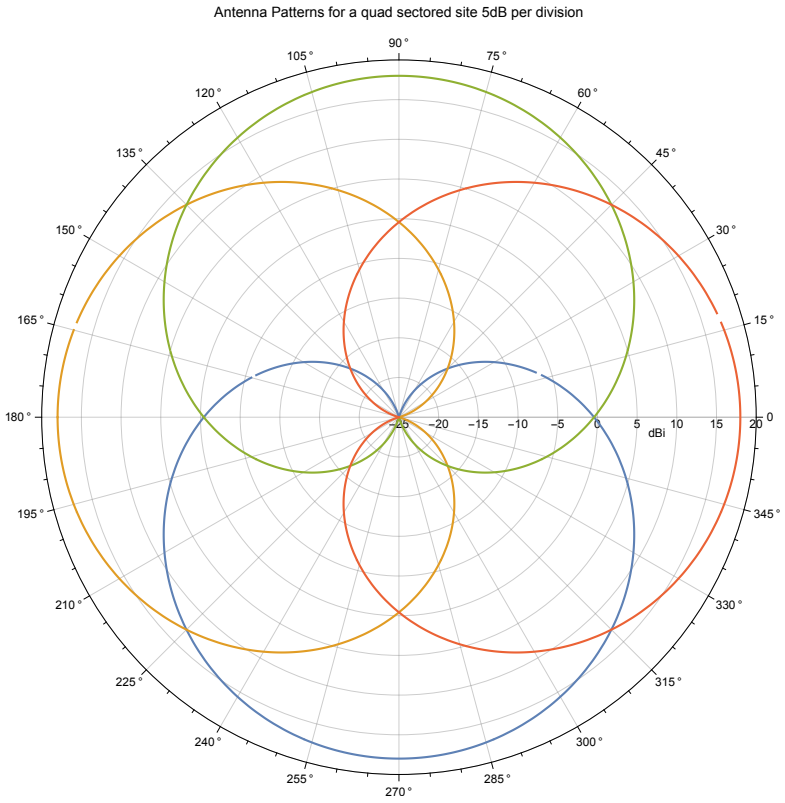

Figure 6 The polar diagrams of the 4 antennas of a quad sectored site

At full capacity transmissions will occur on all four sectors and so the C/I for the SMs positioned can be computed subtracting the wanted antenna gain from the power sum of the unwanted antenna gains. A plot of this is shown in figure 7. The mean value is 9dB which would give about 2.4bps per Hz spectral efficiency.

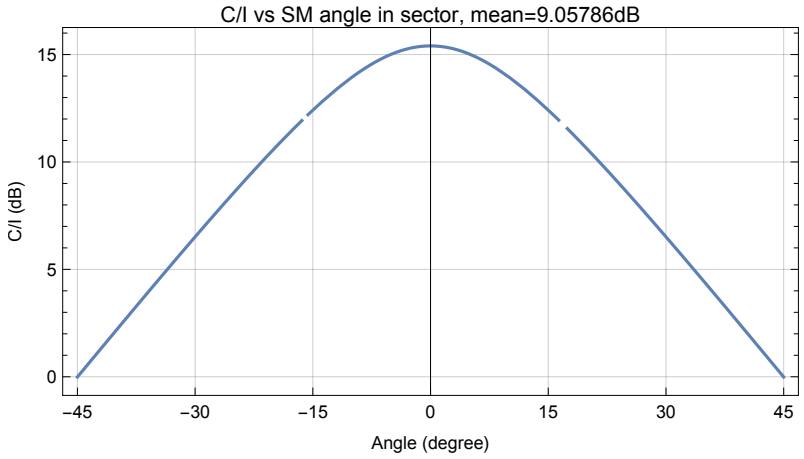

Figure 7 C/I vs SM angle in sector

Computing the capacity which each SM can use for SMs positioned across the sector is shown in figure 8. This graph highlights two problems;

- The mean (2.3) is much lower than the assumed value of 80% of 5.5524=4.44
- the minimum (0.6×20=12Mbps) is too low to support 30Mbps

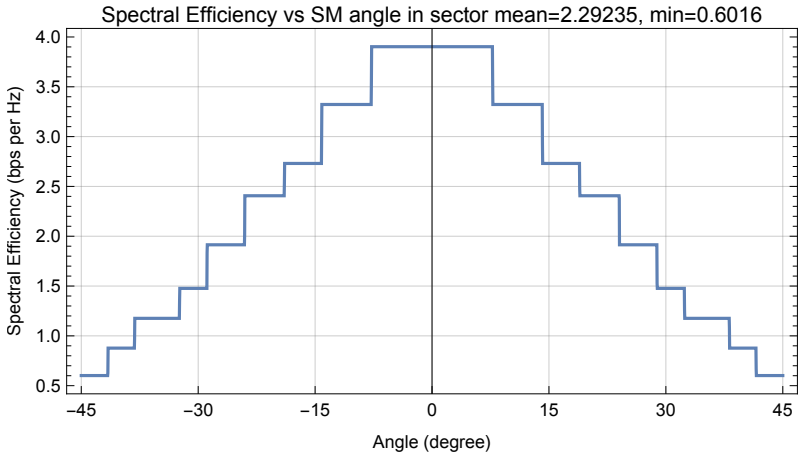

Figure 8 Efficiency vs SM angle in sector

The Mean spectral efficiency is 2.3 bps per MHz. The mean throughput for the sector is then 87×2.3/5.5547=36Mbps. As stated in Comreg 15/75 Section 3.2.2 multiple simultaneous high bit rate services (30Mbps) are required from a single transmitter.

The LTE-A solution will be to use two frequency reuse (ABAB) as is recommended for PMP450. Now 88 LTE-A users can be connected using 40MHz of spectrum. Compare this with 116 PMP450 users using 40MHz of spectrum.

4 Conclusion

Report Comreg 15/75 has been analysed and a comparison made between the performance of LTE-A and the performance with PMP450. After correcting an error in the LTE-A analysis PMP450 is shown to have 30% greater spectral efficiency the LTE-A.

Can Fixed Wireless deliver Next Generation Access speeds ?

Diarmuid Ó Briain, CEng, FIEI, FIET

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1. National Broadband Plan

The Department of Communications, Energy and Natural Resources (DCENR) launched 'Delivering a Connected Society - A National Broadband Plan (NBP) for Ireland'[1] in August 2012. The plan based on the European Commission's 'Digital Agenda for Europe'[2] requires the delivery of at least 30 Mb/s connectivity for all citizens. The plan targets are;

- 70 Mb/s – 100 Mb/s available to at least 50% of the population with a majority having access to 100 Mb/s;
- At least 40 Mb/s, and in many cases much faster speeds, to at least a further 20% of the population and potentially as much as 35% around smaller towns and villages; and
- A minimum of 30 Mb/s available to all.

It is expected that the minimum target upload speeds will be in the region of 25% to 30% of the headline download speeds.

The DCENR carried out a mapping exercise to identify where the target was already reached and the areas yet to meet the target.

A 'Call for Input (CFI) on Key Aspects of the State-Led Intervention' Document No: NBP-TL-0001[3] was released by the DCENR on the 25 April 2014 to allow interested stakeholders the opportunity to make submissions with regard to the plan in the context of state led intervention rules.

1 Department of Communications, Energy and Natural Resources (2012). Delivering a Connected Society - A National Broadband Plan for Ireland. Dublin, 30 Aug 2012.
2 European Commission (2010). COM(2010) 245: Digital Agenda for Europe - Pillar IV: Fast and ultra-fast Internet access. Brussels, 19 May 2010.
3 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, 25 April 2014.

2. Remote homes and wireless

The initial NBP document identified that, in the absence of any Government intervention, there will be a gap in more rural and isolated areas, with between 15% and 30% of the population continuing to have only basic broadband services (speeds are not expected to exceed 5 Mb/s in these harder to reach areas and could be significantly lower). Such areas are typically served by Wireless Internet Service Providers (WISP) using Fixed Wireless Access (FWA) solutions in both the 3.6 GHz Fixed Wireless Access Local Area (FWALA) and 5 GHz Industrial, Scientific and Medical (ISM) radio bands.

A consequence of the state led intervention rules is that the NBP must be technology-neutral. The distributed nature of the Irish population means that while a fibre roll-out is desirable it has been shown in other jurisdictions like the United Kingdom (UK) that it is not economically viable to meet the demand of remote rural homes and businesses. In the UK it is estimated, for example, that the cost of deploying superfast broadband to the last 10% of households is up to three times higher than the first two-thirds of the population[4].

Such remote homes present an opportunity to receive Next Generation Access (NGA) speeds within the NBP targets using FWA.

3. Ripplecom NGA Trial

Ripplecom is a leading Internet Service Provider (ISP) and has significant experience with FWA. Upon consideration of the NBP Ripplecom Engineering was tasked with;

- Identification of a suitable Radio platform for NGA; and
- Conducting a trial of the chosen platform to prove its credentials.

4 European Commission (2012). State aid SA.33671 (2012/N) – United Kingdom National Broadband scheme for the UK - Broadband Delivery UK. Brussels, 20 Nov 2012.

3.1 Cambium PMP450

Illustration 1: PMP450

After reviewing a number of vendors Ripplecom decided upon Cambium Networks as the partner of choice to deliver a suitable NGA platform. Cambium Networks are proven, respected leaders in the wireless broadband industry. They build innovative data, voice, and video connectivity solutions across all geographies. Ripplecom had experience with the Canopy family of products and chose the PMP450[5] family shown in Illustration 1 for the NGA trial due to its advanced Orthogonal Frequency Division Multiplexing (OFDM) and Multiple-Input and Multiple-Output (MIMO) antenna systems. Also with the synchronisation capability of the PMP450 Access Point (AP) it is possible to build clusters of 6 APs, each with 125 Mb/s throughput giving a throughput of 750 Mb/s per cluster.

At the customer site a PMP450 Subscriber Module (SM) is installed with scalable capacity up to 75 Mb/s.

5 Cambium Networks (2015). PMP 450: High Performance, Synchronization and Low Latency. Available: http://www.cambiumnetworks.com/products/pmp/pmp-450 accessed: 2 July 2015.

3.2 NGA parameters

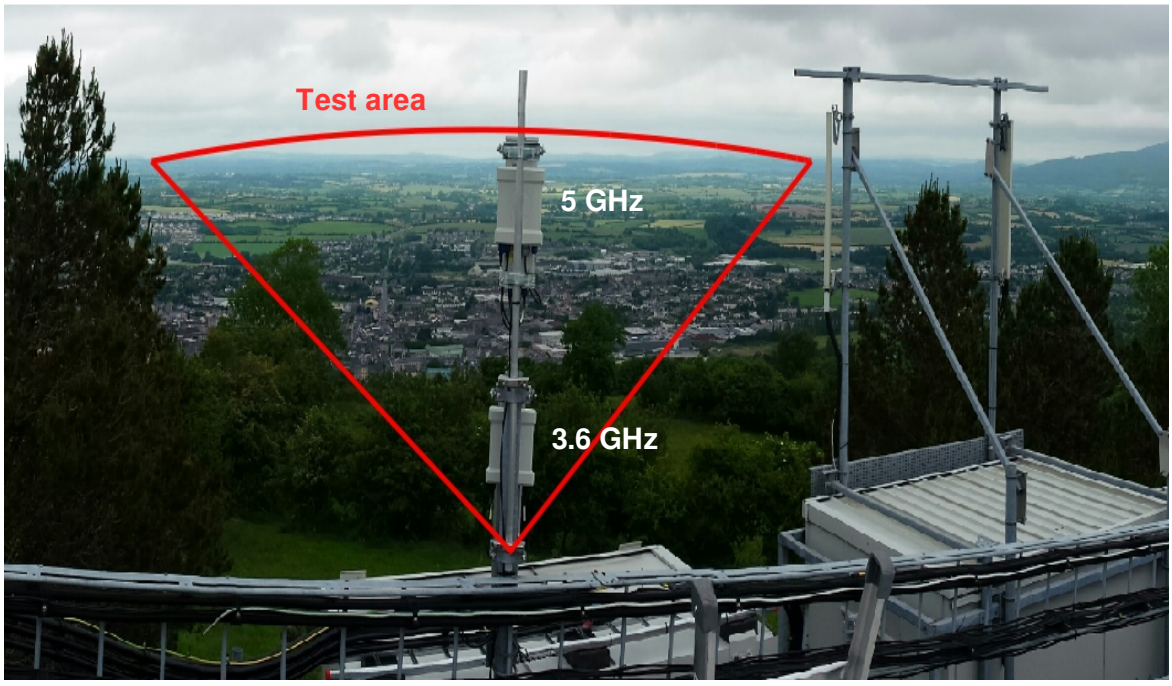

Illustration 2: NGA Trial area

After some discussion and a series of meetings with the vendor it was decided to trial both 3.6 GHz FWALA and 5 GHz ISM as the PMP450 family has solutions for both bands. A trial license was obtained from the Commission for Communications Regulation (ComReg) for channel C in the area of Clonmel in South Tipperary and as shown in Illustration 2. This channel was designed for Frequency Division Duplex (FDD) originally and is in two 25 MHz blocks 3610 - 3635 MHz and 3710 - 3735 MHz. For the trial we decided to use a 20 MHz channel from 3610 – 3630 MHz with a centre frequency of 3620 MHz. In the 5 GHz band we chose 5825 MHz again with a 20 MHz channel.

3.3 The test Area

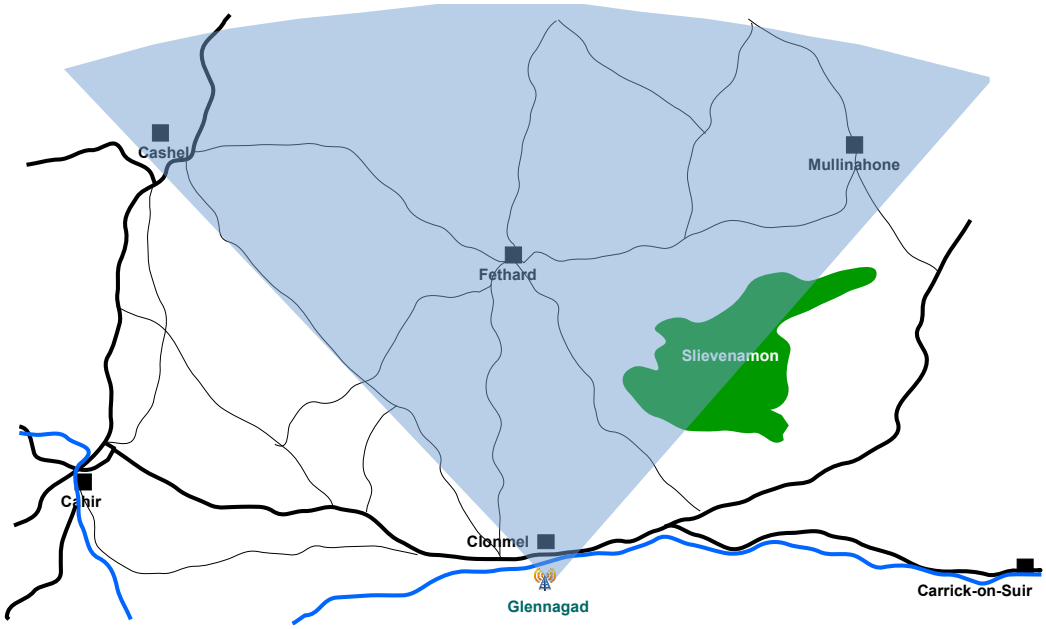

Illustration 3: The NGA test area

The test area shown in Illustration 3 is that area north of Clonmel bounded by Cashel to the west and Slievenamon to the east. The two PMP450 APs, on on 3.6 GHz and the other on 5 GHz with 60º degree sector antennas pointing north in the rough direction of the town of Fethard.

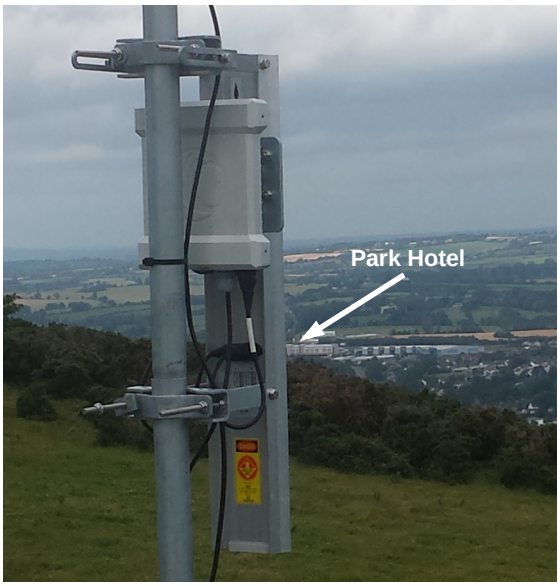

Illustration 4: Park Hotel nLOS

Initial tests were carried out from the Park Hotel roof in Clonmel which represented a relatively local distance of 2.5 Km from the AP but can also be considered a near Line of Sight (nLOS) condition with the edge of the hill within the Freznel zone as can be seen from Illustration 4 and also it is a location outside the western edge of the nominal sector area. This represents a good initial test before progressing to the more detailed analysis of the area. This offered a challenging nLOS and sector edge condition.

Illustration 5: Park Hotel in relation to nominal 60° Sector coverage

3.4 3.6 GHz FWALA result

This initial test proved encouraging with an over the air Downlink/Uplink of ~ 87/21 Mb/s in the Cambium results window in Illustration 6 and an Downlink/Uplink to the Internet of ~ 63/20 Mb/s shown on the OOKLA speed-test result in Illustration 7 below.

Current Results Status

Stats for LUID: 6 Test Duration: 10 Pkt Length: 1500 Test Direction Bi-Directional

Link Test with Bridging

VC	Downlink	Uplink	Aggregate	Packet Transmit	Packet Receive
				Actual	Actual
22	86.78 Mbps	20.87 Mbps	107.66 Mbps, 8754 pps	16966 (1696 pps)	70580(7058 pps)

Efficiency

Downlink			Uplink		
Efficiency	Fragments count		Efficiency	Fragments count	
	Actual	Expected		Actual	Expected
99%	1695499	1695072	100%	407710	407710

Currently transmitting at:
VC 22 Rate 8X/6X MIMO-B

Illustration 6: 3.6 GHz Radio link test result

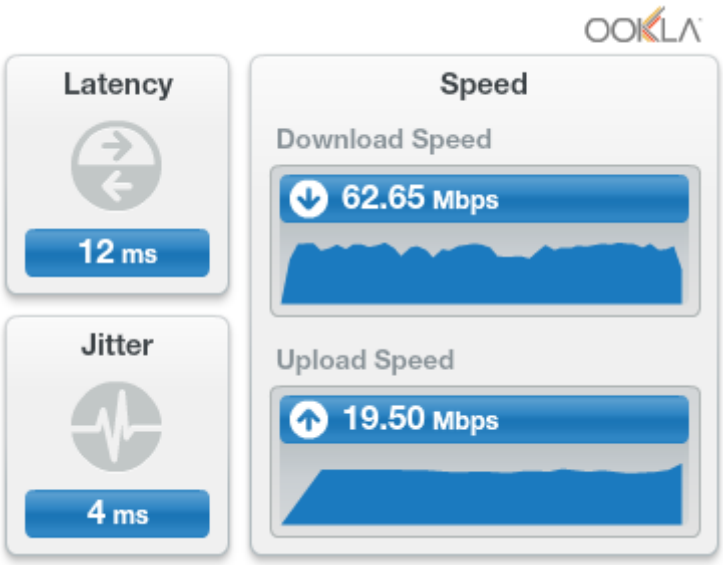

Illustration 7: 3.6 GHz speed-test

3.5 5 GHz ISM band result

Like the 3.6 GHz, the 5 GHz test also proved encouraging with an over the air Downlink/Uplink of ~ 44/14 Mb/s as demonstrated in Illustration 8 and an Downlink/Uplink to the Internet of ~ 42/14 Mb/s shown on the OOKLA speed test in Illustration 9 below.

Current Results Status

Stats for LUID: 5 Test Duration: 10 Pkt Length: 1500 Test Direction Bi-Directional

Link Test with Bridging

VC	Downlink	Uplink	Aggregate	Packet Transmit	Packet Receive
				Actual	Actual
21	44.16 Mbps	14.39 Mbps	58.56 Mbps, 4755 pps	11685 (1168 pps)	35879(3587 pps)

Efficiency

Downlink			Uplink		
Efficiency	Fragments count		Efficiency	Fragments count	
	Actual	Expected		Actual	Expected
99%	866157	862656	98%	284122	281208

Currently transmitting at:
VC 21 Rate 8X/4X MIMO-B

Illustration 8: 5 GHz Radio link test result

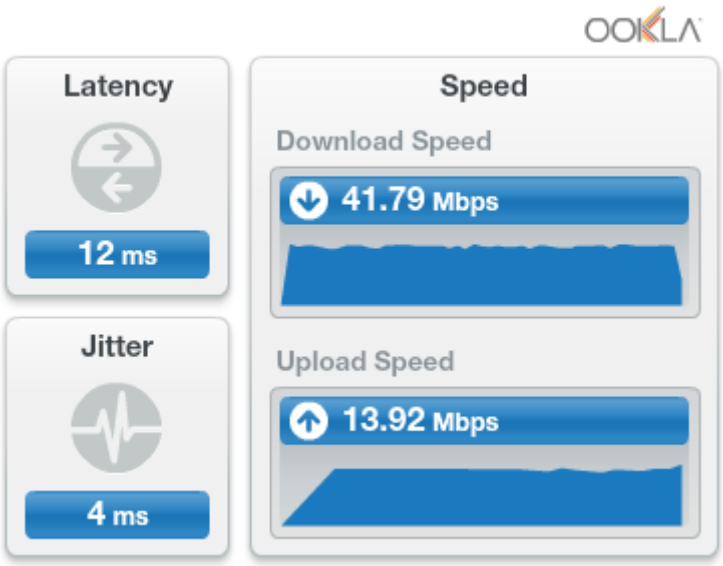

Illustration 9: 5 GHz speed-test

4. Trial methodology

To have a meaningful and systematic approach to the NGA trial data needed to be collected, it had to be analysed based on the requirements of the NBP, the findings presented and from them conclusions made. A dual approach was decided upon of; a quantitative matrix of sites in the selected area where measurements would be gathered and summarise in a table; as well as a qualitative test to involve existing customers who were upgraded to either 3.6 GHz or 5 GHz SMs free of charge. It was hoped that from the latter tests a 'wow factor' would be created with our customers and an information gained on their understanding of the benefits a significant increase in bandwidth offers.

4.1 Performance Results (Quantitative test)

The quantitative tests involved a matrix of 18 sites distributed in bands within the sector footprint at various distances. The field team carrying out the tests were allowed to adjust each location slightly to allow for safety considerations and the suitability of site for radio.

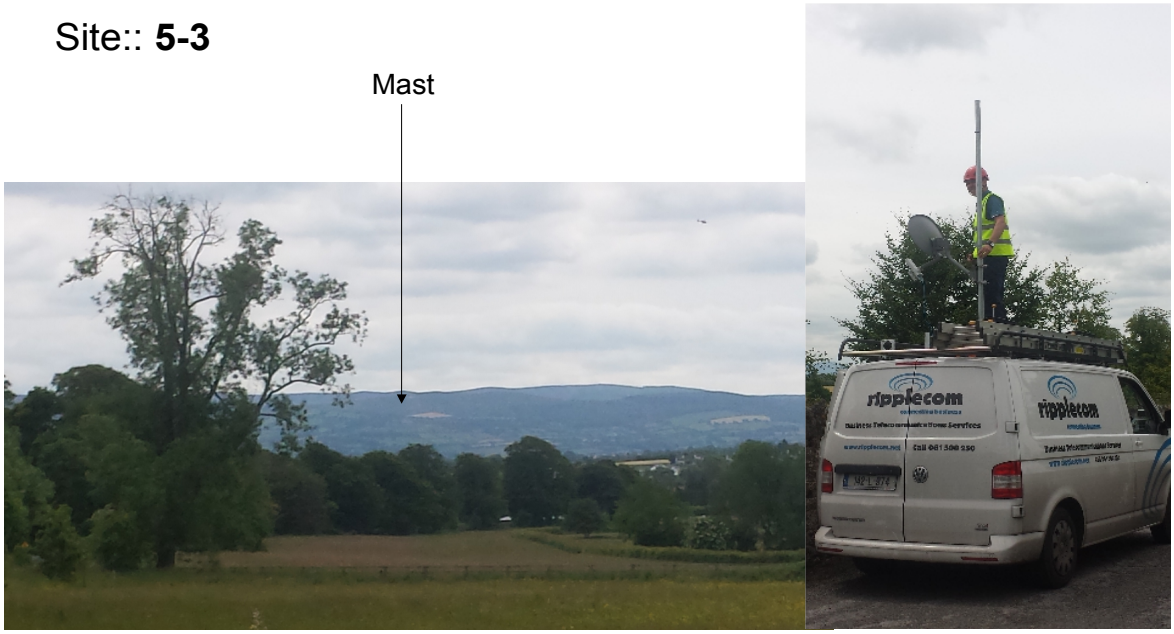

Illustration 10: Field team carrying out test from site 5.3.

Illustration 11 shows the actual test points selected by the field teams on the map. These are shown as yellow at 5 Km, red at 10 Km, blue at 15 Km and green at 20 Km.

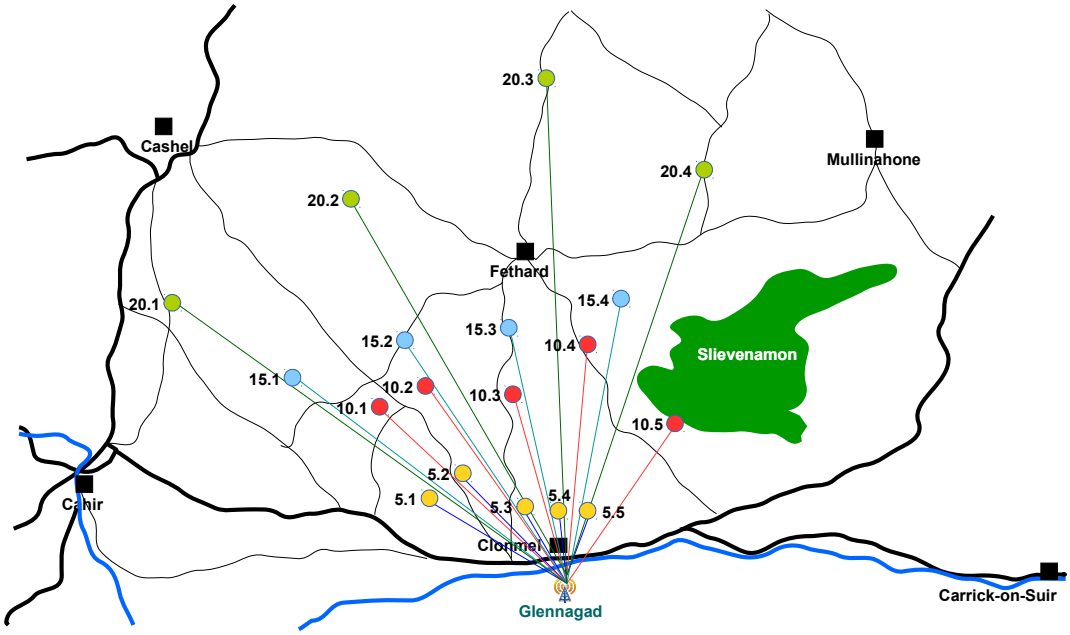

Illustration 11: Quantitative test

4.1.1 3.6 GHz FWALA

Table 1 outlines the results obtained by the field teams. All except two sites exceeded the Downlink/Uplink test level of 30/10 Mb/s. In fact the average Downlink speed was 62 Mb/s with a corresponding Uplink of 19 Mb/s.

Site name	Location	DL Status			UL Status	Link test	
		Receive Power		Link Efficiency %	Link Efficiency %		
		Chain A	Chain B			DL	UL
5-1	52.37192° -7.74338°	-70	-75	78	92	22.12	14.85
5-2	52.3821° -7.72548°	-60	-61	100	100	88.41	27.83
5-3	52.36914°-7.69965	-68	-67	99	99	66.29	20.83
5-4	52.36975° -7.67492°	-57	-57	100	96	88.38	26.75
5-5	52.37033° -7.65988°	-75	-72	92	98	46.21	14.07
10-1	52.41191° -7.77558°	-82	-82	99	99	22.11	6.95
10-2	52.415638° -7.744432°	-61	-63	99	100	85.96	20.86
10-3	52.41744°-7.70283°	-60	-59	100	93	88.36	26.13
10-4	52.43094° -7.65835°	-67	-69	99	99	66.31	20.86
10-5	52.401493° -7.602464°	-71	-73	99	99	66.23	20.76
15-1	52.42546° -7.83086°	-77	-79	99	99	43.88	13.89
15-2	52.43798° -7.75488°	-64	-66	96	99	73.75	21.06
15-3	52.43680° -7.69973°	-67	-63	96	99	71.33	20.33
15-4	52.44872° -7.63360°	-69	-72	99	99	66.24	20.68
20-1	52.44263° -7.88204°	-80	-81	98	86	43.5	11.3
20-2	52.48294° -7.79796°	-68	-71	99	99	66.28	20.84
20-3	52.53756° -7.69751°	-75	-77	99	99	44.2	13.93
20-4	52.50307° -7.59455°	-70	-71	99	99	66.25	20.79

Table 1: 3.6 GHz Quantitative results

4.1.2 5 GHz ISM

Table 2 outlines the results obtained for the 5 GHz sites. 2 sites did not meet the 30 Mb/s criteria. The average Downlink speed was 57 Mb/s with a corresponding Uplink average of 16 Mb/s.

Site name	Location	DL Status			UL Status	Link test	
		Receiver Power		Link Efficiency %	Link Efficiency %		
		Chain A	Chain B			DL	UL
5-1	52.37192° -7.74338°	-72	-72	99	96	67.36	15.05
5-2	52.3821° -7.72548°	-72	-71	99	91	67.28	19.39
5-3	52.36914°-7.69965	-74	-73	97	99	62.25	14.67
5-4	52.36975° -7.67492°	-60	-62	99	95	78.77	21.21
5-5	52.37033° -7.65988°	-70	-71	99	96	67.36	20.84
10-1	52.41191° -7.77558°	-79	-79	99	99	44.78	7.37
10-2	52.415638° -7.744432°	-70	-70	99	99	67.48	22.02
10-3	52.41744°-7.70283°	-76	-71	99	99	44.55	14.69
10-4	52.43094° -7.65835°	-71	-72	99	98	67.51	21.86
10-5	52.401493° -7.602464°	-74	-75	96	99	44.74	14.7
15-1	52.42546° -7.83086°	-75	-76	99	99	45	14.69
15-2	52.43798° -7.75488°	-68	-69	99	97	67.47	21.48
15-3	52.43680° -7.69973°	-69	-67	99	93	67.53	20.7
15-4	52.44872° -7.63360°	-72	-73	99	99	66.72	14.72
20-1	52.44263° -7.88204°	-86	-87	90	99	20.46	3.68
20-2	52.48294° -7.79796°	-75	-76	99	99	45.05	14.67
20-3	52.53756° -7.69751°	-74	-74	95	99	61.26	14.71
20-4	52.50307° -7.59455°	-77	-78	99	98	45.03	14.47

Table 2: 5 GHz Quantitative results

4.2 Qualitative test

A number of customers were approached to participate in the qualitative part of the NDA trial. These customers are shown on the graphic Illustration 12 below.

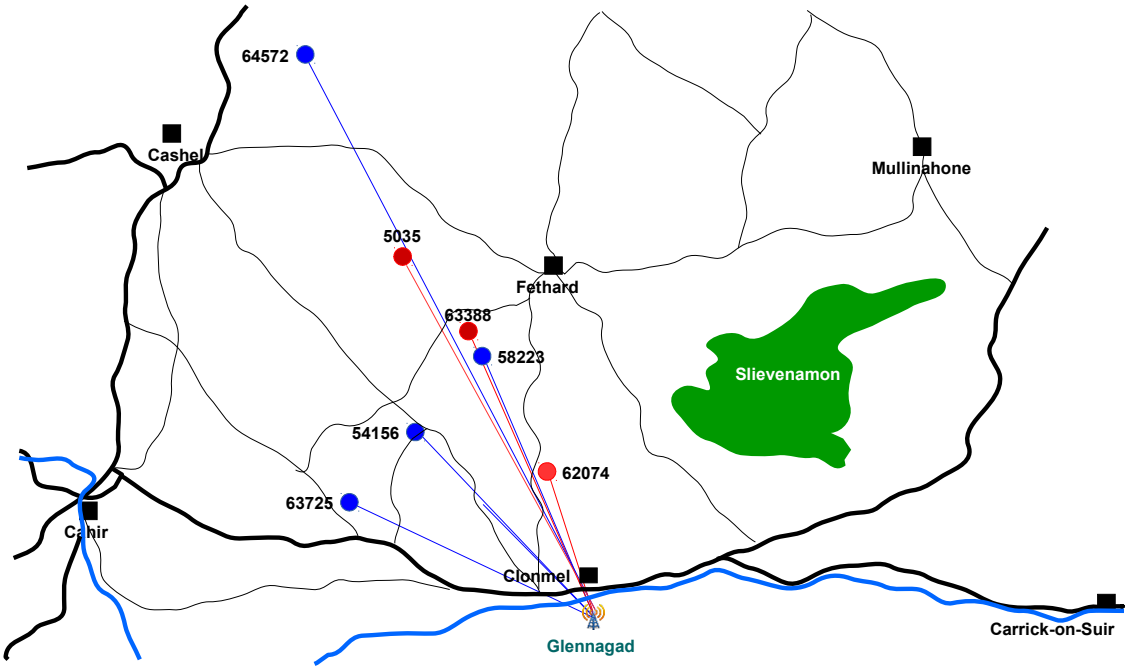

Illustration 12: Qualitative test

Each customer received a free installation of a PMP450 SM and were placed in a special trial bucket within the Customer Relationship Management (CRM) system to permit access to the NGA speeds. Depending on the customer's distance from the AP, the SM was installed directly, with a 'lens' or with a 'dish' to increase the Radio Frequency (RF) gain. These options can be seen in Illustration 13.

Illustration 13: PMP450 SM configurations

4.2.1 Test customer connectivity

Table 3 outlines the connectivity received by the test customers in the trial area. The average Downlink/Uplink received by the 3.6 GHz customers is 62/19 Mb/s while the 5 GHz enjoy 67/16 Mb/s.

ID	Location	DL Status			UL Status	Link test	
		Receive Power		Link Efficiency %	Link Efficiency %		
		Chain A	Chain B			DL	UL
Clonmel NGA Trial – 5 GHz Customers							
54156	52.4079510°, -7.7613390°	-69	-71	99	98	66.2	20.51
58223	52.4382130°, -7.7208590°	-65	-65	99	100	65.8	20.88
63725	52.3823540°, -7.8056500°	-64	-62	99	99	65.94	20.83
64572	52.5390040°, -7.8290600°	-76	-74	88	100	50.85	13.92
Clonmel NGA Trial – 5 GHz Customers							
5035	52.4637100°, -7.7636300°	-72	-72	98	99	66.13	14.68
62074	52.3997630°, -7.6972590°	-69	-68	99	93	67.42	20.58
63388	52.4452390°, -7.7256520°	-69	-71	99	99	67.41	14.74

Table 3: Test customer connections

4.2.2 Qualitative follow-up

Each of the qualitative customers were called to gain an understanding of their experience with the higher speed broadband. The customers were given a number of statements and asked to grade from 1 to 5 (1 - Strongly Disagree, 2 - Disagree, 3 - Neither agree or disagree, 4 - Agree, 5 - Strongly Agree) and were given the opportunity to elaborate.

- This trial service excels all my expectations.
- In comparison to my previous product, this product is far superior.
- Now that I have faster speeds I am doing more online.
- If I had these speeds available to me in the future, I would plan to do more online. (e.g. netflix, smart-tv, etc..).

The results of the first survey are compiled in Table 4. While each of these customers are definitely getting far more bandwidth that they were before (by a factor of 4) the results demonstrate a lack of understanding of high speed broadband and the potential benefits among the customer set. This is particularly borne out by the customer who could not see a difference from the old equipment despite their being an actual significant difference. The agent checked the customer usage and she did not use the broadband service much.

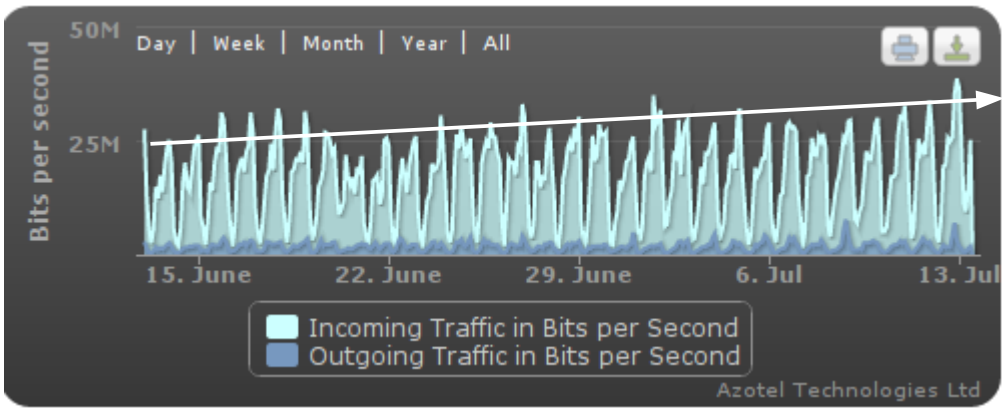

Illustration 14: Clonmel throughput through trial period

When comparing the results of the qualitative test results to the actual throughput at the site, a small increase in gradient of .05 over the month with a peak of 35 Mb/s while the available capacity is 100 Mb/s.

This is a similar trend Ripplecom have also seen with customers where we have replaced a Digital Subscriber Line (DSL) service in one of our fibre towns. An assumption that giving the customer a significant bandwidth increase is going to enable greater use is flawed. Without a corresponding demand stimulation the customers do not necessarily appreciate that they in fact have a significantly improved product.

This trial service excels all my expectations	In comparison to my previous product, this product is far superior.	Now that I have faster speeds, I am doing more online.	If I had these speeds available to me in the future, I would plan to do more online.	Additional Notes
3	5	3	4	Wouldn't elaborate on any question. No comment.
4	5 Faster	4	4	Not very helpful in answering questions and didn't want to elaborate on any statement.
2 Wireless adaptor not allowing him to do much he thinks (New one being issued)	2	2	4	Connection good and faster. (good to talk).
2 No difference to old equipment	2	2	4 Use it a bit more	No difference to previous equipment. Agent checked usage and it is not used much.
4	4 superior not far superior	3 Not really	2	Phone and laptops faster but pc not much different/ OAP he said doesn't use it for films etc.
4	4	4 Youtube, RTE player	4 Netflix	More reliable.

Table 4: Qualitative results

5. Cambium development

Cambium Networks have demonstrated over the years with their PMP products a level of innovation to maintain a continuous gain in capacity, spectral efficiency and throughput. Illustration 15 demonstrates the history of the product and the next step.

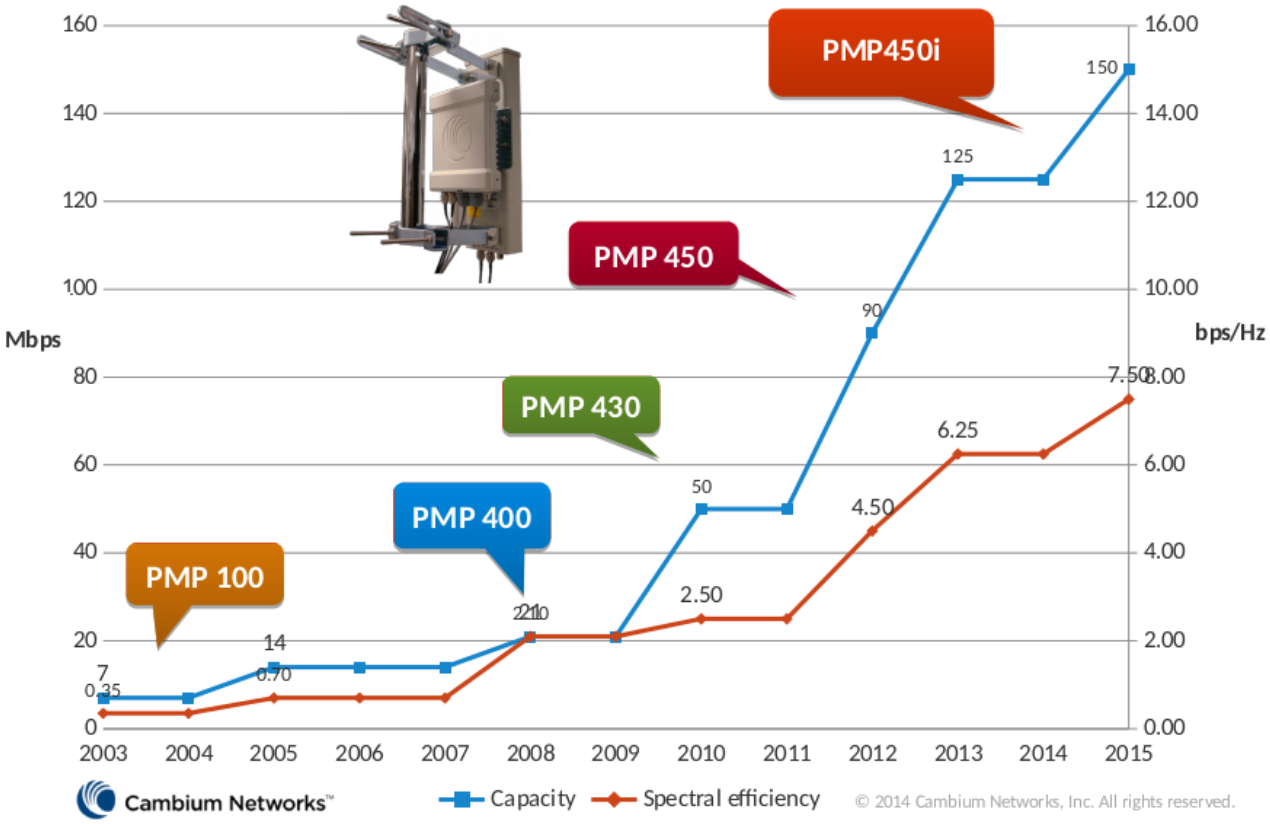

Illustration 15: Cambium technology evolution: past and present

The research and development work being carried out by Cambium on Multi-User MIMO (Mu-MIMO), an advanced form of MIMO where the antennas are spread over a multiple independent APs and independent radio terminals with each having multiple antennas. Additionally work on beam-forming technology in association with Mu-MIMO are showing very positive results and will be seen as capacity increases as demonstrated in Illustration 16.

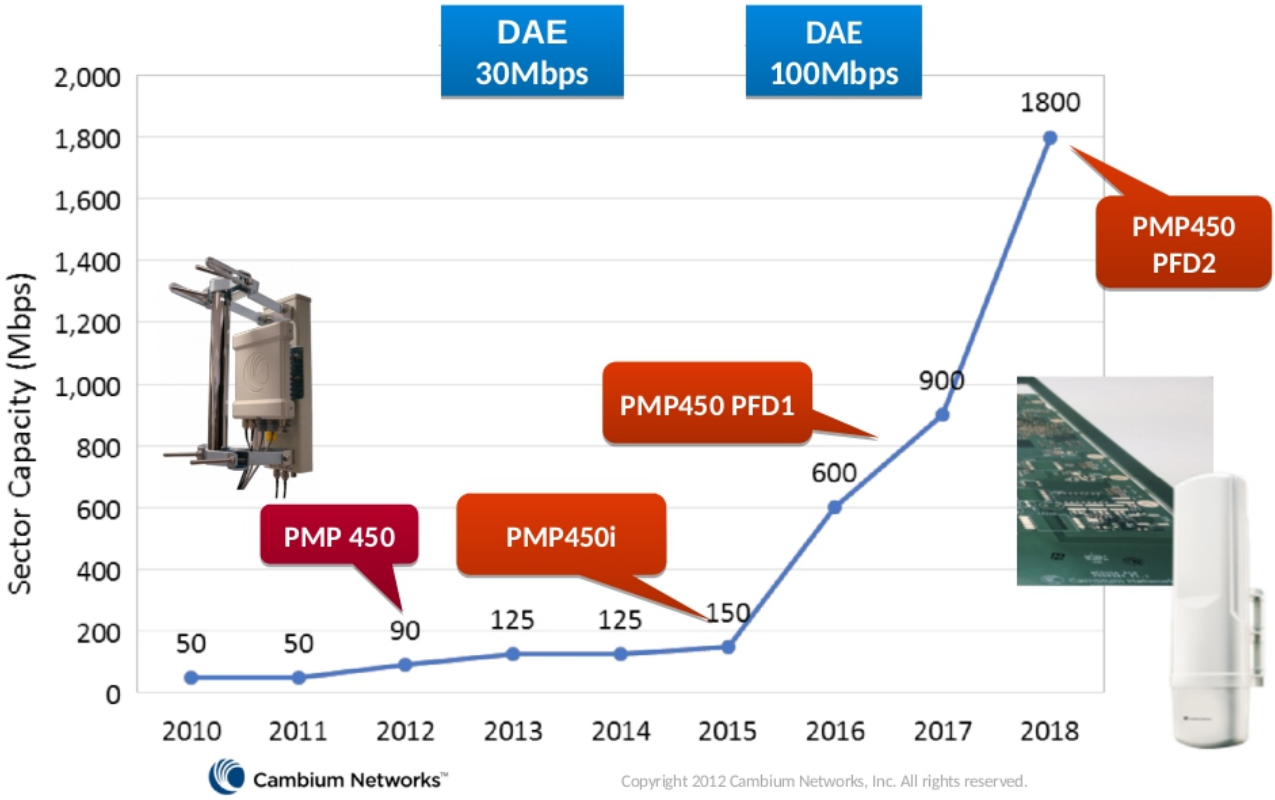

Illustration 16: Cambium: technology evolution: present and future.

6. Conclusions

The NGA trial conducted by Ripplecom has demonstrated that it is possible to deliver NGA speeds in rural environments using wireless technologies. Radio technology is constantly evolving and considering the roadmap from Cambium Networks the improved features to be delivered in the PMP455 demonstrate that while the PMP450 can deliver the NGA speeds required today as well as those for tomorrow, the progressive changes that are expected beyond the year 2020 will be available in line with technology improvements in the radio equipment.

In these tests the 3.6 GHz FWALA spectrum was under trial license from ComReg. It will be necessary for ComReg to consider renewal and reconfiguration of this band beyond the 2017 deadline. This is essential to ensure continuity of broadband service to customers as well as for the delivery of targets under the NBP.

While the NBP can deliver 'superfast' broadband to households across the state, without a corresponding demand stimulation programme it is not clear that the customers will understand the benefits that can be derived from such a speed increase.

7. Table of Abbreviations

AP	Access Point
CFI	Call for Input
CRM	Customer Relationship Management
DCENR	Department of Communications, Energy and Natural Resources
DL	Downlink
FDD	Frequency Division Duplex
FWA	Fixed Wireless Access
FWALA	Fixed Wireless Access Local Area
GHz	Giga Hertz
ISM	Industrial, Scientific and Medical
ISP	Internet Service Providers
Mb/s	Mega bits per second
MHz	Mega Hertz
MIMO	Multiple-Input and Multiple-Output
Mu-MIMO	Multi-User MIMO
NBP	National Broadband Plan
NGA	Next Generation Access
nLOS	near Line of Sight
OFDM	Orthogonal Frequency Division Multiplexing
PMP	Point to Multi-Point
RF	Radio Frequency
SM	Subscriber Module
UK	United Kingdom of Great Britain and Northern Ireland
UL	Uplink
WISP	Wireless Internet Service Providers

16 Three Ireland Hutchinson Ltd (3IHL)

Proposed 3.6GHz Award

Response to Document 15/70 from Three

28th August 2015

Introduction

Three is pleased to respond to ComReg's proposal to award spectrum in the 3.6GHz band. We acknowledge that ComReg has taken into account many of the comments submitted by Three and other respondents as part of consultation 14/101, and has made several modifications to its proposals as a result of them. The most significant of these is the proposal to award 3.6GHz spectrum in a separate process rather than as part of a multi-band award, and Three supports that proposal.

There are also some aspects of the current proposal where Three believes ComReg needs to make amendments. Some of these are new considerations that have emerged as ComReg's proposal has been developed and clarified, and some are issues that have been raised before, where we believe ComReg has not properly taken the response comments into account. Three's view on these issues is provided below in the section-by-section responses.

Overall, we believe ComReg should not be overly prescriptive in its approach to this spectrum or in relation to the licence conditions that will apply. While 3.6GHz is a relatively large 3GPP band and will be included by manufacturers in their LTE roadmaps, its propagation and coverage mean that it will not be used in Ireland in the same way as other mobile bands. In fact it might be used in several different ways depending on the licensee and location, e.g. it might be used for mobile capacity in urban areas and for fixed wireless access or initial stage backhaul in rural areas. ComReg need to allow enough flexibility for these different types of use to emerge.

Response to Chapter 4 Questions

Do you agree with ComReg's preliminary views set out in Chapter 4 and, in particular, that:

> *• the band plan for the 3 400-3 600 MHz sub-band should be TDD (in line with the preference expressed in the 3.6 GHz EC Decision);*

Three agrees with ComReg's proposed band plan (80x5MHz TDD channels). This plan was widely supported in the responses to ComReg document 14/101, and it seems that most interested users would want to use the band in TDD mode only. This means it represents the most efficient duplex arrangement. Three does not agree with the proposal to group channels 3 to 7 into a single lot in the award process though (see further comments below under chapter 5).

> *• regions should be established in line with the principles identified by ComReg;*
>
> *• the regions identified in Option 2 should be used for the proposed award;*

Three agrees with the principles proposed by ComReg to be used in defining the regions for the award process, and supports the regions identified under Option 2, with one proposed modification as explained further below. Three believes the regions should be defined in accordance with the four geographic areas identified by

ComReg, including the borders proposed. Three also agrees that the 5 cities should be separated from the other regions. It is possible that this spectrum will be used in different modes (or for different services) in cities than in more rural areas. The separation of the cities at least allows the possibility for different licensees to obtain the spectrum in the cities than in the rural regions. Three also agrees that the CSO boundaries should be used to define the cities rather than the political boundaries, as this is more reflective of actual population densities, which is the most important factor in determining type of service to be provided.

The amendment Three proposes is that the five cities should be combined together to form a single region for the purpose of creating auction lots. This would leave five regions in total, four large geographical areas plus the five cities. Three's view is that any bidder who is interested in obtaining the spectrum for urban service would want to cover all five cities rather than just one, and this will help to reduce the auction complexity by reducing the overall number of lots.

• a licence duration of 15 years should apply to the 3.6 GHz band.

In relation to the licence term, Three has already explained its view that indefinite term or rolling licences promote continuous investment, and we repeat that in this case we believe a 20 year minimum would be appropriate. ComReg should incentivise continuous investment in networks and services, however it would be impossible for a licensee to create a valid business case to invest in updating their network at a time when the end of a licence term is approaching. The use of fixed term licences thus creates a period of "zero investment incentive". The duration of this period might vary, but is likely to be as long as the final five years of a licence. Rolling licences eliminate this period of zero investment incentive.

It is likely that some service providers may plan to use 3.6GHz spectrum to provide fixed wireless access as part of the National Broadband Plan, and a 20 year licence term would seem to be compatible with the commitments that are required in that context. For this reason, Three believes a minimum licence period of 20 years is appropriate.

Response to Chapter 5 Questions

Three disagrees with several aspects of ComReg's proposals under Chapter 5. In some cases the reason for this disagreement has already been provided to ComReg in response to consultation 14/101, and it is not intended to repeat the arguments in this response, except to provide clarification where necessary.

Do you agree with ComReg's preliminary views set out in Chapter 5 and, in particular, that:

• a combinatorial clock auction is the preferred auction format;

Overall, Three believes ComReg has proposed an award format using a combinatorial clock auction with high minimum prices in order to mitigate aggregation risks and gaming opportunities. Three believes ComReg has placed too much weight on these considerations, and as a result have determined to use an auction mechanism that is overly complex. This award could be expected to be of interest to a broad range of bidder types, however the complexity of the auction

format itself might place some bidders at a disadvantage. Three believes there is a small likelihood of gaming to reduce prices in this process, and that with a large number of spectrum blocks to be awarded the aggregation risk is not a significant consideration. As a result, we believe ComReg has unnecessarily discounted alternative auction types that could produce an efficient outcome while being significantly less complex. For this reason, Three believes ComReg should review its choice of auction type with a reduced weighting on these factors. In this case either SMRA or SCA would emerge as the preferred auction type.

> *• a single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz;*
>
> *• Sixty five (65) frequency-generic lots of 5 MHz each should be adopted for frequencies between 3475 MHz – 3800 MHz;*

Three does not agree with ComReg's proposal to group channels 3 to 7 into a single frequency block for the award. This is an unnecessary restriction or limitation which would reduce flexibility within the auction. If ComReg is to proceed with a CCA auction, then any issues regarding aggregation of channels (which might arise because these lots are separated from main group by the 8 channels reserved for State Services) can be decided within the assignment round. As an alternative, ComReg should consider whether it would be possible to re-tune the existing user to either end of the band so that 70 contiguous lots are available at auction.

Three is of the view that ComReg should include 70 generic frequency blocks of 5MHz each in the auction process.

> *• a competition cap should be set and, further, that such a cap be within the range of 150 MHz to 250 MHz. ComReg is mindful of the alternative uses to which this spectrum can be put and the potential impacts this can have on competitive dynamics in the relevant market concerned (for example fixed of mobile). Accordingly, ComReg welcomes input on any other factors which should be taken into account when establishing the level of any competition cap;*

In relation to competition caps, Three would caution that ComReg should not take any decision in relation to future award processes. The whole purpose of a cap is to influence or determine certain award outcomes. This involves ComReg taking a position in advance of any auction rather than allowing the auction itself to determine the outcome. Competition caps can prevent the most efficient outcome from emerging in an auction, and should only be implemented in full consideration of the circumstances that exist at the time of a particular award. For this reason, ComReg should take no decision now that could fetter its options in any future award process. Any decision in relation to award caps should be limited to what is necessary for the spectrum to be included in this award process only.

In general, competition caps can be used successfully in circumstances where the use or application of a band is suited for a homogenous group of users only, and in particular where there is no other band available which is a good substitute. In these circumstances, caps can have the effect to ensure a minimum distribution of spectrum in order to protect competition in downstream markets. Outside of these circumstances, the imposition of caps can mean ComReg has picked winners and losers in advance of the auction itself.

In relation to the 3.6GHz band, this spectrum might be under consideration for several different types of use, ranging from mobile to fixed access. The award cap

should be large enough to ensure that no valid application or type of use is eliminated. ComReg should not set the competition cap below the maximum value that would be useful and valuable for each type of use under consideration. On this basis, Three believes the competition cap should not be set below 150MHz or 30 channel blocks in any region.

Minimum Price

Three disagrees fundamentally with the approach ComReg has taken to setting the minimum price for this award. In consultation document 14/101, ComReg stated that a minimum price is necessary to prevent bidders from obtaining spectrum below its economic value. Three requested ComReg to clarify what this means, and ComReg has clarified that:

> "*In this context, ComReg considers that the price of spectrum should be reflective of its value for an alternative user, who cannot obtain (any or additional) spectrum due to the limited availability of frequencies. Therefore, by real economic value, ComReg means the highest value that spectrum would have to potential alternative acquirers, if it were not assigned to the user actually acquiring it".*

This raises a basic question as to how this situation could arise in the circumstances where ComReg is to award spectrum by auction. Surely a fair auction will ensure that the bidder who places the highest value on the spectrum will be awarded it. ComReg seems to be attempting to anticipate some potential future change that might radically alter the value of spectrum during the licence term. This is speculative at best, and implies that ComReg would rather see spectrum unsold and unused than have it awarded at what it considers is below the *real economic value*.

A further difficulty with this approach is that the *real economic value* is to be determined by way of benchmark of historical awards rather than the auction itself which is the best determinant of the value of the spectrum at this time. ComReg's approach unnecessarily risks choking demand during the award process, leaving a legitimate interested bidder unable to obtain spectrum. This would be an inefficient outcome, and is contrary to ComReg's statutory objectives.

Three is of the view that ComReg should set a low but non trivial minimum price, designed only to eliminate frivolous bidders.

> • *benchmarking be used as the approach by which to determine a conservative minimum price;*

Subject to Three's comments above regarding the overall approach to minimum price in this case, the use of benchmarking to set the minimum price in this award process, and in particular the approach being taken (to determine a conservative market value) is wholly unreliable and runs a serious risk of choking off valid demand. In the first place, there is no reliable benchmark data available that could indicate the value of this band in Ireland which means there is significant uncertainty as to whether the value produced will be below that of the lowest interested bidder. The minimum price needs to be adjusted downwards by a factor to eliminate this risk.

> • *the minimum price should be apportioned on a 50/50 basis between an up-front payment (SAF) and ongoing annual payments subject to CPI index linking (SUFs); and*

Subject to Three's other comments regarding the minimum fee, the 50/50 split seems appropriate.

> *• the range €0.015 to €0.025 per MHz per capita is appropriate for the setting of the minimum price, with the higher end of the range applying to urban areas and the lower end applying to regions that do not have specific urban areas identified.*

As previously stated, Three disagrees with the approach to setting of a minimum price that has been taken by ComReg. Further, the benchmark is wholly unreliable, and as a result the range proposed above is excessive and risks choking off demand.

> *• the population of each of the regions under Option 2 should be adjusted to take account of the commuter flows between the five identified cities and the other applicable regions. A 7.4 Please provide a detailed explanation of your views, with supporting material, having regard to ComReg's statutory objectives, duties and functions.*

Three does not believe that it is appropriate to adjust spectrum prices to account for commuter flows. This presupposes a particular type of use which would indicate higher value in urban areas. In practice, the 3.6GHz band might be most heavily used to provide fixed wireless access to the commuters in the evening and weekends when they are outside of urban areas. This would imply a higher value per head of population in rural areas.

Response to Chapter 6 Questions

A 7.5 Do you agree with ComReg's preliminary views set out in Chapter 6 and, in particular, that:

> *• the band should be released on a service- and technology-neutral basis;*

Yes, Three agrees that the band should be awarded on a service and technology neutral basis. This must be facilitated by all aspects of the licence terms and conditions.

> *• rights of use in the band should be awarded on a non-exclusive basis;*

While it is acknowledged that other licences are also awarded on a non-exclusive basis, bidders who enter an auction and pay for the right to use spectrum expect to be able to do so free from interference and without unnecessary encumbrance. Other use would need to be on a non-protected non-interference basis, and some degree of certainty in this regard would be required before any alternative licences were granted in the same spectrum.

> *• an obligation to notify of the termination of a technology should apply;*

Yes, Three agrees with this requirement.

> *• a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region;*

Three believes ComReg has approached the 3.6GHz licence obligations in a similar way to that which would have applied to core mobile bands like 900MHz. Three believes this is an incorrect approach for the 3.6GHz band particularly given the mixed use that may emerge. In order to ensure the licences are technology and service neutral, some amendments will be required.

ComReg should only impose the minimum obligation to ensure that spectrum is used by each licensee. At its simplest, this is a requirement that each licensee brings their licensed spectrum into use. It is not appropriate to specify the number of base stations per region, as this might eliminate some valid use types.

> *• a quality of service obligation should apply in relation to each of network availability and voice call standards;*

Again, this type of obligation is more appropriate to a core mobile band, and is not appropriate to mixed use or service and technology neutrality.

> *• licensees should internalise guard-bands as spectrum should be assigned without guard-bands;*

Yes, Three agrees with this requirement.

> *• a default TDD frame-structure based on TD-LTE configuration 2 (3:1) should be applied to incentivise inter-network synchronisation;*

No, Three does not agree that ComReg should specify a TDD frame structure. This is incompatible with a service and technology neutral licence, and could prevent some legitimate use types.

> *• a permissive BEM should apply to synchronised networks and a restrictive BEM should apply to unsynchronised networks;*

Yes, Three agrees with this proposal.

> *• the terminal station in block power limit set out in the 3.6 GHz EC Decision should be relaxed for fixed outdoor installations;*

Yes, Three agrees with this proposal.

> *• at regional borders a coordination threshold should apply to allow for bilateral/multilateral co-existence agreements;*

Yes, Three agrees with this proposal.

> *• where agreement in cross-border coordination fails to be met, the coordination threshold limit should be set as a binding licence condition.*

Yes, Three agrees with this proposal.

Response to Chapter 7 Questions

A 7.7 Do you agree with ComReg's preliminary views set out in Chapter 7 and, in particular, with the following proposals:

> *• Transition Proposal 1: the formulation of a transition plan for the 3.6 GHz band;*

ComReg should formulate a transition plan for the band, however we would make the following observations:

- The outcome of the award process is unknown and difficult to anticipate, and obviously it will be easier to develop a transition plan after the award is complete. The two transitions that followed the 2012 MBSA have shown that

licensees can cooperate and act in good faith. While safeguards and obligations will be required, ComReg should not try to overburden the process of transition planning in advance of the award, as this will be much simpler afterwards.

- For the transitions which followed the 2012 MBSA, the same licensees held spectrum before and after transition, and were capable of maintaining continuity of service. That might not occur in this case.

• *Transition Proposal 2: the Transition Protected Licence;*

Yes, Three supports this proposal.

• *Transition Proposal 3: the Transition Unprotected Licence.*

While Three sees some merit in this proposal, a 5-year term is excessive. The maximum permitted should be 2 years and must be on a non-interference unprotected basis.

End.

17 Viatel

Response to Consultation 15/70

ComReg

3.6 GHz spectrum award

August 2015

Do you agree with ComReg's preliminary views set out in Chapter 4 and, in particular, that:

1 / The band plan for the 3 400-3 600 MHz sub-band should be TDD (in line with the preference expressed in the 3.6 GHz EC Decision);

As mentioned in our previous submission, Viatel agrees that the 3400 – 3600 MHz band plan should be TDD in line with the preference expressed in the 3.6 GHz EC Decision. However, this decision also mentions that "*members states may alternatively implement Frequency Division Duplex (FDD) mode of operation in the 3 400 – 3 600 MHz sub-band for the purpose of […] (b) protecting existing uses […]*". Given one respondent expressed interest for FDD deployment and that the existing usage is widespread on FDD, it may be appropriate to keep a portion of the band available to FDD or TDD. Viatel would suggest the 5 x 5 MHz FDD channels in the range 3 410 – 3435 MHz / 3510 – 3535 MHz. It is interesting to note that the latest 3.6 GHz auction which took place in EU (Slovakia, 2015) did allow for such flexibility. We believe there is sufficient spectrum available to accommodate most of the needs of the marketplace, even though it does mean losing a bit of spectrum by setting additional guard bands. We also would like to see ComReg questioning further the effective usage of the band 3435 – 3475 MHz by the State services. A transition plan could be set out similarly to the FWALA band.

2 / Regions should be established in line with the principles identified by ComReg

Viatel broadly agrees with the principles set out by ComReg. We'd like to add one element as regards of the delimitation of the urban region boundaries. It would be useful to include key elevated rural areas around each urban region allowing operators to make use of key transmitter areas such as ThreeRock near Dublin or Woodcock Hill near Limerick. Similarly to the FWALA scheme, a urban licence could be set out with an appropriately sized radius. ComReg should be able to ascertain which high sites are strategic through its PTP Licence database. Alternatively, Viatel is happy to detail its suggestions. It may also be still pertinent to include an interference contour zone.

3 / The regions identified in Option 2 should be used for the proposed award; and

At first look the regions identified in Option 2 seem coherent. However, using the administrative boundaries does again ignore in many ways the topography of the area, and will limit wireless deployment in certain zones. For example, Viatel's best high site to cover Carlow town is located around the Rossmore Hill, Co Laois, which is located in another rural region. As it is currently laid out, Carlow town urban area will be split between two rural regions making any future comprehensive roll-out difficult to proceed with. We therefore suggest incorporating Laois County into the Wexford-Carlow-Kilkenny-South Tipperary-Waterford region. This should not provoke any great imbalance between regions. In order to resolve any further specific issues, the licence conditions should be allow sub-leases on specific set of electoral divisions in order to resolve any further issues coming from the using of the county boundaries.

4 / A licence duration of 15 years should apply to the 3.6GHz band

As previously stated, Viatel agrees with a licence duration of 15 years. As an effort to take in account feedback received, ComReg may agree to incorporate a 5 years extension post the initial licence term pending the Authority has no material requirement to reclaim the spectrum.

5 / a combinatorial clock auction is the preferred auction format

Viatel agrees that a combinatorial clock auction is the preferred auction format. Viatel has notably used this system in the UK for the assignment of its 10 GHz national licence. Our experience is very positive so we'd support ComReg in its choice.

6 / a single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz;

As stated in our answer n˚1, we first of all would like to have a better understanding of the effective use by the State of the 3 435 – 3 475 MHz band. ComReg is fully entitled to set a cease date of the FWALA scheme and it should be the same situation regarding to this band. More information should be available on the level of usage and its trending overtime, and may allow considering one full contiguous band. Should it be confirmed that the need of the States services band is imperative post 2017 – Viatel does agree that a single 25 MHz frequency-specific lot appears to be the easiest solution to avoid a situation where a bidder would be awarded two non contiguous lots.

7 / Sixty five (65) frequency-generic lots of 5 MHz each should be adopted for frequencies between 3475 MHz – 3800 MHz;

We agree with ComReg's proposal. This lay-out associated with the CCA auction system should indeed allow for maximum flexibility for spectrum allocation while reducing complexity.

8 / a competition cap should be set and, further, that such a cap be within the range of 150 MHz to 250 MHz [...].

Viatel agrees with DotEcon's 150 MHz cap proposal. This has the critical advantage of sufficient enough room for competition by leaving enough spectrum to deploy three separate networks. That requirement is very important especially when you consider the lessons learned from the previous FWALA schemes, from which the Viatel group was a very active player. No appropriate capping methodology has been set out meaning that one single operator currently controls most of the 3.5 GHz capacity in Dublin area, which did de facto limit competition in this strategic market. We consider setting a cap to allow for 3 operators is an absolute minimum requirement; we therefore recommend a cap of 150 MHz and a monitoring of M&A activity in order to prevent the emergence of a near monopoly.

9 / benchmarking be used as the approach by which to determine a conservative minimum price;

Viatel believe it is more appropriate to complete a benchmark with European awards excluding outliers as suggested by DotEcon. We therefore believe setting a maximum price of €0.0064 is pertinent. This comparison pool is the most relevant as its compares country with broadly the same underlying telecom infrastructure. As such, you may find higher price per MHz per Capital in developing countries where fixed networks are not covering the full territory therefore making any benchmarking not applicable. We disagree with the idea that previous valuation may have been undervalued compared to now. In contrary, one could assume that abnormal valuation did actually prevail due to the excessive expectations made by the market toward the WiMax technology from 2005. It is also important to note that further 3.5/3.6 GHz auctions/transactions did occur in Europe which are not listed in the DotEcon report. This may also bring

into question the validity of the conclusions. For example, Free Telecom bought a 3.5 GHz national licence in France from Altitude Telecom in 2005 for a value of €57m[1]. In 2006, still in France, two more 15 MHz FDD were allocated per region for a total proceeds of €126m[2]. Closer to us, the Belgian BIPT has issued a 10 years 3.5 GHz national licence in March 2015, raising a single minor interest due to setting an excessive fee structure. A process is also currently undergoing in Romania and the Moldovan recently failed to find interest on 3.5 / 3.7 GHz bands[3]. We are therefore questioning the representativeness/completeness of the DotEcon benchmark list including dated and recent auctions. A more detailed benchmark should be possible.

10 / the minimum price should be apportioned on a 50/50 basis between an up-front payment (SAF) and ongoing annual payments subject to CPI index linking (SUFs)

Could you please detail using one example the exact workings used for the SUF calculation? Using the "Galway city & Suburbs" SUF price from Table 2 as an illustration, this licence would be worth €12k including €6k payable upfront. We suppose the remaining €6k would be due over a period of 15 years. If you simply divide this value by 15, you find a figure of €400. However, DotEcon's NPV formula makes us achieve an annual fee of €620 (+55%) before you even think about CPI. We have tried to recalculate the SUF without success using the 8.63% discount rate and a 15 years duration. Could ComReg issue a detailed example of the calculation? We strongly question whether the mobile operators' discount rate is applicable for a band suitable for fixed based solutions. Based on ComReg/DotEcon calculations, it is clearly in the operators best interests to reduce the share of ongoing annual payments.

11 / the range €0.015 to €0.025 per MHz per capita is appropriate for the setting of the minimum price, with the higher end of the range applying to urban areas and the lower end applying to regions that do not have specific urban areas identified.

Please see our response 9. We believe a maximum fee of €0.0064 should be used across all regions. An operator wishing to offer a wireless broadband solution based on TD-LTE in Dublin will face much higher competition from fibre/cable based solutions. Therefore, its business model may not necessarily improve to the level that would explain an increase of 67% of ComReg fees. We advise ComReg to complete the benchmark analysis, taking in account in priority developed economies with similar population densities. Review should also be made from failed case studies which often highlight factors such as excessive reserve price.

12 / the population of each of the regions under Option 2 should be adjusted to take account of the commuter flows between the five identified cities and the other applicable regions.

Taking in account commuter flows could be pertinent if you assume the principal use will be nomadic/mobile. However, it would appear that a large panel of operators identified fixed based LTE solution as the biggest opportunity. We would therefore assume such solution would be home-based. By such, we don't believe it is applicable to take in account commuter flow should the spectrum band be primarily used at fixed location, and therefore solely in households.

[1] http://arantxa.ii.uam.es/~ferreiro/sistel2008/anexos/WIMAX%20regulation.pdf
[2] http://www.muniwireless.com/2008/10/29/france-wimax-deployments-severe-delays/
[3] http://www.analysysmason.com/Research/Content/Newsletters/Spectrum-Newsletter-May2015-RDTS0/

13 / the band should be released on a service- and technology-neutral basis;

Agreed.

14 / rights of use in the band should be awarded on a non-exclusive basis;.

Raising the question is somewhat useless if the binding 3.6 GHz EC decision specifically states that the band should be released on such terms. The conditions set out in S.I 251 of 2012 are acceptable.

15 / an obligation to notify of the termination of a technology should apply;

The conditions set out in S.I 251 of 2012 are acceptable.

16 / a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region;

First of all, we don't believe it is pertinent to consider the current total number of BS rolled per region under the FWALA scheme in order to form a view on the minimum number of BS to be deployed per region under the future scheme. The Viatel Group has for example been able to maintain a large customer base in Dublin with just a fraction of the minimum base stations figure suggested by ComReg. Looking at the proposed figures from other regions, we believe them to be sensible. We would however request ComReg to set-up several stages in order to meet this roll-out conditions.

17 / a quality of service obligation should apply in relation to each of network availability and voice call standards;

Viatel has no comment to make at this time.

18 / licensees should internalise guard-bands as spectrum should be assigned without guard-bands;

Viatel has no comment to make at this time.

19 / a default TDD frame-structure based on TD-LTE configuration 2 (3:1) should be applied to incentivise inter-network synchronisation;

Viatel has no comment to make at this time.

20 / a permissive BEM should apply to synchronised networks and a restrictive BEM should apply to unsynchronised networks;

Viatel has no comment to make at this time.

21 / the terminal station in block power limit set out in the 3.6 GHz EC Decision should be relaxed for fixed outdoor installations;.

Viatel has no comment to make at this time.

22 / at regional borders a coordination threshold should apply to allow for bilateral/multilateral co-existence agreements;

Viatel has no comment to make at this time.

23 / where agreement in cross-border coordination fails to be met, the coordination threshold limit should be set as a binding licence condition.

Sub-leasing of portion of regions should be made available. For example, the operator holding the North-East region under Option 2 may find an issue to cover the north-western tip of Cavan. It may be on everybody's best interest to amend the region boundaries at ED level in order to take account of local conditions (position of elevated transmitter, town split between two regions).

24 / Do you agree with ComReg's preliminary views set out in Chapter 7 and, in particular, with the following proposals:

- **Transition Proposal 1: the formulation of a transition plan for the 3.6 GHz band;**
- **Transition Proposal 2: the Transition Protected Licence; and**
- **Transition Proposal 3: the Transition Unprotected Licence.**

Viatel has no comment to make at this time.

18 Vodafone

Vodafone response to Comreg Consultation 15/70 :

Proposed 3.6 GHz Band Spectrum Award

Consultation on Proposed 3.6 GHz Band Spectrum Award

Document No: ComReg 15/70

Date: 10 July 2015

General Remarks.

Vodafone welcome the opportunity to comment on ComReg's Consultation on a proposed 3.6GHz Spectrum Award.

Efficient allocation and assignment of spectrum is of critical importance to the delivery of telecommunications services to customers in Ireland. While the proposed auction of 3.6GHz is welcome this band is only one of the bands proposed for auction in ComReg's consultation 14/101. Whereas Vodafone appreciate the urgency of this particular band, in order for Vodafone to efficiently and effectively deliver services to customers we need to develop long term technical strategy and have a clear view from ComReg of future spectrum assignments. To do this it is necessary for ComReg to publish a Spectrum Strategy and a program of future activity of reviewing assignments and planning future auctions. This Spectrum Strategy is considerably overdue. ComReg have not yet commented on the spectrum commitments given as part of the sale of Telefonica Ireland to Hutchinson Ireland last year and any concerns they may or may not have on current spectrum assignments which are radically different from the assignments and associated caps which were the focus of the MBSA in 2012.

Publication of this Spectrum Strategy and Program must happen before further steps are taken in proceeding to auction the 3.6GHz spectrum. While we have stated previously that the primary use for the 3.6GHz band is non-mobile applications, in the absence of a spectrum strategy and a roadmap for the other mobile bands (2.6, 2.3, 1.4, 0.7 GHz) the value of the 3.6GHz band will be artificially raised as operators cannot plan on when the other bands become available.

Similarly Comreg assert in this consultation that spectrum caps for this band can be assessed without any regard to current mobile assignments. This claim would only be valid if a review of the spectrum allocation to mobile operators was completed and a roadmap produced for auctions of the other bands. Otherwise there is a risk that mobile operators will try and fix issues with allocations in lower band by bidding for 3.6GHz spectrum.

Our prime issue with ComReg's document is the proposed minimum cost. As we discuss in detail in the text below we consider the reserve point to be at least double where it should be. We urge Comreg to change this before proceeding to Auction.

In the following text we respond to specific questions in the consultation:

Consultation Questions

A7.1 Chapter 4 Consultation Questions

A 7.1 Do you agree with ComReg's preliminary views set out in Chapter 4 and, in particular, that:

- the band plan for the 3 400-3 600 MHz sub-band should be TDD (in line with the preference expressed in the 3.6 GHz EC Decision);

Yes - Vodafone agree with the proposal to use TDD, this gives most flexibility in breaking up the band

- regions should be established in line with the principles identified by ComReg

Dividing the country into Regions is a reasonable approach. The design of the split must align with the regional split used in National Broadband Plan.

- the regions identified in Option 2 should be used for the proposed award; and

The design of the split must align with the regional split used in National Broadband Plan. It is reasonable to define cities as separate regions as the spectrum may be used for different applications in these regions.

- a licence duration of 15 years should apply to the 3.6 GHz band.

Duration should align with NBP – 20 years

A7.2 Chapter 5 Consultation Questions

A 7.3 Do you agree with ComReg's preliminary views set out in Chapter 5 and, in particular, that:

- a combinatorial clock auction is the preferred auction 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.

As we stated in our response to Comreg Consultation 14/101, 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.

The uncertainty in the timing of the availability of capacity bands and the terminal support adds to this uncertainty.

Competitive Price Setting

This risk was not mentioned by Comreg in 14/101. 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 previous 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. In practice it was not possible for bidders to take part in the auction without acquiring required specific expertise in the working of the CCA format.

Vodafone's preferred Auction Format.

Vodafone's preferred auction methods are to use 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" behavior 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.

- a single 25 MHz frequency-specific lot be adopted for frequency 3410 MHz – 3435 MHz;

This is a reasonable approach as otherwise a segment of spectrum could end up stranded. It will unfortunately make the auction more complex. We are not clear how this effects the assignment round.

- Sixty five (65) frequency-generic lots of 5 MHz each should be adopted for frequencies between 3475 MHz – 3800 MHz

Agreed

- a competition cap should be set and, further, that such a cap be within the range of 150 MHz to 250 MHz. ComReg is mindful of the alternative uses to which this spectrum can be put and the potential impacts this can have on competitive dynamics in the relevant market concerned (for example fixed of mobile). Accordingly, ComReg welcomes input on any other factors which should be taken into account when establishing the level of any competition cap

Vodafone do not agree with ComReg's assertion that spectrum caps for this band can be assessed separately to mobile assignments. This claim would only be valid if a review of the spectrum allocation to mobile operators was completed as there is a risk that mobile operators will try and fix issues with allocations in lower band spectrum by bidding for 3.6GHz spectrum. In Vodafone's view the issue is not just whether spectrum assignments and holdings in complementary bands should be considered in designing competition caps; the overall spectrum holdings of potential bidders should be considered. As there is uncertainty in terms of future spectrum releases potential bidders may select bands available in the short term to satisfy spectrum needs which may have the effect of artificially inflating demand for this band above what would be expected if assignments in the market had been allocated via spectrum auctions. There is also the potential, specifically linked to our earlier point on the use of CCA that holders of significant assignments of spectrum would bid strategically to raise the price for other bidders without the intention of securing spectrum.

- benchmarking be used as the approach by which to determine a conservative minimum price

See text below on 3.6GHz reserve prices.

- the minimum price should be apportioned on a 50/50 basis between an up-front payment (SAF) and ongoing annual payments subject to CPI index linking (SUFs); and

Agreed

- the range €0.015 to €0.025 per MHz per capita is appropriate for the setting of the minimum price, with the higher end of the range applying to urban areas and the lower end applying to regions that do not have specific urban areas identified

3.6GHz band reserve prices

Vodafone are strongly of the view that the reserve prices indicated by Comreg in this consultation are excessive. This spectrum will be required to support broadband services in rural areas. In order to maximize use of this band and hence support the government objectives of supplying services to these areas at minimum cost it is imperative that this spectrum is effectively utilized.

While we agree that the 3.6GHz band could accommodate a variety of possible uses, including fixed wireless applications, nomadic wireless services, and possibly some additional capacity for existing mobile operators, the propagation characteristics of the 3.6GHz band will ensure that this band is used principally for FWA type services and the consideration of a suitable price for the band should be driven by this usage rather than by comparison with other frequency bands capable of supporting wide area mobile coverage.

There is a risk that Comreg will artificially distort prices upwards by not publishing a program of auctions for true mobile spectrum that we expected to be auctioned in the near future, the 2.6, 2.3, and 1.4 GHz band and the 700MHz band. It is very important that in advance of a 3.6GHz auction Comreg should publish a clear schedule for these other auctions - otherwise they will artificially create a spectrum shortage.

Given the low potential of the 3.6GHz band to support a wide-area mass-market mobile network we believe that Comreg have chosen an excessively high minimum value – this is likely to lead to unassigned spectrum even though there might be demand for it.

We would proposed that the minimum cost is too high by a factor of about two, a more realistic price would be €0.007 to €0.015

We have broken the arguments against the price selected by Comreg in to a number of sections and analysed ComReg's arguments against these headings.

- **Technology**
- **Propagation**
- **Timing of benchmarked awards**
- **Non-European benchmarks**
- **Comparison with FWA**
- **NBP**

Technology

We believe that Comreg have erred in comparing the value of this band closely to the 2.6 and 2.3GHz bands. Comreg attempt to justify this comparison by identifying that LTE technology will be available in the 3.6 band. This is a key error. Although LTE will be used in the 3.6 GHz band the propagation characteristics of this band will not support the implementation of wide-area mobile coverage. The benchmark value of 2.6/2.3Ghz would only be a reasonable indicator of the value of 3.6GHz if they can offer similar services. The uses of the 3.6GHz band will in practice compare most closely to FWA products, and comparison should be made to the other bands used for FWA which typically have lower value than bands used for mobile.

We agree that the use of this band will likely to be TDD. Comreg acknowledge that the WiMAX networks that potentially move to LTE will use this band for fixed wireless applications but fail to add the conclusion that the value comparators should be against other FWA spectrum and not against mobile networks.

The use of the LTE air-interface will not materially increase the value of the band - these operators are still offering services that compare most closely to fixed services.

Using a set of benchmarks against 2.6GHz is therefore faulty - as the service being provided by mobile operators is significantly different to FWA type services. For mobile operators the costs of providing wide-area coverage (for instance on roads) are considerable, and mobile operators expect to charge a premium to cover these costs. These higher costs and higher revenue are not available to an operator in the 3.6GHz band – irrespective of the technology being used.

Propagation

The analysis carried out in ComReg's document does not adequately recognize the effect of differing propagation in lowering the relative value of 3.6GH spectrum when compared to 2.3 and 2.6 GHz spectrum.

The experience of auctions in Ireland, and that in other countries, point to the value of spectrum being very heavily driven by these propagation characteristics of the band being auctioned

In the recent MBSA auction the value of 800MHz and 900MHz spectrum was double that of the 1800 MHz spectrum (both in reserve price and auction result). This fairly reflected the different value of these two bands to operators.

Similarly, for propagation reasons alone, we would expect the value of 2.6GHz spectrum to be double that of 3.6GHz spectrum. ComReg's analysis does not adequately reflect this difference in value.

FWA comparison

Comreg's attempt to compare the current cost of FWA licences with their proposed Reserve price and conclude that they are similar if applied to a nationwide licence.

This analysis is completely incorrect.

The analysis compares the nominal FWALA licence radius of 20km with the total state area.

This is not useful comparison. In practice FWALA operators 'cherrypick' locations that have both good coverage and a high target population. They could not economically replicate these sites to provide 100% coverage at these licence fees given the wide variety of population densities in the state.

It is also significant that the numbers of FWA customers is very low and declining. Clearly it is not economic to provide a nationwide service at the current licence fees.

Alignment with the NBP.

More consideration should be give the Governments desire to implement the National Broadband Plan.

Based on ComReg's proposals it would cost almost € 6m for a nationwide 50MHz licence. This is a very significant cost in the context of providing services to areas with low densities of customers, e.g. the most remote 5% of customers discussed in the latest DCENR consultation documents.

An excessive price for spectrum will distort the choice between wireless and wired solution to serve these customers.

Available international benchmarks

The benchmarks chosen by Comreg include a number of benchmarks from outside Europe. These values may not give a fair indication of spectrum values of spectrum in European countries. In markets outside Europe poor availability or high price of fixed lines can contribute to high values of spectrum capable of providing an alternative service. Benchmarks from these countries are not comparable without analysis of the total telecommunications market in these countries.

Regionalisation of reserve prices

The regions marked in ComReg's document currently do not align with the draft in Dept of Communications consultation. Clearly the regions used in the licence process must align with whatever process is used in the NBP tender processes.

Excluding the major cities seems to be the best option as the application and use of the spectrum in these areas is likely to be different

Differences in the value per capita across regions

In ComReg's valuation process they expect urban regions to command a higher spectrum price than other regions and have applied an uplift to the price for licences in urban regions relative to non-urban areas - a similar 'downlift' should be applied for rural areas

Adjusting for population flows

The process proposed by Comreg for adjusting urban and rural spectrum value is overly complex and unnecessary. If there is different value then auction outcome should determine this.

The benchmarks from other countries have not been adjusted to reflect different demographics in Irelands, and we should not try then to make adjustments within the country.

- the population of each of the regions under Option 2 should be adjusted to take account of the commuter flows between the five identified cities and the other applicable regions

This seems like an overly complex approach. The auction should find any difference in values.

A7.3 Chapter 6 Consultation Questions

- A 7.5 Do you agree with ComReg's preliminary views set out in Chapter 6 and, in particular, that:

agreed

- rights of use in the band should be awarded on a non-exclusive basis;

agreed

- an obligation to notify of the termination of a technology should apply

agreed

- a rollout obligation should apply for spectrum rights of use in this band and that such an obligation should be based on a minimum number of base stations to be deployed per sub-national region;

agreed - this should be set at a low number.

- a quality of service obligation should apply in relation to each of network availability and voice call standards;

agreed

- licensees should internalise guard-bands as spectrum should be assigned without guard-bands;

agreed

- a default TDD frame-structure based on TD-LTE configuration 2 (3:1) should be applied to incentivize inter-network synchronisation;

agreed

- a permissive BEM should apply to synchronised networks and a restrictive BEM should apply to unsynchronised networks;

agreed

- the terminal station in block power limit set out in the 3.6 GHz EC Decision should be relaxed for fixed outdoor installations

agreed

- at regional borders a coordination threshold should apply to allow for bilateral/multilateral co-existence agreements; and

agreed

- where agreement in cross-border coordination fails to be met, the coordination threshold limit should be set as a binding licence condition.

agreed

A7.4 Chapter 7 Consultation Question

- A 7.7 Do you agree with ComReg's preliminary views set out in Chapter 7 and, in particular, with the following proposals:

Transition Plan.

Principles:

It is Vodafone's view that the assignment of 3.6GHz spectrum in the period after 1 Aug 2017 should be decided by the auction process. The use of auctions to assign spectrum is justified by ComReg's position that the auction process gives a result that most efficiently uses this resource.

In order to achieve a smooth transition of assignments Comreg should ensure that the auction happens in time to allow for all transition activities to happen before the Effective date of the new licences (1Aug 2017).

As identified in the consultation document there are mechanisms, such as sub-leasing, by which an auction winner may facilitate another party in the time after this date. Any such arrangement should be at the discretion of the new assignee.

Comreg has referred to the previous transition plan that was implemented after the 2012 MBSA auction. At that time all four mobile operators were swapping assignments, while offering services before, during and after the process dates. The changes required a high level of co-ordination among operators. The management of transition arrangements in the 3.6GHz band should be more simple than this previous transition, the previous transition was made more complex as the date of the 2012 auction was too close to the first change date (TS1 date). This was the reason for a transition plan which ran past the TS1 date. But this is bad practice. Any transition process should be complete before the Effective date of new licences. This better outcome was achieved with the TS2 changes that arose from the 2012 MBSA. Comreg should plan the auction date far enough in advance to ensure completion of transition before the change date.

Having a strict cut-off for current licences will ensure that Comreg do not generate incentive for current operators not to take part in the upcoming auction. There is also a risk that uncertainty in the position of current player's post 2017 would influence new bidders or even prevent them from bidding.

The end date of current licences has been well flagged, with adequate time for existing operators to make any required arrangements.

- Transition Proposal 1: the formulation of a transition plan for the 3.6 GHz band;

We agree with the formation of a Transition Plan, but the activities should be planned to be completed before the effective date of new licences.

- Transition Proposal 2 :

It may be necessary to produce a Transition protect licence, but the time scale short be short. We suggest not longer than six months.

- Transition Proposal 3: the Transition Unprotected Licence.

We would not agree with the proposal to generate a Transition Unprotected licence. This compromises the auction which should generate the best option for customers. This could also provide incentive to ComReg to artificially set higher minimum process in the auction.

Comreg have the opportunity to organise the auction to produce efficient assignments post auction. Certainly a proposal to form any transition plan running to five years is unreasonable.

We would argue that Comreg do not need to take any extraordinary steps to protect current customers:

There are few customers using this spectrum, 27,000 customers, a very small number of users/MHz compared to other bands.

Both UMTS900 and 4G at 800MHz have been rolled out to many parts of the country in the last two years. Many of the existing FWA customers could now get an alternative service.