The UK Wireless Internet Service Providers Association

Response to the Consultation, "Enabling Opportunities for Innovation"

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Abstract — The UKWISPA response to the Ofcom Consultation "Enabling Opportunities for Innovation". UKWISPA request more power for terminal stations and more power for base stations in very rural locations.

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1 Introduction

UKWISPA welcome the opportunity to contribute to the debate surrounding the consultation 'Enabling Opportunities for Innovation'. UKWISPA fully support the change of heart demonstrated in this document by Ofcom and hope that the changes proposed can be brought to a speedy conclusion to support the wireless broadband industry while fibre delivery is not available to rural communities.

Although this response has been written by UKWISPA, INCA also support the views expressed here on behalf of their members. The large majority of Wireless Internet Service Providers (WISPs) are represented by the two trade bodies of UKWISPA and INCA.

The consultation explores the possibility of enabling innovative use of spectrum which might be owned by a mobile operator in areas where the mobile operator is not using, or expecting to use, the spectrum in the next 3 years. Section 8 of the consultation document appears to be a late addition and the responses given by UKWISPA assume that the questions are applying to the spectrum from 3.4 through to 4.2 GHz.

The key application for Wireless Internet Service Providers (WISPs) in this band is Fixed Wireless Access (FWA) and thus the answers are referring to the needs of operating FWA systems in rural areas where we do not expect the mobile network operators (MNOs) to deploy extensively or even at all using these bands. The likelihood is that the MNOs will only deploy using these frequencies in the 10% of densely populated areas, leaving 90% of the landmass free for WISPs to use this spectrum to supply super and ultrafast broadband to rural communities. The technology is available for use today and is supplied to at least 60 countries using these frequencies. The technology available is very advanced and enables the highest spectral efficiency using Multi-User MIMO. The base station capacities in 40 MHz bandwidth are more than 1 Gbps shared across many users with full capacity available to terminal stations in ranges up to 20 km.

This paper looks at the conditions for using that spectrum for Fixed Wireless Access and recommends some small changes, particularly to the EIRP allowed for terminal stations. An increase to the maximum EIRP allowed for base stations would also be useful particularly for use in the very low population density areas where the range of cells is most important.

2 Fixed Wireless Access

3 GHz Spectrum is particularly useful for Fixed Wireless Access (FWA) because:

- there are higher powers available than in 5 GHz,
- the propagation loss through trees is much lower,
- there is equipment manufactured for global markets in this frequency range,
- the cost of such equipment meets the expectations of service providers (WISPs) to be able to make a business,
- there would be lower interference in these frequency ranges than is available in the Light Licensed bands, and
- the latest radio techniques are available to give very high point to multi-point capacities at the highest spectral efficiency.

Enhancement of the business case for WISPs will improve;

- consumer choice for broadband provision,
- broaden the area of the country where superfast and ultrafast broadband are available,
- easier to find suppliers to provide USO, and
- reduce the digital divide.

The key parameters are discussed in section 5 of the consultation document. Figure 5 of the document is reproduced in figure 1

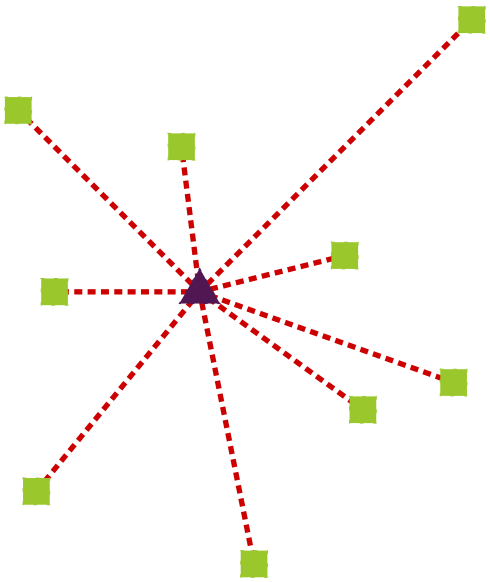

Figure 1 FWA deployment

For FWA the ranges over which high throughputs are possible are up to 50 km in Line of Sight (LoS) conditions. Although this may be unusual there could easily be conditions in Scotland where this can be true. In a 40 MHz bandwidth the delivery could be as much as 150 Mbps simultaneously to multiple terminals at this range, further reducing the digital divide in remote areas.

For the Scottish R100 program this represents a significant improvement for delivering on the promise to the last 5% of the country.

2.1 The Details

§3.14 There may be some equipment that can be tuned into the 3.8–4.2 GHz band but this will always be a more expensive UK-only band than 3.4–3.8 GHz. Low cost 3.4–3.8 GHz devices are already available from the mobile technology of 5 years ago. It will take another 5 years before low cost devices suitable for FWA will be available in the

3.8–4.2 GHz bands. We strongly agree with the other points about FWA that FWA could offer more cost effective delivery of wireless broadband in rural areas where fibre is not available or too expensive to install. The spectrum from 3.4–3.8 GHz could complement the 5.8 GHz band and provide additional coverage from one site, or reduce the number of sites to support broadband delivery.

§3.25 UKWISPA support the view that Ofcom should manage shared access to this spectrum including 3.4–3.8 GHz.

§5.5 The medium power license has lower power than would be ideal for rural broadband. User densities are often extremely variable and while in some cases the base station power (42 dBm EIRP) is excellent, in other low density areas a higher power, as permitted in United States (52dBm EIRP), would be very beneficial. It is likely that the equipment will be standard across the world and will thus support higher EIRPs. UKWISPA encourage Ofcom to consider allowing higher powers in some circumstances.

§5.7 23 dBm is a very low EIRP for terminal stations in a medium power base station environment and would make Fixed Wireless Access unusable. At the presentation at Ofcom on this subject, the cited reason given was for the simplicity of interference planning. Since there are expected to up to 100 times as many terminal stations as base stations Ofcom do not want the additional cost of licensing terminal stations. The next section makes a proposal for consideration.

§5.9 UKWISPA supports that there should be no height limits for medium power base stations

§5.11 3:1 frame structure is unduly limiting and unnecessary in the long range Fixed Wireless Access case.

2.2 Terminal Stations

As stated above, 23 dBm EIRP is an extremely low power for terminal devices used in FWA applications. In 5.8 GHz, 36dBm EIRP is allowed and is demonstrably necessary. The power is required because the link budget in FWA needs to be balanced since the instantaneous upstream data rate must be approximately the same as the instantaneous downstream data rate. Although the average data rate in each direction is normally asymmetric it is normally set and required to be about 6:1. Since the system is Time Division Duplex (TDD), if there is insufficient link

budget in the upstream direction then there needs to be more time allocated to the upstream which limits the downstream average capability.

Before considering the terminal station EIRP specification, it is worth considering the categories of device which needs to be protected. There seem to be Satellite Earth Stations and Point to Point links. The Point to Point links are of long range and $\geq$6ft antennas. The beamwidth is less than 2° and there is normally a well defined azimuth specification from boresight. The Satellite earth stations have even narrower beamwidth but sweep wide angles.

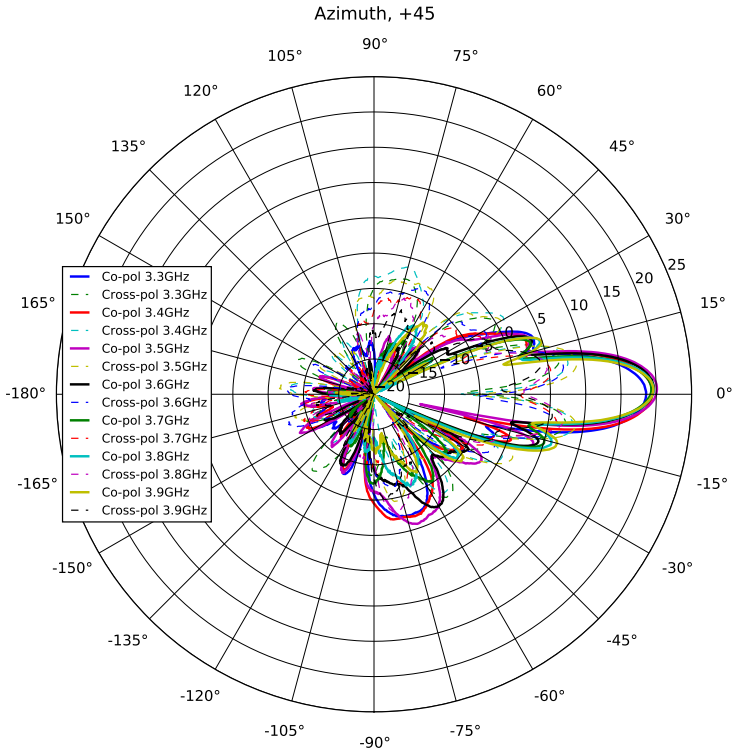

Figure 2 Typical Antenna Pattern at 3.5GHz for a high gain low cost 20dBi terminal antenna

In our view, consideration should be given to increasing the the terminal station EIRP to the same value as the base station EIRP. At this EIRP, the antenna gain is likely to be $\geq$20dBi which ensures that no more power is radiated towards the protected user than from the base station unless the base station is non line of sight and the terminals are line of sight. Ofcom could specify a boundary where high power terminals could be situated assuming that they are pointing directly at the base station assuming the maximum height of terminal stations is 10m.

Figure 3 Diagram illustrating a Protected Service

The antenna pattern shown in figure 2 is a 20 dBi terminal station antenna in the 3.5 GHz band. If this were to be transmitting at an EIRP of 42 dBm then the EIRP outside an azimuth range of ±27° would be lower than 23 dBm. One can imagine specifying the antenna azimuth pattern to correspond to the maximum power outside ±27° to be lower than 23 dBm EIRP as suggested and then allowing up to 42 dBm EIRP at the peak of beam. Since these terminal stations are further from the protected source than the base station, the likelihood of interference is lower unless the terminals have closer to line of sight propagation to the protected service while the base station path is non line of sight.

Figure 2 shows the pattern of a commercial antenna used in this band for subscriber stations. As you can see this antenna has protection of 20 dB for signals outside the ±27° region.

Figure 3 shows a Protected Service which could be a Satellite receiver, a Point to Point link or a Mobile Base station. This Protected Service may be a long way away in the case of Satellite or Point to Point with very high or high gain, but nearby in the case of Mobile Base Stations which typically have low gain antennas and are generally down tilted to face the short range users. In either case the interference direction to that user is very close to the same direction as the FWA base station, and so excluding terrain if the EIRP of the terminal station is equal to the base station, there will be no higher interference provided by the terminal station.

In this diagram the shaded area around the base station is the area where there could be extra interference to the Protected Service. Terminal stations in this area can only be a problem when there is better visibility of the Protected Service than the base station has. Thus bounded areas can be provided to the WISP by Ofcom where the WISP is allowed to provide service at full power.

So the proposal from UKWISPA is:

1. Ofcom/UKWISPA define a specification for the azimuth characteristic of terminal antennas,
2. the WISP applies for a license to Ofcom including an area to be covered by terminals at full power
3. Ofcom respond either allowing the whole area to be used for full power terminal stations or define a smaller boundary.

3 The Formal Questions

Question 1: (Section 3) Do you agree with our proposal for a single authorisation approach for new users to access the three shared access bands and that this will be coordinated by Ofcom and authorised through individual licensing on a per location, first come first served basis? Please give reasons supported by evidence for your views.

We agree with your proposals and hope that they are extended to include the 3.4–3.8 GHz bands as suggested in the presentation on February 8th 2019 and in section 8. UKWISPA is looking forward to having access to these lower frequency bands which have better propagation characteristics than the light licensed 5.8 GHz band and higher power available. The detailed reasons are listed in section 2.

Since suitable equipment is already available for use in the 3.4–3.8 GHz bands and rural broadband is a government priority, expediting this process is urgent.

Question 2: (Section 3) Are there other potential uses in the three shared access bands that we have not identified?

UKWISPA does not have any other uses.

Question 3: (Section 3) Do you have any other comments on our authorisation proposal for the three shared access bands?

UKWISPA are pleased that Ofcom have chosen to take control of the licensing but are nevertheless concerned that spectrum owners will not release the spectrum in areas where they should, because there is little incentive for them to do so. UKWISPA are concerned that they will say that they are going to use the bands without a business case to do so.

The implication is that the spectrum will not be released to FWA users until the auction process has been completed. UKWISPA hope that access to the spectrum from 3.4–3.68 GHz which is already licensed can be completed soon after this consultation.

Question 4: (Section 3) What is your view on the status of equipment availability that could support DSA and how should DSA be implemented?

There are a number of manufacturers who support CBRS and as long as the arrangements are not too dissimilar would be able to support the arrangements for the UK. Given the licensing techniques proposed for these bands it is not obvious how DSA would help and UKWISPA would not want DSA to be an excuse for delay.

Question 5: (Section 4) Do you agree with our proposal for the low power and medium power licence? Please give reasons supported by evidence for your views.

Fixed Wireless Access (FWA) requires the medium power (or higher) license for the base stations. The 23dBm eirp for the terminal stations is completely inadequate and unnecessary. Section 2.2 provides reasons.

Since FWA will normally be well separated from mobile users, it is not clear that it is necessary to specify the TDD cycle to be used. The only time that we would expect the TDD cycle to need to be the same is when operating from the same tower in the same band as the mobile users. UKWISPA would not expect this to be a normal occurrence.

Question 6: (Section 4) Are there potential uses that may not be enabled by our proposals? Please give reasons supported by evidence for your views.

If the terminal station EIRP is not raised to the same value as the base station EIRP then Fixed Wireless Access will not be enabled by these proposals.

Coverage in very low population density areas would be improved by allowing higher power base stations where possible. UKWISPA would like Ofcom to give consideration to this.

Question 7: (Section 4) Do you agree with our proposal to limit the locations in which medium power licences are available? Please give reasons supported by evidence for your views.

It seems that the population density dividing line for deciding whether to allow medium power base station is too small. UKWISPA wonder whether the likelihood of any other broadband provision within the license period would be a better determinant. Obviously it is difficult to discover but a village would be upset if they could not get broadband by any method just because they were too big and yet too far from existing provision. I note that §4.17 potentially provides an outlet for any frustrations which may occur.

Question 8: (Section 4) Do you have other comments on our proposed new licence for the three shared access bands?

UKWISPA have commented upon the unnecessarily low power for terminal stations in section 2.2. This restriction would make FWA impossible.

UKWISPA presume that the 3.4–3.8 GHz band is included in the FWA use case as stated in section 8.

Question 9: (Section 4) Do you agree that our standard approach to non-technical licence conditions is appropriate? Please give reasons supported by evidence for your views.

§4.24 says that the duration of the license is 5 years subject to the payment of an annual license fee. This seems contradictory to §1.19 and §8.25.

Question 10: (Section 4) Are you aware of any issues regarding numbering resources and Mobile Network Codes raised by our proposals which we have not considered here?

UKWISPA has no recommendations on this. Delivery of voice circuits and number is normally done by a VOIP provider using the broadband service as a conduit.

Question 11: (Section 5) Do you agree with the proposed technical licence conditions for the three shared access bands? Please give reasons supported by evidence for your views.

As stated in section 2.2 UKWISPA believes that the terminal stations which are connected to medium power base stations be allowed the same EIRP limit as the base station and we cannot see why the power should be reduced.

There are circumstances where the EIRP for the base station will need to be higher than 42 dBm. As an example, in the North of Scotland where the housing density is obviously very low, the economics will be such that the highest base station powers technically available will be appropriate. This would allow 200 Mbps broadband availability more than 20 km from the base site which could be critical. There are other areas where the density is also very low, particularly in the National Parks and West Wales.

§5.11 proposes a 3:1 frame structure. This may be appropriate for mobile applications but would not be ideal for Fixed Wireless Access applications. The need for this as a compatibility with mobile base stations is not obvious particularly when the medium power base stations are not close to any mobile base stations. If the medium power base stations are on the same masts as mobile stations then §5.14 and §5.15 should be sufficient to ensure not interfering with the mobile service.

Synchronisation of upstream and downstream data is very important for facilitating optimum frequency reuse in an area. Essentially it enables the separation of the upstream and downstream interference in a closely packed area almost the same as the interference case of FDD. Unlike Mobile, FWA normally uses narrow beam

terminal antennas. In combination with synchronisation, the spectral efficiency enjoyed by FWA systems is up to 10 times better than in mobile systems. It is not obvious that synchronising with the mobile systems where the mobile terminals are omnidirectional is helpful.

Question 12: (Section 5) Are there other uses that these bands could enable which could not be facilitated by the proposed technical licence conditions? Please give reasons supported by evidence for your views.

The restriction to terminal station EIRP makes FWA unusable. This is discussed in detail in section 2.2.

§5.26 incorrectly states that the license exempt regulations only permit powers up to 23 dBm and suggest that there will be no demand for higher terminal powers. The 5.4 GHz license exempt band allows 30 dBm EIRP and the 5.8 GHz light licensed band allows 36 dBm EIRP. In order to enable longer ranges in this band it would be extremely useful to have terminal EIRP to be equal to the licensed base station EIRP.

Question 13: (Section 5) Do you agree with our proposed coordination parameters and methodology? Please give reasons supported by evidence for your views.

§5.48 states that Ofcom do not propose to consider other base stations of the same licensee since Ofcom considers that the licensee is best placed to manage interference in its own network. The practical application of this policy will require that consideration is given to the applicant asking for a frequency which does not clash with his own frequency reuse plan. It is not clear how this will be allowed for.

§5.52 It should be a regulation that the terminal station should be directed towards the medium power base station. It should also be a regulation that the profile of EIRP emitted from the terminal station in azimuth be below a certain limit and below the licensed EIRP of the medium power base station. Lower powers should be allowed if they fall below the limit line vs azimuth. The limit line should follow the characteristic of a standard good quality 20 dB gain dish antenna.

Question 14: (Section 5) What is your view on the potential use of equipment with adaptive antenna technology (AAS) in the 3.8–4.2 GHz band? What additional considerations would we need to take into account in the technical conditions and coordination methodology to support this technology and to ensure that incumbent users remain protected?

UKWISPA assume that this is reference to the technology becoming available of Multi-User MIMO. This technology ensures that there is no increase in EIRP in any direction. Beam forming ensures that the data for a specific user is radiated towards them while ensuring that there is no interference to the other users who have data arriving at the same time. Since there is no increase in EIRP in any direction, there is no additional interference to the incumbents.

AAS or MUMIMO increase spectral efficiency and so they must be a desired technology but in some cases the density required should not mandate AAS.

Question 15: (Section 5) Do you agree with our proposal not to assign spectrum to new users in the 3800–3805 MHz band and the 4195–4200 MHz band?

While the risk of interference caused in the manner stated is low, the loss of spectrum is also low, and so UKWISPA has no objections.

Question 16: (Section 6) Do you agree with our fee proposal for the new shared access licence? Please give reasons supported by evidence for your views.

There is no obvious error in your assumptions.

Question 17: (Section 7) Do you agree with our proposal to change the approach to authorising existing CSA licensees in the 1800 MHz shared spectrum? Please give reasons supported by evidence for your views.

UKWISPA have no contribution to make to this question.

Question 18: (Section 8) Do you agree with our proposal for the Local Access licence? Please give reasons supported by evidence for your views.

UKWISPA support the proposed licensing process but are concerned about the potential lack of teeth in the process when an incumbent says they are using the spectrum but in reality are not using the spectrum. Have the incumbents agreed to this process? In many areas there are 4 incumbents in the band to be applied for, presumably Ofcom choose the most likely to agree.

It would be useful for Ofcom to find a mechanism to ensure that the MVNOs do supply spectrum to an area when they are really not going to use the spectrum in that area.

Question 19: (Section 8) Do you have any other comments on our proposal?

Nothing further to our answer to question 18.

Question 20: (Section 8) What information should Ofcom consider providing for potential applicants in the future and why would this be of use?

In the case of Fixed Wireless Access, providing coverage to rural villages and towns is an ongoing problem. It would be nice to have summary information available for those interested in deploying FWA for broadband.

§8.12 I assume that Ofcom will try to avoid licenses which will straddle two operators if possible.

Question 21: (Section 8) Do you agree with our proposal to have a defined licence period and do you have any comments on the proposed licence term of three years?

The period of three years is the absolute minimum that is required to make the investment in an area. If the area is sufficiently rural the balance of probabilities will give an idea as to whether the license will be available for longer. In situations where the license is more likely to be taken back into the incumbents hands, can the FWA operator apply to gain access for longer by reapplying for a lower cost after 1 year to keep his three year investment rugged.

Question 22: (Section 8) Do you have any other comments on the proposed Local Access licence terms and conditions?

§8.32 In the same way as the licensee needs to inform the users of the service, the MNO should be required to ask for the service back with some notice period, preferably 2 years. At the three year renewal point the licensee should have every expectation of being able to continue for at least 2 years if he has not been informed otherwise. Maybe 2 years should be 3 years.

Question 23: (Section 8) Do you agree with our fee proposal for the new local access licence? Please give reasons supported by evidence for your views.

The fee proposal is reasonable.

Many of the early questions and statements do not assume that Section 8 applies. I have answered all assuming that they are applying to Chapter 8 3.4–3.8 GHz as well.

4 Conclusions

UKWISPA support this consultation, which offers a higher density of use for the important frequencies from 3.4–4.2 GHz, particularly ensuring that the bands are not sterilised by MNO ownership while the use is unlikely to be used in more than 10% of the landmass.

Ofcom should look towards creating terminal station antenna rules which would enable higher powers to be deployed.

Ofcom should consider allowing higher base station powers in particularly rural areas in order to improve the economics of covering the most broadband deprived populations.