MOBILE COMPETITION ASSESSMENT AND PROPOSALS FOR THE AWARD OF 800 MHz AND 2.6 GHz SPECTRUM

31 MAY 2011

Cable&Wireless Worldwide

NON CONFIDENTIAL VERSION

SUMMARY

Cable&Wireless Worldwide operates its own fixed and mobile converged service using so called GSM / DECT guard band spectrum. This enables us to combine the benefits of fixed and mobile phones with one handset and develop that capability in accordance with our customers' requirements. It is an exciting proposition and our customers want us to succeed. However, devices today require more and more bandwidth and the constraints of our 2G spectrum combined with wifi based data are not adequate for tomorrow's requirements.

This spectrum award is therefore an exciting opportunity not just for us but for the communications industry and all those that rely on it. Ofcom has the difficult job of managing the award to ensure it delivers the benefits that it promises.

Although in some respects the mobile industry is considered to be highly competitive we do not believe it is true in all areas. Certainly some customers do not get what they want and certainly some pay too much for certain aspects of the service they take. Competition has not been effective in controlling the price of international roaming or calls to non geographic numbers. Competition has not delivered convergence as fast as many would have wished. We believe it is vital that Ofcom takes the opportunity that this award presents to stimulate competition in order to drive ever greater benefit for end users.

Low power spectrum provides an ideal opportunity to achieve just that. It is made even more important as Ofcom is not proposing to structure the main award in a way that will ensure there is at least one new entrant. There are many opportunities for investment, innovation and competition based on low power spectrum that will result in more choice and better value for end users. We believe Ofcom should take greater steps to ensure that low power spectrum is made available.

In our response we set out why we believe that:

- It is vital that Ofcom ensures there are at least four operators capable of providing wholesale services on a national scale. We believe that the allocation of sub 1 GHz spectrum is vital for this and Ofcom has not gone far enough to ensure four operators have adequate holdings;

- There is greater value in awarding some 2.6 GHz spectrum for shared use by up to 10 operators than simply providing a little more spectrum to one of the existing operators; Ofcom should structure the 2.6 GHz award in recognition of this. Without that it will be too easy for the established operators to outbid new entrants just to limit their competition; and

- The optimal structure for the 2.6 GHz award is to reserve 2 x 10 MHz solely for shared low power use and then a further 2 x 10 MHz in an adjacent band should be allocated for concurrent low and high power use.

INTRODUCTION

Cable&Wireless Worldwide was established through the demerger from Cable & Wireless plc in March 2010. We are a global telecoms company providing a wide range of high quality managed voice, data, hosting and IP-based services and applications. We serve the largest users of telecoms services, in total about 6,000 organisations, where we aim to help them deliver their goals. Our vision is to be the first choice for mission critical communications.

In 2008 we launched our own Fixed Mobile Convergence ("FMC") product that offers one phone combining the benefits of both mobile and fixed phones. The service operates using low power spectrum in the GSM/DECT guardband awarded to us in 2006 along with eleven other operators.

Our FMC service uses regular GSM handsets fitted with a Cable&Wireless Worldwide sim card. In our customers' offices we deploy GSM pico cells operating over our low power spectrum. These are connected to our core network using IP-VPN connections. While users of our FMC service are in their office environment their phone connects via the pico cell and service is provided over the Cable&Wireless Worldwide network. When the user leaves the office, out of range of the pico cell, their handset seamlessly transfers connection to the national mobile network of our partner and they can continue to use it wherever they travel in the way that they would any other mobile service.

This means users only require one phone, one number and one voicemail. We offer a seamless user experience through a single dial plan. Our customer only has to deal with one supplier. The in building radio network is tailored to the customers specific requirements. Our solution makes life simpler for the customer and we are able to develop it in response to their needs. Our customers have also started to talk to us about the deployment of collaboration services such as 'presence' which enables an employee to understand the status of a colleague. In order to deliver these services in the most effective way it is critical that we are able to deliver to both fixed and mobile devices, which we can only effectively do by utilising our own mobile network. Our customers like what we have to offer and they really want us to succeed.

However the world is moving on and voice and low bandwidth data are no longer adequate. For example, one of our customers wants to deploy a large number of iphones and ipads and to use these devices to drive productivity via the deployment of a range of applications. Customers need higher bandwidth data delivered using the security and reliability of a mobile network rather than using wifi over unlicensed spectrum. Our spectrum, 2 x 3.3 MHz, is not sufficient to operate 3G and would not provide adequate bandwidths using 4G. We must obtain additional spectrum if we are to evolve our FMC capability for our customers' requirements of tomorrow.

SPECTRUM RELEASE

The 800 MHz and 2.6 GHz award is a fantastic opportunity for the UK. The spectrum will enable higher speed data delivered to ever more bandwidth hungry mobile devices running a vast array of applications. It is Ofcom's duty to ensure that the spectrum is awarded in a way that ensures its

optimal use, in a way that ensures a wide range of communications services can develop and in a way that furthers the interests of consumers, where appropriate by promoting competition.

Ofcom has identified potential benefits that could develop from making low power 2.6GHz spectrum available to a greater number of operators than are likely to be able to win licences for high power spectrum. We believe that low power spectrum offers significant opportunities for innovation and increased competition. Just some of those opportunities are:

- New competitors targeting customers who are not well served by competition today. For example those wanting faster convergence in their fixed and mobile voice, data and IP;
- High quality, high security and high speed data solutions with a user experience that is not achievable using wifi over unlicensed spectrum;
- The possibility of single femto cell solutions that will be capable of handling phones from a variety of national networks without users being forced to consolidate onto a single provider or deploy multiple femto cells;
- An independent market for RAN offload in places of high demand that could be offered on an open access basis; and
- An affordable wireless solution for providing high speed data coverage in rural areas.

Low power spectrum has been awarded before. In 2006 Ofcom awarded 12 licences in the so called GSM / DECT guard band. We recognise that this award can only be considered a partial success in as much as, as far as we are aware, only three commercial services have been launched using that spectrum and only two continue to operate. Our FMC service is one of those. However, we do not believe the limited use of that low power spectrum is an indicator that low power spectrum will not be successful now:

- The award in 2006 was a 2G only award made at a time when 3G was already in service and being rolled out at pace. For some 2G was already yesterday's technology. In this case the low power award for 4G capable spectrum is being considered at the same time as the high power award that will support the majority of 4G; and
- The technology for low power base stations, pico cells and femto cells, was in its early days whereas today it is far more established and developing all the time. See for example the Femto Forum[1] founded in 2007 to promote femtocells and femto technology and the 3GPP LTE Release 10 standard development which is focused heavily on small cells, heterogeneous network and cell relaying capabilities.

We therefore believe that the role of small cells in 4G with the use of spectrum on a shared basis will increase network deployment with disruptive business models to a level far greater than that which the industry has witnessed so far in GSM/DECT guard band.

[1] www.femtoforum.com

Of course the established mobile network operators will believe that they are in the best position to develop services using low power technology that they can do within their licences for high power spectrum. However that is the point, they will have the ability to develop these services whether or not some spectrum is dedicated to shared low power use. Even greater benefit will result if it is not just the existing four mobile operators who develop services using this technology but instead multiple new entrants invest too. Some of the disadvantages of leaving this solely to the big national mobile operators are:

- The big operators naturally focus on the mass market and the biggest opportunities but that means some customers end up not being well served;
- Even with the supposedly high levels of competition in the mobile market, history has shown us that prices for some services still end up being vastly above any level that could be justified by the cost of provision. E.g. international roaming or calls to non geographic services;
- The focus of these operators is normally to encourage customers onto their network and to consume their bundles of services whereas for in-home and in-building networks there is more advantage from network independence to avoid the need for either all users to use the same network or the deployment of multiple low power cells.

We believe the case for dedicating spectrum for low power use is clear and there are plenty of benefits, but it is made even more important given that it is possible that without it there will be no new entrants arising out of this auction. Unlike in the 3G auctions in 2000 Ofcom is not reserving any of the high power spectrum for a new entrant. Instead the requirement to produce four operators with spectrum holdings capable of enabling them to be national wholesalers could be met by the existing mobile network operators. Given the importance of 4th generation based services it is easy to see how those operators could take into account the value of the whole of their existing businesses when considering the price they would be prepared to pay, making it very hard for any potential new entrant to succeed.

We also believe that dedicating spectrum for low power use is absolutely in line with Ofcom's duties. Following this award there will be over 600 MHz of spectrum in the UK allocated for public mobile communications services and it is likely that the vast majority will be shared amongst only four holders. If Ofcom dedicate 2 x 10 MHz of 2.6 GHz spectrum for shared low power use that will represent only just over 3% of spectrum for mobile communications and with have the potential to support up to 10 new operators into the market. There is no good reason for limiting the whole of this valuable resource to just four operators and the opportunity to allocate just a small amount to others is sure to drive investment, innovation and competition which will be beneficial to all consumers of communications services.

ANSWERS TO OFCOM'S QUESTIONS

Question 4.1*: What use, if any, would you make of the top 2x10 MHz of the 800 MHz band in the second half of 2012 if it were available for use? What would be the benefits for citizen and consumers of such availability?*

No comments

Question 4.2*: If we were to offer shared access low-power licences in some way, do you have any comments on the appropriate technical licence conditions which would apply for the different options?*

Cable&Wireless Worldwide have studied the three low power frequency band plan packaging outlined in section 8 of the consultation document, i.e. band plan 1 (2*10MHz dedicated for low power use only), band plan 2 (2*10MHz concurrent low power and high power), and band plan 3 (2*20MHz concurrent low power spectrum with 2*10MHz are for low power use only and 2*10MHz are for high power use with low power as an underlay). In this case, we see that the appropriate technical conditions must encompass the following elements:-

1. Agreement on coordination principles
2. Coordination toolset
3. Technical coordination between low power operators
4. Technical coordination between low power and high power macro operators

Coordination principles

All low power operators must agree to develop an engineering code of practice for technical coordination and adhere to the set of coordination principles as set out below:-

1. To ensure the efficient use of radio spectrum such that base station and antennas can be installed, sited, used and transmit in a manner that will allow services in the permitted frequency and time resource of the adopted next generation mobile services (LTE or WiMax), whether similar, competing or otherwise to be deployed in nearby premises

2. To avoid causing interference to other low power operators by adopting effective interference mitigation techniques relevant to the adopted next generation mobile services (LTE or WiMax) – see *Technical coordination between low power operators* below for more information

3. (In the case of band plan 3) To avoid causing interference to high power operator by adopting effective interference mitigation techniques relevant to the adopted next generation mobile services services (LTE or WiMax) – see *Technical coordination between low power and high power operators* below for more information

4. Selection of sites in a manner that will minimise the probability of interference

5. Installation of base station and antennas within customer premises in a manner that will minimise the probability of interference

6. Efficient use of radio frequency and time resource by not using more such resource than are necessary to service customers

7. Arrangement and exchange of communication information between companies to facilitate engineering coordination

Coordination Toolset

An appropriate measure will be to provide a set of tools to operators to facilitate coordination efforts. The tool can be a members-only web portal that provides access to a coordination database which allows members to perform a number of functions:-

a) Ability to add, change or delete cell information that captured the following:-

- Cell location information (latitude/longtitude, post code, grid reference, easting/northing)
- Deployment scenario (Indoor, outdoor, building name, floor number, number of floors)
- Antenna height
- EIRP
- Status (live, inactive, dormant)
- In service date/time
- Contact person
- Radio technology

b) Ability to search for nearby low power cells at specific location,

c) Ability to export of database, and

d) (In the case of band plan 3) Ability to search for nearby high power cells at specific location.

Technical coordination between low power operators (assuming LTE is the chosen RAN technology)

With the aid of the coordination database as mentioned above, the technical coordination between low power operators could be as simple as agreement to use distance separation and adjustment in power levels at particular target location. Despite this, some form of interference mitigation

technique will need to be put in place in the case where such coordination is not possible, e.g. huge overlap of target location. In this instance, Table 1 below outlines the proposed technical coordination scheme assuming LTE is the chosen RAN technology. It works on a first-come-first-serve basis where the early operator has the priority to (a) use higher bandwidth spectrum to reduce unused sub-band and to avoid spectrum wastage, and (b) use the lower sub-band on the basis of interference avoidance with S-band radar receivers.

Number of low power operators that can co-exist	Usable channel bandwidths per operator	Frequency band plan combinations	Coordination scheme
With 10 MHz low power spectrum			
1	2*10 MHz	2*10 MHz	Early operator will have the opportunity to use the full 10 MHz spectrum
2	2*5 MHz	2*5 MHz + 2*5 MHz	Early operator will use the lower sub-band
3 or more	2*5 MHz, 2*1.4 MHz	*3 operators*: 2*5 MHz + 2*1.4 MHz + 2*1.4 MHz *4 operators*: 2*5 MHz + 2*1.4 MHz + 2*1.4 MHz + 2*1.4 MHz *5 operators and above*: All operators will use 2*1.4 MHz of spectrum	▪ The earliest operator will have the opportunity to use the higher bandwidth (5 MHz) spectrum ▪ Early operator will use the lower sub-band ▪ Later operator will use sub-band above the last active upper sub-band ▪ Up to 7 operators can be accommodated
With 20 MHz low power spectrum			
1	2*20 MHz	2*20 MHz	Early operator will have the opportunity to use the full 20 MHz spectrum
2	2*10 MHz	2*10 MHz + 2*10 MHz	Early operator will use the lower sub-band
3	2*10 MHz, 2*5 MHz	2*10 MHz + 2*5 MHz + 2*5 MHz	▪ The earliest operator will have the opportunity to use the higher bandwidth (10 MHz) spectrum ▪ Early operator will use the lower sub-band
4	2*5 MHz	2*5 MHz + 2*5 MHz + 2*5 MHz + 2*5 MHz	▪ Early operator will use the lower sub-band
5 or more	2*1.4 MHz	*5 operators and above*: All operators will use 2*1.4 MHz of spectrum	▪ The earliest operator will have the opportunity to use the higher bandwidth (5 MHz) spectrum ▪ Early operator will use the lower sub-band ▪ Later operator will use sub-band above the last active upper sub-band ▪ Up to 10 operators can be accommodated

Table 1. Table showing frequency band combinations and the appropriate technical coordination between low power operators.

The technical coordination scheme in Table 1 relied on the frequency partitioning as frequency mitigation technique to avoid co-channel interference between low power operators. This technique is chosen due to its effectiveness to ensure:-

- there is no overlap on control channel particularly the common, broadcast and synchronisation channels that are positioned in the centre resource blocks of every 180 kHz subcarrier, and
- sufficient data channel protection

Cable&Wireless Worldwide have studied other interference mitigation techniques such as time slicing and carrier offset that are aimed to create orthogonality in control channels. However, Cable&Wireless Worldwide have doubts on the effectiveness of these techniques due to its complexity. Furthermore, these techniques will significantly increase the amount of coordination efforts between low power operators in terms of inter-network synchronisation and matching base station capabilities. We therefore believe frequency partitioning is a good compromise between performance trade-off and simplicity of coordination efforts.

Technical coordination between low power and high power operators (assuming LTE is the chosen RAN technology)

Co-channel interference mitigation techniques will be required for the band plan 2 and 3. In this case, the Self Organising Network (SON) developed by 3GPP and Femto Forum is a promising technique that offers control and data channel protection for high power macro operators provided a low power cell (e.g. HeNB) is capable of taking air link measurements from a number of different sources as shown below:-

i. DL channels from neighbour macro eNodeB's to determine the average Reference Signal Received Power (RSRP) across multiple MIMO antennas of each macro eNodeB to judge whether it is near the center or at the edge of the macro eNodeB coverage

ii. UL channels from macro UE's to estimate the RSRP of UL interference caused by macro UE transmitter

iii. UL channels from home UE to estimate the RSRP and path loss from home UE towards selected macro eNodeB as determined in (i)

iv. DL channels from itself towards macro UE to estimate the RSRP of DL interference caused by itself towards the macro UE as determined in (ii)

The aim of taking these air link measurements is to ensure all relevant input parameters are taken into consideration for SON to execute dynamic power control and resource scheduling on the low power HeNB. Cable&Wireless Worldwide is confident that the use of SON and further work undertaken by 3GPP Release 10/11 can provide effective interference mitigation solutions by the time commercial 4G service is launched in 2012/13. This would give strong confidence to the high power operator that the performance of its macro network and users (macro UEs) are protected

whilst allowing the low power operators to offer a good level of service to its own users in a way similar to their heterogeneous deployment of layered cell architecture consisting of macrocell and Femtocell. To aid the process, the coordination database could be used to identify areas where SON operations are most needed and closely monitored. Subject to mutual agreement, a low power operator could also dynamically alter its Closed Subscriber Group (CSG) status to hybrid access mode so that a macro UE is allowed to temporarily use its low power cell in the event where the potential for interference is very high.

In the coming months, Cable&Wireless Worldwide will conduct further study into SON and heterogeneous network (Het-Net) in 3GPP and Femto Forum standards and will share our findings with Ofcom in due course.

Question 5.1*: Do you agree that national wholesalers need a reasonable overall portfolio of spectrum to be credible providers of higher quality data services? In particular, do you agree that national wholesalers need some sub-1 GHz in order credibly to be able to offer higher quality data services? Please state the reasons for your views.*

Yes, we do agree a national wholesaler would require a reasonable portfolio of spectrum including sub-1 GHz spectrum in order to have credible offering. Sub-1 GHz spectrum provides significant advantages for both wide area coverage and building penetration and both of these capabilities are important for end users and hence important for providers.

[Confidential material removed]

Increasing the number of base stations can help to address the coverage and building penetration issues that exist with the higher frequency bands but we do not believe that is a sustainable solution for 4th generation data networks. Firstly we doubt it will be economically viable to deploy sufficient base stations to address the issue that exists today in the most rural areas. However we believe it will go further than that as the requirements of 4G mean that much greater bandwidths will be required in the backhaul between base station and switching centre and it may not be economic to provide sufficient bandwidth to all the existing base stations. Whereas many of today's base stations are served using copper based infrastructure in the last mile that will not support the data rates required by 4G and the upgrade to fibre will often be expensive.

The overall portfolio of spectrum is also important. If a national operator is to have the capability and incentive to offer services on a wholesale basis they must not feel their capacity is constrained. Selling on a wholesale basis enables an operator to build scale that will deliver cost advantages in the whole of its business but the capability to expand capacity is essential and significant discrepancies between the ability of operators to expand capacity are likely to lead to inefficiencies in the wholesale market.

Question 5.2*: Do you agree there is a material risk of a significant reduction in the competitive pressures, at least to provide higher quality data services, in retail and wholesale markets without measures in the auction to promote competition? Please state the reasons for your views.*

Yes, we believe that some sectors of the market are not served as well as they might be today and Ofcom should be taking steps to increase the levels of competition. However, the risk is that without any safeguards competition may actually reduce as, just as was perceived in the 3G auctions, 4G is seen as an essential capability for anyone wishing to offer mobile solutions in the future. The future of whole businesses rests on the outcome of this auction and with stakes that high it is only natural that bidders will be looking at the effect on their competition as well as just their own capability. The power of the existing mobile operators is such that without measures designed to encourage greater competition it is quite likely that the outcome will be reduced competition.

Cable&Wireless Worldwide's experience of developing a fixed and mobile converged service aimed at the corporate market is relevant. Our customers are very interested in the capability; they really want it to be successful, because they do not feel they are getting what they want from competition in the mobile market today. That does not mean the mobile market is not competitive, at the macro level it clearly has been, but the level of competition is less effective in certain areas of the market. International Roaming has been the clearest example of this and several rounds of regulation have been necessary to protect the interests of consumers. As in the case of international roaming we believe regulators should seek ways of addressing competition issues through structural measures to encourage competition. Sometimes regulation is necessary but few cases are as clear as the situation was with international roaming and so regulation will not always be viable. We believe Ofcom's focus should be on how to make competition stronger and merely seeking to avoid a significant reduction of competition is not adequate.

[Confidential material removed]

Question 5.3*: Do you agree there is a risk of potentially beneficial sub-national RAN uses not developing without measures to promote competition? Please state the reasons for your views.*

Yes, there are two essential criteria for sub-national RAN uses to develop that are heavily impacted by the way Ofcom conducts the auction:

- bidders must be able obtain spectrum cost effectively. Sub national RAN solutions provide a way for operators to address specific parts of the market without the huge investment required to become a national operator. Such solutions should prove valuable in addressing parts of the wider mobile market that are not getting what they want from competition among the national operators;

- sub-national RAN operators will normally need to partner with national operators to provide full coverage and a vibrant wholesale market for roaming services is essential. Ofcom must ensure strong competition amongst the national operators if such wholesale capability is to develop.

It is in the interests of the established mobile operators that such competition does not develop as it will impact their business in terms of the pressure to develop new capability and pressure on price. They also have the resources to outbid the sort of bidders who see low power solutions as being an affordable way of targeting specific segments of the market.

We believe that sub-national RAN uses would be beneficial for end users. Particularly in a scenario where Ofcom is not seeking to specifically encourage any new entrants into the national mobile market[2] sub national new entrants could provide valuable innovation and competition in the market. As a result there could be more value to society from awarding a number of low power licences to various investors rather than awarding it to an existing operator who already has sufficient spectrum to be considered to be a national wholesale operator.

Question 5.4*: Do you agree with the analysis that at least four competitors are necessary to promote competition?*

We refer to our answers to questions 5.1 to 5.3 above, we consider four competitors to be the minimum required to promote competition.

Question 5.5*: Do you agree that the specific measures we propose to take to ensure there are at least four holders of such spectrum portfolios are appropriate and proportionate?*

No, we do not believe that Ofcom has done enough to ensure the sub-1 GHz spectrum is distributed amongst the four national wholesale operators. Under the proposed approach to create four national operators each one only requires 2 x 5 MHz of sub-1 GHz spectrum in order to be considered as such. This, along with the proposed caps, means that Vodafone and O2 could each end up with 2 x 27.4 MHz of sub-1 GHz spectrum while two others have only 2 x 5 MHz each. While the Vodafone and O2 spectrum may not be in contiguous frequency bands it would still leave them at a significant advantage compared with the other two wholesale national operators.

Question 5.6*: Given the measures we propose to take to ensure four holders of spectrum portfolios sufficient credibly to provide higher speed data services, do you agree that it would not be appropriate or proportionate to introduce a regulated access condition into the mobile spectrum licences to be awarded in the combined award?*

[2] The proposed auction design being to ensure that 4 operators have sufficient spectrum to be considered national wholesale operators when there are already four national mobile infrastructure operators in the UK today

The existence of four holders of spectrum portfolios capable of providing higher speed data services is not sufficient to ensure that competition will serve the market effectively without further regulatory intervention. It is clear that even the existence of five large mobile operators in the UK was not sufficient to prevent additional regulatory measures needing to be taken with respect to international roaming.

We accept that it would not be appropriate or proportionate to include the more intrusive access conditions in the licences at this stage but we believe that Ofcom should impose some transparency obligations from the start.

These auctions provide a fantastic opportunity to stimulate investment and innovation. One way to achieve that would be to encourage a new entrant into the market but under these proposals that is not guaranteed. Instead sub-national RAN solutions have the potential to stimulate competition for the sectors of the market that are not currently getting what they want but such solutions are dependant upon the ability to agree commercially viable partner agreements. The wholesale market today does not deliver. Stimulation of the wholesale market is vital. A transparency obligation that requires operators to publish details of their wholesale offers would help provide that stimulation in a way that is not too onerous and should not deter investment.

Question 5.7*: Do you consider that we should take measures to design the auction to assist low-power shared use of 2.6 GHz? If so, what specific measures do you consider we should take?*

Yes, we believe Ofcom should take measures to design the auction in a way that will assist low power shared use of 2.6 GHz spectrum. We believe Ofcom should allocate 2 x 10 MHz of spectrum specifically for shared low power use and also allow concurrent low and high power use in the adjacent 2 x 10 MHz block.

Why Ofcom should assist low power shared use

In our response above we have identified why we believe that sub national RAN based solutions based upon low power spectrum have an important role to play in stimulating competition and delivering alternatives to customers that are not served well by the competition that exists today. Low power spectrum offers some significant benefits:

- It enables efficient use of scarce spectrum resources. Multiple operators will be able to develop different propositions using the same spectrum resources, potentially ten different operators focusing on their own particular niche solutions rather than one trying to address the biggest priorities that are already well served by others;

- Reduces the barriers to entry encouraging more new entrants. The deployment of nationwide mobile networks is an unreachable goal for all but the very largest organisations not just because of the cost of the spectrum but even more so the network

required. Investment in low power solutions is more achievable and therefore more investors are able to participate; and

- It gives focus to the new technology that can be used to fill in the not spots and provide efficient offload from the macro networks.

Of course the existing mobile operators will believe that they are the best placed to provide all the services that customers want in the most efficient manner. However experience shows that not all customers benefit, some end up paying vastly over the odds for services where there is no logical justification other than it's what the mobile operators feel able to get away with[3]. It is exactly for this reason that the established mobile operators will not want Ofcom to assist low power users. They will not want the extra competition that will naturally focus on the parts of the market where today prices remain high or innovation is slow.

In considering whether to and how to assist low power operators we believe there are two factors to consider:

1. Whether there is more value to society from having multiple low power operators each able to focus on their own particular areas of the market rather than providing a little more spectrum to an existing national operator. We clearly believe that there is. And if so it is simply not enough to take measures that enable potential low power bidders to aggregate their bids in competition with the high power operators. Instead the spectrum should be reserved for low power use or made available at a lower price in aggregate than the best high power bids;

2. The extent to which the established mobile operators will seek to gain spectrum not just because they need it but also to keep other potential competitors out of the market. It is undeniable that established mobile operators have the financial muscle to outbid the sort of potential new entrants that are seeking to develop low power solutions. This too suggests that spectrum should be reserved solely for low power use.

How Ofcom should assist low power shared use?

Ofcom has considered three ways in which it could design the auction to assist bidders for shared low power use:

- Introduce a mechanism to aggregate bids from potential low power users to enable them to compete with high power users;

- Reserve some spectrum solely for low power use; and

- Allow low and high power users to share the same block of spectrum on a concurrent basis.

[3] For example calls to 0800, 0845 and 0870 numbers from mobile phones are often charged at rates that bear no relation to the costs involved.

We do not believe that simply aggregating bids from potential low power users is enough. We have argued above that there is greater value in having multiple new entrants focusing on specific parts of the market that are not well served by competition and in any case we believe the established mobile operators have the incentive and the financial strength to outbid low power operators to keep their competition to a minimum.

If Ofcom sees value in promoting innovation and competition via low power operators then we believe it should do more and one way it could do that would be to attach greater weight to the low power bids than the high power bids when comparing the two. For example Ofcom could require the aggregate of bids for low power spectrum to be at least 33% of the final price for the same amount of high power spectrum in order for it to be allocated to low power use. A benefit of this approach would be that it would enable the auction to reflect the actual interest in low power bids based upon real bids.

The approach favoured by Cable&Wireless Worldwide is that spectrum is reserved solely for low power use. Particularly in the circumstances where the auction is not otherwise requiring any new entrants into the market beyond the four established mobile operators we believe there is real benefit in stimulating the market with low power users and this is the only practical way that Ofcom can ensure that happens.

We have also studied the possibility of allowing low and high power users to share the same block of spectrum on a concurrent basis. We believe this can work with the right technical measures in place and it would enable more efficient use of spectrum. However the network performance achieved under this approach will be heavily influenced by the specific deployment of both the low and high power cells in the area. Whereas there is a high probability that interference between multiple low power operators can be dealt with in such a way that it will rarely impact performance significantly we believe that there will be more occasions where the performance of low power networks are significantly limited by high power networks. As a result this solution is not suitable as the sole solution. Low power operators would not invest and innovate with the level of risk of interference rendering their solution inoperable in some locations. However the approach would work in conjunction with adjacent spectrum that was dedicated to low power use and would serve as a very efficient method of providing greater bandwidths in some locations whilst maintaining the confidence that a certain level of performance could always be provided.

Ofcom's options

On Page 56 of the consultation document Ofcom sets out a number of specific options to assist low power users. We list them here in our order of preference (our preferred options first) :

1. Option 5 – 2 x 20 MHz exclusively for low power use. We list this as our number one choice because this option gives us the ability to get the maximum performance out of LTE equipment and deliver the highest bandwidths to our customers. However we recognise that it would be hard to justify reserving this amount of spectrum solely for low power use;

2. Option 6 – reserve 2 x 10 MHz exclusively for low power shared use with an adjacent 2 x 10 MHz shared between high and low power use. This is the option we believe Ofcom should adopt. It will ensure low power users are able to purchase spectrum and therefore drive

investment and innovation to address parts of the market that are not well served by the existing operators. The use of an additional 2 x 10 MHz of shared spectrum will enable those operators to get the most out of LTE technology performance in a way that drives more efficient use of spectrum rather than limiting that available for high power users;

3. Option 4 – reserve 2 x 10 MHz exclusively for low power shared use. This is the option we believe Ofcom should adopt if it does not opt for option 6. It will ensure that spectrum is made available to new entrants who will target the parts of the market that are not well served. It is the least costly option of ensuring that it is not just the existing mobile operators that win spectrum in this award and invest in 4th generation high bandwidth mobile data services;

4. Option 2a – this is our variation on Ofcom's option 2 to aggregate bids for low power spectrum in competition with high power use for 2 x 10 MHz. In our variation the spectrum would be awarded for the low power use as long as the aggregate bid price made at least a predetermined proportion of the bid price for the high power 2.6 GHz lots. This would assist low power use which we believe to be very beneficial for end users but still ensure that some account is taken of the operator's willingness to invest in such services;

5. Option 2 - aggregate bids for low power spectrum in competition with high power use for 2 x 10 MHz. We believe this option fails to recognise the benefits to end users for increased competition and innovation. It also makes it too easy for the established mobile operators to outbid the low power operators for reasons of limiting their competition rather from the pure value they place on their own use of that spectrum;

6. Option 3 - aggregate bids for low power spectrum in competition with high power use for 2 x 20 MHz. For the same reasons as for option 2 we do not favour this option. In addition, as it reduces the amount of high power spectrum available if it is awarded for low power use it is even more likely that the low power users are outbid; and

7. Option 1 is not really an option given Ofcom's duty to further the interests of consumers and allocate spectrum in an efficient manner. Having previously supported low power and now seen more interested in it within this award it would be wrong to fail to make any provisions for low power users.

Question 6.1*: Do you have any comments on the proposal to include in one of the 800 MHz licences an obligation to serve by the end of 2017 an area in which 95% of the UK population lives, while providing a sustained downlink speed of 2Mbps with a 90% probability of indoor reception? Do you think there is another way of specifying a coverage obligation that would be preferable?*

We support Ofcom's proposals

***Question 6.2**: We would welcome views and evidence on the costs and benefits of imposing an additional coverage obligation focussed on particular geographical areas, and if such an obligation were to be imposed what might be the appropriate specification of geographic areas?*

No comments

***Question 6.3**: Do you have any comments or evidence on whether an additional obligation should be imposed to require coverage on specific roads?*

No comments

***Question 6.4**: Do you have any comments on our proposal not to use the combined award to address existing not-spots?*

No comments

***Question 6.5**: Do you have any comments on our proposal not to impose 'use it or sell it' obligations but to consider including an additional power to revoke during the initial term of the licences?*

We have some concerns over Ofcom's approach on this issue. Spectrum is a scare national resource and it is important that it is used efficiently for the benefit of the UK overall. Ofcom raises some legitimate issues over timing of technology evolution and investment decisions but there are also competitive reasons for holding spectrum un-used, or used inefficiently. One only has to look at the legal arguments that have taken place over the conditions and award of mobile spectrum over the last few years to see the approach adopted by holders of this valuable resource.

Therefore we believe it is appropriate that Ofcom retains some discretion to require spectrum to be sold (or handed back for re-auction with the proceeds being returned to the original holder) in the event that it is not being efficiently used and there is clear demand from others to use that spectrum in the national interest. This should not be a power that is reserved only for the case of mergers and acquisitions but one capable of being used following an investigation by Ofcom.

***Question 7.1**: Do you have any comments on the proposals relating to the duration of the initial licence period, our rights to revoke the licence during this period, the charging of licence fees after the end of the initial period and our additional revocation powers following the initial period?*

No comments

***Question 7.2**: Do you have any comments on the proposal to amend the spectrum Trading Regulations to apply to the auctioned licences in the 800 MHz and 2.6 GHz bands, to include a competition check before we consent to a spectrum trade of mobile spectrum and not to allow transfers that would increase the number of 2.6 GHz low-power licensees?*

Cable&Wireless Worldwide agree with Ofcom's proposals on spectrum trading.

***Question 7.3**: We welcome views on the merits of the proposed approach to information provision; in particular concerning the type of information that may be helpful and any impacts that publication of information might have both on licence holders and the wider spectrum market.*

No comments

***Question 8.1**: Do you agree with the way in which we are taking account of the main factors relevant to spectrum packaging and why?*

Yes

***Question 8.2**: Are there other factors that we should consider to develop our approach to packaging? If so which ones and why?*

Cable & Wireless Worldwide prefers UK-wide lots given the target market segments and the nature of our products and services. However, we are concern with restriction at 2.6 GHz that need to be put in place to avoid interference with S-band radar operators. Cable & Wireless Worldwide fully agreed with Ofcom's view to protect S-band radar as much as possible. But without knowing the rollout programme for S-band radar modifications that is due to commence in 2012 and whether any exclusion zone will be imposed during such period, it will very difficult to rollout services to our customers under such restricted conditions. Therefore, Ofcom should outline the approach that will be taken by CAA and MOD prior to the auction so that interested 2600MHz bidders can judge the practicality of any coordination efforts needed.

***Question 8.3**: Do you agree with our packaging proposals for the 800 MHz band? Please give reasons for your answer*

No comments

***Question 8.4**: Do you agree with our proposal not to allow relinquishment of 900 MHz spectrum and why? Do you have any other comments regarding our packaging proposals for the 900 MHz band?*

No comments

***Question 8.5**: Do you agree with our proposal not to allow relinquishment of 1800 MHz spectrum and why? Do you have any other comments regarding our packaging proposals for the 1800 MHz band?*

No comments

***Question 8.6**: Do you agree with our proposal not to make provisions to include 2.1 GHz spectrum in this auction and why?*

No comments

***Question 8.7**: Which aspects of our packaging proposals for the 2.6 GHz band do you agree with and why?*

We agree with the overall allocation of the band for paired and unpaired spectrum.

Within the paired lots we agree that most of the individual lots can be considered generic. However we have argued that Ofcom should allocate one lot solely for low power use and an adjacent lot to be shared between low and high power users. The implication of this is that one of the high power lots needs to be treated as a specific lot. In fact we believe that in all cases the lot (or even two lots) that are adjacent to the low power lot should be considered as a specific lot. This is because there is value for the winner of the high power lot being adjacent to the low power lot as they can bid for both and give themselves the ability to operate either 2 x 10 MHz at high power or 2 x 20 MHz at low power.

***Question 8.8**: Do you agree with our proposed approach for eligibility points and why?*

Yes, we are happy with Ofcom's approach.

***Question 8.9**: Which approach to reserve prices do you think would be most appropriate to secure optimal spectrum use in the interests of citizens and consumers, and why?*

We think Ofcom's combined approach is likely to be the best approach. An outcome which results in four operators with holdings capable of supporting a national wholesale operator is essential if the market structure is to lead to a good outcome for consumers. However there are risks with this if only four operators are serious about bidding to be this; we think that is unlikely but if Ofcom believes it is a risk then it should take steps to address it.

***Question 9.1**: Do you agree with our proposals for the auction design and why?*

While we accept the auction is primarily designed to address the high power awards of both 800 MHz and 2.6 GHz spectrum we note that it does lead to particularly complex auction design for those whose focus is primarily on low power spectrum.

***Question 9.2**: Do you have any comments on the proposed auction rules as explained in section 9, Annex 9 and Annex 10?*

See our answer to question 9.1.

***Question 9.3**: Do you have any comments on how we should approach the payment of deposits and licence fees?*

We understand Ofcom's desire to secure material deposits that keep pace with bids during the auction but request that, particularly where new entrants are being encouraged, such deposits are limited to a maximum of 25%.

***Question 10.1**: Do you have any comments on our proposal to use 800 MHz price information as derived from the auction to estimate the full market value of 900 MHz spectrum?*

We support Ofcom's approach providing they implement new fees for the 900 MHz spectrum quickly.

***Question 10.2**: Do you have any comments on our proposal to use an average of 800 MHz and 2.6 GHz price information as derived from the auction to estimate the full market value of 1800 MHz spectrum?*

We support Ofcom's approach providing they implement new fees for the 1800 MHz spectrum quickly.

Question 10.3*: Do you have any comments on the proposed approach to convert lump sum amounts into annual payment?*

No comments.