

Consultation on Spectrum Framework Review – Microsoft Comments

Executive Summary

Overview

Microsoft welcomes the Spectrum Framework Review and fully supports Ofcom's increasing emphasis on technology neutrality and licence-exemption. Ofcom is leading the way in Europe in light-touch spectrum regulation and we believe this will lead to greater spectrum efficiency and economic benefits. So the major thrust of our response is to strongly support the direction of the review and most of its specific proposals.

Our main detailed comments relate to licence-exempt spectrum, where we believe that some minor adjustments to the proposed policy will enable citizens to benefit from a wider choice of new applications and industry to increase its productivity via greater technological innovation. These proposals will also help achieve Government's priority of stimulating broadband across the whole of the UK, especially in rural areas.

Specific Proposals concerning Licence-exempt Spectrum

We agree with Ofcom that there is no immediate need to increase licence-exempt allocations at 2.4GHz or 5GHz. However, we believe that to facilitate rural and inner-city broadband access, and more generally to encourage innovation in the UHF TV bands, three of the 8MHz channels being reclaimed from UHF TV should be made available for licence-exempt applications after digital switchover. Such an allocation of 24MHz is well within the 200MHz already contemplated by Ofcom for licence-exempt expansion and is compatible with the weighted percentage splits illustrated in the consultation document.

In addition we believe that licence-exempt use of fallow spectrum (vacant channels) within the pre-switchover UHF TV spectrum should also be permitted. Finally we propose that the use of UHF channel 36 should be reviewed – if made licence-exempt, this would reduce the requirement for licence-exempt capacity within the spectrum to be released by switchover.

Responses to the Specific Consultation Questions

Q1: Are there any other major medium- to long-term spectrum management issues that this review should be considering? Are there any other significant technological or market developments that this review should be aware of when developing its thinking?

We consider that Ofcom has identified the key issues very well, and we are not aware of any other significant technological or market development that the review needs to take into account. For example, the issue of deciding how much spectrum to set aside for licence-exempt use has been clearly highlighted in the review, and the benefits of this model in stimulating innovation clearly noted. Also the arguments for the use of market mechanisms over command and control have been clearly set out, and we strongly support Ofcom's vision that Spectrum should as far as possible be free of technology, policy and usage constraints.

Q2: Do you believe it is useful to publish a compendium of issues? How frequently should it be published? What information should be included?

Microsoft supports the proposed continuation of the Radiocommunications Agency's past practice of issuing a "compendium" of information about issues and changes for each band or user group, including an annotated frequency table. This is important in the interests of openness and transparency and of providing a well-signposted approach to spectrum, giving more certainty in the market. We suggest that publication of the compendium of issues every two or three years should be sufficient, but that the annotated frequency table should be constantly updated and available online. We recommend that this should be available for downloading in a database (machine searchable) format, so that maximum opportunity is provided for information providers and potential users to come up with innovative means of increasing spectrum efficiency.

Q3: Are there any other issues of sufficient significance to merit mention in this document?

We believe Ofcom has correctly identified the four main band-specific issues that are of such significance that they could impact high-level spectrum strategy.

Digital TV switchover is clearly vital since it represents a unique opportunity for re-farming some of the prime spectrum below 1GHz. Our main comments in response to this consultation relate directly to this issue.

The potential for *re-farming military or radar bands* could also be of huge significance, and we welcome the reviews and research that Ofcom is carrying out in support of this.

On *mobile issues*, we strongly support Ofcom's aim to see spectrum available for any application, whether fixed, mobile, broadcast or some convergence of these, with no unnecessary technological constraints and as little use as possible of policy goals such as coverage obligations. For example, we believe that the third generation mobile (IMT-

2000) expansion bands should not be constrained to have to use current 3G systems, but should be free for the use of OFDM technologies like Wi-Max or any other new technology solution.

Concerning *broadband fixed wireless access*, Microsoft agrees with Ofcom that there should not be any regulation specifically aimed at providing an advantage for broadband fixed wireless over other uses of spectrum. Instead, through trading and change of use, we agree that Ofcom should allow potential broadband fixed wireless operators to have access to the widest possible range of frequency bands and technologies.

Q4: Are there important lessons to be learnt from experience in other countries that is not addressed here?

The context of this question in the consultation document concerns spectrum trading. We consider the Ofcom summary of international experience in this area to be adequate. However, we would encourage Ofcom to learn as much as possible from international experience in other areas. One example is the very important FCC Notice of Proposed Rulemaking concerning the use of existing UHF TV bands for unlicensed devices (the “Vacant channels” ruling), about which we say more in response to question 9 below.

Q5: Do you agree with Ofcom’s intent to maximise the use of trading and liberalisation?

Yes, we believe that in the long term this will have a significant impact in increasing the efficiency of spectrum use and enabling innovation.

Q6: Are there other areas, apart from those identified [above], where trading and liberalisation should be restricted? Are there areas identified above where you believe the trading and liberalisation could be fully implemented?

The areas referred to by this question are: satellite, EC harmonised bands, maritime and aviation bands, services operating below 30MHz, all analogue broadcasting, radio astronomy and radio amateurs. In order to maximise the use of trading and liberalisation, we recognise that Ofcom has kept this list of “restricted areas” as short as possible and we support the list.

Our main caution comes from the reference to “EC harmonised bands”. We strongly support Ofcom’s work in leading and supporting moves in the CEPT and the European Commission to make harmonisation more flexible, technology-neutral and dynamic, and would not wish to see the list of EC harmonised bands expand from the current small sample without a very clear cost-benefit justification.

Q7: Do you agree with Ofcom’s approach to providing spectrum for licence-exempt use?

Microsoft agrees with and strongly supports Ofcom’s general approach of light-touch regulation, which, as the consultation document states, biases it towards deregulating access to spectrum where possible and appropriate. However, we consider that Ofcom

should go further in this direction by extending, as the opportunity arises, the licence-exempt model to a wider portfolio of bands at high and low frequencies. We set out below some further comments related to this section of the consultation document.

Benefits of Licence Exemption

There are different costs and benefits of both licensed and licence-exempt regulatory models and so we agree with Ofcom that no one solution is best. To find the right policy result, it is best to have a mix of spectrum regimes and this should apply not just to the spectrum as a whole but in different parts – both high and low frequency.

Both licensed and licence-exempt uses can result in citizen benefit. The combination of the two will likely result in a greater benefit than each individually, in the same way that a public park enhances the value of surrounding owned and leased properties, and the use by residents in the surrounding properties increases the utility of the park.

Unlicensed spectrum is particularly useful when "transactions costs" are not justifiable given the value of the use. For example in many of these applications the benefits for any individual user are relatively small, but when the aggregate number of users is considered the benefits become huge.

As Ofcom recognises in the consultation document, another major benefit of licence-exemption is the encouragement of innovation. A good example is the phenomenon of Wi-Fi, with new applications constantly emerging and annual equipment revenues already exceeding \$2 billion and growing rapidly.

Politeness Protocols

Ofcom recognises in the consultation document that “advanced technology using ‘politeness protocols’ can result in more efficient licence-exempt use and should be encouraged through the appropriate standards bodies”. Microsoft supports this position and we urge Ofcom to follow this work closely because of its substantial policy significance. A well-known example is Dynamic Frequency Selection (DFS), now used to avoid radar operations in the 5GHz band, which was designed as part of the 802.11 standard to ease sharing among unlicensed devices. But other techniques have been developed and are being improved upon. For instance, device manufacturers could cluster their choice of operating frequency so that narrowband operations are separated from broadband operations; devices might observe a common power spectral density limit (i.e., less time on the air would mean more power); devices could employ listen-before-talk techniques; and/or the maximum time a station can transmit or otherwise occupy the medium could be limited.

Such protocols could significantly increase spectrum efficiency and quality of service, and so Ofcom should take a close interest in them, even if not directly involved in their enforcement.

Q8: Is Ofcom’s proposed methodology to estimate the amount of spectrum provided for licence-exempt use likely to deliver the right results?

We welcome Ofcom's transparency in setting out and consulting upon its proposed methodology to estimate the amount of spectrum to be provided for licence-exempt use. However, we believe that the current proposals have some major limitations.

The consultation document states that Ofcom is minded to use a combination of two approaches - block-by-block assessment of likely congestion, and prediction of short-range communication needs. The first relates to the appropriateness and timing of adding more spectrum to existing licence-exempt bands, and the second to a broad-brush overview of the total amount of licence-exempt spectrum likely to be required in the long term (i.e. around 800MHz - rather than 80MHz or 8GHz).

However, they both overlook two important points. First, Ofcom has a duty under the Communications Act to use licence exemption wherever undue interference can be avoided. This suggests that for any newly available or re-farmed spectrum, it is the case for licensing that needs to be made rather than the case for licence-exemption.

Secondly, Ofcom's proposed methodology takes no account of the unique features of specific frequency bands. The calculations suggest that a total of 800MHz may be needed in the long term (although we suspect that the correct figure will be higher than this, due to ever-increasing demands for information communication) but they do not indicate where in the spectrum this capacity should be. Freeing up 200MHz of spectrum for licence-exempt use at 5GHz would have a very different effect than at 500MHz! Indeed we consider that the allocation of even 20MHz at 500MHz would be of massively greater value to citizen-consumers than 200MHz at 5GHz, even though both would correspond to the same percentage under Ofcom's weighted frequency analysis.

Q9: What is the appropriate timing and frequency bands for making available any additional spectrum needed for licence-exempt use?

Both licensed and licence-exempt allocations should consist of a portfolio of bands at low and high frequencies. High frequencies are appropriate for high-capacity, short-range use, and lower ones for longer-range uses¹.

We agree with Ofcom that there is no immediate need to increase licence-exempt allocations at 2.4GHz or 5GHz. However, we believe that to facilitate rural and inner city broadband access, and more generally to encourage innovation in the UHF TV bands, three of the 8MHz channels being reclaimed from UHF TV should be made available for licence-exempt applications after digital switchover. Such an allocation of 24MHz is well within the 200MHz already contemplated by Ofcom for licence-exempt expansion and is compatible with the weighted percentage splits illustrated in the consultation document. In addition we believe that licence-exempt use of fallow spectrum (vacant channels) within the pre-switchover UHF TV spectrum should also be permitted. Finally we

¹ We do not accept that the only use for licence-exempt is short-range, personal services. Already it has been used with some success in medium-range community applications, e.g. municipal hot-zones and rural wireless internet service providers (WISPs).

propose that the use of UHF channel 36 should be reviewed – if made licence-exempt, this would reduce the requirement for licence-exempt capacity within the spectrum to be released by switchover. More details on these proposals are set out below.

UHF TV Spectrum and the Digital Dividend

Ofcom recognises in the consultation document that switching off analogue TV broadcasting will release 14 channels (112MHz) of prime UHF spectrum, and suggests that Ofcom's preference is likely to be for a technology-neutral auction process to redeploy this spectrum.

Our proposal is for a technology-neutral auction for most of the capacity (11 channels), but for the remainder (3 channels) to be made available for licence-exempt applications.

Spectrum below 1GHz has great value for citizens in rural and even in inner city areas. The greater propagation characteristics enable the creation of innovative applications that can penetrate structures like walls in a building or trees or hills and the signals penetrate further, lowering the capital and labour costs required to roll out new services. This means more services, for more people, in more places, much more quickly.

It is not possible to predict with certainty what these innovative services will be, just as it was not possible to predict what services and products exist in the current licence-exempt (ISM) bands. Innovators will take the spectrum below 1GHz and produce valuable new applications and uses that we cannot now imagine. The new spectrum (which is only a small portion of the total spectrum being re-allocated) and the low transaction cost for consumers to make use of it will produce a new “platform for innovation.”

It is not credible to argue that only licensed services can benefit citizens. The unlicensed band at 2.4GHz sits right next to licensed services and no substantial harm has resulted – in fact, huge benefits have been created. In the United States, some wireless Internet services has been provided around 2.5GHz using licensed bands, and others have successfully used licence-exempt technology around 2.4GHz.

Consequently Microsoft supports taking a suitable fraction of the “digital dividend” spectrum and making it available for licence-exempt applications operating at low power levels (e.g. of the order of 100mW). Given the benefits that the ISM bands have delivered, it is absurd to argue that similar benefits could not accrue in a band below 1GHz. It is not credible to claim that the benefits to citizens of new innovation will be small given the unexpected value that has been created by the very small amounts of spectrum, weighted by frequency, that have been allocated to licence-exempt uses so far.

Such an allocation does not damage the holders of licensed spectrum, nor does it reduce their access to spectrum. Licence-exempt uses are open to anyone, including the licence holders themselves. In fact, licensees have made great use of licence-exempt spectrum. Bluetooth headsets and other mobile phone add-ons operate in a licence-exempt band, and are a boon to mobile telecom providers. Mobile and fixed telecom providers are using Wi-Fi as a key part of their service offerings. Last but not least, holders of licensed

spectrum are, under the proposal being advanced, in any event getting the lion's share of the spectrum being released by digital switchover.

One important application is rural broadband, where the economics do not work for the licensed model because of the low population density and the infrastructure and reception costs are too high with 2.4GHz or 5GHz. Lower frequencies with better propagation characteristics are simply better suited for creating cost-effective, robust wireless broadband. We have shown that a Wireless Internet Service Provider (WISP) using spectrum below 1GHz would need about 1/3 fewer base stations than, and about 50% of the capital investment of, a WISP using the 2.4GHz or the 5GHz bands. That, in turn, could make all the difference in providing cost-effective broadband to unserved and underserved areas of the country. Also, indoor antennas are feasible in the UHF TV bands enabling a “plug and play” solution, whereas at 2.4GHz or 5GHz professional installation is typically required in this application. There are also opportunities for peer-to-peer networking between homes that do not pre-suppose the existence of a service provider; licence-exempt is the only way to implement such services.

Broadband in poor inner city areas is another example where, although the population density is high, the economics do not necessarily support implementing an ADSL or cable infrastructure or a licensed spectrum model.

In urban or suburban areas more generally a transition from licence-exempt to a licensed model is quite feasible. Licence-exempt would give entrepreneurs an opportunity to get a Broadband Wireless Access service up and running without the cash outlay for spectrum licences; then if they are successful and get to enough customers to worry about interference, they could have the option to devote cash flow to licences.

A single 8MHz channel would not be sufficient, due to interference and frequency re-use constraints. So three channels should be designated as licence-exempt after switchover.

Ideally, the same channels should be available in this way across Europe. However, Ofcom's own research has shown that in most cases the UK could adopt a different approach to its European neighbours with minimal interference. If the rest of Europe did not follow the UK's lead in this area, the UK would not be going it alone in terms of the market for suitable equipment because of the developments in the US and elsewhere.

The availability of this spectrum from the switchover date (e.g. 2012) would enable sensible long-term infrastructure planning, but we believe that an important start can be made now by allowing licence-exempt use of vacant TV channels before switchover.

Vacant channels

In the US the FCC has issued a landmark Notice of Proposed Rulemaking concerning the use of existing UHF TV bands for unlicensed devices. This recognises that even in apparently congested broadcast bands, there are vacant channels in the spectrum that could be used for broadband access based on a licence-exempt model². One option would

² See http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-113A1.doc

be to use “mesh networks”³, with cognitive radio or spectrum sensing employed to identify available spectrum in a given area.

We consider that in the chapter of the Framework Review document on Cognitive Radio, Ofcom has too quickly dismissed the FCC proposals, by claiming that spectrum-planning differences between the two countries make them inappropriate for the UK.

The suggestion seems in essence to be that the US vacant channels simply don’t exist in the UK planning environment. It is true that unlike the US the UK plans for near-universal TV coverage, but it is equally true that there are more TV services squeezed into the spectrum in many urban areas of the US than in the UK – and the vacant channels exist in these urban as well as in rural areas. Looking at the measurement data in Annex I of the consultation document, some clear spaces can be seen in the TV broadcasting bands⁴ even in and close to London. This can be contrasted with the nearby GSM band, which appears to be very fully utilised.

We are inclined to believe therefore that there are in fact substantial vacant channels in the TV spectrum even in the UK planning environment. As a minimum, Ofcom’s contention that there are not should be properly tested before dismissing the FCC approach, given its huge potential benefits.

The vacant channels in the TV broadcast spectrum can be seen as spectrum-holes which remain un-assigned by Ofcom, rather than spare spectrum that has already been assigned to individual broadcasters. Hence, although cognitive radio techniques may be employed, it is not “entitlements in time” that are being considered here but merely the use of vacant (unassigned) spectrum. Any licence-exempt use would clearly need to protect adjacent broadcasters, and also ancillary users (such as radio microphones) licensed by the Joint Frequency Management Group, but these requirements can readily be met. There are similar constraints in the US, but the FCC has accepted that there are solutions.

More technical details are provided in Microsoft’s recent comments on the FCC’s Notice, available for downloading from the FCC web site⁵.

Channel 36

Additionally, we note that UHF channel 36 (a broadcast channel that is anomalously reserved in the UK for airport radar) appears to be hardly used at all, and also that it does not feature in the broader switchover plan. We suggest that outside of the wider Framework Review, Ofcom should review the use of this channel, with a view to its early release for alternative uses, including licence-exempt. For example, if it was made available for licence-exempt applications before switchover, then only two of the 14

³ Essentially, each device in a mesh network serves as an access point, client device and router. The beauty of this topology is that as each user adds a device to the mesh, the network grows “organically” without the need to add additional base stations, routers and other infrastructure. Consequently, at very little cost, mesh networks can grow to serve underserved neighbourhoods (rural, suburban or urban) and then grow further to connect neighbourhoods.

⁴ For the purpose of this discussion, we include channel 69 (854-862MHz) as part of the TV broadcast spectrum

⁵ http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516883601

channels (e.g. c35 and c37) to be released by switchover might need to be licence-exempt, rather than the three we have proposed above.

In any event, to have a whole 8MHz channel apparently sterilised by out-of-date airport radar systems operating in just one or two locations seems to be an unjustified inefficiency, given Ofcom's duty to secure optimal spectrum use and to encourage the availability and use of broadband services throughout the UK.

Q10: Do you agree with Ofcom's longer term proposals for market-based spectrum management methods?

Yes, in bands which are not set aside for licence-exempt use or where command-and-control remains essential, Microsoft supports Ofcom's plans to make use of auctions, trading and liberalisation to provide market-led management of the spectrum in the longer term. To move from zero to around 70% of the spectrum under Ofcom's management becoming subject to such a market-based approach by 2010 is a very bold and progressive objective for which Ofcom should be applauded.

Q11: Is the approach set out here, and in Annex H, for developing technology-neutral spectrum usage rights appropriate? Are there alternatives?

We believe that much more work is needed in this area. We are concerned that the "restricted" spectrum usage rights described in the consultation are too limited for most practical applications and we would encourage further dialogue with the industry on this issue. Also, while we recognise the advantages of negotiation over regulatory imposition, we are concerned that to get the full benefits of liberalisation a spectrum user would need to negotiate with neighbouring users with no clear definition of who those users are nor any obligation on them to come to an agreement. We believe that as a minimum Ofcom should specify who the affected neighbours are, and would need a back-stop power to arbitrate in the absence of an agreed position. We consider that this would be a proportionate measure, given the importance of opening up new liberalisation opportunities while recognising the inherent conservatism of many existing users.

Q12: Should Ofcom do more to resolve interference?

We agree with Ofcom that whatever the spectrum management method employed, one of the key roles of the spectrum manager will remain the resolution of interference issues and we support the two approaches (pro-active and reactive) that Ofcom intends to use as set out in the consultation document. The main issue going forward is likely to be one of Ofcom ensuring that it has adequate resources for this work.

Q13: To what extent should Ofcom intervene in promoting innovation?

Microsoft strongly supports Ofcom's bias towards light touch regulation, and hence its preference to help the market find innovative solutions rather than to intervene directly. We also agree that Ofcom's duty to stimulate innovation in spectrum management is best

achieved through a combination of market mechanisms and making spectrum available for licence-exempt use. In particular we note that licence-exemption has enabled substantial innovation in Wi-Fi related applications in the 2.4GHz band. We believe that this benefit should be extended also to some of the “digital dividend” spectrum below 1GHz. Digital switchover is a unique opportunity to do this, which we believe Ofcom should embrace enthusiastically.

Q14: Do you agree with Ofcom’s proposed approach to harmonisation?

Q15: Can you foresee any problems with the proposed approach to harmonisation other than those listed above?

We agree with Ofcom’s proposed approach to harmonisation. We think Ofcom has got the right balance, and has summarised the pros and cons well.

Q16: Do you agree with Ofcom’s proposal to continue with division by frequency as the primary method of dividing the spectrum?

Yes, we see no sensible alternative to this basic method at this time.

Q17: Is Ofcom’s approach of not intervening to mandate entitlements in time appropriate?

Yes, we believe that the proposed approach of allowing licence holders to enable opportunistic access if they wish to do so (as part of the general trading regime) strikes a reasonable balance between the rights of licence holders and the opportunities for greater spectrum efficiency provided by new technologies.

However, in the UHF TV broadcasting bands, where Ofcom is responsible for the spectrum planning and there are localised vacant channels, we believe that Ofcom should be more adventurous and, like the FCC in the US, consider allowing licence-exempt use based on cognitive radio techniques. As explained in our response to Q9, we consider that Ofcom has too quickly dismissed the FCC proposals, by claiming that spectrum-planning differences between the two countries make them inappropriate for the UK.

Q18: Do you agree with the Regulatory Impact assessment?

Yes, we agree that the benefits of Ofcom’s proposals to significantly increase the role of market mechanisms in the management of spectrum will substantially exceed any costs.