Organisation: Microsoft Corporation

Summary

Microsoft welcomes Ofcom's leadership in the discussion of how best to manage licence-exempt use of spectrum in the future. We believe that licence-exemption is critical to stimulating innovation and increasing the value of spectrum to consumers and citizens. We also support Ofcom in its efforts to move away from the application and technology-specific restrictions that currently apply to much of the licence-exempt use across Europe.
Given Ofcom's duty to manage licence-exempt spectrum to maximise consumer benefit, Spectrum Commons Classes seem on the surface a logic proposal. Developing supporting metrics such as the Consultation's proposed interference indicator also seems logical, given that it seeks to encompass all the factors that can play a role in causing interference. Nonetheless, we have a number of reservations about the implementability of these proposals.

Just like Ofcom, Microsoft wants consumers to enjoy services and applications that do not suffer unduly from the effects of interference. However, we feel that there is a strong risk that the potential benefits sought in the Consultation document would be more than offset by the inefficiency inherent in the administrative judgments of defining the classes.

Regulation should be kept as simple and transparent as possible, steering away from application and technology-specific measures. In this way, one can let the market find the best ways to extract value from licence-exempt use of spectrum. We believe that Ofcom's proposed interference indicator could be a valuable contribution to thinking in the industry, facilitating further innovation. But, it is too early to say what if any role it might have in regulation.

We also share Ofcom's intuition that rules for polite operation could improve the health of the licence-exempt ecosystem, but, here too, feel that it is too early in the industry and regulatory discussion to move towards detailing specific rule sets. Detailed rules are better evaluated down the road on an allocation by allocation basis.

The principle of fairness in licence-exempt use of spectrum is commendable as well, but we feel that implementation of this principle as a rule would be problematic and could lead to a greater level of regulatory intervention than needed.

Finally, one should not forget that an additional way to meet the increasing demand for this mode of access is to increase the extent of licence-exemption across all the bands.

Discussion

Microsoft firmly believes that licence-exemption is a cornerstone of wireless innovation and is of critical importance for the future of the UK's and the world's information economy. Many of the applications listed in Ofcom's recent Tomorrow's Wireless World thought piece[1] will probably be supported at least partially through licence-exempt access, including, for example, personal medical applications using electronic implants. Licence-exemption is an important complement to the liberalisation and trading of spectrum licences.

We also support Ofcom's continuing emphasis on technology and application neutrality in the management of spectrum. It is important to extend these principles to licence-exempt access as a way of increasing the supply of spectrum for innovation. It is also important to encourage other European regulators to adopt the same approach in order to reap the benefit of economies of scale in the production of devices.

As to regulation, our conviction is that having fewer, simpler rules around licence-exempt use will create the most favourable conditions for innovation and greater value for consumers. We are therefore concerned about proposals to partition new (or existing) bands where licence- exempt use is allowed. Partitioning licence-exempt use of spectrum risks introducing the very inefficiencies which Ofcom has sought to reduce through its market-led approach in licensed spectrum access:

- An administration might choose the wrong application for which to reserve spectrum
- Different administrations might choose different classes in the same band, fragmenting the market

We are concerned that the proposed new classes of spectrum commons will create administrator-driven allocations, with the risk of substantial inefficiencies. In our opinion, the market is better able to determine the share of spectrum which applications and technologies require.

For example, consider a case of just two spectrum classes, where "Class 1" is above and "Class 2" is below a given interference indicator threshold. Suppose that application A (e.g. keyless car locks) is in Class 1 and another application B (e.g. wide-area citizens band) falls into Class 2. Suppose we then take a hypothetical 100 MHz band and allocate distinct sub-bands (e.g. 50 MHz) to each class of device. We can observe two problems:

1. The choice of the threshold partitioning the classes may be open to challenge
2. Assigning shares of spectrum exclusively to particular classes would inhibit the market from matching demand with capacity

[1] http://www.ofcom.org.uk/media/news/2008/05/nr_20080507

If Class 2 applications fail to take-up, then 50 MHz of spectrum would be under-used. The regulator might change the rules to reflect this, but only after a substantial delay. Creating more than two classes would compound the problem.

The interference indicator analysis might be a useful contribution to industry thinking and thereby facilitate further innovation. However, we feel that it is not, as it stands, a sufficiently robust basis for regulation. In particular there are three features of its derivation that appear substantially debatable:

1. **The choice of scenario**. A technology can be implemented in many scenarios/applications, and it may be difficult to determine the relative importance of each
2. **The calculation.** For example, the index to which the various factors are raised would give different weights to different scenarios. A logical starting value for the index might be one, but could equally be two, three etc. It is not self-evident what the starting value should be.
3. **The choice and number of thresholds** which divide classes is not self-evident

We also feel that the interference indicator calculation should take account of the use of politeness protocols, since techniques that improve spectrum sharing are already an important part of licence exempt technology.

Finally, we believe it worth noting that **the market already provides incentives** and mechanisms to help limit the impact of interference, obviating the need for Spectrum commons classes..

Incentives arise from achieving a competitive advantage in the crowded consumer electronics market, for example, through applying techniques that provide greater interference tolerance on one hand and conserve energy on the other.

Licence-exempt technology providers are accustomed to working with interference, and they generally take this into account in developing their products. The success of their products in the market at least partly depends on their success at achieving the right balance of performance and price. The market therefore tends to reward interference-tolerant approaches, provided that costs are not out of proportion. Bluetooth provides a good example of such a technology, which is designed with the assumption of the risk of interference. Techniques such as frequency and antenna diversity are increasingly used to improve performance in noisy environments. Thus the potential harm from interference can be reduced without resorting to restrictions on the types of application that can enjoy licence exemption in a given band.

Device makers have market incentives for reducing energy consumption, which tends to favour minimising transmission power. Much of the innovation in wireless technology finds early application in portable and personal devices, where its value is greatest. Such devices are inevitably dependent on batteries as their

power source and designers are aware that maximising the time-between-recharges increases competitive advantage. The market will tend to reward devices that use energy sparingly and we believe this will help moderate transmission power and duration used by new wireless technologies.

All this said, we do see grounds for **one important caveat**. Given that regulators **must** establish power limits for licence exemption, we can see that there may be a case for granting additional power allowances – **in specific allocations** -- for devices that meet additional requirements. For example wireless access points might be allowed to use higher power in rural areas, conditional on implementing a means of detecting the device's location and determining whether higher power is allowed there. Alternatively, or in addition, devices might be allowed to operate at higher power if they implement suitable politeness technologies. For example, different device profiles could be used to distinguish between low-cost, low-impact wireless devices designed for near-field communication (which might be excused implementation of politeness rules) and higher power devices such as wireless access routers (which would probably be required to implement them). And, the simplest category of device might include those which remain silent unless invited to transmit, for example RFID tags and building structure sensors.

This approach will help make the best use of spectrum currently set aside for licence-exempt access. Over the course of time, it will also be important to allocate additional spectrum for licence-exempt use below 3 GHz and particularly in the bands below 1 GHz where this key mode of access is currently very limited.

Responses to the specific consultation questions

Q1: Do you agree that the spectrum commons class of a technology should be based on its interference characteristics?

We feel that implementing spectrum commons classes would hinder the realisation of the economic benefits which licence exemption can unlock. Spectrum classes are intuitively attractive, but implementing them represents an enormous step that we feel is not yet supported sufficiently well by analysis. First, it will be necessary to consider the cost of mistaken classification, for example in the loss of opportunities to use spectrum more efficiently, to set against the notional benefits. Second, the benefits derived in Annex 4 of the LEFR[2] appear tentative given the sophistication of the analysis.

However, should Ofcom decide to implement spectrum commons classes, then interference characteristics are in principle an acceptable approach.

[2] Licence exemption framework review, statement published December 2007, http://www.ofcom.org.uk/consult/condocs/lefr/lefr_statement/lefr_statement.pdf

Q2: Do you think that the ratio of channel bandwidth to the width of the band is a
good representation of the use of the frequency domain resource and the interference potential of a technology in this domain?

Even though it might represent the use of the frequency domain resource, the proposed ratio could be raised to any index without loss of generality. In the present proposal, the index has been set to one, which appears the obvious place to start. However, since different values of the index divide up applications in different ways, the choice of index has real-world, potentially dampening impact on innovators' flexibility.

Q3: Do you think that the duty cycle is a good representation of the use of the time domain resource and the interference potential of a technology in this domain?
Do you agree that the duty cycle should be evaluated at the busy hour?

As with the channel bandwidth ratio, the duty cycle could be raised to any index without loss of generality. We agree with Ofcom's approach of seeking to move away from application-specific spectrum allocation. However, the interference indicator is closely coupled to the type of application. Microsoft believes that the wisest course would be to lean towards application-agnostic regulation in which the proposed interference indicator might not be needed.

It also is unclear whether 'busy hour' is a still a meaningful concept. With the increasing prevalence of storage in end-user devices and the growth in peer-to-peer distribution technologies, quiet periods might become scarcer, or at least more random, and therefore the busy hour(s) would be less distinct.

Q4: Do you think that the interference coverage plus the density of transmitters give a good representation of the use of the space resource and the interference potential of a technology in this domain?

We agree that interference coverage is a key metric of spectrum use. However, as noted in Consultation paragraph 5.40, it can be linked to applications as much as technologies. Further, since this is a dimensionless number, it can be raised to any index. In this case the index chosen is one, but this value is not self-evident. Sets of applications will be sorted into different interference classes depending on the value of the exponent, thus its (non-self-evident) value would be significant.

Q5: Do you agree with our method to calculate the interference coverage area of
a transmitter? What is your view on a threshold level of -80 dBm/MHz to determine
the interference range? Do you think the threshold level should be expressed as power density (dBm/MHz) or as power (dBm)?

The chosen calculation method is only one of many valid alternatives, and we would be concerned about too much being built on it at this stage. The threshold level also seems to rely too much on existing technologies for reference.

Q6: Do you agree with using a busy yet realistic scenario to derive the transmitter density of a technology?

It is natural to want to consider the 'worst case' in framing regulations. However, this ought not be a stand-alone consideration. The proper assessment is more complex. It ought to consider at least the likelihood of the worst case arising, the desirability of minimising the regulatory burden, and the regulatory and technical burdens required to prevent harmful interference.

Q7: Do you agree with the Interference Indicator being a product of the frequency domain factor, the time domain factor, the interference coverage area and
the transmitter density?

We agree that these factors are important, but again we feel that the proposed method of combining them is far from definitive at this stage, as noted in our answer to Question 4.

Q8: Do you think that three classes of spectrum commons is the right number? What is your view on the proposed boundary values for the three classes?

Our concern is with the whole principle of dividing up licence-exempt spectrum and thus excluding potentially valuable, innovative applications from accessing the capacity that their market success warrants.

Q9: Do you agree with our definition of fairness and that all systems should be required to behave in a fair manner?

We think that requiring devices to behave according to their needs is logical, resulting in greater efficiency of spectrum use as well as potential user benefits such as lower power consumption. However, "needs" are in the eye of the beholder; for example, a manufacturer might argue that a device needs to be low cost, demanding higher power operation since detection and error correction can then be less sophisticated. A device might also "need" very rapid access to the medium, which could be used to justify maintaining an open channel even though minimal information is being transferred. It is not clear how devices could, by themselves, judge what is 'equitable' in a given situation. The most they could reasonable do is to listen-before-talking and insert gaps in their transmission (quiet periods) such that other devices have a chance to use the spectrum too. We feel that the basis for equitable sharing is subject to debate: for example, is it according to application requirements? (In which case, a video streaming service would be entitled to more capacity than text email access.) Or should it be according to data volume? (In which case, video would be

entitled to no more capacity than email.) Ultimately, we believe that being too prescriptive on fairness risks limiting innovation.

Q10: What is your opinion on the effectiveness of blind detection sensing techniques
compared to signal specific techniques?

We prefer blind detection techniques, where energy is detected rather than specific signal characteristics. The key principle for us is that regulators should avoid being technology specific in creating the enabling framework for licence exemption.

Q11: Do you agree with the proposed polite rules?

We agree with the principle that rules for polite operation could improve the health of the licence-exempt ecosystem and hence the value enjoyed by users. However, we would want to see such rules evaluated on an allocation by allocation basis. We feel therefore that it would be premature to comment on the rules proposed in the present consultation paper.