

Higher power limits for licence exempt devices

Understanding the Scope for a Power Increase at 2.4 and 5 GHz

Intellect welcomes this opportunity to respond to Ofcom's consultation on "Higher power limits for licence exempt devices", due date 20th September 2006.

Intellect notes that the title of the document refers to *licence exempt* devices, but it appears to include the 5.8 GHz band that is actually licensed (albeit on a light basis). It is our understanding that the scope of the document is broad, in that for the 2.4 GHz it does not simply relate to the question of higher power for broadband in rural areas but for all licence-exempt devices in that band. In this case Intellect believes that it is not appropriate to simply consider all devices in the same way, as their ability to "politely" share the band is different (WLAN uses certain protocols that facilitate shared use of the band, whereas some other technologies do not).

Intellect recognizes the leadership that the UK has previously shown in opening the bands in question for innovative services such as public WiFi at 2.4 GHz / 5 GHz and for Fixed Wireless Access at 5.8GHz. Whilst some fine tuning of the regulations in this band may be appropriate, Intellect has concerns about the very high power levels being proposed by Ofcom. We would also highlight the need to introduce any changes into Europe and try and carry our neighbours along with the UK thinking. It is therefore essential to coordinate the regulations for these bands with the CEPT.

Intellect shares the Ofcom objective of ensuring that broadband is available in rural areas. We recognize that there are many ways in which this could be achieved. Indeed, as you would expect, many of our members can offer a variety of solutions to achieve this. Ofcom needs to be careful not to introduce any regulation that might make it more difficult for the market to naturally decide which is the most appropriate solution to this problem. We also note that other bands (e.g. 5.8GHz) may also be suitable for this application. We have analysed the techno-economic consultancy study done by Scientific Generics and consider that the economic benefits derived from that analysis are significantly overstated. We say this because of some of the assumptions made in the study concerning broadband pricing and the nature of the services that will be demanded in these locations.

In our answer to Question 1 we explain why we do not consider that the interference issues have yet been adequately considered. Higher power in these bands will increase the need for coordination while the problem of "Spectrum Usage Rights" is proving difficult to resolve.

We expect that rural markets will find quality and accountability for their service to be as important as they are in urban markets, yet they can only be satisfactorily secured though exclusive licenses in wide coverage area scenarios..

The use of these bands is internationally harmonized, albeit with some local variations in the power levels allowed (e.g. France and the USA currently allow different 2.4GHz power levels to those in the UK). A low cost environment for the introduction of personal devices was thereby created. Ofcom should acknowledge that to have been the correct decision for these bands.

Intellect does not consider that the proposed increase in power levels at 2.4 GHz has been justified. Intellect proposes that consideration of what, if any, power increase is appropriate should be carried out in the appropriate international bodies and that any change to regulations in the UK should be pursued also in an internationally coordinated manner. Separately, a small general increase in WiFi power levels (to a maximum of 500mW) might be justified to improve coverage in certain locations (e.g. large buildings), or to recognize the specific features of the later versions of the IEEE WiFi standards that include MIMO / smart antennas where the energy can be focused in certain directions. The effect of increased interference would need to be carefully considered, as too high levels will reduce capacity available to all users in the band and may impact services in adjacent bands.

Intellect notes that the 2.4GHz band is used by devices such as video senders, which do not detect other devices and hence do not share the band “politely”. Intellect therefore opposes any increase in power levels for these devices, as to do so could lead to a significant increase in the potential for harmful interference.

Consultation questions

Q1: Have all the possible victims of interference been correctly identified and quantified as far as possible?

No, Intellect does not consider that the identification and quantification of the issues is yet complete.

The point of these bands is that they are for licence-exempt use and can be used for a very wide range of technologies. The designation as being also for ISM use emphasizes this. It is therefore almost by definition impossible to identify all possible victims of interference. In addition this band may be used in the future for innovative new technologies that we, by definition, are not yet aware of. There is therefore a major risk than any drastic changes in the regulation of these bands could stifle future innovation.

An example of a concern is the statement that “Coexistence between high power WBA and Bluetooth is unlikely to cause significant interference due to the introduction of Adaptive Frequency Hopping/AFH in Bluetooth V1.2”. Increasing the power output will not only raise the power level of the main lobe of the transmitting signal but also of the side lobes and the skirts (caused by noise in the VCO). For example, for a system like WLAN, the first side lobes are at -30dBc and the skirts at -50dBc. Raising the power in

the main lobe (e.g. to 40dBm) will raise the transmission levels outside the main lobe as well. This out-of-channel “spurious” emission can be very wideband and raises the noise floor in the 2.4 GHz band. AFH must now not only avoid the main lobe, but also the side lobes and possibly the skirts. Furthermore, the frequency hopping feature of Bluetooth V1.2 also only applies when the data link is established.

We are concerned about the out of band limits. As an example, assume the high-power systems have a transmission spectrum similar to the current WLAN. The main lobe has a null-to-null bandwidth of 22MHz and its level is at 0dBc which is currently 20dBm maximum. But with the new proposal of 40dBm the first side lobes are at both sides of the main lobe and each must have a bandwidth of 11MHz. Their level is at -30dBc, which is 10dBm with the new proposal. A Receiver must keep a distance of more than 50m to such a high power transmitter to ensure that the side lobes do not disturb the Bluetooth reception. Alternatively AFH is applied which should now avoid 44 MHz, which is more than half the 2.4 GHz band. This will impact the capacity of the Bluetooth piconets as they will have to share a bandwidth which is reduced by a factor of 2. If more than a single high-power transmitter is nearby there is nowhere to avoid the interference. AFH will not work and Bluetooth is affected unless more than 50m distance is kept. This analysis only considered the main and sidelobes. The situation worsens if also VCO skirts are taken into account.

Considerable further study is needed to ensure that high power equipment doesn't raise the noise floor in the entire band to the detriment presumably of all the users of the 2.4 GHz band including for example both WLAN and Bluetooth. In particular, in addition to the impact of raising the main lobe, the effects of the side lobes and skirts should be considered. More stringent suppression of the emissions outside the main lobe may need to be considered. Note that the existing ETSI standard is only applicable for devices up to 100mW (and that the unwanted limits in the standard provide insufficient protection for it to be applied to higher power devices.). It would therefore be essential that unwanted limits be defined in any new UK regulations.

Spectrally, there is some evidence that some inexpensively built licence exempt equipment tends to spread more than expected and there is a very real possibility that spurious or desensing from higher powered systems could increasingly affect adjacent bands including the new 2.5-2.69 GHz as well as the 2.7-2.9 GHz radar band. There is also a possibility of increased harmonics rising into 7GHz Mil-Satcomms and X-band Radar receivers.

Q2: Have the costs and benefits been correctly captured? In particular, are the costs of interference to WLANs appropriately assessed?

Not yet. As indicated in our answer to Q1 above, we do not consider that the analysis is yet complete. We also wonder whether the full range of devices that may have to migrate from 2.4GHz to 5 GHz if interference arises, has been considered. For example, laptop PCs or phones with 2.4GHz but not 5GHz WiFi built-in could cost more than the

£100/user considered. Furthermore, we would question the stated assumption that the cost to domestic users of WiFi who may have to change channels is likely to be 'negligible'. It appears to be based on the assertion in the Scientific Generics report that the [average] data rate for domestic users is low. Nevertheless, the cost of changing channels or bands remains the same. As noted above we also would question some of the assumptions in the techno-economic analysis concerning broadband demand and pricing in the rural areas. Moreover we believe that the calculated economic benefits have been significantly over-stated.

Q3: Are there any other mechanisms that could be used to restrict device operation to appropriate areas? Of the schemes set out which should be preferred?

Devices of these types rely on having international markets. They may be used in countries other than the one in which they were purchased. No changes should be made in their regulation without also seeking international agreement. That would need to take into account not only the existing situation but also the opportunities for innovation in the future. We believe that the techniques Ofcom suggests for restricting very high power devices to certain areas are impractical and unworkable.

Q4: Should we move from specifying radiated power to specifying conducted power?

The UK should not consider changes without first achieving consensus on them within such multinational bodies as the ITU-R and CEPT/ECC. The benefit of retaining an EIRP limit is that the worst case interference is predictable. However, if the separation distance required to avoid interference cannot be maintained, the probability of the resulting interference is more closely related to conducted (or total radiated) power. Therefore although a conducted power cannot replace EIRP, higher limits deem it appropriate to set an additional tighter limit on conducted (or total radiated).

Q5: For 2.4GHz which of these options do you favour? Are there other viable options that should be considered? Or should regulations be left unchanged?

Intellect does not support the proposals to introduce very high power levels (10W) at 2.4GHz in rural areas or elsewhere, since it has not been demonstrated how such systems could be policed, in practice.

Intellect does not support increased power levels for non-WiFi devices in the 2.4 GHz band. Intellect is not opposed to a review of general WiFi power levels with the possibility of a small increase in power levels to improve coverage or to take account of new features in the latest WiFi standards such as MIMO/smart antennas. Intellect proposes that a maximum value of 500mW EIRP should be considered (possibly in conjunction with a tighter conducted limit). However the impact on capacity (and on

services in adjacent bands) of the increased interference levels would need to be considered, and any changes should be pursued internationally.

Q6: For 5GHz should Ofcom increase the power to 4W EIRP at 5.8GHz in accordance with ECC Recommendation and as set out in the draft IR2007? Should Ofcom open the database for public access to facilitate coordination?

We welcome the commitment of Ofcom to following appropriate international agreements in this band, which have come from technical studies to which the UK has made a major contribution.

A manufacturer's self declaration of compliance to an appropriate European Harmonised Standard should be an adequate (though not the only) route to placing a radio product in the UK market.

Intellect agrees that it may be reasonable to open the database to public access in order to facilitate coordination.

-----**end of 6-page Intellect response**-----