

# “A sledgehammer to crack a nut”

## 1. Introduction

Further to Ofcom’s “Consultation on Higher Power Limits for License Exempt Devices”, The Cloud wishes to submit the following response and recommendations for further action.

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The Cloud Networks Limited is the UK’s largest provider of public access WiFi hotspots and network services, with network of over 7,000 locations across the UK and comprising almost 10,000 access points devices. The Cloud is pioneering the deployment of urban WiFi metrozone networks in the UK to provide contiguous WiFi coverage at street level across city and town areas for a range of current and future applications, including mobile voice and data communication, public internet access, mobile entertainment applications, and public sector security, community service and public sector communication applications. The Cloud’s networks support internet and application services for business and consumer applications and provided by a wide range of service providers, which in the UK includes BT, O2, iPass, Skype, Vonage, Nintendo, among others. In addition, The Cloud operates public access WiFi networks in Germany, Sweden, Denmark, Norway and The Netherlands.

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The three options currently proposed by Ofcom are as follows:

### Option 1

Powers of up to 10W EIRP would be allowed throughout the UK in the band 2450-2483MHz, with no geographical restrictions. Devices need not be location aware and no registration requirements would be placed on users.

### Option 2

The use of 10W EIRP would be restricted to hamlets, villages and rural towns. Devices would be required to be location aware and only transmit at higher powers if they were in appropriate areas.

### Option 3

The restriction of the use of 10W EIRP operation to all areas except large and major urban conurbations. Devices would not need to be location aware but a mandatory registration scheme would operate and users would need to operate according to a code which required them to work collaboratively to resolve interference issues.

## 2. Critique of the framework of analysis

It is The Cloud's view that all three of these options have inherent and hidden costs that have not been adequately considered in the economic and technical analysis on which the initial consultation has been based. Outlines of the key criticisms are as follows:

- **Increased power demands on mobile terminals will substantially limit portable application viability and hence limit the economic benefits derived by end users from the technology** - The semiconductor and terminal component sector have made many advances over the past 5 years to reduce the power drain of WiFi chipsets within current power output limits and to make the technology suitable for mobile devices and applications. The vast majority of terminal devices introduced into the market equipped with WiFi currently and over the forthcoming period are provided with the purpose of meeting mobile and portable application requirements. An increase in the allowable power to 10W from 100mW will have a direct impact on the applicability and user viability of these devices through increased power draw, and is likely to lead to a significant detriment to the benefits provided by WiFi technology for members of the public and the economy of the WiFi industry itself - limiting the application of the technology to laptop and similar larger form factor portable computing devices. The initial consultation document states that the net benefit to the UK economy of Option 1 is £177 million. We suggest that the loss to the UK economy of the preclusion of an economy of WiFi-connected mobile devices far exceeds £177 million, leading to a substantial net cost and impacting the economic benefits enjoyed by over 9m individuals in the UK today with WiFi enabled terminal devices.
- **The cost of operating and enforcing location awareness in devices is substantial and in practical terms un-enforceable** - Option 2 implies the need for a positioning database that will control software determining power outputs for devices dependent on their location. We suggest this will have a major administration and device implementation cost, as well as an increase in WiFi device costs to the end user and device and application providers, which will exceed the estimated net economic benefit for Option 2 of £50 million. The reality is that the global economies of WiFi technology supported by its global standardisation have generated a substantial production and supply channel of devices. The proposed mechanism would require a response and investment from terminal manufacturers around the world as well as from access point manufacturers around the world which will lead either to a substantial increase in cost borne by UK device consumers or to a withdrawal of devices from the UK, even if it can in real terms be practically enforced. Similar models in for example the DVD regional standards market have proven ineffective.
- **The highly distributed nature of the WiFi ecosystem makes a voluntary enforcement scheme unenforceable and will lead to a chaotic environment** - Option 3 is an invitation to public abuse and in practical terms will see very limited applicability due to the nature of the sales and distribution channels. It is inevitable that cases of abuse by end users if their devices are physically capable of very high power output rates will be substantial and with end users having no real means of identifying abusers with whom to attempt to negotiate cooperation, a chaotic and much reduced qualitative experience will ensue. The operation of a regulatory database would be reliant on the user not abusing a mandatory registration scheme, which in real terms is unlikely to take place.

### **3. Spectrally-efficient, technology-driven solutions: MIMO and 802.11n**

Our criticism of the consultation however runs deeper than the failure of the economic analysis to consider the costs of specific line items for each of the proposed options.

The economic benefit of increasing the power of WiFi has been calculated in the Ofcom consultation document by the incremental improvement in the business case for fixed wireless broadband services over WiFi. Increasing the allowable power for unlicensed devices creates this effect because of an increase in the broadcast range and throughput between a WiFi base station and a client terminal device or a relaying base station.

However there are numerous mainstream technology based solutions that are available today, and that are fast becoming available within the timeframe of the introduction of any of the proposed options, that do and can produce the desired benefits without modification to the regime of spectrum usage and power output. These technology based solutions negate the implications of the options suggested by Ofcom for terminal device battery life, interference through overlap, or administrative and compliance overhead.

The Cloud believes Ofcom is proposing to apply a spectral solution to a problem well addressed by technology solutions, and that that Ofcom's objectives will be better served in the medium term by encouraging the development of these technology based solutions to lead to an environment of greater benefit from WiFi technologies. Technology-based solutions to the problem of increasing the range and throughput of between base stations and devices that operate in license-exempt spectrum is inherently more spectrally efficient. Spectrum for any country is a scarce resource and it is a wasteful strategy to use such a resource in a less efficient manner than is absolutely necessary.

To illustrate the point, we highlight one technology in particular that is available to the market today and which we believe is particularly relevant to the issues that this consultation is attempting to address - MIMO and 802.11n.

#### **MIMO**

Traditional wireless communication systems operate by having an antenna at the transmitter whose signal is picked up by the receiver antenna. In such systems the signal follows different paths from transmitter to receiver (multipath) and this compromises the received signal quality resulting in reduced capacity. Multiple Input-Multiple Output (MIMO) systems divide the same transmitted signal simultaneously across a set (two or more) of antennas to be received by another set of antennas. The signals traverse different paths, known as MIMO channel, and when appropriate spatial-time coding is used, the single antenna multipath problem can be turned into an advantage and used to enhance the received signal quality, thereby enhancing capacity, throughput and range and resulting in a more spectrally efficient and more reliable system with no increase in power levels.

Various theoretical and experimental studies indicate up to 10 dB (factor of ten) improvement in receiver performance may be achieved coupled with doubling of the spectral efficiency and doubling of the cell radius when MIMO systems are used. Such improvements are comparable to those expected when power levels are increased tenfold in a closed system environment, but reflect an applied scenario for real world application.

Because of the huge advantages inherent in MIMO systems, and the competitive advantage that the inclusion of MIMO technology can deliver for WiFi access points in the market, hardware vendors and semiconductor vendors are driving MIMO technology into the market place, eroding the cost differential between MIMO enhanced-WiFi and standard 802.11a/b/g. This efficiency comes without any administrative or compliance based overhead, which is optimal for lowest possible cost delivery of the technology and application benefit to the market.

### **802.11n**

The emerging IEEE 802.11n standard, supported now by almost all hardware and semiconductor vendors, aims to use MIMO concepts together with space-time coding. This is to improve the performance of the 802.11 family in terms of capacity and quality of service and to reach data rates beyond 200 Mbps with little (or zero) power increase.

MIMO and in the future 802.11n are far more efficient and elegant technology solutions to the need to increase range and power of WiFi to improve the business case for rural wireless broadband access. The benefits would be similar to that of increasing the power of WiFi to 10W, without the massive cost of spectral inefficiency and potential regulatory enforcement. In addition, the benefits of these new technologies will be compromised in high interference environments such as that resulting from high power 802.11 devices.

## 4. The case for a power increase – 1W EIRP harmonisation

Increasing allowable power output to 10W EIRP is an extreme solution. Is there a more efficient regulatory framework for power output in the UK?

The Cloud believes that the increase of the allowable power output for license exempt devices to 1W EIRP will have a net benefit for the UK and will bring the UK market into line with the US and much of Asia. This harmonization will reduce the cost of chipsets and hence hardware in the UK, improving the economic case for WiFi for consumers and service providers. The US has had ample opportunity to study the interference effects of WiFi at 1W, and little detrimental effect has been recorded relative to operation at 100mW.

## 5. Options revised

In summary The Cloud recommends two potential options to Ofcom:

### **Revised Option 1**

Increase power but only to 1W to harmonise the UK with the US and much of Asia. Parties within the WiFi value chain, such as chipset vendors, hardware vendors and WiFi network operators have developed IPR that operates efficiently within the defined operational parameters of the ISM bands. Do not disrupt this investment and let the market find a spectrally-efficient, technology-led solution to the issue of the rural wireless broadband access business case.

### **Revised Option 2**

If Ofcom considers that the operational parameters of the market are too stringent for such a solution to emerge and a regulatory intervention is required, then The Cloud recommends that an increase in power be allowable only for operators that meet specific requirements. We suggest that these requirements are as follows:

- The operator is providing broadband access services using unlicensed technologies in a market that precludes the operation of DSL, cable or fibre access services.
- The operator is liable for the prevention of leakage of high power hardware in the mainstream unlicensed hardware food-chain.
- Thorough surveys are conducted to ensure that devices that operate in the 2.4GHz ISM bands, such as medical equipment, are not adversely affected.
- The application is limited to a point-to-point base station to base station or base station to statically deployed relay device.

## 6. Summary

The Cloud believes that the motivations of Ofcom's Consultation on Higher Power Limits for License Exempt Devices is unequivocally laudable in attempting to address the needs of rural communities for access to broadband services and in enhancing the reach and throughput of ISM band technologies to for application benefit. We believe fundamentally in the economic and social benefits of broadband internet access for all, irrespective of geography.

However, The Cloud believes that increasing the available power limits to 10W for license exempt device is akin to using a sledgehammer to crack a nut. The consultation needs to be reframed within the context of optimising the full value chain of the spectrum, technology, device and application stack to solve the problem. The Cloud's recommendation is in the short to medium term, either increase power output to 1W to harmonise with other major markets, or to maintain the current regulatory regime and if appropriate take steps to encourage and motivate the market introduction of available and impending technology based solutions.

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