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RADIO SPECTRUM POLICY GROUP OPINION

ON

ASPECTS OF A EUROPEAN APPROACH TO 'COLLECTIVE USE OF SPECTRUM'

JUNE 2008

1. INTRODUCTION

In May 2007, the European Commission requested the Radio Spectrum Policy Group (RSPG) to develop and adopt an Opinion on *Aspects of a European Approach to 'Collective Use of Spectrum'*. This paper represents the RSPG's response to this request.

Demand for services which are dependent upon access to the radio spectrum are increasing rapidly and certain parts of the radio spectrum are becoming an ever greater scarce resource. Innovation, however, is driving the development of radio technologies which are increasingly able to share spectrum in various different ways amongst themselves and/or with other spectrum users, within certain hardware limits and cost constraints.

A coherent approach to Collective Use of Spectrum (CUS) can stimulate the development of sharing technologies in Europe, resulting in more sophisticated sharing possibilities and more efficient use of spectrum. In particular, spectrum managed under the CUS model has the potential to stimulate service innovation by offering comparatively easy access to spectrum and technology innovation by offering a long term perspective and a wide range of potential users. The aim of this Opinion is to explore the broad context of CUS, including identification of potential benefits and costs and consideration of how the CUS model can best be implemented.

This Opinion complements previous RSPG Opinions on secondary trading and on spectrum flexibility (the Opinion on WAPECS)[1]. These two Opinions focused on a market based approach to spectrum management but also advocated that a balanced approach should be found between the three commonly cited approaches to spectrum management (market mechanisms, administrative assignment and collective use). Although this Opinion focuses on the CUS model, it should be considered in the context of identifying the right mix between the different licensing models and approaches to spectrum management.

2. THE CUS CONCEPT

The RSPG defines Collective Use of Spectrum (CUS) as:

> "Collective Use of Spectrum allows an undetermined number of independent users and/or devices to access spectrum in the same range of frequencies at the same time and in a particular geographic area under a well-defined set of conditions."

The above definition is based on that developed by Mott MacDonald in the study they prepared for the European Commission on *Legal, Economic and Technical Aspects of*

[1] See http://rspg.groups.eu.int/rspg_opinions/index_en.htm

"Collective Use" of Spectrum in the European Community. It differs from this and from other interpretations of collective use in that it refers to an "undetermined number of independent users" and therefore excludes sharing between a known number of users (for example two licensed users). The above is intended to be a high level definition which covers different approaches to the application of CUS. As a result, there are some important aspects of CUS which are not covered by the definition but which are relevant to the understanding of CUS.

2.1 QUALITY OF SERVICE UNDER CUS

One issue not covered by the above definition is quality of service (QoS). Under the CUS model QoS cannot be guaranteed at all times as the responsibility for interference management is delegated to the manufacturer and, to a lesser extent, the end user. In this case it is the manufacturer and/or user that takes responsibility for congestion management – in other words how users behave as the spectrum becomes more heavily used or how the equipment mitigates against other users. This is somewhat different from the individual licensed model where the National Regulatory Authority (NRA) – through the issue of a licence and managed co-ordination between licensees – effectively provides an assurance over the level of protection that may be expected. In cases where both approaches share the same band, the regulator maintains a role with regard to dealing with issues of harmful interference.

It should not however be assumed that just because a level of protection cannot be guaranteed that it automatically equates to low quality of service. Indeed, under CUS, quality can and should be high and, for many users, CUS is likely to provide a perfectly acceptable level of service. However, while individually licensed users, through the regulator, have means to deal with harmful interference, the individual CUS user is unlikely to have any such recourse, neither through the manufacturer nor the regulator (unless it is caused by illegal transmissions).

QoS is dependent upon the level of congestion within the band and co-existence between the different technologies and services deployed. CUS requires agreement on the level of politeness that must be achieved. This translates into 'politeness rules' (such as restrictions on power, duty cycle…) which are generally imposed by the regulator and 'polite protocols' (technological requirements) which are generally defined through voluntary standards. Different management approaches under the CUS model (generic uses, specific uses, light licensing…) result in market players having different levels of control over the radio environment. This impacts on the QoS that can be offered by radio systems operating under a CUS model.

2.2 IMPLEMENTATION OF CUS

Another aspect influencing QoS is the way in which CUS is actually implemented. For example, many licence-exempt allocations (such as for Short Range Devices (SRDs)) do not regulate the number of users and hence the potential level of congestion within the band. In certain cases, and typically where higher power levels than those typically employed for licence-exempt applications are required, congestion may not be manageable without limiting the number of users in the band. Through a **light licensing model** the regulator may achieve this, thus enabling market players to manage the

interference environment better. In general, light licensing may be used to authorise typically greater power than licence-exempt regimes.

An alternative approach might see the regulator giving the role of managing interference to private entity. Under a **private commons** arrangement – where the rules that determine access to the band are set by the entity to which the band has been licensed – the users are dependent on the licensed entity, as well as other users, to manage the risk of interference while the regulator has very little need for intervention.

Under the CUS model, three levels of responsibility can be considered: user, manufacturer and the regulator:

- the **user** is responsible for applying the conditions imposed by general authorisation and the usage information provided by the manufacturer;
- the **manufacturer** ensures the conformity of equipment with the necessary spectrum and equipment regulation;
- the **regulator** sets/implements minimum conditions, normally through a general authorisation, which seek to ensure appropriate protection for other services.

Many applications which utilise spectrum falling under the CUS model are technologically very basic. The emphasis can often be on low cost, mass market products which are fit for purpose but which involve minimum technical complexity. This can potentially result in less efficient use of spectrum if there is insufficient incentive on manufacturers to develop innovative products which would improve sharing capabilities.

Under the R&TTE Directive manufacturers are under an obligation to minimise the risk of harmful interference by deploying 'state-of-art' technology. The purpose of this requirement is to try to optimise use of spectrum. The effectiveness of such incentives is however a little unclear. The RSPG would therefore welcome comments from manufactures and other stakeholders on this point.

2.3 GENERIC AND SPECIFIC APPLICATIONS

Although there are different ways of implementing CUS, the common thread between them is that they all seek to lower barriers to entry, thus making it easier for new users to access spectrum. This can result in significant benefits for consumers through the promotion of innovation and competition. However, the lower the barriers to entry and thus the greater the innovation potential, the harder it may be to manage interference and quality as a broader range of different applications will be able to access the band.

Generic use models of CUS provide greatest scope for innovation by opening the band for a broad range of applications. The generic approach relies extensively on adequate 'politeness rules' and 'polite protocols'. The alternative approach is to designate spectrum for a specific application. This limits entry to the band, meaning that the number of devices may be better estimated and interference scenarios may be more reliably predicted, but risks inefficient use of spectrum if the specific applications are not taken up as expected. The RSPG's views on the use of generic and specific allocations is set out in Section 6.

3. CUS AND ALTERNATIVE MODELS OF SPECTRUM MANAGEMENT

There are three commonly cited approaches to spectrum management (market mechanisms, administrative assignment and collective use). Under all the overall objective behind frequency management is the same, i.e. to promote the efficient use of the spectrum in order to maximise benefits of spectrum use for consumers. However, within this overall goal, the three general approaches reflect different constraints and obligations associated with the specificity of respective end users and are in this sense complementary to each other.

Under the European regulatory framework, authorisations for spectrum use distinguish between two different licensing regimes: individual authorisations and general authorisations. General authorisations differ from individual authorisations in that the latter assign a certain frequency band to an individual user and effectively guarantee protection for this "primary" user. Administrative assignment and market based approaches to spectrum management are generally associated with individual authorisations while CUS is most usually associated with general authorisations.

However, the RSPG noted that, under certain circumstances, individual authorisations could also fall within the CUS approach. This may be particularly relevant in relation to 'light licensing regimes' where, for example, there may be a need to co-ordinate with an incumbent user; or 'private commons' where an individual (and licensed) user sets the conditions for access.

In the past, individual authorisations may have been granted (or assumed to be granted) access to spectrum on an "exclusive basis". While this still may be appropriate in certain circumstances, primarily for safety of life services where the avoidance of harmful interference is critical, the granting of exclusive rights is becoming less and less common. This is because technical developments are further increasing opportunities for sharing, especially between licence-exempt and licensed services. This is beginning to cause a blurring of the distinction between particular spectrum bands either being used for licensed or licence-exempt devices.

The attached graphic (see annex B) seeks to identify some of the different approaches that can be considered within the CUS model (generic and specific uses, light licensing and private commons). It also seeks to explain how these approaches fit within the 3 approaches to spectrum management, how the level of protection may change and how different types of spectrum fee may be applied.

It is essential to get the right mix of the various spectrum management models. However, this mix is complicated as there may be a mixture of more than one model in a single band. This is particularly true in relation to CUS as bands are likely to be shared between licensed and licence-exempt devices.

3.1 WHAT APPLICATIONS ARE COVERED?

The most common application of CUS at present is for Short Range Devices (SRDs), including WLAN and RFID. SRD is the generic term for a number of applications and technologies, most of which operate in frequency bands which have been harmonised across the EU.

In terms of the types of service we envisage and the spectrum bands in which they operate, CUS includes:

- narrow band devices below 1 GHz such as model control, wireless alarms, hearing aids, radio microphones, medical and biological applications, private mobile radio, industry telemetry, RFIDs.
- between 1 GHz and roughly 6 GHz, devices include DECT, radio local area networks and wideband transmission networks.
- around 5 GHz and above include radio level gauges, point-to-point relays, intelligent transport systems and vehicle radar.

A more detailed overview of the spectrum bands currently administered under the CUS approach is set out in Annex A

It is also worth noting that some administrations are considering CUS as a spectrum management model for certain high-powered applications, which have traditionally been managed by an administrative assignment model. This may be appropriate if the applications are used by few users, thus minimizing the risk of interference, or are used in areas with low density of expected usage. This may for example be appropriate in sparsely populated areas of Europe or for radio equipment used by sports or other teams travelling to events in different countries.

4. ASSESSING THE PROS AND CONS OF CUS

4.1 THE BENEFITS AND DISADVANTAGES OF CUS

Advantages

The primary benefit of the CUS model is that it provides access to spectrum with minimal entry barriers. In particular, users are not generally required to apply for licences, are unlikely to be subject to licence fees and are generally not required to co-ordinate with other users. Manufacturers can therefore be certain, when developing equipment and conducting experiments, that their equipment will have access to spectrum provided it meets certain specified criteria. This encourages rapid innovation as manufacturers know they will be able to get new products to market quickly, as well as enabling industry to rapidly address niche applications and markets that may not be suitable for licensing.

The CUS model should also have the benefit of lowering the administrative burden, both for the user and the regulator. This has the effect of lowering costs, both of regulation and to society as a whole as consumers benefit from cheaper and better equipment. Wherever individual licences are unnecessary because the risk of harmful interference is minimal, the benefits of the CUS model are likely to be significant.

There is also an important EU dimension attached to many devices which operate within the CUS framework. This is most applicable to SRDs which benefit from the creation of European wide markets, thereby allowing manufacturers to exploit economies of scale which in turn leads to lower equipment costs. Consumers may also benefit directly from the ability to roam, utilising equipment across national borders. Furthermore, the creation of single conditions throughout Europe reduces the risk of interference resulting from

cross-border usage of devices. Mott MacDonald estimates the NPV to the EU of harmonising CUS is between Euro 463-898 billion.

Disadvantages

A key disadvantage of the CUS model is that, once a spectrum band has been designated for CUS, refarming for any other use is likely to be difficult. Even if 'better' services emerge in future, old equipment is entitled to stay in use for many years. Since the location of this equipment will be unknown it may, in practice, be impossible to clear the band. Measures can be taken to try to mitigate this problem, eg through transition periods or communication strategies aimed at the spectrum users. In reality, however, refarming will be dependent upon the behaviour of the users which in turn will be driven by the lifespan of existing devices, as well as the availability and price of new equipment. This issue may become increasingly complicated with the wider use of generic applications in a given band.

It is not just licence-exempt devices that are affected. CUS allocations in a shared band could potentially impose constraints on the evolution of primary users in the band (where the primary user is not licence exempt). Once the compatibility studies have been undertaken and a sharing scheme defined, the licence exempt device operating under the CUS approach and the primary users are closely tied. It means that any unexpected evolution in the licence exempt use of the spectrum may create a new interference environment to the primary users (eg, if the deployment is larger than expected). Similarly, the possibility for the primary user to evolve in terms of technology or services could be constrained as such evolution may not be protected to the same level as the initial primary users.

In some cases the risk of harmful interference to licence exempt devices may also be an issue. Quality of service may be high, but protection cannot be guaranteed which may cause problems for some types of services. The regulatory environment for devices working under a CUS allocation should provide clear directions regarding the obligations and behaviour (politeness) of the devices. While this should help to mitigate interference through lower power or new technologies, the incentives to minimise interference may not be obvious as the benefits may be to neighbours or incumbents, who will receive less interference, rather than to the user deploying the new technology.

4.2 WHEN IS CUS APPROPRIATE?

All approaches to spectrum management are concerned with getting the best use of spectrum. CUS can therefore be considered to be appropriate when the benefit to consumers and society is greater than that which would be derived from other approaches to spectrum management. A comparison of the benefits, enabling such decisions to be taken, can be informed by undertaking Impact Assessments and cost benefit analysis of the various options. Any such Impact Assessment will need to take into account options for sharing with other users in the band.

Defining sharing conditions for the efficient use of spectrum for a certain frequency band and application usually requires comprehensive compatibility studies so as to ensure that such new collective usage will not be detrimental to primary users. This is particularly challenging since the application and deployment which has been originally planned within a frequency band can change significantly with the evolution of services and

technologies. In particular, advances in technology are constantly providing for greater opportunities for compatibility to be achieved. The regulatory regime must therefore be careful to ensure that it does not put forward proposals which may inadvertently hinder such developments.

The increasingly global nature of markets for equipment is especially relevant for a number of CUS applications such as SRDs. Manufactures are keen to exploit global economies of scale and develop equipment which is interoperable around the world. For this to work, regulatory frameworks need to be co-ordinated globally and in a timely fashion in order to provide certainty. Within Europe, it is important that the regulatory framework is justified and robust and agreed on quickly as this could give Europe a head start and influence developments in the rest of the world.

5. RESPONSES TO THE CONSULTION (SECTION TO BE ADDED)

6. THE OPINION OF RSPG

The RSPG considers it likely that technological developments will lead to greater use of CUS. However, without knowing exactly what technologies will emerge nor how markets will develop (which of course we cannot), it is difficult to make precise predictions about future demand, especially in the longer term. This section seeks to identify issues which can be more practically addressed, sets out the views of RSPG and seeks to provide a direction for any future work.

6.1 A FRAMEWORK FOR CUS

The RSPG considers that spectrum for CUS will need to be available in bands across the entire frequency range. In particular, spectrum is not homogeneous and different spectrum bands have different characteristics (propagation and bandwidth). As a result, different applications will require access to different frequencies in order to deliver the required services to consumers.

The RSPG considers that CUS is likely to be particularly appropriate for smaller users that need to access spectrum. However, there is a balance to be struck in terms of the way in which spectrum is made available on a CUS basis. On the one hand, manufacturers want low barriers to entry through least restrictive access conditions. On the other, they also need certainty that their device will operate effectively and be able to share with other devices in the band.

The RSPG considers that reliance on sharing mechanisms whereby devices operating under a CUS model are required to share spectrum with primary users (and in some cases with secondary licensed users) is likely to increase. In particular we may expect greater use of cognitive technologies in many (including existing) CUS bands as well as increased emphasis on deploying CUS in higher bandwidths. Given these uncertainties, the RSPG has sought to identify markers which can help to create a framework to determine when CUS is likely to be appropriate. These are:

a) Distance of communication: communications over short distances (often with high bandwidth) in order to facilitate re-use. In some cases however frequency re-

use need not be limited to short distances: for example maritime applications would not normally be expected to be short distance but may still be suitable for CUS;

b) Power level: low-power applications are generally less likely to cause interference and therefore tend to be more suitable for CUS.
c) The part of the spectrum being used: spectrum is not homogeneous and some bands are therefore more suitable for CUS than others. In general, high frequencies are most suitable for CUS as they are less congested. Furthermore, some bands have very poor long range propagation characteristics which makes them ideal for frequency re-use over relatively short distances.
d) Type of usage: some users, such as those which can operate effectively at low power, are inherently more likely to be suitable for CUS than others.

The RSPG considers that carrying out an Impact Assessment can help to determine when a CUS approach will be appropriate. Impact Assessments can provide a framework to assess the benefits of a particular approach (such as CUS) against the cost of denying spectrum to alternative users – see for example Section 7 of CEPT Report 014[2]. The RSPG also considers it would be worthwhile to investigate trends relating to use of the CUS model, including the potential for a gradual increase in the use of CUS for longer range applications.

6.2 How to 'future-proof' the Opinion?

The RSPG considers that regulators should seek to remove constraints on spectrum use wherever technology allows. In the case of CUS, this means that allocations and associated regulations should be made as generic as possible and should not impose unnecessary constraints on the technologies or services that may be deployed in the band. This provides maximum opportunity for innovation by giving industry and other spectrum users flexibility over the development of new applications and technologies and minimises the risk of spectrum being under-used if a particular technology does not develop as expected. It also reduces the risk of regulatory distortions caused by unnecessary technical or usage constraints which artificially restrict the way in which spectrum is used.

The RSPG notes that exceptions may be required if the technologies permitted in a particular band identified for CUS need to be restricted in order to prevent harmful interference. This is particularly relevant for safety of life services or any other services which need to be prioritised as they are deemed to be of particular value to society. However, it is the view of RSPG that such restrictive technical constraints should be the exception and that, in such cases, the additional constraints that are imposed should be clearly justified on a case by case basis. In general, the RSPG strongly supports the use of generic CUS allocations as far as is possible.

Furthermore, regulators should be encouraged to explore the removal of existing constraints and question whether they continue to be justified. This is becoming increasing important as some current rules for CUS are conservative and highly

[2] http://www.erodocdb.dk/Docs/doc98/official/pdf/CEPTREP014.PDF

specified. There is a risk that overly specific rules could be driven by certain industrial policy interests that seek to promote certain technologies. This is likely to be detrimental to innovation and competition. At the same time, it is important to recognise that it is generally industry that funds the initial compatibility analysis. RSPG considers it important that regulators have the necessary tools to manage transitional periods and deal with legacy equipment, enabling new and better equipment to be introduced to the market.

The RSPG considers that more dynamic sharing of spectrum is becoming increasingly viable through the greater availability and effectiveness of appropriate politeness rules and polite protocols. It is important that the regulatory framework acts to incentivise such innovation and promotes greater opportunity for frequency sharing. The RSPG anticipates that this will facilitate greater reliance on the generic allocations under CUS.

The RSPG notes that some spectrum bands are likely to be more suited to the deployment of flexible conditions than others. In particular, flexible conditions in high frequency ranges can provide an incentive to develop new products and services. On the other hand, offering more flexible conditions in lower bandwidths may be more difficult as a result of the possibility of interference to incumbent users and the risk of congestion. Furthermore, where a band is already congested, greater flexibility is only likely to result in greater demand and consequently greater congestion. The application of the CUS model therefore needs to be considered on a band by band basis. In general however the RSPG considers that spectrum users should, where possible, be encouraged to migrate to higher bandwidths where frequencies are less congested.

The RSPG considers that, in cases where co-existence between different types of usage would be difficult (for example low and high power applications), one potential solution may be to consider various multiple classes of collective use whereby each class would be associated with a particular piece of spectrum and be managed by a specific set of rules defined by the regulator. The rules could be determined in such a way so as to ensure that the applications permitted in each CUS band would have broadly similar interference generating characteristics.

In considering the future evolution of CUS, it makes sense to focus on those areas where we expect to see significant demand for spectrum allocations under the CUS model in the future. In doing so, it is important to ensure that any rules which are to be imposed are sufficiently flexible to take account of future developments in order to ensure that innovation is not restricted.

6.3 MAKING SPECTRUM AVAILABLE FOR CUS

The RSPG considers that, as well as the traditional approach of making spectrum available in response to demand from industry, there may, under the CUS model, also be opportunities to make spectrum available in order to stimulate demand. The RSPG has given some thought as to how this may be achieved.

As there are more opportunities in the higher frequency bands, one approach is to make spectrum available in these higher frequencies (for example above 40 GHz where spectrum is more widely available and where flexible approaches are most appropriate) in order to encourage the development of new technologies. This would have the advantage of minimising the risk of spectrum being denied for other uses and could also

encourage migration from lower (highly congested) spectrum bands to higher (less congested) frequencies. This would support more efficient spectrum use. However, manufacturers of devices that use spectrum under the CUS model generally develop their application on the basis of existing technologies that be found on the shelf. These manufacturers will often not have the financial power to develop new technologies. The RSPG considers that it might be helpful to explore if the current EU Research programme could provide any possibility to facilitate the development of new radio technologies above 40 GHz for CUS applications.

The RSPG considers that further work should be undertaken in order to study whether such an approach will actually promote technological innovation. Of course, while users may be encouraged to utilise higher frequencies, CUS allocations are likely to be required across the entire frequency range. Further consideration is required as to how this spectrum should be made available and for what purpose, in particular whether it should be demand led or to stimulate demand and when to distinguish between these approaches.

Another approach is to consider whether there is a power threshold below which devices can operate across entire frequency ranges on a CUS basis without causing interference to existing users (whether licensed on a primary or secondary basis). This could effectively be an extension of the limits developed for Ultra Wideband (UWB) devices which operate at sufficiently low power levels so as not to cause interference to existing licensed users.

A complementary approach, which may be appropriate in low population density areas of Europe, could be to implement a test and trial licensing scheme to provide industry with a facility to assess consumer feedback on wireless services and assess equipment performance in a live trial environment prior to commercial launch. An example of such a scheme operated by the Irish telecom regulator, ComReg, is outlined in Annex C.

A further approach is to consider whether broad categories of use could be identified where we foresee that significant demand for spectrum under the CUS model may be required in the future. Examples of such broad allocations could include:

- High data rate communications: short range (eg Personal Area Network); medium range (eg indoor RLAN); long range (eg outdoor LAN, BWA). Drivers include increased communication between individuals and access to multimedia information;
- RFID and sensor technologies. Drivers include increased automation of logistics chains, greater reading range and performance, faster data rates, “internet of things” etc.

Given the potential of the CUS model to promote innovation, the RSPG considers that further work should be undertaken to assess how this objective can best be achieved. This should include investigation of the different approaches to making spectrum available for CUS. In particular, the RSPG believes there may be opportunities to exploit the relatively low opportunity cost of high frequency spectrum as well as sharing opportunities across the entire frequency range for very low power devices. The RSPG believes this could help to stimulate demand for new services but notes that any such initiatives will be dependent upon carrying out the Impact Assessments and, at least in relation to a threshold for very low power devices, the necessary compatibility studies.

Annex A

Spectrum bands currently designated for CUS

The following table identifies spectrum bands currently designated for CUS on a generic basis in Europe and provides an indication of their typical use.

Frequency band	**Power**	**Typical use**
40.660-40.700 MHz	10 mW erp	Toys, Model control, Baby monitors
433,05-434,790 MHz	1 & 10 mW erp	Radio Activated Key Entry (key fobs)
863-870 MHz 869.4-869.65 MHz	5, 25 & 500 mW erp	RFID, Cordless Audio, Industrial telemetry, Tele-command
2400-2483,5 MHz	10 mW erp	Video senders, CCTV, Wideband data
5725-5875 MHz	25 mW erp	CCTV, Wideband bata
24.05 – 24.25 GHz	100 mW erp	Movement detection
61.0-61.5 GHz	100 mW erp	Not presently used – no generic equipment standard developed
122 – 123 GHz	100 mW erp	Not presently used – no generic equipment standard developed
244 – 246 GHz	100 mW erp	Not presently used – no generic equipment standard developed

In addition, the following bands on Wideband Data Transmission systems allow wide range of communication applications:

Frequency band	**Power**	**Typical use**
2400-2483,5 MHz	100 mW erp	WLAN, Model control, Video distribution, Wire free connectivity

5150-5350 MHz	200 mW erp	WLAN
5470-5725 MHz	1 W erp	WLAN
17.1 – 17.3 GHz	100 mW erp	WLAN

Spectrum available for inductive applications operating within the frequency range 9 kHz to 30 MHz for Inductive and Near Field Connectivity (NFC).

Frequency band	**Power**	**Typical use**
20.05 kHz to 148.5 kHz	37.7 dBµA/m at 10m	Touch screen
148.5 kHz to 5 MHz	148.5 kHz - 5 MHz	Sensors
5 MHz to 30 MHz	-20 dBµA/m at 10 m	RFID, Entry control, Transport ticketing

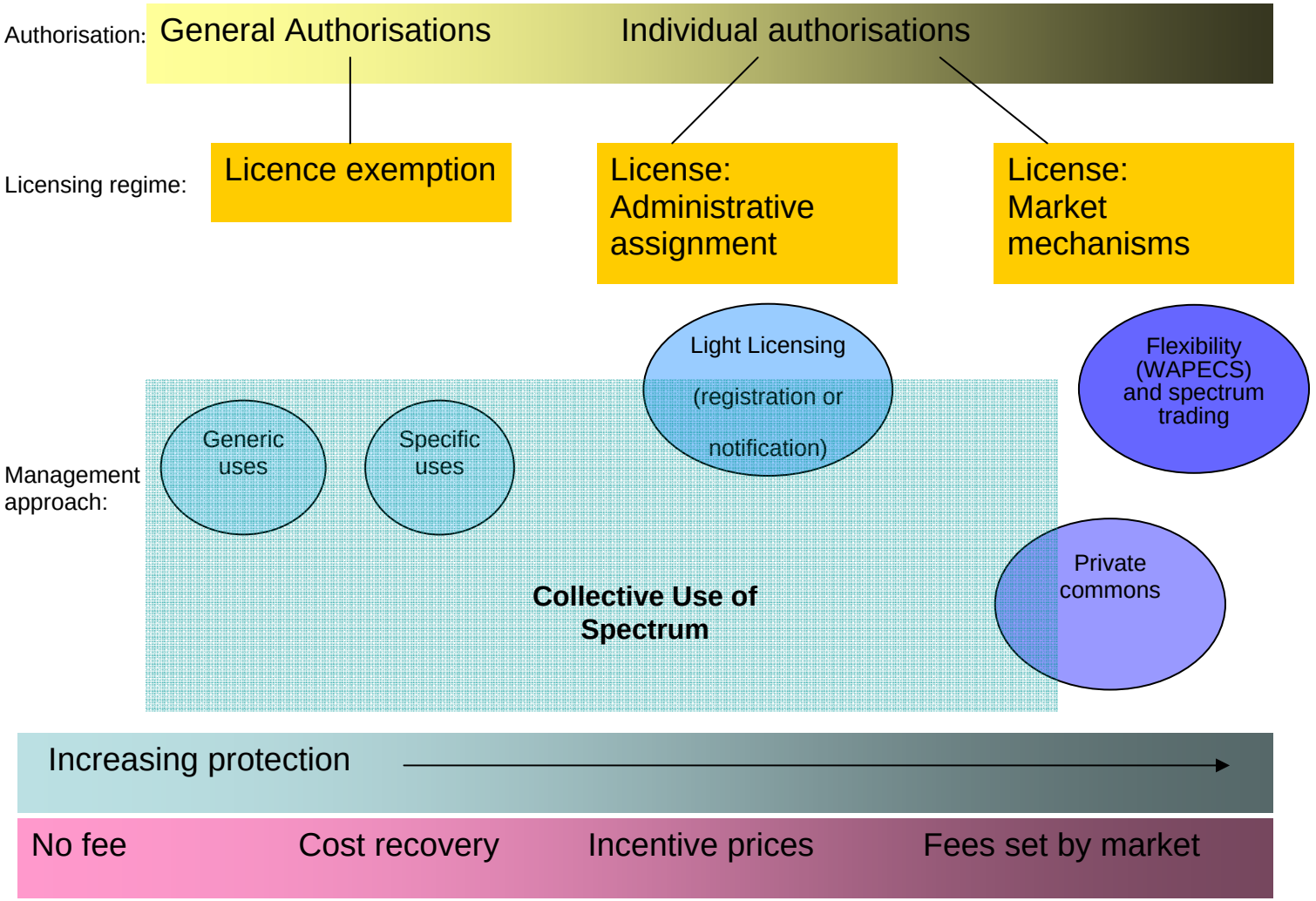
Spectrum regulation for UWB

Frequency range	**Maximum mean e.i.r.p. density (dBm/MHz)**	**Typical use**
3.1 to 4.8 GHz	–41.3 dBm/MHz	Wire replacement technologies (home hub to display screens), object detection and location
6 to 8.5 GHz	–41.3 dBm/MHz	

Spectrum in the 57-66 GHz band

Frequencies	**Application**	**Parameters**
57 – 66 GHz	Indoor, +40dBm eirp.	MGWS WLAN/WPAN
57 - 66 GHz	tbd	MGWS FLANE (PP FS)
63 – 64 GHz	200 mW eirp.	ITS
61.0-61.5 GHz	100 mW eirp.	SRD

Annex B: Place of CUS in models of spectrum management



ANNEX C

ComReg's Wireless Test & Trial Licence Scheme

Overview

Ireland's geographic position on the western edge of Europe and low population density provides a key natural advantage that allows ComReg to promote its test and trial licence scheme. A lack of congestion in most frequency bands means that frequencies can be made available to test products in a live environment, aimed at Irish, European or wider global markets. When taken with the rapid evolution of wireless technology Ireland has an excellent opportunity to encourage global developers to choose this country as a test-bed for new product or service concepts.

In response to market demands and to encourage and maximize the use of radio spectrum for the benefit of industry and research institutions in Ireland, ComReg launched a substantially enhanced Test and Trial wireless scheme in 2005.

The test licence facility enables innovators to carry out field tests (e.g. testing of new standards) of wireless technologies and services that otherwise would not be possible under typical spectrum management regimes. This can give companies in Ireland a clear advantage over other nations where access to spectrum is more restricted. Additionally it also facilitates the testing and manufacture of systems destined for deployment in foreign markets, where different standards and regulations may apply. The test licensing scheme has enabled a wide variety of organisations including international equipment manufacturers to test and develop new radio equipment.

The trial licensing scheme allows industry to have the ability to garner consumer feedback on wireless services and assess equipment performance in a live trial environment prior to commercial launch. The scheme, which has been praised by many markets players, is currently being used by mobile network operators , for example, to trial mobile TV, to trial 3G services at 900 MHz and to trial digital TV and radio (TDAB, DRM). Ireland's abundance of uncongested spectrum allows ComReg to accommodate requests for any frequency bands not currently being used in a particular location for test licences, including parts of the mobile and broadcasting bands.

Further Information on the ComReg Test & Scheme is available at:

Test Licence – Aimed at wireless research (e.g. the study of propagation effects and applications testing), and wireless Product Development & Testing. Cost €200 / year.

http://www.comreg.ie/_fileupload/publications/ComReg0535a.pdf

Trial Licence – Targeted at companies seeking to carry out trials of new services that involve actual test customers. This gives service providers the opportunity to develop innovative new services in a realistic environment. Cost €500 / year

http://www.comreg.ie/_fileupload/publications/ComReg0535b.pdf

Link to Test & Trial Guidelines

Explanatory Information for the applicants on the licence scheme.

http://www.comreg.ie/_fileupload/publications/ComReg0535.pdf

Link to Test & Trial Webpage

Information on how to apply to a licence, existing licensees etc.

http://www.comreg.ie/radio_spectrum/search.541.874.10025.0.rslicensing.html

Link to Test and Trial Licence Brochure:

Summary information on the Test & Trial Licensing Scheme

http://www.comreg.ie/_fileupload/publications/IP191006.pdf