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DG INFSO/B4

**RSPG08-203**

## **SECOND PROGRESS REPORT**

ON

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

#### **1. PROGRESS REPORT TO RSPG#15**

A second meeting of the RSPG Working Group on Collective Use of Spectrum (CUS) was held in London on 22 January 2008. The purpose of the meeting was to build on discussions from the first Working Group meeting (held in October 2007) and on the outcome of the November 2007 RSPG meeting. The main issues discussed at this Working Group meeting included:

- Definition of CUS – discussion of Quality of Service under the CUS model and the greater responsibility it affords to manufacturers and users.
- Positioning of Collective Use - the relation between primary and secondary (CUS often falls in this category) users.
- Current rules for CUS can be highly specified: better to have generic (or at least more generic) CUS allocation rather than specific CUS allocations.
- Benefits of CUS are not exclusively related to SRDs but may be much broader than this, especially in relation to lower barriers to entry and lower regulatory burden. Potential disadvantages include the difficulties of re-farming and the risk of interference.
- Expectation that CUS is likely to increase in future but very difficult to predict how much spectrum should be made available. Instead it was proposed to focus on the identification of criteria which could help to determine when CUS should be used.

- How can spectrum most effectively be made available for CUS: should it be made available simply on demand or might there be merit in making spectrum available beforehand in order to stimulate innovation?

Following the Working Group meeting, and taking account of various contributions provided, the Rapporteur produced the attached document (annex) which is intended to provide the basis of a draft Opinion on CUS.

## **2. ISSUES RAISED AND NEXT STEPS**

There is clearly still further work to be done in the development of this Opinion and a further Working Group meeting has been scheduled for 24 April in Brussels. In the meantime the Working Group would welcome view of the RSPG on the attached Summary of working group findings (Annex).

**One issue on which the Working Group would particularly welcome feedback concerns the way in which spectrum should be made available for CUS. Two options in particular were discussed by the Working Group:**

- a) to make spectrum available as the need arises (i.e. in response to user demand);**
- b) to make spectrum available in advance of market demand in order to try to stimulate demand and promote innovation.**

We would welcome views of the RSPG on the appropriateness of these two options, as well as on other issues raised in the attached document, such as the expected areas of future demand for the CUS model and implications for its future use.

## **3. CONSULTATION**

Since the Request for Opinion was published, a number of stakeholders have asked about progress and indicated that they would potentially be interested in contributing to the development of the Opinion. Given this, the Working Group considers that it may be appropriate to consult publicly on the Opinion before it is finalised.

If this is accepted, it is proposed that that RSPG should aim to issue a consultation on a draft Opinion immediately following the June 08 RSPG meeting, with a view to formally adopting the Opinion at the following November 08 meeting.

**Chris Woolford**

Rapporteur

February 2008

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## Annex

### **Summary of working group findings after the second meeting**

#### **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 increasingly 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). 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*

*“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.

### **3. 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 as the responsibility for interference management is delegated to the user and/or manufacturer. In this case it is the user and/or manufacturer that takes on responsibility for congestion management (ie how users behave as the spectrum is more heavily used). This is somewhat different from the licensed model where the regulator – through the issue of a licence – effectively provides an assurance over the level of protection that may be expected.

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 CUS user is unlikely to have any such recourse, neither through the regulator nor the manufacturer.

QoS is dependent upon the level of congestion within the band and co-existence between the different technologies and services deployed. It can be improved through the use of ‘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 standards. Different management approaches (generic uses, specific uses, light licensing...) reflect different levels of control of the radio environment by the regulator, which should have an impact on the QoS that can be offered by radio systems operating under a CUS model.

Generic use models should facilitate the introduction of new applications and are likely to extensively rely on adequate ‘politeness rules’ and ‘polite protocols’. An alternative approach that can be used to try to deliver an appropriate QoS is to designate spectrum for a specific application. With this approach the number of devices may be better estimated and interference scenarios may consequently be more reliably predicted. The issue of generic and specific allocations is further considered later in this document.

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. Under a light licensing model, on the other hand, the regulator may be able to manage the interference environment better, in some cases by limiting the number of users in the band. In practice, light licensing may be used to authorise typically greater power than licence-exempt regimes. 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 third party, as well as other users, to manage the risk of interference while the regulator has very little influence.

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;
- manufacturers ensure the conformity of equipment with the necessary spectrum and equipment regulation. Manufacturers can seek to improve QoS over the longer term through the development of new equipment using better technology which may help to minimise the risk of harmful interference. This objective is supported by equipment regulation (the R&TTE Directive) which seeks to promote technical innovation in equipment in order to optimise use of spectrum.
- the regulator adopts the relevant regulation, in particular the conditions of the general authorisation which seek to ensure appropriate protection for other services.

#### **4. CUS AND ALTERNATIVE MODELS OF SPECTRUM MANAGEMENT**

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.

Under all three spectrum management approaches (market mechanisms, administrative assignment and collective use), 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.

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) 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.

For the regulator, it is essential to get the right mix of the various spectrum management models. However, in the particular case of collective use, this mix is complicated as there may be a mixture of more than one model in a single band.

## **5. ITU RADIO REGULATION AND WHAT IS COVERED BY CUS**

Several articles of the ITU Radio Regulations (RR) address sharing and coordination between different types of services (primary, secondary etc). Although the RR address the relationship between administrations in case of interferences from one country to another and not the co-ordination within a particular country, the concept is relevant to CUS since collective use often operates on a secondary basis. According to the RR secondary services:

- shall not cause harmful interference to primary services;
- cannot claim protection from harmful interference from primary services;
- can claim protection, however, from harmful interference from the same or other secondary services.

The most common application of CUS at present is for Short Range Devices (SRDs), although other devices including 5 GHz RLAN and RFID also fall within the scope. SRD is the generic term for a number of applications and technologies, most of which operate in frequency bands which have been harmonised across Europe.

In terms of the types of service we are talking about, these include:

- 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.

## **6. THE BENEFITS AND DISADVANTAGES OF CUS**

The primary benefit of the CUS model is that it provides access to spectrum with minimal entry barriers. In particular, users are not 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, that they will have access to spectrum provided they meet 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.

The CUS model also has the benefits 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. From a regulatory perspective, this can be achieved by affording greater responsibility to manufacturers, through the obligation of conformance of products with necessary spectrum and equipment regulation and, to a lesser extent, to users which have to conform with usage instructions.

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.

A disadvantage of the CUS model is that, once a spectrum band has been designated for CUS, re-farming for any other use is extremely 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.

Moreover, 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). This is because the primary user may be required to take account of radio devices, the number and location of which is likely to be unknown.

In some cases the risk of harmful interference 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 are complex as the benefits may be to neighbours, who will receive less interference, rather than to the user deploying the new technology.

## **7. EXPECTED TECHNOLOGICAL, SOCIETAL AND ECONOMIC DEVELOPMENTS**

The RSPG considers it likely that technological developments will lead to greater use of CUS. However, without knowing exactly what technologies will emerge (which of course we cannot), it is very difficult to predict what the implications are for spectrum managers. One question that could be asked concerns the amount of spectrum which should be set aside for CUS.

It is the RSPG's view that this question cannot be answered directly as it would require too many assumptions to be made about how the markets and technologies will develop in the future. Moreover, it is probably the wrong question as it implies exclusive bands being made available for CUS whereas in reality CUS is likely to be a secondary service which will share with primary users. Therefore, rather than attempt to answer the question directly, the RSPG has sought to identify markers which can help to inform the development of the most appropriate framework for CUS. The RSPG is also keen to better understand trends relating to use of the CUS model, including how its use may evolve in future. This could, for example, include an assessment of the potential for a

gradual increase in the use of CUS for longer range applications. A more appropriate question therefore concerns when CUS should be used in a modern framework for spectrum management.

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. The RSPG considers that carrying out an Impact Assessment can help to assess the benefits and costs of denying spectrum to alternative users before identifying any new spectrum bands for CUS – Refer to CEPT Report 014 [ref to be added].

The RSPG considers that there are some markers which can help to determine when CUS is likely to be appropriate. These are:

- a) Distance of communication: communications over short distances (often with high bandwidth) are less likely to cause interference and are therefore more suitable for CUS. Particularly relevant for ‘wire replacement technologies’.
- b) 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 and the propagation characteristics of the spectrum mean the risk of interference is less. Furthermore, some bands have very poor long range propagation characteristics which makes them ideal for frequency re-use over relatively short distances.
- c) Type of usage: some users, such as those which operate at low power, are inherently more likely to be suitable for CUS than others. Are their limits that can be placed on this (eg using UWB as an example)?

## **8. 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 regulators should where possible make allocations 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 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 technical or usage constraints creating artificial distorting effects on the way in which spectrum is used.

There may be exceptions to this when the technologies permitted in a particular band identified for CUS may 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, in existing CUS bands, regulators should be encouraged to explore the removal of existing constraints and question whether they continue to be justified. This is becoming increasingly important as some current rules for CUS are conservative and highly 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.

[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 portion of the 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.]

## **9. HOW TO MAKE SPECTRUM AVAILABLE FOR CUS [TO BE DISCUSSED FURTHER BY WG]**

In general, spectrum use is driven by the demands of industry and in general this model has also been applied to CUS. However, the RSPG questioned if spectrum could be made available under the CUS model in order to stimulate demand. If so, when? One approach is to make spectrum available at higher frequencies (for example above 40 GHz where spectrum is more widely available) 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 might support more efficient spectrum use.

It is questionable whether such an approach will actually promote technological innovation. However, given the relatively low opportunity cost of such high frequency spectrum, it seems worth considering. 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, 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 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.

*COMMENT: The mechanisms under which spectrum should be made available for CUS – including whether it should be demand led or designed to stimulate demand – is an area that requires further work. This issue will be considered further at the next meeting of the Working Group and, in the meantime, views of the RSPG would be welcomed.*

## **10. IMPLICATIONS OF INCREASED USAGE OF THE CUS MODEL [TO BE DISCUSSED FURTHER]**

The definition of 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 Opinion must therefore be careful to ensure that it does not put forward proposals which may inadvertently hinder such developments.

Once the sharing scheme has been 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 (eg, staggered radars at 5 GHz, radars with lower power).

Finally, it is worth noting the increasingly global nature of markets for equipment, which 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.

## Annex: Place of CUS in models of spectrum management

