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JOINT BEREC/RSPG WORKING GROUP ON COMPETITION ISSUES

**Report on exploring the economic and social value
of radio spectrum for certain electronic
communications services with respect to the
frequency assignment procedures**

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Annex 1: Questionnaire

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1. Introduction

The Radio Spectrum Policy Group (RSPG) shall assist and advise the Commission on radio spectrum policy issues, on coordination of policy approaches, on the preparation of multiannual radio spectrum policy programmes and, where appropriate, on harmonised conditions with regard to the availability and efficient use of radio spectrum necessary for the establishment and functioning of the internal market.¹

Within the scope of Directive 2002/21/EC (Framework Directive) and Directives 2002/19/EC, 2002/20/EC, 2002/22/EC and 2002/58/EC (Specific Directives), Directive 2009/140/EC (amending above-mentioned directives) and of Regulation (EC) No 717/2007 the Body of European Regulators for Electronic Communications (BEREC) shall inter alia develop and disseminate among NRAs regulatory best practice, such as common approaches, methodologies or guidelines on the implementation of the EU regulatory framework; issue reports and provide advice, upon a reasoned request of the Commission on any matter regarding electronic communications within its competence; and on request, the Commission and the NRAs in relations, discussions and exchanges with third parties; and assist the Commission and NRAs in the dissemination of regulatory best practices to third parties.²

The Joint BEREC/RSPG Working Group on competition issues was tasked to explore the way in which the economic and social value of radio spectrum used for electronic communications services is determined in relation to authorisation and frequency assignment issues.

In accordance with the relevant RSPG 2011 Work Programme and BEREC 2011 Work Programme, the objective of this report is to share experiences and views on how to determine the social and economic value of the use of radio spectrum for electronic communications services (ECS), specifically with respect to the process of authorisations and frequency assignments. Due to the fact that this study is conducted in a limited time frame, that WAPECS bands are subject to interest from the market and from policy makers to support mobile broadband, and that these bands are also subject to significant amounts of long term investments, RSPG/BEREC decided to collect views from Member States on the following WAPECS bands:

- 790-862 MHz (800 MHz band);
- 880-915 MHz / 925-960 MHz (900 MHz band);
- 1710-1785 MHz / 1805-1880 MHz (1800 MHz band);
- 1900-1980 MHz / 2010-2025 MHz / 2110-2170 MHz (2 GHz band);
- 2500-2690 MHz (2.6 GHz band); and
- 3.4-3.8 GHz (3.6 GHz band)

¹Article 2 Commission Decision establishing a Radio Spectrum Policy Group

²Art. 1 and 2 of the Regulation (EC) No 12/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Office;
see <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0001:0010:EN:PDF>.

Based on the results of the questionnaire, this RPSG/BEREC report examines experiences and views of regulators based on recent award proceedings for rights of use of spectrum.

2. General Considerations on recent assignments of radio spectrum for electronic communications services

The regulatory environment for the use of radio spectrum is extensive and complex. It is a long way from the allocation of radio services to specific frequency bands at international level to authorizations of assignments for frequency utilizations at national level.

RSPG/BEREC has already published a report on "New competition challenges resulting from a more flexible management of spectrum" and RSPG published a report on „assignment and pricing”

A number of features have to be taken into account in the decision making process at national level during the preparation of the assignment process. Among them are considerations on the economic and social value of the radio spectrum.

The general considerations below focus on radio spectrum for ECS and provide a rather limited background which is limited due to the complexity of the topics. The readers should refer to other previous RSPG/BEREC reports or to other relevant RSPG opinions and progress reports to complete its background.

2.1 General considerations on the economic value of the radio spectrum for electronic communications services

There is a limited amount of radio spectrum currently designated for ECS. The exact characteristics of that spectrum cannot be readily duplicated. Therefore, from an economic point of view the supply of radio spectrum is relatively inelastic. Various governmental and electronic communications applications are using different parts of the radio spectrum depending on the relevant radio communication service.

In this report, those general considerations focus on electronic communications services and issues that relate to individual authorisations.

The economic value of radio spectrum is derived from the profits a service provider could earn for providing applications and valuable services by using this scarce resource exclusively. The present value of the economic profit is normally calculated by using the method of discounted cash flows (revenue minus cost) over the lifetime of the rights to use radio frequencies.

The value of radio spectrum is influenced by various factors, including:

- The rights to use radio frequencies: the duration of the rights, the coverage requirements, the openness to mobile virtual network operators;
- The technical conditions to use the spectrum, namely

- the size of frequency band available
- the technologies which can be implemented: e.g. wideband technology (10 MHz bandwidth or more)
- the technical conditions to coexist with adjacent services;
- The regulatory certainties to support long term investments are among other examples of factors that impact the value;
- Propagation characteristic of specific frequency bands – each frequency band has its own characteristics which explains the variety of applications (not only electronic communications applications) using the spectrum; and the suitability of specific frequency ranges for particular applications;
- The existence of technologies appropriate to particular applications; restrictions on licensed use; and existing and expected other users. For example, rights to use radio frequencies in certain frequency bands will be of higher value for rights holders if propagation characteristics are such that applications could be realised at lower cost compared to other frequency bands (e.g. through using a lower number of base stations); and
- The degree of competition. For example, the greater the competition on the retail market, the lower the revenues an operator may earn and the lower the value of rights to use those radio frequencies may be.
- The demand of services. The greater the demand for services on the retail markets, the more efficiently the spectrum is used. When there is high demand for the services on retail markets, the more valuable the spectrum is for the owner

All of these above factors can influence the value of individual rights to use radio frequencies in the business plans of operators and users of the rights.

The economic value of individual rights to use radio frequencies can alter over time. For example, technological progress may enable more efficient use of radio spectrum or new applications may require considerably more bandwidth.

In a market economy, the value of an object or service is reflected by market prices – through the willingness of individual companies to pay for exclusive rights to use radio frequencies in expectation of resulting profits (microeconomic perspective). These expectations depend on the company's forecast of number of users, the costs and prices and future market activity.

Normally, the awarding body (generally a government body or regulatory authority) does not have sufficiently reliable information about the value a company places on the rights of use of radio frequencies. As radio spectrum suitable for ECS is a finite resource, it should be ensured that the party or parties receiving the usage rights is the party which can realise the greatest possible benefits from its use. This can be

ensured by selling the usage rights at a price which reflects the margin profit/benefits.³

However, from a macroeconomic perspective (and from that of the awarding body) it is not generally desirable that price should be the sole criterion. The objectives of an efficient company need not necessarily be the same as those for the economy as a whole. For example, a financially strong and established company could obtain all available rights to use radio frequencies in order to prevent market entry by other companies. Alternatively, it might only cover regions which are particularly lucrative owing to high population density and/or density of commercial undertakings.

Regulatory conditions attached to the acquisition of rights to use radio frequencies should be clearly defined and publicly available.

Not all award proceedings are equally suited for achieving efficient outcomes. Those generally considered are first-come first-served proceedings, lotteries, beauty contests and auctions. There now follows a brief evaluation of these proceedings which could cover various combinations.

First come first served

Award of spectrum rights on a first-come first-served basis is made according to the order in which applications are received. Successful parties are those who submit their application the quickest in response to a call to tender.⁴

This process is suitable in particular for those frequency bands in which scarcity of spectrum is not expected in the foreseeable future. In a public consultation process the awarding body needs to ensure that there is no scarcity of spectrum as well as ensuring that all interested parties are fully aware of the process.

These proceedings alone cannot ensure that the selected party is the one that places the highest economic value on the rights to use radio frequencies or uses it most efficiently. Even though applicants may meet certain minimum requirements for the usage of radio frequencies, there is a possibility that, at some point in the future, significant demand might emerge for those frequencies.

In summary, a first-come first-served approach is an appropriate awarding process where there is no scarcity of spectrum.

Lottery

Similar conditions apply to award of spectrum rights by lottery where success depends on the luck of the participant. A lottery has the advantage that an award decision is achieved quickly. If no suitability test or pre-selection of participants is carried out and no regulatory conditions are attached to the acquisition of rights to

³Falch/Tadayoni, Economic versus technical approaches to frequency management, Telecommunications Policy 2004, p197 (205).

⁴WIK Discussion Paper No 165, p42.

use radio frequencies, there is a high risk that unsuitable companies or speculators who wish to make short-term capital gains may be awarded such rights.

Beauty contest

Beauty contests are a good option to promote several policy objectives, such as coverage or quality of service. The licensees are selected using criteria set by the awarding body and that are well known before the process. Licences are awarded to the applicant who best meets the identified criteria and can make optimum use of the radio spectrum. The applicants may compete to achieve the best overall rating on a combination of criteria. Some of these criteria will involve applicants making undertakings, e.g., on roll-out and coverage or quality of service. These undertakings will generally be translated into authorisation requirements.

The advantages of such proceedings are that there is a flexible element to the decision and that factors beyond the purely economic value of the radio spectrum can be considered. These could include, for example, the purchasing power of an applicant, technical experience, innovation, expansion plans, planned degree of coverage, market penetration and price.⁵ The success of this procedure is, to an extent, dependent on transparent criteria and a sufficiently clear evaluation process.

There are some potential disadvantages to beauty contests when compared with auctions such as an elevated risk of legal challenge against the outcome of the beauty contest process. However, we also note that an auction process is likely to involve greater legal risk of challenge than a beauty contest during the consultation period ahead of the award itself. The challenge therefore is to minimise those legal risks by establishing robust and transparent award procedures.

Depending on the set-up of the proceedings, the administrative costs should be carefully assessed in advance. Nevertheless, there is the risk that the revenue obtained for the rights does not sufficiently reflect its economic value due to uncertainties in assessing the economic benefits that rights to use radio frequencies can deliver to the service provider.

Auction

An auction is a market institution with an explicit set of rules determining resource allocation and prices on the basis of bids from the market participants⁶. In an auction of rights to use radio frequencies, the provider (normally a government body or regulatory institution) is offering access to a scarce resource, and faces a certain number of potential requesting parties, or bidders. Usually, the provider is uncertain of the value afforded to the auction object by the potential bidders.⁷

⁵Paier, *Frequenzmanagement in der Mobilkommunikation in Österreich*(Frequency Management in Mobile Communications in Austria), p10.

⁶ McAfee/McMillan, Auctions and Bidding, *Journal of Economic Literature* 1987, p699 (701).

⁷Cf also McAfee/McMillan, Auctions and Bidding, *Journal of Economic Literature* 1987, p699 (703f).

An auction process could take various forms such as multiple rounds of bids or multiple rights to use radio frequencies in various frequency bands at the time.

The objective of the auction is to determine the actual market value of the rights to use radio frequencies as the successful party is the one who values the rights the most. A bidder's willingness to pay depends on, amongst other factors, an efficiency edge over the other bidders. If his willingness to pay is high, this may be as a result of cost advantages such as

- effects of scale or synergies due to existing infrastructure; or
- the economic benefits expected from his business model.

Where there is scarcity of spectrum, the auction appears to be a suitable form of award as bidders show their true valuation of the usage rights, meaning that it is sold to the one who is likely to use it most efficiently. The auction should be non-discriminatory with objective and transparent requirements and each participant should have the same chances whilst being treated equally by the auctioneer. The results of an auction should be efficient and transparent, thereby minimising the risk of litigation.

Normally, a range of other welfare maximisation objectives play an important role in the auction. These include, most notably, efficient use of the radio spectrum; as high a degree of coverage as possible; a positive influence on an economy's competitive ability and thus the promotion of economic growth through the provision of mobile communication media, fast implementation of new and innovative services and the prevention of market concentration.

Appropriate parameters can be selected for the auction in order to take these factors into account. For example, there may be a limit on the maximum number of frequency blocks a company can acquire or there may be a coverage obligation linked to obtaining usage rights.

This means that the auction, if appropriately designed, can be considered suitable, not only for determining the value of the rights to use radio frequencies and identifying the company that will use it most efficiently, but also for ensuring various other factors desirable to increase welfare.

Summary

In summary, the value of rights to use radio frequencies is dependent on the services which can be realised with these rights, as well as the expectations of the company regarding future market activity and profit. This value can be determined using suitable proceedings. However, price should not be the sole criterion when awarding rights to use radio frequencies. Welfare factors also need to be taken into account.

There is no universal answer to the question of a suitable method for awarding the rights to use radio frequencies and establishing its economic value. Suitability depends both on the design of the proceedings (and any accompanying regulatory measures) and on the particular circumstances of the award. Depending on the

specific case at hand, any of the features described above (or a combination of those features) could be best suited to determining the economic value of the rights to use radio frequencies. That is why it must first be established for each award which requirements are to be set and which form of award is best suited to meet the objectives.

In addition to the various factors outlined above another aspect that needs to be taken into account is consumer welfare.

Consumer welfare

To maximize the economic welfare, the consumer surplus has to be taken into account as well. Consumer surplus is a measure of consumer satisfaction that calculates the difference between what the consumer is willing to pay for a service (or goods) in comparison to the price of this service (goods). A consumer surplus occurs if the consumer has to pay less than he is willing to pay.

More competition in the mobile sector due to more operators being able to use the spectrum could lead to falling prices for the services which will result a) in a higher consumer surplus and b) in making these services available for consumers who previously may not have been able or willing to pay the prices demanded. More competition could also lead to a differentiated offer and more choice for the consumers. Quality of services may be also one element of differentiation between operators. The more different offers there are, the better are the consumer's chances to find a service or bundle of services that for a similar price (nearly) perfectly suits their needs.

The consumer may make a trade-off between the retail tariff and other elements of the service such as quality and the bundle of services on offer.

2.2 General considerations on the social and public value of the radio spectrum for electronic communications services

In this section, we briefly review possible approaches towards the definition of social value of radio spectrum in the context of electronic communications services as described in other sections of this report. We also provide some explicit or indirect references to social value in recent procedures on radio spectrum assignment in Europe, to illustrate, by way of example, how the concepts have been used in practice.

The social value of radio frequency spectrum within the framework of this report is understood to be the social value of spectrum in the context of usage of radio frequency by electronic communications services.

In many countries, especially in European countries, the radio spectrum is part of the public domain of the State which defines the real property rights granted as

authorisations⁸ to operators (private or public bodies). The radio spectrum as a public domain exists only through the use of frequencies and responds to some public interests objectives thus covering social considerations⁹.

It may be noted that the perception of social values can evolve or change over time under various influences (scientific, technical innovations, changing demographics, culture, beliefs and religions, economic changes, changes in prevailing economic doctrines). In fact, it is difficult to give a clear and objective definition of the social value in the context of usage of radio spectrum and even to give a measure. Nevertheless, the social value is different from the social responsibility of organizations; one of these social responsibilities could be the environmental impact of energy consumption.

Solely for the purposes of this report, social value is treated separately, as a notion, from economic value.

Social value could be hereby defined as that value which is not captured by the price paid resulting from spectrum assignment. More importantly, the question is how to measure it in the context of spectrum assignment and relevant usage for electronic communications services?

Various approaches exist to measuring and/or estimating the social value resulting from the usage of electronic communications.

However, it remains difficult to evaluate the outcomes of radio-spectrum assignments in terms of social benefits in cost-benefits analyses.

The challenge is to develop recognizable metrics for social value and the social impact of an administrative decision.

By way of example, it could be a traditional cost effectiveness analysis, focusing on the effects in terms of coverage cost, measured in Euro/MHz; a wider focus could assess the degree of enablement of some particular service(s), such as ultra-broadband, measured in capacity/Euro/MHz, or it could come from a net present value assessment, where positive aspects (coverage, service availability, etc.) are matched against potential downsides.

2.2.1 Social value of radio spectrum in the context of electronic communications services

Radio frequencies are public goods and considered as intangible assets that acquire a measurable value whenever they are put to some use (either commercial or governmental/public). One of the main objectives of the spectrum manager will be to ensure an effective usage between various interested parties of spectrum users.

⁸ The processes for granting licences can follow many techniques based on administrative or market-based types (public administration pre-emptions, first come –first served, auctions, ...).

⁹ « Le domaine public hertzien – Attribution et exploitation des fréquences radioélectriques » Thomas Pez – L.G.D.J. Editions

Regulators must not only pay attention to the private values of bidders (which reflect the private benefits, such as profits, that bidders expect to receive from using the radio frequency spectrum), but also to the social value (the value to society, as measured for instance by consumer surplus or increased economy-wide output) created by particular firms' use of radio frequency spectrum.

In order to provide some elements to this analysis, this section will focus on the electronic communications services and relevant social value generated by this form of radio frequency usage. Nevertheless, this section does not intend to provide an exhaustive definition due to the complexity of the subject and the variation from one usage (voice) to other usages (data upload, download, applications etc) and from country to country.

Ultimately, the impact in terms of social value will have to be carefully assessed at national level and will be part of a decision making process for any evolution of radio frequency spectrum usage.

The social value is linked to benefits from the trade-off generated by the decision to release spectrum for an electronic communications service, which will allow for a number of intrinsically related developments of economic, social and possibly cultural phenomena and which could be driven by requirements included in the authorization granted to the mobile operator. The initial policy decision will generate principles to capture social values from usage of radio spectrum.

Most of the time the economic activities unleashed by such radio frequency assignments will also correlate with increased social welfare for a number of players, in direct or indirect ways. This should be compared with the social value generated by the current usage of radio frequency. This is an exercise which is part of a decision making process of releasing a frequency bands at national level.

External benefits following the valorization of radio frequencies, whose economic value has been extracted by means of an assignment procedure could also be considered.

Social value resulting from the usage of radio spectrum

For the purposes of this report, social value is primarily approached as benefits intrinsic to radio frequency usage by electronic communications services. The focus will shift to the overall evaluation and impact of the assignment procedure, which might or might not contain and dictate most of the foreseeable conditions in which the new services will be offered.

When assigning radio frequencies to a particular commercial activity, the social value of usage of radio frequencies is carefully assessed at a national level based on policy decisions such as pluralism, commercial activities, consumer welfare and externalities such as productivity and better competitiveness. This assessment includes the need to implement coverage obligations in particular areas and a trade off with other competitions measures (MVNO access for instance). This issue is discussed in another report (see RSPG report on Improving Broadband coverage).

In practice, some principles in relation to the usage of radio frequency spectrum by electronic communications services will be considered by the legislator:

- Facilitating access to resources for citizens and the economic sectors
- Continuity of services
- Quality of the service (availability, data rates, etc.)
- Coverage of some parts of the territory. In Europe, the deployment of mobile networks was initially to first serve the densely populated areas and then complete the coverage of rural areas. In some European countries, rural areas are still underserved by mobile services. The legislator may also identify mobile networks as a means to bridge the digital divide.
- Facilitating the prospects of competition and growth in a market

Such principles are then translated in requirements within the authorization granted to the mobile operator further to the assignment process.

Over time at least the perception of social welfare might vary, due to the dynamic notion of social value resulting from usage of radio frequencies, such as:

- The awards of rights to use radio frequencies might not allow for disruptive technologies or innovative business model.
- The average length of individual authorizations (which are increasingly of a longer duration) might change;
- If commercial activities are increasing due to the usage of radio frequencies, an increment in the social value should be considered: over time there might be a perception that, for instance in the case of mobile telephony, beyond a certain amount of network coverage having more fully fledged competitors becomes an overarching objective which might lead to increased social value.
- The Network effect/network externality¹⁰

For most electronic communications regulators 'optimal use' could mean that the radio frequency is used in a way that maximises the value that citizens and consumers derive from it, including the wider social value of radio spectrum use, and taking into account the specific consumer and citizen interests, including the interests of particular groups within society¹¹. A regulator would also typically include in the 'optimal use' the positive impact resulting from competition. A spectrum manager needs to reconcile various opposing and diverging objectives of potential spectrum users and hence is likely to emphasise in its analysis the impact in the long term of the overall social value.

Social value as an externality resulting from the usage of radio spectrum

Where the social value is examined as an externality in the case of electronic communications services, the analysis will be aimed at identifying the benefits derived from the usage of spectrum. The social value of the usage of radio spectrum¹² would not be created by the availability of radio frequencies per se, but by

¹⁰ The value of network depends on the number of users in connection with others using it.

¹¹ see also RSPG Report 09 298 : Report on Assignment and Pricing Methods

those activities, economic, cultural, collective and social which are made possible by using radio frequencies. Another section of this report (see 2.1) describes in more detail the conditions which can ensure a proper usage of radio frequencies.

Different assignment and authorization systems could impact on the level of social value, but this will have to be ascertained on a case by case basis.

The social value resulting from usage of radio frequencies by electronic communications could include various factors, due to development of unexpected activities stimulated by innovation such as:

- results of coverage obligations (including a higher or lower percentage of rural areas);
- direct and indirect employment;
- taxes generated by direct and indirect commercial activities;
- perspective of growth of GDP, etc.

Assessment of relevant benefits in terms of social value due to the usage of radio frequencies

More specific determination of the social value of the usage of radio frequency spectrum by electronic communications services could be based on an analysis of the implementation of relevant requirements from the authorisation granted to the commercial entity (type of service, coverage of population and coverage of the territories, quality of service, interconnection, etc.) and by the overall welfare effects created by its uses and not anticipated by the legislator.

When measuring externalities or relevant benefits the resulting social value could be assessed according to the following non-exhaustive factors:

- Benefits to citizens/firms from coverage obligations or innovative services;
- The service provider/operator can generate its own profits, i.e., enhance the economic value from various uses of radio frequency spectrum. At the same time consumers would benefit not only from services offered by service providers / operators, but also by non-economic activities (i.e. safety, culture, social services, etc.) which are enabled by current and future usages of spectrum;
- The citizen benefits from additional revenues for the State generated by awards, direct and indirect jobs created by the direct and indirect commercial activities, relevant fiscal revenues from related services, , etc.
- Service providers and consumers would benefit from the social component of network effects, i.e. the “social layer” of network externalities which have now come to be epitomized by social networks of various kinds, but which could also be represented as the collective intelligence and global awareness which is the main result of the availability of fast communication-enablers including wireless networks.
- The level of competition which may bring benefits to consumers or to the mobile network operator, the social tariffs or any measures responding to social aids requirements. Increasing competition will decrease margin

- opportunities of the commercial entities but will impact positively on the retail tariff and services to consumers.
- The impact on social integration and on the fight against different types of exclusion.
 - The positive impact on the environment and the contribution to the sustainable development.
 - The level of harmonisation of frequency bands and harmonisation of standards which reduce the fragmentation and ensure economies of scale, including pan-European services. The social value of the radio spectrum will increase the greater the harmonization at European, regional or even worldwide level.
 - The development of public health and security services.
 - The benefits from cultural exchange.
 - The impact on the employment rate and the diversification of the industry, the level of competitiveness and the attractiveness of a territory. Multiplier effects or spill-over effects in other sectors or on the performance of the economy as a whole (effect on GDP);
 - Externalities or merit goods (democracy, educational standards...)

The social value of rights to use radio frequencies differs from the economic value a firm attaches to the relevant authorization (or firm's valuation).

The social value is ultimately the results of the usage of radio frequencies and services generated.

In assessing the amount of social value related to specific radio frequency assignment, it is recognized that there are several other effects, such as broader social values arising from different services (e.g. a better-informed democracy, higher educational standards or a more inclusive society) and other externalities (e.g. investment spillovers, non-internalised network effects, and potential health effects)¹³ The overall effect of reforming the radio frequency spectrum to introduce electronic communications services should also be considered.

2.2.2 Examples of consideration of social value resulting from the usage of radio spectrum

In this paragraph, we look at concrete examples of reference made to social value when assigning radio frequencies, as a way to help define social value in practice (best practices).

In particular we surveyed whether in the EU framework (2009) and in recent assignment procedures at the national value „social value” elements were taken into consideration in the spectrum pricing approach of awarding bodies such as administrations and NRAs.

13 Report for the Ministry of Economic Affairs of the Netherlands, Economic and Social Limitations to Alternative Uses of 'Digital Dividend' Spectrum, Final Report 24 July 2008

With the Communication on the economic and social benefits of digital dividend¹⁴, the European Commission outlined a roadmap for the digital dividend. However, the definition of public and social value was left to the companion study commissioned to Analysis Mason, which spells out some criteria to evaluate how spectrum assignment can foster public welfare¹⁵.

Most importantly, the amending Directive¹⁶ has set the new the framework for the public value of spectrumThe new article 9 points out that.

Taking due account of the fact that radio frequencies are a public good that has an important social, cultural and economic value, Member States shall ensure the effective management of radio frequencies for electronic communication services in their territory in accordance with Articles 8 and 8a.

Article 8 stresses among others the need:

- to improve the welfare (expressed in terms of choice, quality and price) of all users, with particular emphasis on some categories (elderly, disabled and users with social needs).
- Article 8a is important in setting a cooperative strategic approach to spectrum assignment:

Article 8a underlines that

Member States shall cooperate with each other and with the Commission in the strategic planning, coordination and harmonisation of the use of radio spectrum in the European Community. To this end, they shall take into consideration, inter alia, the economic, safety, health, public interest freedom of expression, cultural, scientific, social and technical aspects of EU policies as well as the various interests of radio spectrum user communities with the aim of optimising the use of radio spectrum and avoiding harmful interference.

Examples drawn from experiences in assignments at the national level

Social value is sometimes implicit, other times explicitly referred to in sectorial policy at the national level. In this section some examples from national experiences are illustrated.

14 Transforming the digital dividend into social benefits and economic growth Brussels, 28.10.2009 COM(2009) 586 final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

15 Exploiting the digital dividend: a European approach, 14 Aug 2009. Several studies are mentioned in this report, with particular emphasis on the measurement of social value.

16 DIRECTIVE 2009/140/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009, amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorisation of electronic communications networks and services

For example, the assignment procedure of the licenses in the 800 MHz and 2,6 GHz bands in France had several objectives fixed by the Law, one of them was to make the regional digital development a priority of the procedure. This objective of the "Pintat's law" (adopted at the end of 2009) has been translated in the procedure as one of the three criteria used to select the licensees: the undertaking from the MNO in favour to the regional digital development. See also France Digital 2012 plan and the report to the Prime Minister of the Commission on Digital Dividend¹⁷

In Ireland, the need to maximize social value is explicitly referred to¹⁸. Noting, however, that the use of the term "social value" in this instance is intended to mean the value to society in terms of the normal consumer and producer surplus. Auctions can only identify the private valuations of the spectrum rights of use and a competitive auction will only pick winners with the highest private valuation. Hence, there is no direct link to any external benefits to which the use of the spectrum might be put.

In Spain (social and economic benefit from the service)and Portugal (economic and social factors) for instance, were explicitly mentioned. Plum Consulting¹⁹ reviewed spectrum pricing criteria and in the case of Spain found that Spain has developed a generic formula which it applies to all radio services, namely:

Annual fee = surface area in km² x Bandwidth (kHz) x C1 x C2 x C3 x C4 x C5] / €166.386. The five parameters C1 – C5 are set for each service and take into account:

- The level of occupancy and demand for that service in the frequency band.(C1)
- The type of networks that use the spectrum e.g. whether they provide public services as in the case of broadcasting (C2).
- Whether the spectrum is awarded on an exclusive basis or shared. Also services that are deployed in non-standardised bands are charged a premium.(C3)
- The type of technology deployed and whether it uses the spectrum efficiently (C4)
- The social relevance of the services and the relevant economic interest or benefit (C5).

¹⁷ http://archives.dividende-numerique.fr/pdf/Rapport_de_la_CDN_-_23_Juillet_2008_-final.pdf

¹⁸ "Because radio spectrum is a public resource, it is important that licences for spectrum usage are awarded in a way that is objective, transparent, non-discriminatory and proportionate while maximising the social value that can be obtained from using the relevant frequencies available. However, where spectrum is scarce, the demands of potential users necessarily conflict, as there are multiple ways of allocating these resources to the interested parties. An administrative allocation of spectrum is always subject to the fundamental limitation that the administrator may have relatively little information about which of these multiple ways of allocating a scarce resource generates greatest social value. In contrast, spectrum auctions are designed to incentivise bidders to express their willingness to pay for spectrum licences, and aim to allocate the licences available to the bidders who value them most. The assumption underpinning the desirability of using an auction for awarding public resources is that the value of the licence to an operator should be a good proxy for the social value from granting the licence to that operator" see Issues relating to the award of spectrum in multiple bands in Ireland Prepared for ComReg by DotEcon (Non-confidential version) Commission for Communications Regulation. Document No: 11/58 Date: 24/08/2011

¹⁹ See Plum Consulting, Study on Radio Spectrum Pricing System: Final Report. A report for OFTA, December 2009

This approach is applied to setting fees for both broadcasting and other radiocommunications services and is based on promotion of spectrum efficiency and the intention is to reflect the market value of spectrum when setting spectrum fees. However, although the parameter C5 refers to economic benefit it is unclear how the values were derived or why there are wide variations between different services.

In Portugal, the approach for the calculating the fees due to the use of radio spectrum aim at meeting two areas of concern, one of them being the social nature (the other is the competition area). As a consequence, spectrum usage fees for services which are considered fundamental as far as social cohesion is concerned (e.g. as radio and television broadcasting services), have a reduction in price so as to reflect the inherent social benefit. Another example regarding Portugal is the multiband auction carried out in dec.2011. This auction's regulation established that who wins one lot in the 800 MHz has a coverage obligation and, this way, information society is promoted and the number of info-excluded areas reduced.

In Denmark the assignment methods distinguish between assignments of frequencies where essential public interests have to be met and assignments where there are no essential public interest considerations. The notion of essential public interests has many similarities to the concept of social value. Essential public interests are valuable to society as a whole, including the availability of services considered vital to society, or considerations which may not be met to a sufficient extent by the market. Only where essential public interests have to be met can the Minister in the auction or tender impose minimum requirements such as coverage obligations e.g. the coverage obligation in the forthcoming 800 MHz-auction."

3. Example cases for the consideration of economic and social value of authorisations of use of spectrum for mobile and fixed services in the process of frequency allocation

The Radio Regulations (RR) is a legal instrument of the International Telecommunication Union (ITU) having treaty status between signatory states. The RR is revised every 3 to 5 years²⁰ at WRCs. This is the primary basis for generating laws and rights in spectrum usage. Without such a legal instrument, the radio spectrum has no value due to the lack of the rules of usage between radiocommunications services. The RR must be applied by all ITU Member States in order to preserve access to spectrum and orbit resources in all parts of the world without harmful interference, and to facilitate the efficient and effective operation of all radiocommunications services.

One objective of the RR is to define various radiocommunications services and to identify frequency bands where these radiocommunications services could operate. The most prominent article of the Radio Regulations is Article 5, 'frequency allocations', which allocates each frequency band to one or more radiocommunications service(s) with its respective status and any relevant technical or operational conditions.

²⁰ An RSPG opinion describes and provides relevant background on the WRC preparation and recommendations (see RSPG 09-294 for more information). The mechanism of WRC preparation is outside the scope of this RSPG/BEREC report

However, the RR also includes all coordination and notification procedures (particularly important for space services); relevant measures to avoid interference between services and for the operation of certain services; procedures for cases of interference; assignment or allotment plans for certain frequency bands, and many other provisions.

The main objectives of the Radio Regulations are to ensure equitable access to radio spectrum and orbital resources and to avoid harmful interference between the radio services of different administrations (the signatory states).

Each administration keeps the right to use spectrum as it wishes inside its national borders provided that there is no interference or constraint to other countries. However, the physical properties of radio are such that, in practice, the Radio Regulations' provisions are an essential framework for CEPT decisions and national spectrum management regulations. The RR provisions are taken into account in the drafting of regulations for ECS even if the scope of radiocommunications services and ECS differs. ECS will operate in a relevant frequency band in conformity with the RR and in particular with the rights granted to the radiocommunications services in the band (such as mobile services, fixed services, land mobile services and mobile satellite services).

The RR is also used in particular cases to foster harmonisation in areas where it is essential for the operation of services for reasons such as international operations (e.g. aeronautical, maritime or space services), and economies of scale (e.g. IMT). In particular, economies of scale are one of the main economic criteria considered for development of mobile broadband services, such as ECS, (referenced as IMT²¹ in RR.) In consequence, harmonisation of further frequency bands for mobile broadband services is one objective which will drive the process of updating the RR. The RR provides rules which, by itself, increases the economic and social value of the spectrum. Nevertheless, RR provides flexibility by giving the same legal status to two different radiocommunications services, such as broadcasting versus mobile services.

In such cases, at a national level, other elements affecting economic and social value can be identified. These include :

- potential of economic growth;
- perspectives of new employments and industry developments;
- benefits of pan-European services; and
- where applicable, the private value which could be generated.

This could be the basis to make the trade-off at national level in favour of one radiocommunications service - for example the mobile service versus the

²¹ IMT refers to relevant standards for mobile applications including mobile broadband (see for more details relevant ITU recommendations on IMT)

broadcasting service, as it was done in the 790-862 MHz band. Further to this process, appropriate regulations to support the development of relevant electronic communications services such as mobile broadband could be drafted, including technical conditions for use of the band, definition of rights of use and award processes.

4. Frequency bands and aspects of the frequency assignment processes that are analysed in this report

This Report assesses the frequency assignment process. As a first step, it identifies relevant frequency bands to be studied and sets these out in chapter 4.1.

As a second step, the Report identifies features of the frequency assignment processes that are key in determining economic and social value of spectrum. These are highlighted in chapter 4.2. The intention was to gather the relevant information for this report from Member States with the help of a questionnaire (document BEREK/RSPG E&S(11)003rev2). For completeness, the questions can also be found in Annex 1 of this report.

Based on the responses to the questionnaire this report describes best practices amongst Member States in determining the economic and social value of spectrum.

4.1 Frequency bands considered in this report

This Report considers it most appropriate to study in detail the following WAPECS bands:

- 790-862 MHz (800 MHz band)
- 880-915 MHz / 925-960 MHz (900 MHz band)
- 1710-1785 MHz / 1805-1880 MHz (1800 MHz band)
- 1900-1980 MHz / 2010-2025 MHz / 2110-2170 MHz (2 GHz band)
- 2500-2690 MHz (2.6 GHz band)
- 3.4-3.8 GHz (3.6 GHz band)

In other frequency bands and for other ECS there also could be specific examples in Member States where the economic and/or social value of spectrum was determined and which could be helpful for the studies of the Joint BEREK/RSPG Working Group. Therefore, the questionnaire gave Member States the opportunity to provide this additional information (see Question Q8 in Annex 2).

4.2 Features of the assignment processes to be assessed

The following features of the frequency assignment and authorisation processes in each of the above-mentioned frequency bands are assessed in order to describe best practices in Member States on how the economic and social value of spectrum is established.

- General aspects on award proceedings;

- Aspects on coverage obligations;
- Frequency related aspects (e. g. spectrum caps);
- Aspects concerning the conditions for infrastructure and spectrum sharing;
- Financial aspects (e. g. fees); and
- Refarming aspects with respect to liberalization of spectrum use (applicable to 900 and 1800 MHz only).

This Report deals with the identification of methods and procedures to determine the value of rights to use radio spectrum and not the specific values themselves.

Award proceedings in some of the frequency bands took place some time ago in Member States. It is therefore likely that the reasons and objectives that had been taken into account when deciding on the award proceeding at that point in time were valid in that particular context. On the other hand, award proceedings in other parts of the frequency bands may still be in the planning phases. The Questionnaire allowed Member States scope to decide which information on past, ongoing and/or planned award proceedings they consider to be relevant in the various frequency bands.

The questions of the Questionnaire can be found in Annex 1.

5. Summary of the responses to the Questionnaire

26 Member States responded to the Questionnaire and provided valuable information for the studies of the RSPG-BEREC Joint Working Group.

The following paragraphs summarize the responses of Member States to the eight questions of the Questionnaire.

5.1 General aspects on award proceedings (Q1)

26 Member States responded to Q1. Annex 2 provides an overview over the award proceedings carried out in the Member States in the frequency bands covered by this report.

1. Award proceedings

At first sight the responses show a mixed picture of award proceedings which the Member States have *already* carried out. Almost all Member States have carried out a competitive selection procedure (i. e. auction) to assign spectrum for electronic communications services in the WAPECS-bands at least once. Likewise, Member States have also carried out beauty contests. Moreover, some radio spectrum assignments have also been implemented through first-come first-served procedures in some frequency bands or by administrative order where there is no scarcity. However the picture of award proceedings is somewhat diverse because award proceedings in some of the frequency bands have to be considered in a historical

context and the reasons for adopting particular approaches may not be considered valid any longer. In particular the 900 and 1800 MHz bands are those WAPECS bands represent a significant diversity of award proceedings that ranges from administrative orders, beauty contests and auctions. Most of the Member States declared that award proceedings in the 900 MHz and 1800 MHz bands took place some time ago²².

On the other hand, the current award of the 800 MHz band gives a useful insight into award proceedings. In particular, it allows an up to date view on the reasons and objectives for choosing an award proceeding where mobile services are largely deployed in European countries and where the introduction of mobile broadband for all is a major policy objective. 800 MHz band awards for ECS commenced in 2010 and the majority reported that they already have carried out an auction (Germany, Italy, Spain and Sweden) or that they have already decided or at least were planning to auction the radio spectrum and relevant access to the rights to use (Austria, Czech Republic, Denmark, Norway, Ireland, Netherlands, Romania, Poland, Portugal, Slovak Republic, Switzerland and United Kingdom).

France applies a combinatorial single-round sealed bid process with three selection criteria (regional development defined as a priority by the Law, ensure and foster competition [conditions offered to MVNO], value of spectrum [financial amount]).

In a few countries (Belgium, Cyprus, Estonia, Finland, Greece and Malta) no decision has been taken yet.

One Member State, so far, (Lithuania) has chosen a beauty contest proceeding.

The responses to the 2 GHz, 2.6 GHz and 3.6 GHz bands show a similar picture as the majority reported that they have already carried out an auction or that they are planning to auction spectrum. Nevertheless, beauty contests were an important procedure for awarding 2 GHz, 2.6 GHz and 3.6 GHz spectrum and were considered to be a valuable process. Regarding the 2 GHz and 3.6 GHz bands some of the Member States declared that the award proceedings took place some time ago. Therefore several award proceedings in the 2 GHz and 3.6 GHz frequency bands have to be considered in a historical context and the reasons for adopting particular approaches may not be considered valid any longer.

2. Reasons for choosing awards in WAPECS bands

The key reason for choosing a competitive selection (auction) procedure for the WAPECS bands is in general to comply with national law:

- In the Netherlands and Austria, for example, the competitive selection procedure is regulated by law in relation to all WAPECS radio frequency bands for “commercial use”;
- In Germany and Denmark auctions have been the primary method of assignment in case of frequency scarcity since 1999 as well as 2001 according to the Frequency Act and the Telecommunications Act. For example, in Germany an auction is to be held unless this form of proceeding

²²Compare the above chapter 4.2.

is unsuitable for ensuring regulatory aims. Therefore, the comparative selection procedure is stipulated in German law to be an exception. Another Member State in which auctions are in principle carried out is Italy. Auction procedures were adopted by Agcom in every assignment procedures starting from 2000 for awarding spectrum for TLC mobile services.

The opposite view is stipulated in the Lithuanian law. In view of exceptional economic value of the frequency bands and the scarcity of the spectrum that restricts the number of authorisations the beauty contest is legally the only possible award proceeding. Therefore Lithuania has chosen beauty contest procedures for all of the WAPECS bands until now.

3. Objectives in choosing awards in WAPECS bands

The aim of award proceedings is to determine the best placed applicants to make efficient use of the frequencies to be assigned. In the ongoing award processes auctions are the most employed method. Member States cited auctions as being the most suitable procedure to assign valuable frequencies to the network operators according to their conflicting demands. The main characteristics of an auction procedure mentioned are transparency, fairness and optimal value discovery. Italy stated that auctions can be a very effective and reasonably efficient assignment mechanism when national administrations pursue objectives consisting of obtaining the simple best evaluation of the spectrum. It added that auctions also support transparent procedures and provide a clear signal about economic market value of the rights to use radio spectrum. In practice, the result can be less contestable in court²³.

The auction is regarded as a means to promote effective use of spectrum. Germany and the United Kingdom said that the successful bid typically proves the willingness and ability to use the frequency to be assigned in the most optimal way. This promotes greater service range and competition and allows users to strive for efficient and economic use of the frequency and therefore ensures the best outcome for citizens and consumers. Furthermore, the auction has proved to be a swift procedure in administrative practice. It represents a suitable procedure for awarding frequencies which quickly harnesses the potential of spectrum and puts it to use.

Ireland, for example, is one of the Member States in which the assignment procedure in the 800 MHz band is still under consideration, but an auction is favoured. Ireland considers the proposed combinatorial clock auction (CCA) format to be the best to meet the NRA's statutory functions, duties and objectives. The specific CCA format is deemed appropriate to "mitigate business continuity risks and reduces incentives for tacit collusion as well as strategic demand reduction"²⁴. Also, in Romania an auction is envisaged for this band. The main objective of the Romanian authority is to enable an efficient introduction of new innovative broadband mobile communications services, bearing in mind the high economic and social value of the 800 MHz band and the significant benefits for the economy and society. Among the other objectives mentioned above, Romania and other Member States emphasized that auctioning

²³See 'RADIO SPECTRUM POLICY GROUP REPORT ON ASSIGNMENT AND PRICING METHODS' (RSPG09-298 page 2).

²⁴See pg 44-45 of ComReg's Consultation '800 MHz, 900 MHz & 1800 MHz spectrum release' (http://www.comreg.ie/_fileupload/publications/ComReg1071.pdf) and ComReg's Document 09/99.

respectively bringing spectrum from several bands together prevents an artificial scarcity which would otherwise arise, and affords potential bidders a greater level of flexibility to acquire the usage rights required for their business plans. Another objective of Romania is to conduct an efficient, objective and fair selection process, which fulfills the requirements of non-discrimination, openness and transparency, without (or with a minimum of) legal challenges. The results of this selection procedure are expected to reflect the high economic value of this spectrum and, on the other hand the license fees to be collected will be sufficient to phase out the governmental equipment which currently occupies parts of the 800 MHz band.

In Portugal the definition of the allocation procedure was decided by the regulator and the objectives that lead to selecting the auction were, on the one hand, to increase flexibility with regard to the technology that could be used, services to be implemented and on the amount of spectrum that is suitable for the need of each operator; and on the other hand, the need to bring the value of spectrum closer to the market reality.

Similarly, it is the aim of comparative selection procedures to determine the best placed applicants to make efficient use of the frequencies to be assigned. In cases of spectrum scarcity both auctions and beauty contests could be suitable procedures to select the most suitable assignees and assign valuable frequencies. Employing a beauty contest as an assignment method based on multidimensional comparison can be a solution if the NRA wants to pursue several goals, which cannot be applied as admission criteria for an auction²⁵. The beauty contest method of frequency assignment may include pricing among the selection criteria and could therefore be considered as a method allowing valuation of spectrum²⁶.

5.2 Aspects on coverage obligations (Q2)

The commonly used approach to promoting wider wireless broadband service coverage is through the introduction of specific obligations in spectrum licences that are issued to operators. The questionnaire sent in support of this report informs much of the assessment below as it gives an up-to-date picture of what Member States are planning for future awards as well as a comprehensive picture of what was done in the past to promote broadband coverage.

Responses to the questionnaire suggest that there are three key and recurrent themes that need to be addressed. They are:

- what the factors are which determine whether coverage obligations should be imposed in the first place;
- how any coverage obligation should be defined to ensure that defined goals are effectively met; and

²⁵See 'RADIO SPECTRUM POLICY GROUP REPORT ON ASSIGNMENT AND PRICING METHODS' (RSPG09-298 page 3).

²⁶Compare the abovepara. 1.

- how operators' performances against coverage obligations can be accurately measured and how to establish robust enforcement measures.

Determining whether coverage obligations should be established

Broadly speaking, the impetus for the setting of these coverage obligations came from three considerations, namely:

- fulfilling Government social policy objectives of ensuring wider service coverage;
- ensuring that networks were deployed in a timely fashion, thus ensuring that hoarding of spectrum did not occur; and
- elements of both of the above, where relatively modest coverage obligations were set to stimulate network deployment with a view to competition between operators driving much wider service coverage.

There is some evidence that the objectives of ensuring wider coverage have been focussed on lower frequencies. A number of Member States stated in their responses to the questionnaire that this was the specific goal of establishing coverage obligations in the 900 MHz band and, indeed, in the ongoing 800 MHz awards. Although this is, to some extent, repeated in the 1800 MHz band there are some coverage obligations that are of a lower magnitude.

In the case of the 2.1 and 2.6 GHz bands, the primary objective of the coverage obligations appears to be to stimulate network deployment and avoid spectrum hoarding. In some countries, the coverage obligations as set out in these licences are, accordingly, more modest in the scope of their coverage ambition (usually between 25-50 % population coverage, but up to 75 % for some countries). A few Member States, such as Sweden, UK, Portugal, Denmark and Finland have decided not to establish coverage obligations at all in the 2.6 GHz band, citing the unfavourable technical characteristics of the spectrum. The authorisations granted in the 3.6 GHz band related primarily to fixed broadband coverage objectives with a number of them being granted by mid 2000s. These coverage obligations were also modest in their total population and/or area coverage ambition at a national level due to the nature of the frequencies and expected level of usage.

Defining coverage obligations

Member States have approached this in a number of different ways:

- by reference to covering a proportion of population;
- by reference to covering a proportion of area;
- by reference to covering key national infrastructure such as roads and ports;
- by reference to covering specific locations which have been identified based on their access to broadband services or no service at all. These range from regions and towns to individual addresses; or

- any combination of the above solutions.

Most Member States have opted for the first approach above by establishing a population obligation, although all of the approaches have been followed on more than one occasion. The purpose for focussing on populations is clearly to ensure that services are provided to those areas of a country where they are likely to be in demand.

Measuring operators' performance against coverage obligations and enforcement processes

For any coverage obligation to be credible there would have to be mechanisms in place to monitor whether obligations were being met. Separately, there would have to be enforcement powers in place so that operators had sufficient incentive to fulfil those coverage obligations.

According to the responses to the questionnaire, in most cases the approach to measurability is twofold. Firstly, there is a form of self-declaration from operators themselves in which they provide evidence that they have met the coverage obligations as set out in their licences. This may be followed up by a form of measurement by the authority which can take the form of field measurements or computer monitoring.

With regards to enforcement, the two sanctions that are commonly used (and, in a number of cases, *both* sanctions are available to Member States) are:

- the ability to fine operators in accordance with the provision as set out with National law; and/or
- the ability to vary or revoke licences (rights of spectrum use).

Coverage obligations and economic and social value of spectrum

There is a balance to be found between setting coverage obligations at a level which achieves wide scale access to broadband services, thereby realising significant social value, but also allowing services that use the spectrum to achieve their highest possible economic value. The more ambitious that a coverage obligation is set at, the lower that an operator will value the service. In other words, increasing social value of services will tend to decrease their economic value. This applies not only to the extent of the stipulated coverage but also to the timescales that deployment is mandated within as well as any in-built complexities to the obligation itself (such as the need to cover key national infrastructure).

This applies also to the frequencies that coverage obligations apply to as the costs of deploying a network increases at higher frequencies. As a result, applying ambitious coverage levels to those higher frequencies will cause the operator to value that spectrum at an even lower level – to the extent that it might value it at zero (or close to zero) and the spectrum becomes unutilised.

5.3 Frequency related aspects (Q3)

Spectrum caps, whereby limitations in the amount of spectrum that a single license holder can be awarded, are common. They are often applied in spectrum auctions in order to promote competition and avoid hoarding by, for example, trying to achieve a minimum number of licence holders and at the same time trying achieve some kind of symmetry in their spectrum holdings. Spectrum caps are generally used together with spectrum packages. These packages are commonly used to avoid fragmentation and in order to implement technologies such as LTE, that allow services that need high bandwidth.

When awarding bands that have not been used before for mobile phone/broadband-services via spectrum auctions, as done in many countries when awarding the 2.6 GHz band and the 800 MHz bands, it is common to have some kind of spectrum cap. These caps often have some kind of cross-band limitation whereby the amount of spectrum that may be acquired in the 800 MHz bands is dependent on holdings in the 900 MHz-bands. One such example is the German award of the 800 MHz band where there was a cap of 2x20 MHz below 1 GHz (the sum of holdings in the 800 and 900 MHz band) as well as an exclusive cap of 2x10 MHz in the 800 MHz band.

Other bands that already are in use for ECS such as mobile phone/broadband-services (notably the 900 MHz band, the 1800 MHz band and some parts of the 3.6 GHz band) have not been awarded using traditional spectrum caps as applied when using spectrum auctions. In many countries, these bands have been awarded through an administrative process. As part of this process there have been limitations in the number of licenses and the bandwidth of these licenses, in some cases taking into account spectrum holdings in both the 900 and 1800 MHz band at the same time. Greece, for instance, in 2002 introduced a cross-band limitation defined as a cap of 2 x 35 MHz in the sum of holdings in the 900 and 1800 MHz bands.

The important 2 GHz band paved the way for mobile broadband services. There have been limitations concerning the amount of spectrum and number of operators allowed in the band. How these caps have been designed differs over time as well as between countries. Many countries awarded the band during the 1990s and have recently re-awarded the band,. A trend in the more recent awards has been for there to be a number of competing operators as well as some kind of symmetry in their spectrum holdings.

In general, the designs of spectrum packages in bands that have been surveyed often have their starting point in international harmonisation requirements.

5.4 Aspects concerning the conditions for infrastructure and spectrum sharing (Q4)

The Joint BEREC/RSPG Working Group has already produced a Report on Infrastructure and spectrum sharing in mobile/wireless networks, which was adopted

by both BEREC and RSPG plenaries²⁷. Further information was requested here solely on aspects of infrastructure and spectrum sharing in the context of spectrum assignments, to assess whether conditions have been imposed to limit/allow infrastructure and spectrum sharing.

1) Conditions imposed for infrastructure and spectrum sharing

Of the 26 NRAs/Admin who responded to the questionnaire, not all of them responded to Q4.

The majority who did respond described existing obligations (such as national roaming), the reason for imposing them (i.e. fostering competition), and the target/modality for imposing such obligations (for instance, aimed at the incumbent on a mandatory basis).

In a few countries there are no explicit conditions or obligations imposed on network sharing, although it is possible that their national law provides guidance in this regard. In two cases (Belgium and Ireland) the regulator promotes site sharing but there are no proposed licence conditions mandating it. Guidelines may be offered to the operators in the future.

Some of the conditions imposed may be linked to the existence of guard bands. Other conditions (for instance, granting non-discriminatory access to competitors, or sharing infrastructure) are conditional on acquiring new spectrum rights following an assignment procedure.

With regards to infrastructure/spectrum sharing, in some cases, such as the 3.6 GHz band, an agreement can allow the separation block to be used by the owners of the neighbouring blocks.

In Germany, sharing other than passive infrastructure might be subject to a formal evaluation by the sectoral regulator and the competition agency. However, spectrum sharing might be allowed in non-commercial areas. In Denmark, active sharing is now possible although this was not allowed previously for 2G networks (passive sharing was possible for all however). In the Netherlands (800 MHz) spectrum sharing is only allowed when both parties transfer their licences to an entity (e.g. a joint-venture) that subsequently uses the frequencies.

In the case of France's 800 MHz award, a priority area was identified (18% of the population and 63% of the surface) where network and frequency sharing is facilitated for the operators willing to do so. Another set of rural zones and minor cities is covered by extending an existing 2G/3G sharing agreement.

In some cases, such as Italy, a sunset clause exists where roaming obligations are in place. In the case of Italy, these are for up to 5 years depending on coverage plans and obligations.

2) Reasons for imposing conditions

²⁷ See BoR (11) 26, BEREC-RSPG report on infrastructure and spectrum sharing in mobile/ wireless networks (ibidem RSPG 11 – 374)

Amongst the reasons for imposing obligations, the time needed by new entrants to deploy their networks; the willingness to promote competition at large or more specifically facilitate market entry, and improving coverage were mentioned.

In Austria, a very detailed set of requirements designed to preserve competition is provided to would-be network sharing operators. Additionally, with regard to spectrum sharing, an Operator A may make excess capacity available to Operator B if the latter fulfills its coverage mandate independently of that arrangement. As a result, mutual spectrum sharing is only possible in those areas which go beyond the minimum required coverage level.

3) Legal base for imposing obligations

The legal base for imposing obligations is normally found either in the fundamental law on electronic communications in each country or in the spectrum auction.

5.5 Financial aspects (Q5)

The financial aspect answers are divided, in line with the questionnaire, into the type of award (auction, beauty contest, first come first served) and the frequency bands. They provide a varied picture with regard to minimum bids, spectrum fees and other costs. As a result, there are no common principles set out in the following section. The comments concentrate on a small number of key aspects. Full details on each Member State can be found in the answers to the questionnaire.

In the case of auctions, the minimum bids for a paired frequency block (2 x 5 MHz) in the 800 MHz band were between €2.5 million (Germany) and €353 million (Italy). Germany, in 2010, was the first member state to auction spectrum in the 800 MHz band, together with spectrum in the bands at 1800 MHz, 2 GHz and 2.6 GHz. It set the minimum bid for a frequency block at the uniform price of €2.5m for every paired block (2 x 5 MHz). The level of the minimum fee was oriented towards the lower level in the scale of fees envisaged in the Frequency Fees Ordinance for frequency assignment. This reflected the statutory frequency assignment fee. In Italy, the auction was held in September 2011. The minimum bid for the 800 MHz spectrum was based on the annual fees for 900 MHz spectrum with an incremental factor. It was €353m for each paired 5 MHz block. France envisaged a comparable minimum bid level as Italy, based on economic analysis and benchmarking. The same applies to the UK and Spain. In Denmark the minimum bid for a paired frequency block (2 x 5 MHz) will be €6.7 million. Not all countries gave reasons for the level of minimum bids they had established. However, the results of the auctions for 800 MHz spectrum held in the meantime could have been a factor in determining the level of minimum bid.

Besides the minimum bids, a number of countries require additional annual or one-off spectrum fees, whereas other countries do not ask any additional fees.

In the case of beauty contests, we see quite a number of fees which differ from country to country. These include registration fees, frequency access fees, frequency usage fees.

In the case of first come first served we should note that according to the information to hand, this type of award was found only in the bands at 900 MHz, 1800 MHz, 2 GHz and 3.6 GHz and only in a few countries, as scarcity did not arise as a result of demand. For the most part, one-off or annual fees are raised for assignment and use. How these fees are arrived at was mostly left open in the answers to the questionnaire. Only a few countries provided information on this. In some countries then, even those using the first come first served approach the economic value of the spectrum is taken into account, while in others it is solely the administrative effort.

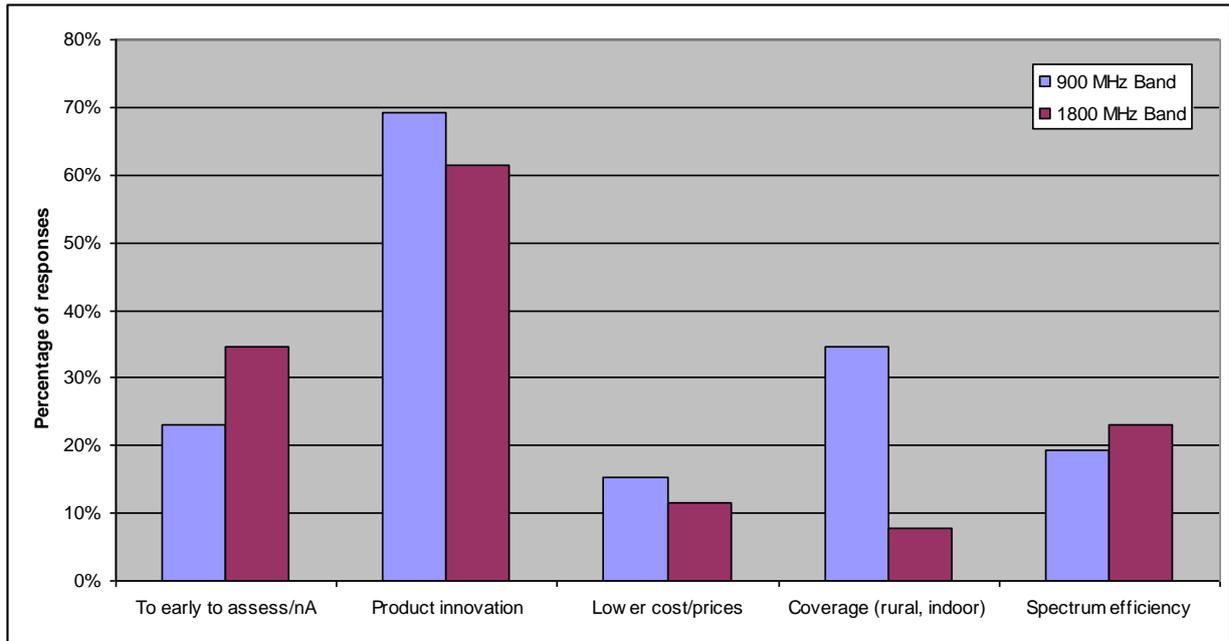
5.6 Refarming aspects with respect to liberalization of spectrum use (Q6)

Status

The process of liberalization of the 900 MHz band and 1800 MHz band (in the sense that all operators in the band could deploy UMTS, LTE and/or WiMax without any further formal application) has been completed in many countries. In other countries the process is still in progress, though at different stages. For example, in some countries parts of the band have been liberalized whilst in other countries the amended GSM Directive has already been implemented (eg by amending the frequency allocation table). Nevertheless, the licence conditions are still restricted to GSM. In some of those countries the regulatory authority waits for an application from the licence owners. In other countries the band will be re-auctioned soon on a technology neutral basis.

Benefits for the operators and the customers

Several benefits are connected with the liberalization of spectrum use. The three main benefits are product innovation (especially new services with higher data rates), spectrum efficiency and coverage improvement. However, coverage improvement is clearly linked to the 900 MHz band. A relatively small fraction of respondents expect lower prices to be seen as a result of liberalization of the bands. Overall, the liberalization of the 900 MHz band seems to have clearer benefits than the liberalization of the 1800 MHz band.



Impact of the liberalization on competition and economic and social valuation

There seem to be no a clear answers to this question (at least for the time being). Whereas some countries see positive effects on competition others see potential problems. Some respondents highlight that their national operators have a symmetric spectrum holdings, which makes negative impact on competition less likely. In a few countries, measures have been taken in order to remedy possible distortions. Several respondents see a positive impact on the economic and social value of the band.

Relocation of spectrum users

Relocation of existing and/or previous frequency users was an issue for many countries that have liberalized the 900 MHz and the 1800 MHz band (see figure below). Some countries have postponed a decision on that issue or are waiting for an application from the operators.

The aim of reallocating spectrum users was:

- to get a fairer distribution of spectrum;
- entry assistance for a newcomer;
- to have assignments with 5 MHz blocks; and/or
- to have assignments with contiguous blocks.

The following measures were taken:

- Spectrum were freed and assigned to other parties such as new entrants;
- Spectrum were taken back and re-auctioned;
- Spectrum were swapped among operators;
- Amount of spectrum for a single operator was capped;
- Spectrum blocks were rearranged or reallocated on the basis of 5 MHz blocks;
or
- Spectrum trading was allowed and negotiations fostered.

In some countries operators have been compensated for relocation and freeing spectrum through:

- Extension of licence; or
- Spectrum from other bands

5.7 Other aspects (Q7)

Question 7 aimed to cover all relevant key aspects of spectrum distribution that have not yet been raised in the questionnaire. The participating Member States used this question to describe any particular features of the spectrum mentioned in Chapter 4.1 of the report and the method of its award.

Overall, 8 of the 26 countries answered this question. It was mentioned in one response that frequency coordination²⁸ in border areas (and thus the availability of frequency utilizations in border areas) could have an impact on the economic value of the radio spectrum. The remaining answers received relate to the factors (covered in chapters 5.1 to 5.6 above) that influence the spectrum value and have therefore been considered in the previous sections. The responses of Member States confirm that the factors given in chapter 4.2 of this report are the key factors for determining the economic and social value of spectrum with respect to the authorization and frequency assignment process.

5.8 Other electronic communications services (Q8)

Question 8 looked at frequency bands not related to the ECS described in Chapter 4.1 of the report. These are not the focus of the report, however. But as they also could represent an economic and social value, the information submitted on these frequencies and their usage in the MS is presented below.

Only 8 of the 26 MS answered this question. The responses, whilst informative in themselves, provided no additional information on the determination of economic and social value of radio spectrum in other frequency bands or for other ECS than those considered in this report.

6. Key issues of the responses

The Joint BEREC/RSPG Working Group on competition issues was tasked to explore the way in which the economic and social value of spectrum is determined in relation to authorisations and frequency assignment issues. It was the objective to share experiences and views of Member States with respect to the frequency assignment procedures and to describe best practices in Member States in determining the economic and social value of spectrum with respect to the frequency assignment process.

The previous chapter summarizes in detail the responses of Member States to the questionnaire. This chapter highlights the core points and key issues.

The responses of Member States confirm that the factors given in Chapter 4.2 of this report are the key factors for determining the economic and social value of spectrum with respect to the authorization and frequency assignment process.

There are some key observations that are valid for all Member States.

At present and based on the recent examples of **awards proceedings**, Member States predominantly use auction as the primary method for awarding the frequency bands that are studied in this report. The mature markets in the European Union and in the Member States are typified by sustainable competition between (radio) network operators. Mobile services in the WAPECS bands have been assigned since around

²⁸ This issue is carefully addressed at RSPG level : see RSPG Opinion on the process for EU assistance in bilateral negotiations with third countries and between EU countries

2000 as a result of conducting such auctions. Nevertheless, the precise process may differ from one country to another in particular frequency bands and therefore the beauty contest has also been an alternative procedure for awarding spectrum, in particular in the 2 GHz, 2.6 GHz and 3.6 GHz bands. The main reasons why award proceedings vary between Member States are rooted in the legal and in the prevailing circumstances in each Member State (e.g. substantial competition, largely deployed mobile services, area-wide coverage, political objectives and regulatory aims).

Irrespective of the chosen assignment procedure, some economic and social value of spectrum considerations are taken into account. For example:

- regional development;
- foster competition between networks operators;
- foster competition on retail market (MVNO); and/or
- radio spectrum valuation with the proper defined rights to use it.

A **minimum bid for the auction**, taking into account the frequency usage conditions (rights and obligations), is generally defined by Member States. However, a minimum bid could not be considered as a way to assess the value of spectrum. Various objectives not related to the value of spectrum are pursued with the minimum bid.

Besides minimum bids, some countries require additional **annual or one-off spectrum fees**, whereas other countries do not ask for any such fee. These fees have an important influence in many Member States on the determination of the economic value of spectrum. Due to the complex and different structures in Member States, no general conclusions can be drawn, however, from the responses to the questionnaire with respect to their influence on determining the value of spectrum.

The definition of conditions attached to the **rights of usage**: technical conditions to use the band, coverage obligations, access obligation to MVNO, will directly impact the business plan of a market player and, in practice, the value given to the rights of use of radio spectrum by this market player.

In consequence, according to various policy and regulatory objectives at national level, the importance of the various parameters determining the economic and social value of spectrum changes over the years. It reflects the economic and social situation of the Member State at the time of preparing or carrying out the award procedure.

Before deciding on the frequency usage conditions (rights and obligations) and award procedure, Member States conduct **public consultations** in order to make sure that there is transparency and to facilitate participation from stakeholders. This is especially true for award proceedings such as auctions and beauty contests but this could also be the case where the first-come first-served approach is being applied. These public consultations make sure that economic and social implications are taken into account by Member States.

One important aspect when considering the social value of radio spectrum are **coverage obligations**. The establishment of coverage obligations has an impact on

the economic and social value of radio spectrum. There is a balance to be found between setting coverage obligations at a level which achieves wide scale access to wireless broadband services, thereby realising significant social value, but also allowing services that use the spectrum to achieve their highest possible economic value. The more ambitious that a coverage obligation is set at, the lower that an operator is likely to value the service (depending on any other factors which might minimise operators costs such as infrastructure sharing conditions).

Spectrum caps play an important role when evaluating the economic and social value of spectrum. The rationale behind spectrum caps and packages are to favour a situation where there is competition and where the most suitable and efficient technical solution is deployed. Even though it is common to have a general regime of service and technology neutral spectrum packages, award designs often aim at allowing technologies, such as LTE, that meet tomorrow's needs for services with high bandwidth.

How spectrum caps and packages are constructed mirrors NRAs objective to maximise the social and economic value of radio spectrum. The information on how this is executed in detail is however not described in the answers collected via the survey.

Annex 1

The Questionnaire to Member States contained the following questions:

Q1: General aspects on award proceedings:

- What kind of award proceeding (first-come-first-served, auction, beauty contest) is/was chosen?
- What are/were the reasons and objectives for choosing this kind of award proceeding?

Q2: Aspects on coverage obligations:

- Has the operator to fulfill any coverage obligations connected with the frequency utilization?

If yes:

- What kinds of coverage obligations (geographical and/or population and/or temporal) were defined?

Note:

In order to determine the implication of coverage obligations on the value of spectrum the exact provisions have to be known. These obligations define e.g. a certain percentage of the geographical area of a country and/or of the population to be covered in a certain period of time. Moreover, there could be one or more deadlines with graded coverage obligations.

- What were the reasons and objectives for defining these coverage obligations?

- How were the coverage obligations established?

Note:

The Joint Working Group is interested in the national process that lead at the end to the definition of the coverage obligations (e. g. which stakeholders were involved in the decision making process, were competition issues addressed in the decision making process, ...)

- How is the compliance with the coverage obligations monitored?
- What kind of procedures will be applied in case of non-compliance with the coverage obligations?
- Are there any undertakings that can be set by operators, in addition to coverage obligations?

Note:

It might be the case that the coverage obligations were defined by the operator itself e.g. in the case of a beauty contest. The Joint Working

Group is interested to know whether or not there are special commitments by the operator with respect to coverage.

- Are there competition implications in setting coverage obligations?

If no:

- What were the reasons for not imposing any coverage obligations?

- Has spectrum not been awarded or returned because of lack of demand?

If yes:

What is the reason for the lack of demand?

Q3: Frequency related aspects:

- Are there any spectrum caps and/or basic spectrum packages established?

If yes:

- What parameters were defined for spectrum caps and/or basic spectrum packages?
- What were the reasons and objectives for defining these spectrum caps and/or basic spectrum packages?
- How were the spectrum caps and/or basic spectrum packages established?

- Are there other frequency related aspects (e. g. band channeling plans) to be considered with respect to economic and social value of spectrum use?

Q 4: Aspects concerning the conditions for infrastructure and spectrum sharing:

The Joint BEREC/RSPG Working Group has already produced a Report on Infrastructure and spectrum sharing in mobile/wireless networks, currently in the phase of adoption at the level of BEREC/RSPG plenaries. Further information is requested here solely on aspects of infrastructure and spectrum sharing in the context of spectrum assignments, to assess whether conditions have been imposed to limit/allow infrastructure and spectrum sharing.

- Can you add further information to the table in Annex I of the infrastructure sharing report (RSPG 11-374)?
- Are there any conditions concerning infrastructure and spectrum sharing connected with the frequency utilization?

If yes:

- What kind of conditions for infrastructure and spectrum sharing were defined?
- What were the reasons and objectives for defining these conditions?
- How were the conditions established?

Q5: Financial aspects

In case of auction:

- Is there a minimum bid for a frequency block determined?

If yes:

- How was the minimum bid for a frequency block determined and what considerations were taken into account (e. g. licence duration)?
- Are there other fees and/or costs (apart from the result of the auction) connected with the frequency utilization?

If yes:

- What is the amount of these fees and/or costs?
- How were these fees and/or costs determined and what considerations were taken into account (e. g. duration of licence)?

In case of beauty contest:

- What is the amount of fees and/or costs for the frequency utilization?

Note:

These fees could be e. g.: frequency access fees, ongoing frequency usage fees (e. g. on a yearly basis)

- How were these fees and/or costs determined and what considerations were taken into account?

In case of first come - first served

- What is the amount of fees and/or costs for the frequency utilization?

Note:

These fees could be e. g.: frequency access fees, ongoing frequency usage fees (e. g. on a yearly basis)

- How were these fees and/or costs determined and what considerations were taken into account (e. g. AIP)?

Q6: Refarming aspects with respect to liberalization of spectrum use (applicable to 900 and 1800 MHz only)

- Describe the degree of liberalization of spectrum use (for each frequency band)?

Note:

Spectrum liberalization refers to less restrictive technical and usage conditions on spectrum licences. In this respect, information on the current status of the liberalization of the band is asked for (e. g. is the utilization of the band restricted to certain technologies or are the least restrictive conditions already achieved).

- What measures were taken to liberalize the spectrum use?
- What were the benefits for the operators and the customers?
- What was the impact of the liberalization of spectrum use on competition, and thereby on economic and social valuation of frequency?
- Are there any future plans to (further) liberalize the spectrum use?
- Was the relocation of existing and/or previous frequency users required in order to implement the liberalized spectrum use?

If yes:

- What measures were taken?
 - Which considerations were taken into account?
 - Was there any compensation for relocation of existing users and how was it calculated?
- Are there other refarming issues to be considered with respect to the frequency band?

Q7: Other aspects:

Are there aspects other than those mentioned in Questions 1 to 6 that should be taken into account?

Q8: Other frequency bands and/or other electronic communications services:

What are the assignment methodologies used and economic and social considerations taken into account for other parts of spectrum of electronic communications services (i.e. fixed service(Point to Point, Point-multi point), wireless access applications, etc.) than frequency bands mentioned in 4.1

Annex 2: Award Proceedings

This table reflects the status of award proceedings in Member States at 29 February 2012.

Member State	800 MHz band	900 MHz band	1800 MHz band	2 GHz band	2.6 GHz band	3.6 GHz band
Austria	auction	auction (stepwise since 1996)	auction (stepwise since 1997)	auction in 2000	auction in 2010	auctions in 2004, 2008 and 2009
Belgium	under consideration	beauty contest	beauty contest	auction in 2001	auction	beauty contest
Bulgaria ²⁹	No decision has been taken to award this band for terrestrial systems capable of providing electronic communications services in accordance with COMMISSION DECISION 2010/267/EU.	The first GSM authorization was awarded on first-come-first-served basis in 1994. The second GSM authorization was awarded by auction in 2001. The third GSM authorization was awarded to the incumbent operator in 2004. The E-GSM spectrum was granted directly to three mobile operators in 2008.	The frequency spectrum in those bands was directly awarded as additional frequency recourse to two mobile operators in 2002. The third GSM authorization was awarded to the incumbent operator in 2004.	Auction	The spectrum in 2.6 GHz band is still not available for providing electronic communication services. The band is used for national security purposes.	The spectrum in the 3.4 – 3.6 GHz band was awarded in the end of 2005 by auction. One BWA license (2x12 MHz) in the 3.6 – 3.8 GHz band was granted on first-come-first-served basis.
Cyprus	under consideration	auction in 2003	auction in 2003	auction in 2003	under consideration	auction

²⁹ Bulgaria sent the answers to the questionnaire only after the completion of the report and therefore the data could not be taken into account regarding the core text of the report.

Member State	800 MHz band	900 MHz band	1800 MHz band	2 GHz band	2.6 GHz band	3.6 GHz band
Czech Republic	auction	beauty contest in the past	beauty contest in the past auction for remaining frequency bands	beauty contest	auction anticipated	combination of first-come-first-serve approach and beauty contest in the 3.4-3.6 GHz in the past 3.6-3.8 GHz: under consideration
Germany	auction	beauty contest in the past	beauty contest in the past auction in 1999 and 2010	auction	auction	auction for regional licenses in 2006; remaining spectrum firstcome,firstserved
Denmark	auction in 2012	beauty contests in 1991 and 2000/2001 auction (refarming) in 2010	beauty contests in 1997 and 2000/2001 auction (refarming) in 2010	sealed bid auction in 2001 sealed bid auction in 2005	auction 2010	mix of beauty contest, firstcome, firstserved and auction.
Estonia	under consideration	firstcome, firstserved in the past	Firstcome, firstserved in the past 3 licenses auctioned	3 licenses given to 900 MHz operators 1 license auctioned	beauty contest with fixed license fee	firstcome, firstserved
Finland	under consideration	firstcome,firstserved in early 1990s	beauty contest in 1995 - 1998	beauty contest in 1999	auction	firstcome, firstserved for current licenses
France	combinatorial single-round sealed bid	call for tenders in the early 1990s	call for tenders in the early 1990s	beauty Contests in 2001-2009	single-round sealed bid	---

Member State	800 MHz band	900 MHz band	1800 MHz band	2 GHz band	2.6 GHz band	3.6 GHz band
	process with three selection criteria (financial amount, regional development, conditions offered to MVNO)	licenses were renewed in the late 2000s 5 MHz duplex are allocated to a 4 th operator (frequencies given back by the 3 other operators; process of restitution already defined in the first calls of tenders for 3G networks in the early 2000s)	licenses were renewed in the late 2000s	single-round sealed bid process with two selection criteria (financial amount, conditions offered to MVNO) in 2010	process with two selection criteria (financial amount, conditions offered to MVNO)	
Greece	under consideration	beauty contest in 1992 auction in 2001 auction in 2012	beauty contest in 1996 auction in 2001 auction in 2012	auction in 2001	under consideration	auction
Hungary	--	auction	auction	auction	--	auction
Ireland	under Consideration, auction envisaged	one licence was awarded to incumbent and beauty contest in the past under consideration (auction proposed)	beauty contest in the past under consideration (auction proposed)	Beauty contest	--	Beauty contest in 2003, 2008 and 2009. Aside from those, license award for Fixed Wireless Access Local Area Licenses (FWALA) is by first-come-first-served format.
Italy	Auction	First GSM license awarded to incumbent on administrative basis and beauty contest procedures in the past.	1800 MHz band spectrum for two GSM existing licenses were awarded on administrative way as	Auction in 2000 and 2009	Auction	Auction

Member State	800 MHz band	900 MHz band	1800 MHz band	2 GHz band	2.6 GHz band	3.6 GHz band
		On the basis of reassignment process introduced for refarming of 900 MHz band, a 2x5 MHz block was made and the chosen assignment procedure was the auction	extension of existing licenses at 900 MHz. Other 2 licensees with rights of use of spectrum at 1800 MHz were awarded on a beauty contest procedure auction, for some remaining 1800 MHz blocks, has been recently established.			
Lithuania	beauty contest	beauty contest	beauty contest	beauty contest	beauty contest	beauty contest
Latvia	--	under consideration auction preferred	under consideration auction preferred	under consideration auction preferred	under consideration auction preferred	under consideration auction preferred
Malta	under consideration (not yet decided)	In 2011 there was a call for expressions of interest. Demand for spectrum exceeded supply. Meetings (brokered meetings) were then held with all the qualifying applicants and a solution was found to avoid the need for an auction. An auction would have	In 2011 there was a call for expressions of interest. Demand for spectrum exceeded supply. Meetings (brokered) were then held with all the qualifying applicants and a solution was found to avoid the need for an auction.	Demand did not exceed supply so a comparative / competitive procedure was not required.	Auction currently preferred.	A beauty contest was held in 2005 A auction is currently preferred for future assignments

Member State	800 MHz band	900 MHz band	1800 MHz band	2 GHz band	2.6 GHz band	3.6 GHz band
		taken place if the meetings were unsuccessful.	An auction would have taken place if the meetings were unsuccessful.			
The Netherlands	auction	auction	auction	auction	auction	auction
Norway	under consideration	auction ten years ago, beauty contests or administrative decisions in the past	under consideration	beauty contest in 2000	auction	auction
Poland	under consideration auction envisaged	tender proceedings	first come,first served tender proceedings	first come,first served tender proceedings	tender proceedings	tender proceedings
Portugal	multiband auction in the end of 2011	beauty contest in 1991 and 1997 extension bands: multiband auction in the end of 2011	Beauty contest in 1997 remaining spectrum available: multiband auction in the end of 2011	beauty contest in 2000 2.1 GHz band: multiband auction in the end of 2011	multiband auction in the end of 2011	Auction in the end of 2009
Romania	auction envisaged	beauty contest and administrative order in the past	administrative order in the past	beauty contest	auction envisaged	beauty contest
Spain	auction	auction and beauty contest	beauty contest	--	auction	--
Sweden	auction	administrative process	administrative process for parts of	beauty contest	auction	auction

Member State	800 MHz band	900 MHz band	1800 MHz band	2 GHz band	2.6 GHz band	3.6 GHz band
			the band (extension) and auction in 2011 for parts of the band			
Switzerland	auction in 2012	auction in 2012	auction in 2012	auction in 2012	auction in 2012	auction for nationwide licenses in 2006; firstcome, firstserved for regional licenses
Slovak Republic	action in 2012 under consideration	beauty contest in 2006	beauty contest in 2006	beauty contest in 2006	auction in 2012 under consideration	auction under consideration
United Kingdom	auction proposed	firstcome,first-served	beauty contest in 1991	auction in 2000	Auction proposed	auction