

# **A proposal for a model for market-based frequency management**





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Abstract Ms Suvi Lindén, Minister of Communications, appointed a working group to examine what measures and legislative amendments are needed for developing and commercialising radio frequencies in Finland. The working group's term of office was from 1 September 2007 to 1 May 2008.  The working group heard a wide range of actors in the sector, examined the practices in other EU states and studied the frameworks related to market-based models. In the final report the working group proposes the following: - A market-based model for frequency management could be applied within the frequency band of 2.50-2.69 GHz. - A total of four network licences could be granted for providing electronic communications services within the band. - The licences would be granted for 15 years following the principle of technology and service neutrality. - The frequency band would be designed to include three networks ideal for frequency-division technologies (e.g. UMTS LTE) and one for time-division technologies (e.g. mobile WiMax). - At least one of the four licences would be granted to an operator not holding a valid operating licence for a 3G mobile network. - The licences could be granted on the basis of an auction or a beauty contest. If auctioning was used, the operating licence fee would be paid annually in equal instalments, one instalment being the highest bid in the auction divided by the length of the licence period. In a beauty contest, the operating licence fee would be a fixed annual fee (an administrative incentive price). - As a rule the licences would be transferable but the Government would maintain the right not to accept the transfer for special reasons (e.g. distortion of competition, national security). - It would be imperative to attach conditions to the licences in order to avoid harmful interference. - The report estimates the impacts of introducing a market-based model for frequency management on user charges. It also discusses the possible legislative amendments needed. - The working group itself does not take a stand on whether or not the proposals should be taken into use.			
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To the Ministry of Transport and Communications

On 29 August 2007, Minister of Communications Suvi Lindén appointed a working group to examine the legislative amendments and other practical measures required to develop the use of radio frequencies available in the communications market. The working group's term of office was from 1 September 2007 to 1 May 2008.

Behind the establishment of the working group were measures prepared by the European Commission to increase the flexibility of frequency management and to commercialise frequency access rights. By the commercialisation of frequencies is meant the granting of access rights either by auction or by some other selection procedure in which the price payable for frequency access rights has the greatest influence on the selection. Commercialisation also encompasses the resale of access rights.

The working group was assigned the task of examining the measures required to facilitate the commercialisation and other development of radio frequencies in Finland. According to the assignment, the report should include, among other things:

- the practices of European Union member states in the commercialisation and other development of frequency access rights
- its proposal for models for granting frequency access rights in Finland
- the frequencies to be used in possible commercialisation
- timetables by frequency band for the possible introduction of commercialisation
- other limiting conditions for the possible commercialisation of frequencies
- the roles of different ministries and agencies in the possible commercialisation of frequency access rights
- the impact on annual fees for frequency access
- a proposal on the use of revenue received from possible commercialisation
- an estimate of the impact on revenue of possible commercialisation
- other issues to be taken into consideration in the possible commercialisation of frequencies

Communications Counsellor Juhapekka Ristola of the Ministry of Transport and Communications was appointed chairman of the working group, Counsellor Olli-Pekka Rantala of the Ministry of Transport and Communications as secretary, and Unit Manager Kirsi Karlamaa of the Finnish Communications Regulatory Authority, Director Kari Koho of the Finnish Communications Regulatory Authority, Senior Advisor Tero Kuitunen of the Ministry of Trade and Industry (Ministry of Labour and Industry), Assistant Director Timo Mattila of the Finnish Competition Authority, Deputy Director-General Kristiina Pietikäinen of the Ministry of Transport and Communications, and Budget Counsellor Esko Tainio of the Ministry of Finance as members. In spring 2008, Ministerial Advisor Maaret Suomi of the Ministry of Transport and Communications also participated in the work of the working group.

The working group submitted its interim report to the Ministry of Transport and Communications on 27 November 2007.

The working group met a total of 12 times during its work. The working group began its work in autumn 2007 with hearings of operators in the sector. A further hearing was arranged on 7 March 2008.

In accordance with the assignment, this final report presents a summary of the practices of EU countries in the commercialisation and development of frequencies as well as the working group's proposal for the possible commercialisation of frequency access rights in Finland, including the necessary limiting conditions and an assessment of the legislative amendments needed.

The working group itself does not take a stand on whether or not the proposals it presents should be taken into use.

Having completed its work the working group respectfully submits its final report to the Ministry of Transport and Communications.

Helsinki, 29 April 2008

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# A Market-Based Model for Frequency Management

## Working Group Proposal

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Abbreviations used in the report:

AIP  
CEPT  
FDD  
GSM-R  
ITU  
PPP  
TDD  
UMTS HSPA  
UMTS LTE  
WAPECS  
WiMax

Administrative Incentive Price

European Conference of Postal and Telecommunications Administrations  
Frequency Division Duplex  
Global System for Mobile Communications Railway International Telecommunications  
Union  
Purchasing Power Parity  
Time Division Duplex  
Universal Mobile Telecommunications System High-Speed Downlink Packet Access  
Universal Mobile Telecommunications System / Long Term Evolution  
Wireless Access Policy for Electronic Communications  
Worldwide Interoperability for Microwave Access

## **1. Summary of the working group's proposals**

In accordance with its assignment, the working group proposes possible market-based models for frequency management, which could be taken into use in Finland if desired. The working group's proposals can be summarised as follows:

- A market-based model for frequency management could be applied in the frequency band 2.50– 2.69 GHz, which will be liberated from other use at the beginning of 2009. The frequency band size is a total of 190 MHz and it could as matters stand be used to provide wireless broadband services. (more detail in Chapter 7.1)
- A possible timetable for starting the award of frequency access rights on a market basis could be the end of 2009. (more detail in Chapter 7.2)
- Licences would be awarded following the principle of technology and service neutrality for the offering of electronic communications services. (more detail in Chapter 7.7)
- A total of four network licences could be awarded in the frequency band, so that
  - three licences (two 2 x 25 MHz network and one 2 x 20 MHz network) would be best suited for frequency-division technologies (e.g. UMTS LTE) and
  - one licence (40 MHz) for time-division technologies (e.g. mobile WiMax).
- The division would conform with both the CEPT recommendation on the use of this frequency band and the Europe Commission's future harmonisation decision and it would allow a sufficiently large transmission capacity relative to the present third-generation networks. (more detail in Chapter 7.3)
- At least one of the four licences would be awarded to an operator that does not currently hold an operating licence for a 3G mobile network. No more than one network licence could be received by the same operator. (more detail in Chapter 7.4)
- Licences could be awarded either by auction or by beauty contest. An annual licence fee would apply for both models.

1) In the auction model the operating licence fee would be paid annually in equal instalments, so that the size of one instalment would be the highest offer made in the auction divided by the length of the licence period. The advantage of the equal instalment model would be, among other things, that the high front-loaded payments typical of auctions could be avoided.

2) In the beauty contest model the operating licence fee would be a fixed annual licence fee (administrative incentive pricing).

In both models, the normal frequency fees charged for radio licences would be paid in addition to the operating licence fee. (more detail in Chapter 7.5)

- Licences, with all rights and obligations attached to them, would as a rule be transferable either completely or partially. Although the transferability of licences would be the norm, transfers would require, however, the prior approval of the
- Government, which could maintain the right not to accept a transfer for special reasons (e.g. competition issues, national security). (more detail in Chapter 7.6)
- Licences would be national and valid for 15 years. (more detail in Chapter 7.8)
- It would be imperative to attach conditions to the operating licences and radio licences in order to avoid interference and to ensure that obligations resulting from international agreements are taken into consideration. It would also be possible, if necessary, to amend these conditions without, for example, any liability for compensatory damages arising to the State. (more detail in Chapter 7.9)
- The operating licence authority would be the Government, which would for example decide on the frequency bands to which the market-based model would be applied, award the licences and decide on their conditions, and could in exceptional cases and for special reasons decide not to accept the transfer of a licence. The Finnish Communications Regulatory Authority would, among other things, supervise adherence to the conditions of operating licences and radio licences, and determine the licence fees to be paid. (more detail in Chapter 7.10)
- An attempt can be made to assess the impacts of the introduction of a market-based management model on spectrum usage fees and State revenue on the basis of the frequency auction that took place in Norway in November 2007. By this comparison, the market value of the 2.50–2.69 GHz frequency band in Finland could be 25–34 million euros, in which case the fee for a single operating licence could be 412,000–570,000 euros per year. If a decision were taken to introduce a licence fee according to administrative incentive pricing, its size should reflect the assumed market value of the frequencies. (more detail in Chapter 7.11)
- The working group makes no proposal on the use of the licence fees that may be collected by a market-based model. (more detail in Chapter 7.12)
- The working group's report presents an assessment of the legislative amendments required by the introduction of a market-based management model, chiefly in terms of the Communications Market Act and the Radio Act. (more detail in Chapter 7.13)
- The working group itself does not take a stand on whether or not the proposals it presents should be taken into use.



<b>Frequency granting model</b>	<b>Present model (beauty contest)</b>	<b>Possible market-based model (auction)</b>	<b>Possible market-based model (administrative incentive pricing)</b>
<b>Technology and service neutrality</b>	Restrictions can be imposed on the technology used and the service offered.	An attempt should be made to minimise conditions relating to the technology used and the service offered.	
<b>Operating licence award method</b>	Government awards licence based on beauty contest	Government will auction off licence to party that bids most (those participating in the auction must fulfil the conditions of Section 9 of the Communications Market Act).	Government will award licence based on beauty contest
<b>Operating licence fee</b>	No licence fee	Annual licence fee, with level of fee determined by auction.	Annual fixed licence fee determined by the authority (administrative incentive pricing), with the level of the fee reflecting the market value of the frequencies.
<b>Frequency fee</b>	Administrative costs covered by frequency fee.		
<b>Transferability of operating licence</b>	Transfer of operating licence is prohibited.	Operating licence transferability would be the rule, if not prohibited for special reasons.	
<b>Operating licence conditions</b>	Restrictions necessary to avoid interference or to conform with international agreements can be imposed in operating licences and radio licences.		
<b>Licence period</b>	The Communications Market Act allows a licence period of 20 years at most.	15 years	

*Table 1. The working group's key proposals for a possible market-based model for frequency management compared with the model currently in use.*

## **2. Organisation of working group's work and hearings of operators in the sector**

The radio frequencies development working group started its work in autumn 2007 with extensive hearings in the sector. The working group heard, among others, telecommunications operators, mass communications operators, equipment manufacturers, other frequency users, and business and consumer representatives. Most of the parties heard considered at the time that possible commercialisation should not be directed at existing frequency access rights.

In its interim report, the working group proposed that other current users of frequencies would be guaranteed undisturbed continuity in terms of valid access rights (official and research activity, television and radio, mobile communications and wireless broadband). In its interim report, the working group decided that, in accordance with the assignment, a process for the possible commercialisation of frequency access rights would be planned for frequency band 2.50–2.69 GHz, which will be liberated from other use after 2008. The working group further decided in its interim report that the main principles of the planned commercialisation process would be the promotion of competition and new investments, the right to transfer access rights, and service and technology neutrality. The Europe Commission's future recommendation relating to the granting of frequency access rights, the Wireless Access Policy for Electronic Communications Services (WAPECS), would be taken into account where applicable.

During spring 2008, the working group decided to propose the possible frequency commercialisation models described in this report as well as limiting conditions relating to them. During its work, the working group updated the principles outlined in the interim report, so that:

- 1) in the proposed models, money would act as a control mechanism in achieving the desired objectives and no fiscal targets would be set for money,
- 2) the objective of the proposed models would be as good as possible communication services to users (price, quality, availability); other objectives would be to promote competition and as low as possible an entry threshold into the market, and to create opportunities for new services and technologies,
- 3) the models would be built so that licences could be awarded for four parallel networks, and so that at least one licence would be awarded to a newcomer to the business, and that
- 4) the final report would propose two alternative models, of which in one the granting of the first stage would take place by auction and in the other by a beauty contest.

As part of its work during the spring, the working group examined the practices and experiences of other EU countries in the commercialisation of frequencies, the technical limiting conditions relating to the commercialisation of frequencies, efficiency and competition aspects relating to commercialisation, as well as assessments of operators' interest towards the chosen 2.50–2.69 GHz frequency band. On 7 March 2008, the working group held a hearing, which was attended by more than 30 representatives of key operators in the sector. The hearing discussed the approaches agreed by the working group in its interim report as well as preliminary approaches relating to the main principles of the

commercialisation models proposed in the final report. The hearing responded positively to the approach selected by the working group, particularly the choice of the 2.50–2.69 GHz frequency band. After the hearing, four written statements were delivered to the working group (DNA Oy, Elisa Oyj, Erillisverkot Oy, SW Television Oy). Most of the written statements considered the present frequency management practices to be good and responded critically to auctions in particular. The Erillisverkot Oy statement considered it good that the decision has been made to leave official frequencies outside the possible market-based model, but the statement also requested that the frequency needs of the authorities be better taken into consideration.

Chapter 3 of this final report describes the practices of European Union member states in the commercialisation of frequency access rights. Chapter 4 assesses the technical limiting conditions of access rights to frequencies, taking into consideration, among other things, the principles of technology and service neutrality. Chapter 5 examines efficiency and competition aspects of the commercialisation of frequency access rights. Chapter 6 evaluates factors relating to demand for the 2.50–2.69 GHz frequency band. The working group's actual proposals for the possible commercialisation of frequencies are presented in Chapter 7. In addition, the working group's proposals are summarised in Chapter 1. The proposals include all those elements called for in the working group's letter of appointment. The proposals also include an assessment of the necessary legislative amendments, if it were decided to take the models into use.

The working group's interim report, which has not been separately issued as a Ministry of Transport and Communications publication, is attached in its entirety to this final report.

### **3. Practices of European Union member states in the commercialisation and other development of frequency access rights**

To ascertain the practices of European Union member states, the Ministry of Transport and Communications initiated a research project entitled “Models of Radio Frequency Commercialisation in EU Countries”. On the basis of a competitive tender, Nordic Adviser Group IT & Telecom Oy were selected to carry out the research project. The research was completed by 15 February 2008 and it has been published as Ministry of Transport and Communications publication 8/2008. The research (Finnish-language only) can be found in its entirety on the Ministry’s website [www.mintc.fi/julkaisut](http://www.mintc.fi/julkaisut).

The research project was assigned the task of describing the commercialisation models applied in key EU member states. The project was particularly requested to explore:

- how commercialisation has been implemented (description of commercialisation models),
- the frequencies to which commercial models have been applied,
- the conditions imposed for licences awarded on a commercial basis in respect of, for example, efficient use of frequencies, technical interference, cultural aspects and media diversity, duration of licences, coverage areas of licences, and transferability, lease and sharing of access rights,
- the grounds on which access rights awarded on commercial terms have been priced and the nature of the experiences obtained about pricing
- the impact on annual user fees for frequencies
- how commercialisation has influenced the efficient use of frequencies
- how commercialisation has influenced investments in wireless technologies
- how commercialisation has influenced competition
- what the roles of different authorities are in the commercialisation of frequency access rights
- how large has been the revenue received from the commercialisation of access rights and what it has been used for.

The research was executed partially through data gathering and on summaries prepared on the basis of it, and partially on interviews with communications officials of selected EU countries (the UK, Germany, Spain, Sweden, Denmark, Ireland and the Netherlands).

The information presented and the terminology used in this chapter of the report is based mainly on the research conducted by the Nordic Adviser Group.

#### *Commercialisation v. market-based approach?*

The European Union is moving towards a market-based approach to radio frequency management. The general objective is to make more efficient use of the spectrum and

facilitate the introduction of new technologies. It is assumed that this will lead to increased competition and innovation, which will be further reflected in practice as new services and lower prices. Finland is one of the last western European countries in which a beauty contest based purely on official discretion is used to grant operating licences without significant fees. Other significant countries of western Europe, excluding Spain and France, use auctions in the granting of operating licences.

Frequency commercialisation and market-based radio frequency management are defined to mean different things. According to the definition used by Nordic Adviser Group, frequency commercialisation means the granting of frequency access rights primarily based on the price paid (e.g. an auction or beauty contest in which the price paid is the key criterion for granting an operating licence). The market-based frequency management concept is wider and it means maximising the efficiency of frequency use, for example by frequency commercialisation means. In some rare situations, these objectives may be in conflict, such as if some of the operating licences remain unsold at auction due to too high minimum prices or if the regulator favours operators whose frequency fees are linked to the companies' success, thus restricting competition.

In addition, market-based frequency management as a concept is considered to be wider than frequency commercialisation. Frequency commercialisation is considered to encompass the following options:

- Auction
- Beauty contest in which the price paid for an operating licence is one of the most important criteria (reminiscent of the normal comparison of tenders)
- Beauty contest to which a continuous frequency fee clearly higher than administrative costs is connected

Market-based frequency management is considered to include the following tools:

- Frequency commercialisation (the above-mentioned three award methods)
- Technology neutral operating licences
- Service neutral operating licences
- Administrative Incentive Pricing (AIP)
- Tradable operating licences

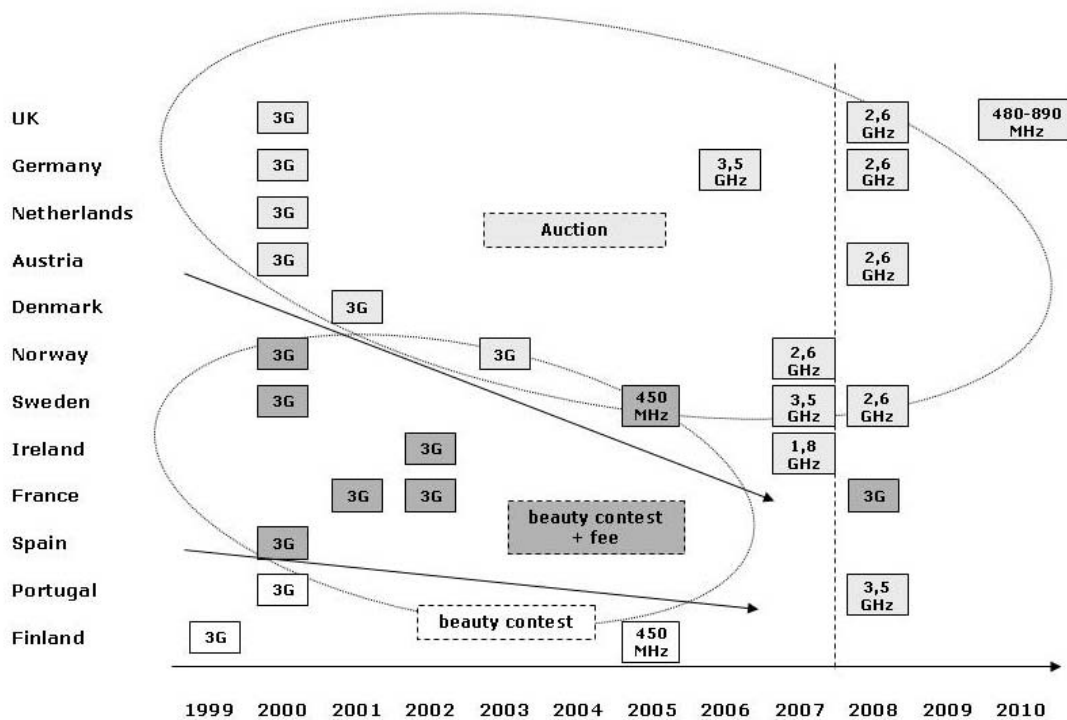
All of the above-mentioned commercialisation and market-based frequency management methods are termed market mechanisms. In the pursuit of more efficient use of frequencies, auctions are not the only mechanism.

### *Commercialised frequencies and their purposes*

In the 1990s, a comparison procedure, i.e. beauty contest, was still the most used method in granting competitive frequencies. For their operating licences, operators only paid an administration fee that covered the regulator's costs.

A combination of beauty contests and higher frequency fees as well as, to an increasing extent, auctions have been applied since the turn of the millennium. Initially, market mechanisms were applied only in the case of those frequencies most in demand, but now the use of the mechanisms has also extended to official frequencies and in future may also extend to TV and radio frequencies. Currently Finland, alongside Portugal, is the last western European country in which a beauty contest based purely on official discretion is used to grant operating licences without significant fees. In fact, Portugal has already announced that it will use an auction to grant 3.5 GHz frequency band licences to be allocated during 2008.

Countries that have pioneered the use of market-based models of frequency management have also utilised other market mechanisms in addition to auctions, such as tradability of licences and administrative incentive pricing (AIP). In Sweden, for example, all frequencies are tradable, and in the UK AIP has been applied successfully also to the public sector.



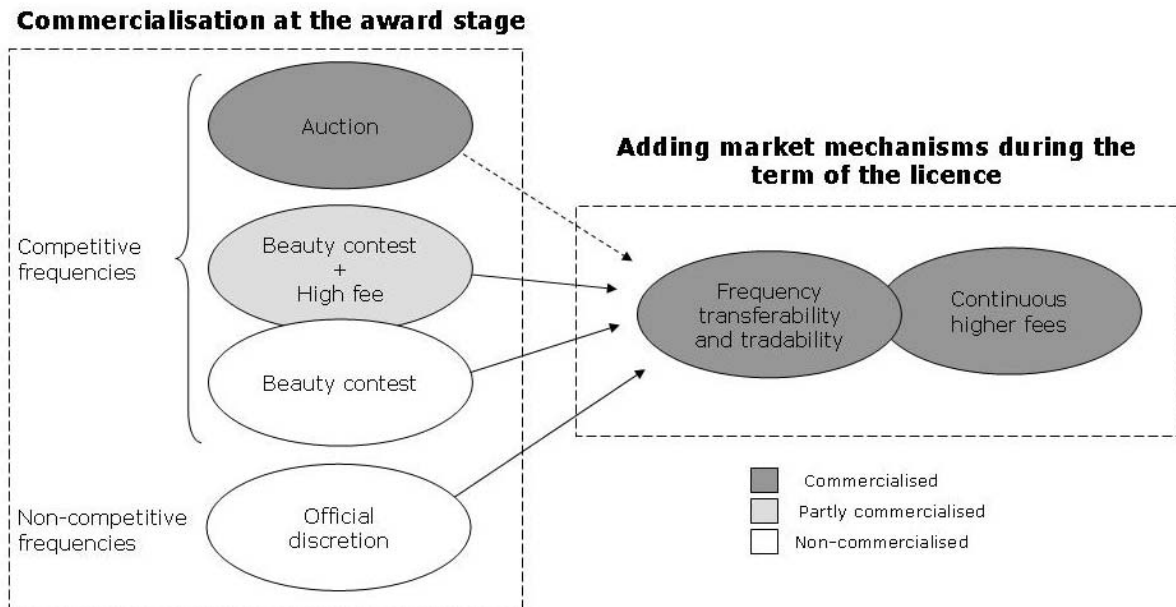
**Figure 1.** National licences awarded in significant European countries, by award method and technology (3G means third-generation telecommunications technologies utilising frequencies around the 2 GHz frequency band). Not included in the figure are Italy, Belgium and Switzerland, which have used the auction method throughout the whole period under examination. (Source: “Models of Radio Frequency Commercialisation in EU Countries”, Ministry of Transport and Communication publication 8/2008).

### Ways of implementing market-based models of frequency management

Frequencies can be managed on market terms both at the licence award stage and at the usage stage. Traditionally the introduction of market mechanisms has focused on the award stage, when commercialisation could be implemented either by an auction or a beauty contest in

which the price paid by the applicant is included either as a threshold condition or as one selection criterion.

Introducing market-based elements into frequency management at the licence usage stage is possible by permitting the tradability of frequencies and, alongside this or alternatively, taking into use administrative incentive pricing (AIP).



**Figure 2.** An auction is not the only market-based model of frequency management available to the regulator. Tradability and continuous frequency fees can also be taken into use during the term of the operating licence. (Source: *Models of Radio Frequency Commercialisation in EU Countries*, Ministry of Transport and Communication publication 8/2008).

The auction method and the beauty contest are the most important methods of awarding desirable frequencies. An administrative decision in which a licence is given to the first applicant is applied only to less desirable and financially less significant frequencies.

The beauty contest has many good features. The authority can implement its view of the public interest and control the development of the sector with rules and, furthermore, if the operating licence costs are kept low, this may have the effect of lowering prices for end-customers. A beauty contest, however, is challenging to execute neutrally and transparently. Even if this is done successfully, the selection made and the criteria can always be criticised, and the decisions made can often be followed by lengthy appeal procedures. The traditional beauty contest cannot actually be considered to be a market mechanism, because the allocation of licences is the responsibility of a regulator not market forces. Market mechanisms that have an impact at the licence usage stage, such as administrative incentive pricing (AIP) or transferability, can however be added to an operating licence allocated through a beauty contest. These will be discussed later in this report.

The auction procedure is neutral and straightforward. The process is completely transparent when price alone decides. The auction procedure has its problems, however. It does not work properly if interest is low. Correspondingly, in a situation of overdemand, it can happen that the licence winner encounters a “winner’s curse” in the form of an excessive price, which might have a negative impact on investments, the scheduling of the start-up of services, and pricing. The auctioning of frequencies may also lead to a weakening of competition, with market leaders occupying frequencies only to prevent competition. This can be limited, however, with conditions and regulation.

Between these two models is the beauty contest in which price is included as one important criterion. The procedure is therefore reminiscent of a normal comparison of offers, except that a high offer price is considered to be an advantage. Including price as one element facilitates the regulator’s burden of justification and might reduce any complaints made about the licences. At the same time, it moves the allocation of licences towards a market-based approach, while leaving some power of discretion with the regulator.

During the term of the operating licence, licence holders can be charged frequency fees equivalent to the regulator’s costs, royalties higher than these, or an administrative incentive price (AIP).

Covering the regulator’s costs is the most traditional model. The regulator’s costs are split among the licence holders and charged as annual fees. This model, however, does not necessarily encourage the efficient use of frequencies.

Royalties are fees that operators pay as a share of the business revenue made possible by the licence, for example as a percentage of turnover or earnings. Royalties are a tax-like charge and they do not encourage the efficient use of frequencies. Moreover, earnings fluctuate, which might lead to problems if the fees are used to finance the regulator’s activities. Companies also strive to avoid fees as far as possible. Most problematic, however, is that the regulator’s neutrality is threatened if its funding is dependent on the operators’ earnings.

A fee that follows the administrative incentive pricing (AIP) practice is an annual fee that is substantially higher than the administrative costs. Payment is dependent on the commercial value, size and generally also the geographical coverage of the frequency band being used. AIP sets for frequencies a cost that exceeds the regulator’s administrative costs, and it is a way of creating pressure for the efficient use and trading of frequencies in addition to the opportunity cost of merely using the frequencies.

By applying AIP, the objective is to ensure that a powerful company in the market is not able, except at considerable cost, to collect frequencies and reserve them for itself. AIP can also help to shape the use of publicly funded operators’ frequencies in a more efficient direction, because AIP fees are real, budget-derived costs, not merely opportunity costs.

In practice, an effort is made to determine the AIP fee by assessing the opportunity cost of each frequency band and its use. If, for example, a mobile phone frequency as well as the frequency next to it and its purpose are examined, the opportunity cost is found at the point where the benefit of transferring a frequency to mobile phone use corresponds to the loss experienced by the other purpose. Calculating the AIP fee in practice is very challenging, because assessing the effects and costs is difficult due to a lack of information. The AIP fee



should preferably be set too low rather than too high if the objective is to ensure that the fee is not excessively high and that companies are not burdened by an additional tax-like charge. On the other hand, if the AIP fee is set too low, then the desired control on the efficient use of frequencies will not be achieved.

### *Operating licence conditions*

EU Directive (2002/20/EC) on the authorisation of electronic communications networks and services places restrictions on the imposition of the conditions set for spectrum accessibility. According to the Directive, only the following conditions can be set for operating licences:

- The frequency purpose or network type/technology
- Conditions relating to the efficient use of frequencies (e.g. coverage requirements)
- Technical and operational conditions aimed at minimising the effects of interference and magnetic fields
- The maximum duration of the authorisation
- Conditions and restrictions relating to the transfer of access rights that takes place on the licence holder's initiative
- Usage fees
- Other undertakings made by the licence holder during the selection process
- Requirements relating to international agreements

Comparing conditions of licences awarded by both auctions and beauty contests in a number of European countries shows that the award method simply has no impact on the number of conditions. Irrespective of the award method, regulators have therefore been able to set the conditions they wish within the framework of restrictions prescribed by the EU.

In November 2007, the Europe Commission issued its proposal for amending the current electronic communications directives. In terms of licence conditions, the directive proposals would, when implemented, particularly affect restrictions relating to purpose and technology, with principles of technology and service neutrality becoming the norm, as well as to restrictions relating to transfer of access rights, with transferability being included as a key element in the new regulatory framework.

Irrespective of the Commission's proposals, the number of licence conditions in European Union member states has been declining in recent years – coverage and start-up scheduling requirements as well as technology and service requirements in particular are increasingly being abandoned completely. Licence tradability, moreover, is also more common.

### *Tradability*

Spectrum tradability or transferability means that licence holders can if they wish sell or otherwise dispose of their licences / access rights to a third party. Efforts are currently being made to promote licence tradability in a number of European countries, because a secondary

market for licences is considered to enhance the efficient use of frequencies, create an opportunity cost for frequencies, and promote the more efficient allocation of frequencies. If, for example, a licence holder needs only part of the frequency it uses, it is to the holder's advantage to sell the excess portion of the frequency to the buyer that will pay most, thus enhancing the use of the whole frequency band. In most European countries, the transfer of frequencies requires the advance approval of the licence authority.

### *Licence award process*

Licence award processes vary from country to country, particularly in respect of the regulators who participate in the process and the market mechanisms used. Despite the differences, the licence process generally has the following stages:

- *Evaluation of supply.* This can be done either actively or passively. A passive regulator waits for enquiries on the need for spectrum use from users and acts accordingly. An active role, on the other hand, requires a survey and evaluation of possibilities, based on which an attempt is made to direct supply to correspond with expected demand. NITA (Denmark) is an example of a passive regulator, while OFCOM (UK) can be considered an active regulator.
- *Evaluation of demand.* The biggest challenge of regulators is, more often than not, the evaluation of demand for spectrum, because it is central in determining the ways in which spectrum licences can be awarded and therefore the opportunities to use market mechanisms in the said frequency band. It is impossible to evaluate demand completely reliably, because it depends on a number of uncertain factors, including technology development and timing, end-customers' needs, companies' ability and willingness to invest and develop services, and the impact of possible competing technologies. Evaluating demand is particularly important, however, because it is only for frequency bands where demand clearly exceeds supply that it is worthwhile organising onerous competitive procedures, such as auctions, for example.
- *Planning of frequency division and terms.* Although there is an increasing desire to set conditions on frequency use in a manner that is service and technology neutral, in practice the allocation of frequencies significantly influences the technologies that can be applied in the frequency band. In addition, when different technologies operate side by side, significant guard bands may be required to ensure that interference is minimised. In some cases, there are clearly some technologies that can be used in a certain frequency band. Such a situation exists, for example, in the 2.50–2.69 GHz frequency band, which is suitable for both a U-TMS- and a WiMax-based solution. The conditions attached to licences can be used to influence decisively the goals that can be achieved, for example in terms of increasing competition, service provision, innovations and other goals of the regulator. The absolute number of conditions applied to licences has declined in EU countries in recent years, as discussed above, and there is no perceptible difference in the number of licence conditions, irrespective of whether licences are awarded by auction or beauty contest.
- *Planning and selection of award method.* The selection of the award method is based particularly on an evaluation of the demand, supply and potential purpose of the frequency. If demand for the frequency is low, an official decision to the award the frequency is, in practice, given quickly. If there is more demand than supply for the frequency band, the licence recipient is selected by a beauty contest or auction. Price planning of the award

method is particularly important, because there are many kinds of award method, and most are suitable only for certain situations.

– *Awarding the licence.* The award of the licence itself by beauty contest or auction is a rather fast and straightforward process, when preparations have been made with care. This stage typically lasts a few weeks. Nowadays auctions are often executed using computer programmes that enable dozens or even hundreds of operators to participate in the auction, which may last without a break for several days. Often the licence applicants must, at the application stage, give information about their financial status and their background, for example in relation to national security. A similar process is followed in connection with licence trading. Regulators in the countries studied report, however, that where most frequencies are concerned national security is not a very significant issue. Certain radio frequencies, however, are also used by the defence forces, in which case the regulators may be more interested in any other parties who wish to operate on the same frequency band.

– *Supervision.* The need for official supervision of licence conditions has reduced in recent years due, among other things, to the decline in the number of licence conditions and the EU's policy of promoting competition. Naturally, regulators will still intervene in structures that prevent competition or distort market efficiency, to ensure that individual operators do not obtain a controlling market position.

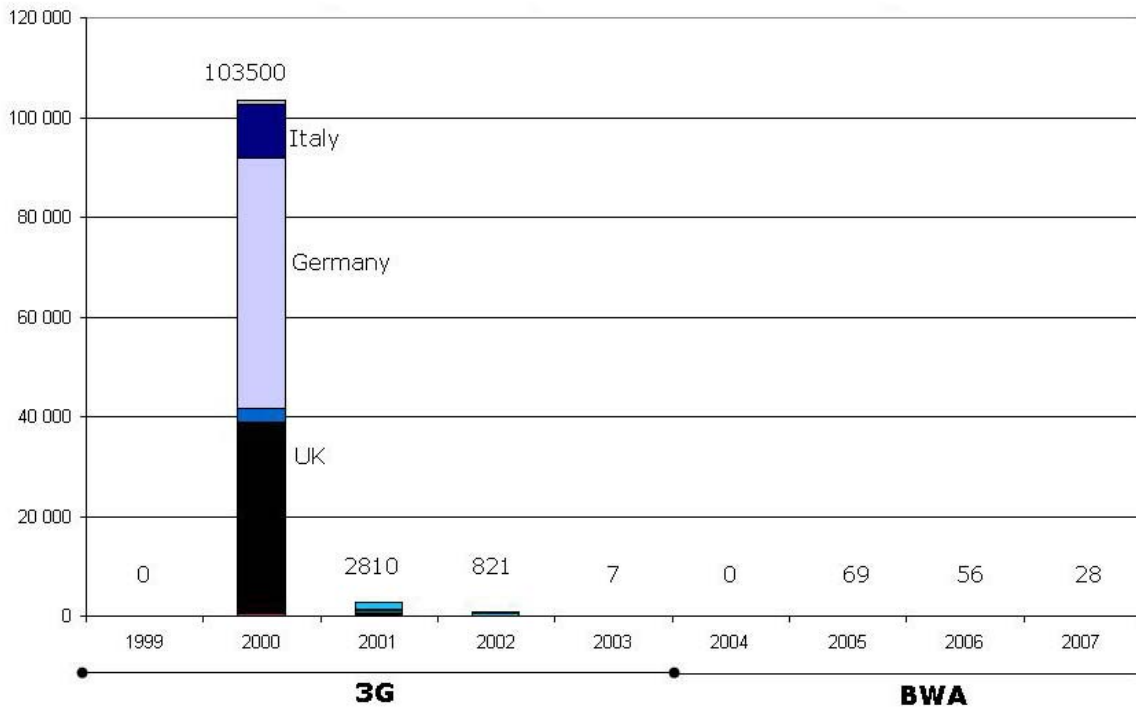
### *Roles of different operators*

Practices in the awarding of licences vary considerably from one EU country to another. Most typically, the national regulator participates in the awarding of licences in collaboration with the Ministry of Communications. The participation of industry in the sector is also common. In some countries, the award process might additionally involve the Ministry of Finance, the competition authority or some other ministry.

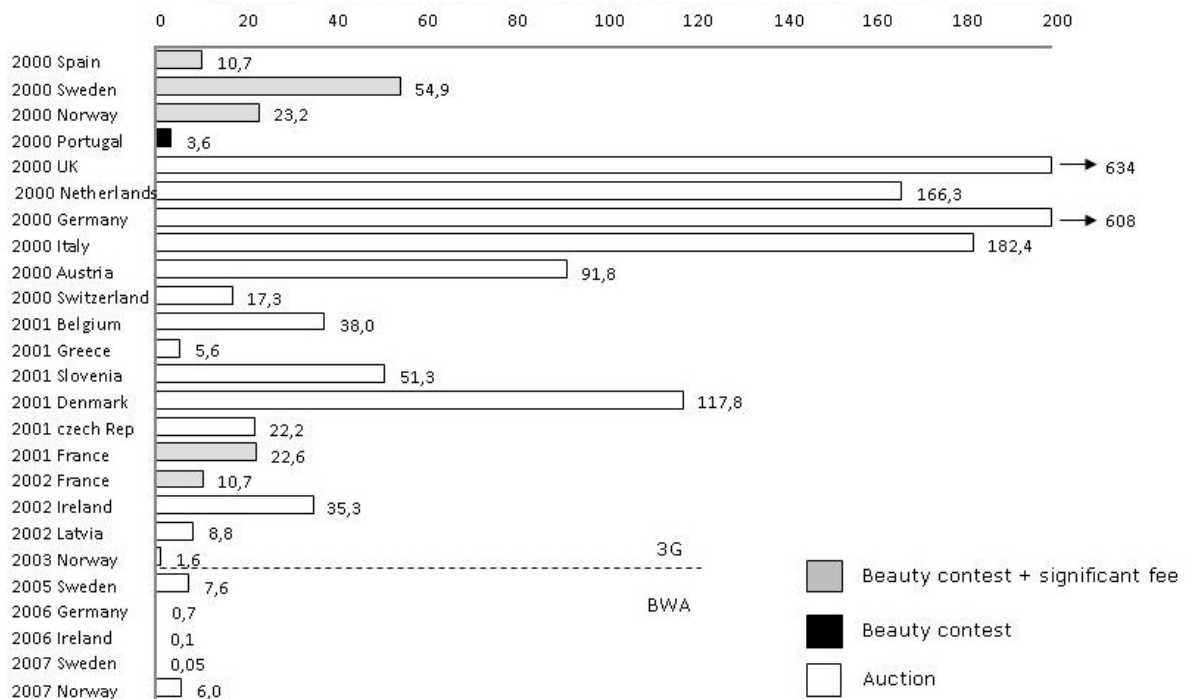
The licence award process is considered to work most efficiently when responsibility for completing the process is clearly borne by one actor. The responsible authority listens during the process to industry and experts in the sector, but itself forms an overall view and is clearly responsible for advancing the process. Market mechanisms, such as auctions, licence tradability and administrative incentive prices transfer responsibility for tasks relating to the awarding and use of licences from the regulators to market forces, which underlines the regulator's own activity in promoting competition.

### *Use of revenue*

In connection with the revenue received from commercialisation, the 3G auctions of the turn of the millennium, which collected a total of more than 100 billion euros in Europe, come easily to mind. Three auctions alone, namely in Germany, the UK and Italy, collected a total of 99 billion euros, corresponding to 93 per cent of all revenue. The annual auction revenue in Europe currently totals only a few tens of million euros, i.e. less than one thousandth of the 3G auction revenue.



**Figure 3.** Revenue received in licence auctions in Europe, including the first year's revenue from the auction and other fees. (Source: Models of Radio Frequency Commercialisation in EU Countries, Ministry of Transport and Communication publication 8/2008).



**Figure 4.** Revenue received in Europe by awarding licences (EUR/resident) 2000-2007. Relative revenues have varied markedly, depending on time, award method and technology. (Source: Models of Radio Frequency Commercialisation in EU Countries, Ministry of Transport and Communication publication 8/2008).

It is probable that the auction results were inflated by the turn-of-the-millennium IT fever and that corresponding figures will not be seen again.

Under the present practice, the EU countries use the money they collect from auctions for the state budget. There are, however, some exceptions in which revenue has been earmarked for the development of IT activity or frequencies. Examples of this can be found, for example, in Germany, France and Guatemala, but in the UK the allocation of money for a particular purpose is also possible, in principle.

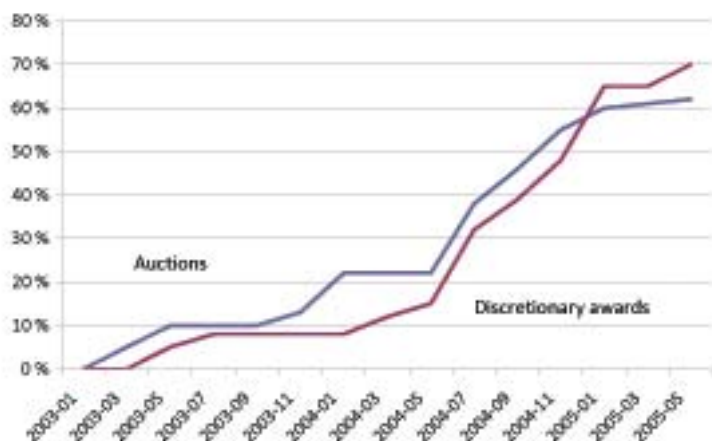
*The impact of commercialisation on the efficiency of frequency use, investments, competition and consumer prices*

Frequency management objectives in different EU countries are very similar, irrespective of whether or not market mechanisms are used in frequency management. In recent years, the use of market mechanisms to promote these objectives has clearly increased, however. According to the authorities of countries that use market mechanisms, the objective of applying market mechanisms has not been mainly to collect money for the state; it has been to increase competition, improve the efficiency of the award process, ensure transparency and promote innovation and more effective technologies.

The efficiency of frequency use must be evaluated more widely than by traditional methods that measure technical frequency efficiency (bits/MHz). The evaluation should take into account a number of factors, such as the scope and price of services, service need and service necessity.

The authorities of countries that use market mechanisms consider that auctions have not reduced the efficiency of spectrum use in the countries in question. The regulators considered it good practice that an effort is made in connection with each auction to give a licence to at least one new operator. Increasing competition was considered to be a key factor in improving the efficiency of spectrum use. Administrative Incentive Pricing (AIP), moreover, was considered a good tool in improving the efficiency of use public operators' frequencies.

The significance for network investments of the auction prices paid for operating licences was actively discussed when the 3G auction wave was at its peak at the turn of the millennium. In the opinion of one school, large auction prices reduce investment, because after the auction the company's financial status is weakened and the company does not necessarily have the capacity to make rapid investments, which will weaken the company's financial situation further. On the other hand, it can be argued that willingness to invest is determined purely by a comparison of investment costs and expected yields, so investments made previously have no significance. If the 3G investments which have been made are examined, research indicates that no licence award method seems to have had a significant effect on network investments (see figure).



**Figure 5.** 3G investments made in Europe in relation to the number of licences awarded by auction and by official discretion. (Source: *Models of Radio Frequency Commercialisation in EU Countries*, Ministry of Transport and Communication publication 8/2008).

Key criteria in evaluating the competitive situation are the number of competitors and particularly end-customer prices. An examination of 2G and 3G licences awarded by both beauty contest and auction in OECD countries indicates that auctions have been to some extent more successful in promoting competition (number of operators). An average of 1.14 new operators were obtained for the 3G market by auction and an average of 0.67 by beauty contest. In addition, the absolute number of operators in a market was clearly greater in countries that used an auction as the licence award procedure.

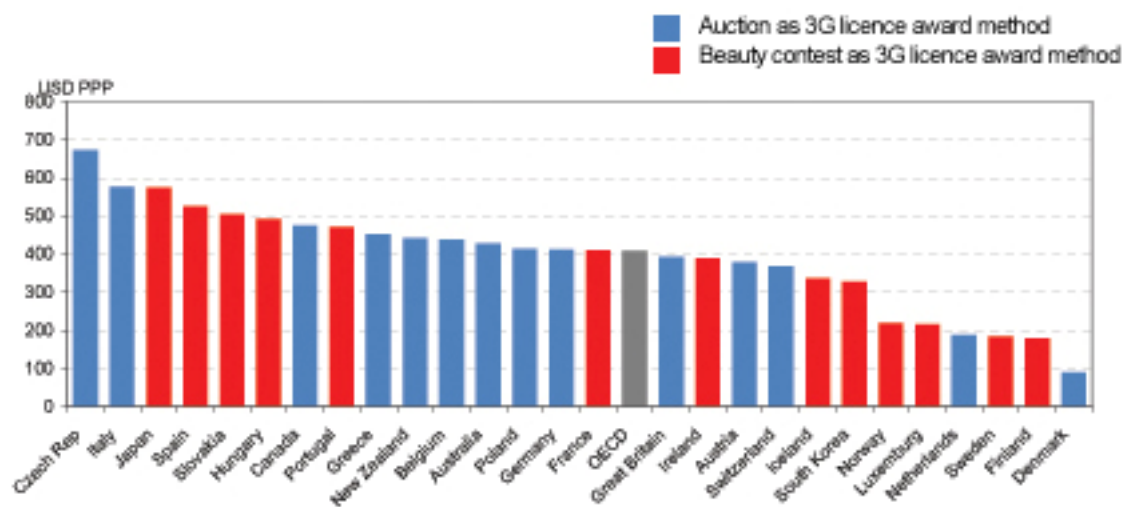
<b>3G licences auctioned</b>				<b>Population</b>	<b>Population density</b>
<b>Country</b>	<b>Number of GSM operators</b>	<b>Number of 3G operators</b>	<b>Change</b>	<b>(million)</b>	<b>(people/km<sup>2</sup>)</b>
Australia	4	6	2	20,4	3
Canada	4	5	1	32,6	3
New Zealand	2	4	2	4,1	15
Latvia	2	3	1	2,3	36
Greece	3	3	0	11,1	84
Austria	4	6	2	8,2	98
Poland	3	5	2	38,5	123
Denmark	4	4	0	5,5	126
Switzerland	2	4	2	7,5	182
Italy	4	5	1	58,1	193
Germany	4	6	2	82,7	232
Great Britain	4	5	1	59,9	245
Belgium	3	3	0	10,4	341
Netherlands	5	5	0	16,4	398
	<b>3,43</b>	<b>4,57</b>	<b>1,14</b>	<b>25,5</b>	<b>148,5</b>

<b>3G licences allocated by beauty contest</b>				<b>Population</b>	<b>Population density</b>
<b>Country</b>	<b>Number of GSM operators</b>	<b>Number of 3G operators</b>	<b>Change</b>	<b>(million)</b>	<b>(people/km<sup>2</sup>)</b>
Norway	2	2	0	4,6	14
Finland	3	4	1	5,3	14
Sweden	3	4	1	9,1	20
Ireland	3	3	0	4,2	61
Spain	3	4	1	43,4	86
France	3	3	0	60,7	112
Portugal	3	4	1	10,5	115
Luxemburg	2	3	1	0,5	182
South Korea	2	3	1	48,0	487
	<b>2,67</b>	<b>3,33</b>	<b>0,67</b>	<b>20,7</b>	<b>121,2</b>

**Table 2.** Numbers of GSM and 3G operators in different countries categorised according to 3G licence award method. (Source: *Models of Radio Frequency Commercialisation in EU Countries*, Ministry of Transport and Communication publication 8/2008).

In a comparison of end-user prices in OECD countries at purchasing power parity (PPP), an average mobile communications price basket in August 2006 was valued at 409 USD in countries that applied an auction process and 372 USD in countries that applied a beauty contest. The most expensive 3G licence fees were paid in Germany and in the UK, which even so are around the average in terms of price levels among OECD countries. Rather than the application of the auction process, end-user prices are influenced more by genuine competition in the market, which can be achieved by successful regulation, irrespective of the way the licences are awarded. For example, in northern European countries end-user prices have been inexpensive, irrespective of the way that the frequencies were allocated.



**Figure 6.** Value of an average mobile communications price basket calculated by the OECD, by country in US dollars, August 2006. (Source: Models of Radio Frequency Commercialisation in EU Countries, Ministry of Transport and Communication publication 8/2008).

3G licences auctioned					3G licences allocated by beauty contest				
Country	Fixed	Use	Messages	Total	Country	Fixed	Use	Messages	Total
Czech Rep	451,6	131,5	90,2	673,4	Japan	310,4	255,1	8,8	574,3
Italy	145,4	319,1	112,1	576,6	Spain	10,7	383,5	130,9	525,1
Canada	364,7	24,8	85,5	475,0	Slovakia	319,3	148,8	36,6	504,7
Greece	403,2	8,5	39,7	451,4	Hungary	294,8	45,4	151,5	491,7
New Zealand	433,2	7,2	1,6	442,0	Portugal	90,1	376,7	4,7	471,5
Belgium	344,9	74,2	18,5	437,6	France	332,9	76,4	0,5	409,9
Australia	397,6	22,9	6,2	426,7	Ireland	388,4	0,0	1,8	390,2
Poland	318,4	30,7	65,4	414,4	Iceland	68,7	207,8	59,4	336,0
Germany	328,8	53,9	28,8	411,4	South Korea	246,1	72,4	9,9	328,4
UK	392,6	0,0	0,0	392,6	Norway	43,9	173,6	1,7	219,2
Austria	18,4	255,0	105,9	379,3	Luxemburg	0,0	153,0	63,3	216,3
Switzerland	7,5	309,2	52,6	369,2	Sweden	3,7	133,7	47,3	184,7
Netherlands	188,0	0,0	0,0	188,0	Finland	47,8	97,4	32,7	177,9
Denmark	3,9	68,9	16,4	89,2					
			USD PPP	409,0				USD PPP	371,5

**Table 3.** Value of an average mobile communications price basket calculated by the OECD, by country in US dollars, categorised according the 3G licence award method, August 2006. (Source: Models of Radio Frequency Commercialisation in EU Countries, Ministry of Transport and Communication publication 8/2008).



#### **4. Technical limiting conditions, taking into consideration e.g. technology and service neutrality principles**

*Conditions and restrictions of a technical nature set for users in current radio licences, particularly from the perspective of mobile communications frequencies*

The Finnish Communications Regulatory Authority (FICORA) has awarded radio licences in accordance with a Government decree on the utilisation plan for frequency bands allocated to television and radio operations and licensed telecommunications activity as well as in accordance with the FICORA Frequency Regulation No. 4. The FICORA Frequency Regulation No. 4 covers the frequency range 9 kHz – 400 GHz. In the utilisation plan, each frequency band is allocated to the use of certain types of radio systems. Each frequency band can typically be used for a number of different purposes. The sufficiently interference-free use required by the Radio Act (1015/2001) is as far as possible ensured in the utilisation plan by defining the technical criteria to be applied in the use of each radio system and by referring, according to need, to the applicable standards. Therefore in radio licence decisions there has been no need to define technical conditions and restrictions on use in comprehensive detail.

In licence decisions it is, however, necessary to oblige network companies to adhere in border areas to obligations resulting from coordination agreements concluded with neighbouring states. These coordination agreements separately define the preferential channels usable in border areas. In certain cases it is also necessary to set power restrictions in order to protect use in neighbouring bands. For example, it is necessary to set restrictions on UTMS in the 900 MHz band in order to protect GSM-R use in the adjacent band.

*The impact of technology neutrality on conditions and restrictions set for access rights*

A key point of departure and objective of the EU's reformed frequency regulation is liberalising the purpose of frequency bands so that access rights are awarded in a technology and service neutral way, i.e. for the offering of electronic communications services.

This means in practice that spectrum users can, as a rule, select the technology to be used themselves and decide on the kinds of electronic communications services they will offer. In terms of the conditions set for access rights, national room for manoeuvre may narrow through EU-level harmonisation.

Technology and service neutrality in connection with commercialisation could give rise to a situation in which a new licence holder wishes to change the technology previously used on a frequency to another, or changes the technical parameters of radio network base stations, for example transmitter locations, transmission powers or antenna characteristics. This could affect radio networks operating on adjacent or the same frequencies so that their operation is interfered with or traffic transmission capacity declines.

Certain technical and non-technical (e.g. geographical) conditions necessary to safeguard sufficiently interference-free use may also be set for spectrum use. Ensuring that spectrum use does not cause unreasonable interference or disturbance to others using the same or adjacent frequency band when users change, would require that certain technical limiting conditions, binding on present and future users of the frequency band, be specified for operations. The

specification of technical conditions becomes significantly more challenging as frequency purpose and the technology used are liberalised. Authorities should have sufficiently wide powers in this field. Examples of technical conditions are spectrum mask criteria, power restrictions and interference levels, particularly on the boundaries of the licence area (in-band, out-of-band and areally specified restrictions). Correspondingly, it may be necessary in future to specify more precisely how much interference resulting from the use of a neighbouring band a spectrum user is obliged to tolerate. Despite the liberalisation of purpose, the above-mentioned restrictions will also to some extent direct the purpose of frequency bands in future.

The obligations arising from coordination agreements between states would also still be necessary. Moreover, it should be noted that it may be necessary to amend coordination agreements now and then, for example when the technology used in a certain frequency band changes or the number of network operators changes.

To ensure interference-free communications, the authorities must have information on the technology that will be used in the radio networks as well as information on who has the right to use each frequency band. For this reason, frequency users would have an obligation to inform the authorities in advance about changes in the technology used and about any change in the holder of the access rights to the frequency band. In connection with changing the technology, it should be possible to change the technical conditions of the licence for reasons connected with ensuring interference-free operations.

The interference situation as a whole would be more simply managed in connection with commercialisation of frequencies; the technical conditions of the licence would be binding as they are on the new holder of the access rights to a frequency, and they would change only if the Finnish Communications Regulatory Authority approved an application to change them.

To investigate cases of interference, it is necessary for the authorities to have information about all holders of access rights to frequency bands at any given time.

#### *Obligations resulting from international agreements*

The Radio Regulations of the ITU constitute the most important international agreement binding the spectrum decisions of states. The Radio Regulations are amended at the ITU Radio Conferences, which are held at 3-4 year intervals. As a result of changes made to the Radio Regulations, administrations may have to clear frequency bands of their old uses to make way for a new use that comes in their place or change the technical specifications of systems in a frequency band. This possibility should also be provided for in any market-based situation in which frequencies are managed on market terms. In matters of spectrum access, the possibility of taking into consideration frequency decisions of the European Commission that are binding on Finland should be continued.

It should be possible to change conditions relating to spectrum if so required by international decisions that are binding on Finland.

Finland has concluded coordination agreements on the use of different frequency bands with the spectrum administrations of neighbouring countries. These agreements specify the

procedures to be followed when frequency use affects the use of frequencies in a neighbouring country. The agreements also contain detailed frequency arrangements. To ability to honour obligations arising from coordination agreements must be maintained irrespective of how frequencies are managed.

Individual frequencies have been coordinated with the spectrum administrations of both neighbouring and more distant countries. The authority of the country in whose territory a system or transmitter is to be taken into use and which might affect the radio communications of other countries or be affected by the radio communications of other countries sends to the countries in question a coordination request and gives details of the transmitter being taken into use to the administrations of the countries within its area of influence. If the transmitter being coordinated does not cause interference in the countries that receive a coordination request, it is approved. At the same time, the country approving the coordination assumes responsibility for ensuring that the coordinated transmitter or system receives interference protection from any transmitters that may be taken into use at a later date. A similar protection need covers transmitters that have been entered in the ITU International Frequency Register as a consequence of ITU notification and coordination procedures.

The Finnish Communications Regulatory Authority has received from and sent to other administrations many such coordination requests. It should be possible to manage changes to the technical specifications of radio transmitters so that no interference is caused by a foreign system that has received the approved frequency coordination. The same requirement naturally applies to a foreign country that has approved a coordination requested by the Finnish Communications Regulatory Authority.

#### *Ensuring that spectrum use is adequately free of interference*

The technology neutrality objective connected with commercialisation will reduce the detailed regulation of technical specifications in the present operating licence and radio licence procedure. This will significantly increase the risk of interference. That is why it is necessary for national authorities to be able to set the technical restrictions relating to spectrum use that are necessary to ensure that radio communications are adequately free of interference. It should be possible to set restrictions nationally, because the use of adjacent frequency bands, for example, might differ in different countries. Similarly the same frequency band can be used for some completely different use in a neighbouring country (for example Russia), so avoiding interference should be planned on a case-by-case basis.

National authorities should have adequate powers and means to continuously monitor that spectrum use is adequately free of interference in terms of those frequencies where operating licence transferability has been permitted.

A new user of a frequency band should adhere to the technical restrictions that were imposed on the first user of the band to avoid radio interference. These restrictions are impossible to specify in advance on a general level for all radio networks and all frequency bands. They can be specified on case-by-case basis for each frequency band. In other respects, a new user of a frequency band could freely determine the technical specifications of its own network. It is necessary to impose geographical restrictions in the proximity of the national frontier or when network coverage has been geographical restricted.

In a situation where only part of a frequency band is transferred to another user, it should also be possible to set licence conditions relating to any guard bands that may be needed and other technical parameters that may be necessary to ensure that spectrum use is adequately free of interference. In such a situation it may be necessary to set conditions for both the transferor and the recipient of the frequencies.

#### *Fixed term of access rights*

It should be possible to re-examine the purposes of frequency bands and, if necessary, change them. The need to change may follow, for example, from harmonisation work in the European Union or the ITU. As a result, it would be necessary for the authority to award frequency access rights always for a fixed term to the first recipient of the frequencies. The fixed term would also be binding on any later holders of the access rights.

#### *Summary of technical limiting conditions*

- Technology neutrality could be applied in frequency bands managed on market terms, but not without restriction. In all cases, care should be taken to ensure that the radio frequency operating characteristics of the technology used are such that no interference arises to other frequency use and that use does not require unreasonable protection from other users outside the band. To ensure adequately interference-free radio communications, the authorities should have up-to-date information about the technology used and the network structure.
- Restrictions imposed to avoid interference cannot be specified in advance for all radio networks and all frequency bands; they should be specified for each frequency band separately. It should be possible to change restrictions if this is necessary due to a change of the technology used.
- To protect radio networks operating in the same frequency band from interference, technical restrictions may be tighter in the proximity of the national frontier or adjacent to the network operating area. For compatibility of neighbouring countries' frequency use, it may be necessary to change national frequency access rights in frontier areas.
- If the access right to a frequency band transfers to another user, this user should also adhere to the technical restrictions imposed on the first user to avoid interference. In other respects, frequency band users could freely determine the technical specifications of their own network.
- Frequency access rights should always be awarded for a fixed term.
- The EU and the ITU make decisions on frequency use that are binding on Finland. It should be possible to change national frequency access rights if so required by international obligations.

## **5. Efficiency and competition aspects of the commercialisation of frequency access rights**

Problems relating to the commercialisation of frequency access rights, in terms of the competitive situation and financial efficiency, might arise mainly in such exceptional situations where, due to technical reasons or licence conditions, only a narrow frequency band can be utilised in the offering of services. In such situations, the companies controlling the frequencies might have a business incentive to hold the frequencies without using them and thus prevent competition.

Potential problems caused by a concentration of frequency control can probably be prevented by the technology and service neutral allocation of frequencies. If the same or sufficiently close substitute services can be freely offered on a number of frequency bands or utilising other distribution channels, it is less likely that problems will arise.

If sufficiently flexible conditions are created for frequency transfers in the secondary market, it can be assumed that the likelihood of problems arising will be reduced. Centrally connected with this, moreover, is the creation of systems that encourage the transfer of frequencies when they are left unused. Accordingly, holding frequencies while not using them should be too expensive for those who hold them in relation to the benefit received from trading them. Such an incentive could be a continuous licence fee (for example based on an auction or administrative incentive pricing).

Taking the above into consideration, it can be said that efficiency and competition problems which are connected with spectrum commercialisation and which threaten its success do not appear particularly probable, if the market-based model is planned and implemented with care. Planning and implementation of commercialisation should take into account, however, the possible disadvantageous effects that could arise, for example, from the concentration and hoarding of frequencies. This chapter has presented solutions through which these effects could be prevented in advance. It should also be noted that in a situation in which some of the frequencies have been allocated on market terms (as well as technology and service neutrally) and some by administrative procedures, particular consideration should be given to the efficiency of competition and the realisation of financial efficiency. If different principles are applied to different frequency bands in respect of frequency allocation, this might more probably have an impact on competitive conditions between companies.

### *Inactive spectrum hoarding and speculation in access rights*

Frequencies ending up in the hands of major operators, and thus a concentration of the market, represent a threat associated with frequency commercialisation that should be prepared for, even though in those EU countries, for example, where market-based models of frequency management have been taken into use, threats of spectrum hoarding have not materialised. Unsupervised frequency commercialisation, however, could in principle facilitate spectrum hoarding or speculation in access rights. In such cases, market mechanisms would not result in the efficient use of frequencies.

Hoarding a frequency band means purchasing and holding the access right to frequencies without utilising them in building a network. In such cases, operators purchasing access rights

would attempt to gain control in key market areas for their business as much spectrum as possible and perhaps leave this unused in order to prevent the entry of new operators into the market and an expansion of competition. A company that operates in this way assumes that the benefit of the market power achieved will exceed the benefits obtained from selling the frequency access rights.

Another possible threat associated with frequency commercialisation is the use of frequency access rights as a speculative asset. The speculating company does not use the frequencies to develop a network; it purchases their access rights like financial instruments and waits for technology to develop and the value of the frequencies to grow in order to ultimately sell on the access rights.

In order to prevent hoarding and speculation, frequency licence conditions should be made sufficiently incentivising. Holders of access rights should be bound, also when access rights are purchased from another company, to use the frequency band obtained within a period specified in advance or to give sufficient justification for not using the frequency band. Charging a sufficiently large annual licence fee and setting a time limit on spectrum access would reduce the risk of spectrum hoarding and speculation in access rights.

### *Market concentration*

Frequencies in themselves do not constitute a communications market. Because frequencies are production factors that in a market-based model of frequency management have a market-based price, the trading of access rights is actually the trading of assets. Spectrum trading might lead to the creation of a dominant market position (significant market power) in the electronic communications market, mainly in situations in which there are no alternative frequency bands or other distribution channels for offering a certain service. Unsuccessful operation of the spectrum market may thus also be channelled into the electronic communications wholesale and end-product market that uses the frequencies. Unsupervised spectrum trading could cause a concentration of the market. This would prevent the increase in financial efficiency sought by permitting the transferability of frequency access rights.

Frequency commercialisation could, in principle, lead to a market situation in which fewer companies than before have control not only of larger numbers of customers (market share) but also a bigger share of the spectrum. In such a case, smaller companies have less potential to expand their capacity and thus less incentive to increase their market share. Accordingly it is possible that a few large network companies will set, in a coordinated way<sup>1</sup>, an excessively high price for communications services, such that it would not be profitable for a small company to deviate from that price, because it would be unable at a reasonable investment cost to expand its operations and serve a greater number of end-customers.

Market failures arising from frequency commercialisation could in principle be addressed using the advance regulation that already exists in the sector. Both general competition law and special regulation for the sector are applied in the electronic communications market. Through regulation, an attempt is made in advance to ensure that communications networks

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<sup>1</sup> A price set in a coordinated way does not mean a price agreed by an explicit agreement (=cartel), but tacit collusion in which the companies have no real competition pressures and they have natural incentives and opportunities to 'divide the market' and charge a monopolistic price.

and services are available to all telecommunications operators and users on reasonable terms. Through advance regulation, an attempt is made at the same time to prevent cases of misuse arising from a dominant position. A communications sector market regulated in advance must, however, fulfil certain advance criteria before the competitive situation of the said market can even be analysed and, if necessary, companies with significant market power in the said market can be regulated. As stated above, frequencies do not in themselves constitute a product market; they are production factors for communications services. Thus advance regulation based on the principles of competition law is not as such applicable to the prevention of the possible problems of frequency commercialisation.

Misuse of market power can be addressed afterwards by general competition law. Regulation of company acquisitions is not directly applicable to spectrum trading. Under the provisions of the Act on Competition Restrictions relating to monitoring of company acquisitions, addressing spectrum concentration is possible in practice only when spectrum is transferred as part of an acquisition defined in the Act on Competition Restrictions (see Act on Competition Restrictions, Section 11).

It would, however, be appropriate to be able to prevent market failures effectively in advance by monitoring spectrum trading. Under Article 9(4) of the framework directive on electronic communications, transfer of frequency access rights requires advance notification to the national regulatory authority responsible for spectrum assignments. National regulatory authorities must ensure that competition is not distorted as a result of any such transaction. The Finnish Communications Market Act currently has no corresponding provision. If transferability of frequency access rights were permitted, the said provision of the above article would become a part of national legislation.

#### *Summary of competition aspects*

- Unsupervised trading of frequency access rights could in some special situations lead to a concentration of both frequencies and the end-product market, which in turn could prevent the increase of financial efficiency sought by frequency trading.
- To ensure efficient frequency trading, the terms of frequency access rights should be specified such that they are also binding on the recipients of the frequencies.
- Charging an annual licence fee that seems adequate, flexible opportunities to transfer frequency access rights, and the setting of a time limit for frequency access rights would reduce the risk of inactive spectrum hoarding and speculation in frequency access rights.
- Various market failures in the electronic communications market could in principle be addressed with regulations that already exists. General competition law is not, however, applicable to secondary trading of spectrum. Through special regulation of the electronic communications market, an attempt can be made to prevent cases of misuse of significant market power. Current advance

regulation is not, however, directly applicable to the supervision of problems that may possibly be related to frequency trading.

## **6. Interest in the 2.50–2.69 GHz frequency band in Finland**

For the successful completion of the licence allocation process, it is essential to be able to assess in advance the level of interest among market operators in the frequency band. To ascertain this, the Ministry of Transport and Communications has commissioned Nordic Adviser Group to conduct a study based mainly on interviews with Finnish telecommunications operators (Elisa, DNA Finland, TeliaSonera, Digita, Finnet, TDC Song, SuomiCom), potential foreign entrants into the market (Tele2, B2 Bredband, Telenor) and key equipment manufacturers (NokiaSiemens Networks, Ericsson, Alvarion/Daimler Finland).

The assessments presented in this chapter are based to a large extent on the above-mentioned study.

### *Maturing of technologies*

The 2.50–2.69 GHz frequency band would be best suited, as matters stand, for mobile the WiMax and UMTS LTE technologies, which over time will converge and increasingly begin to resemble each other. The roots of mobile WiMax technology are internet technologies that can be characterised as inexpensive, local and simple in terms of their invoicing systems. The roots of UMTS LTE technology, on the other hand, are in telephone technologies, which in terms of starting point are more expensive, but which offer scale and are suitable for extensive networking. These are also characterised by technically demanding invoicing systems. In the maturing stage of the technologies, the frequency band could also be used for UMTS HSPA technology, which is a technology that is ready now.

Currently, mobile WiMax is a time-division (TDD) technology and UMTS LTE is a frequency-division (FDD) technology, but it is possible that in future both technologies will be able to utilise both time- and frequency-division frequency usage.

Equipment manufacturers estimate that the technologies will mature such that UMTS LTE networks and terminal devices could be available during 2009/2010, mobile WiMax networks and devices possibly a little earlier. It might be, however, that thereafter it will take 1-2 years before the technologies are mature for the mass market.

The interest of operators will be influenced decisively by how the 2.50–2.69 GHz frequency band would be allocated to different operators as well as the size of the frequency segments for which licences would be granted. Both network and terminal equipment manufacturers as well as most telecommunications operators consider that Finland should adhere to the CEPT recommendation whereby the 2500–2570 MHz and 2620–2690 MHz frequencies would be reserved for frequency-division technologies and the 2570–2620 MHz frequencies for time-division technologies. This would facilitate frequency coordination between countries and would bring economies of scale, which would promote the availability of inexpensive networks and terminal devices.



### *Telecommunications operators' frequency needs*

According to the conducted survey, all the interviewed Finnish telecommunications operators consider the 2.50–2.69 GHz frequency band to be either very interesting or fairly interesting and expressed their intention to apply for a licence, although some only in the event of the licences being awarded by a beauty contest. The interest of present third-generation mobile communications operators is directed above all towards mobile services to be offered using the UMTS LTE technology. The interest of other domestic telecommunications operators is directed mainly towards mobile WiMax. Not one of the foreign operators showed interest in the frequency band and thus had no intention of applying for a licence.

From the telecommunications operators' perspective, a suitable time for the awarding of licences could be in 2009, when the technologies to be used could be mature enough for testing. The telecommunications operators estimate, however, it would be a further year or more after this until the start-up of commercial services.

In the opinion of all the telecommunications operators interviewed, the most sensible option would be to award the licences nationally while perhaps including within this the option to transfer frequency access rights to some extent.

The telecommunications operators consider it important that operating licences are awarded in sufficiently large frequency segments, which would enable them to offer significantly higher speeds than the present third-generation mobile networks. In terms of frequency-division licences, the general view is that a sufficient size would be 2 x 20 MHz per operating licence. In terms of a time-division frequency band, the minimum size is generally considered to be around 30 MHz.

In terms of the duration of an operating licence, the telecommunications operators' views vary from 10 to 20 years. Most consider a licence period of at least 15 years as desirable.

Many operators responded sceptically to technology neutrality, because the necessary technical limiting conditions will, in practice, significantly restrict the choice of the available technology. Most considered service neutrality and transferability to be good.

### *Licence award method*

The telecommunications operators interviewed in the conducted survey were asked their views on two theoretical market-based methods of awarding licences: an auction plus a normal frequency usage fee corresponding to administrative costs, and a beauty contest featuring an initial fee as well as a continuous fee higher than administrative costs (Administrative Incentive Pricing). Most operators interviewed considered the latter model to be the better of these alternatives. The auction model was supported by or responded to neutrally particularly by those telecommunications operators whose parent companies already had experiences of auctions in other countries. It was notable also that the interviewed foreign telecommunications operators considered the auction procedure to be transparent, and that they considered they would not apply for an operating licence in a country where the award

procedure was at the discretion of the national authorities. On the other hand, these telecommunications operators were not interested in the Finnish market as far as the 2.50–2.69

GHz frequency band is concerned, irrespective of what award method would be chosen for this band in Finland.

*Summary of frequency-band demand factors*

- The number of mobile data services is growing rapidly, which requires the introduction of a capacity band. Demand for the 2.50–2.69 GHz frequency band in Finland seems to be more than frequency capacity for the awarding of sensibly sized national operating licences, which supports the arrangement of a competition (either beauty contest or auction) for the frequencies.
- Interest in the frequency band is above all domestic; there is no sign of possible interest from foreign operators.
- Interest of present GSM and UMTS operating licence holders is directed particularly towards UMTS LTE technology, whereby the offered services would probably be an evolution of present mobile data services. Interest of potential new operators is directed more towards mobile WiMax, whereby the offered services could possibly also include various applications of small customer groups.
- Potential users of the frequency band consider 2009 to be a suitable time for the award of operating licences.
- Both telecommunications operators and equipment manufacturers are of the opinion that the frequency plan for the 2.50–2.69 GHz frequency band should be made in accordance with the CEPT recommendation. Frequencies should be awarded in sufficiently large segments, which would enable higher data transfer speeds than the present third-generation mobile networks.
- Award national licences makes most sense.

## ***7. Models proposed by the working group as a possible model for market-based frequency management in Finland***

### **7.1. Frequencies to be used in a possible market-based model**

The radio frequencies development working group concluded in its interim report that the proposed models for possible frequency commercialisation would be planned for the 2.50–2.69 GHz frequency band.

An advantage of the said frequency band is that the band will be released from use after 2008 and the possible introduction of a new type of model for awarding frequencies in this band would not impact on present frequency users nor on existing frequency access rights. In this way, the public television and radio service as well as television and radio operations under Government-awarded software licences could be safeguarded, as could uninterrupted continuity for frequencies currently in mobile communications or wireless broadband use and in official and research activity according to existing frequency access rights.

The frequency band size is a total of 190 MHz and with the present technology it could be used mainly for offering wireless broadband services (for example UMTS-LTE or mobile WiMax).

### **7.2. Timetables for possible introduction of market-based model**

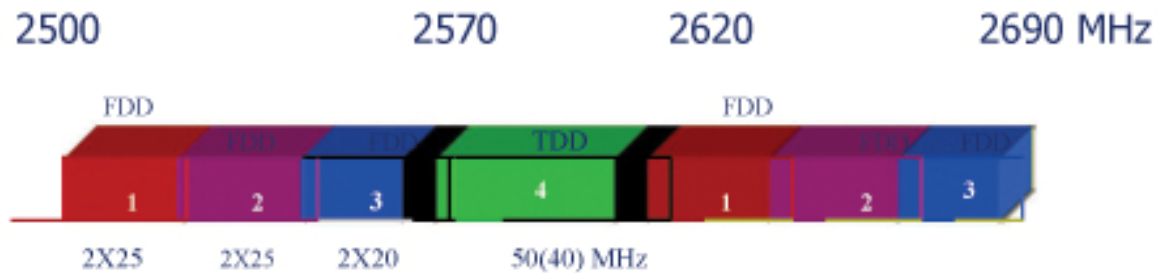
The selected 2.50–2.69 GHz frequency band will be released from radio link use at the beginning of 2009, which is therefore the earliest point from which new licences could be awarded in terms of spectrum availability.

When assessing demand for the frequency band in question, it is probable that commercial operations would begin around 2010 at the earliest. One reason for this is particularly the development of the first technologies that can extensively utilise the frequency band. Network and terminal equipment technologies based on the UMTS-LTE technology are expected to mature during 2009–2010. Technologies based on the mobile WiMax technology are expected to mature perhaps a little earlier. It is probable, however, that thereafter it will take 1-2 years before these technologies are mature for the mass market. From a demand perspective, it would be sensible to award frequency access rights at the stage when the above-mentioned technologies are ready for testing, i.e. in 2009 at the earliest.

Awarding frequency access rights according to a market-based model would require legislative changes (more detail in Chapter 7.13). It can be assumed that a full year will go on preparation of the legislative proposals, parliamentary proceedings and the licence award process, in which case from an administrative perspective a realistic time for awarding frequency access rights on a market basis could be the end of 2009.

### 7.3. Frequency band allocation

The working group proposes that commercialisation of the 2.50–2.69 GHz frequency band could be implemented such that the frequencies of the said frequency band are awarded in four segments.



**Figure 7.** Working group proposal for the allocation of the 2.50–2.69 GHz frequency band between four operators.

Frequencies 2500–2570 MHz (a total of 70 MHz) and 2620–2690 MHz (a total of 70 MHz) would be awarded as two 2 x 25 MHz frequency bands as well as one 2 x 20 MHz frequency band, and they would be best suited to frequency-division technologies (FDD). At least at the early stage of the licence period, the frequency-division technology could most probably be UMTS-LTE or at the very early stage possibly UMTS-HSPA, which is currently ready.

The 2570–2620 MHz frequency band (less 5 MHz guard bands both sides), on the other hand, would be awarded as one actual 40 MHz segment and it would be best suited to a time-division (TDD) technology. At the early stage of the licence period, such a technology could most probably be mobile WiMax.

The proposed allocation would be in accordance with the CEPT recommendation on the frequency band and also, as matters stand, the Europe Commission harmonisation decision to be approved in summer 2008. The solution, which will be widely adopted in Europe, would ensure that reasonably priced terminal devices could be obtained for the Finnish market. It would also be easier to agree on the use of the frequencies with neighbouring countries if the pan-European recommendation is followed.

The proposed allocation would also ensure that the frequency segments would remain sufficiently large (in terms of FDD at least 2 x 20 MHz, in terms of TDD at least 30 MHz), which would enable the offering of significantly faster wireless broadband services than at present and would make the frequency band attractive in comparison with the present UMTS frequencies, for example.

### 7.4. Promoting competition

When granting frequency access rights, in a competition (auction or beauty contest) a condition would be imposed such that at least one of the four operating licences would be

granted to an operator other than those who have an existing second- or third-generation mobile network licence in Finland. This would contribute to increasing competition in the frequency band. A corresponding model has been used in a number of European countries.

Similarly, when granting licences a condition would be imposed that the same operator could receive only one of the four licences.

## **7.5. Two alternative ways of awarding frequency access rights and determining the operating licence fee**

As stated in Chapter 6 above, demand directed at the 2.50–2.69 GHz frequency band is expected to be more than frequency capacity for the awarding of sensibly sized frequency segments. This supports the arrangement of a competition for the frequencies in question.

The working group proposes two alternatives, with differing models of awarding frequency access rights:

In Model 1 the Government would grant licences by auction to the operators who bid most. One operator could obtain one licence. The annual licence fee for each licence would be calculated such that the highest bid in the auction would be paid annually in equal instalments, with the size of one instalment being the sum bid in the auction divided by 15 (length of licence period). The advantage of the instalment model would be, among other things, that this would avoid too large front-loaded fees during the technology maturing stage.

In Model 2 the Government would award licences using a traditional comparison method (beauty contest) and as in Model 1 each operator could receive one licence at most. In this model, a fixed annual licence fee (administrative incentive price, AIP) would be attached to the licences.

The size of the licence fees in respect of both models has been assessed in more detail in Chapter 7.11.

In both models the applicants would pay an application fee in accordance with the Communications Market Act, the size of which according to the present law is 1,000 euros, but which could be reassessed in connection with other legislative amendments. As is presently the case under the Communications Market Act, a condition for granting an operating licence in both models would be sufficient financial resources as well as there being no proven grounds to suspect that the applicant will violate the provisions of telecommunications legislation.

In both models, normal administrative frequency fees charged for radio licences would be paid in accordance with the decree of the Ministry of Transport and Communications on the fees collected by the Finnish Communications Regulatory Authority for radio administrative services pursuant of the Act on Criteria for Charges Payable to the State (150/1992).

## 7.6. Transferability of operating licences

In both models, operating licence holders could transfer (sell or lease, completely or partially) their licence to another operator. Operating licence conditions, and those of the radio licence connected with the operating licence, as well as the size of annual licence fee would remain the same in the event of a transfer.

An intention to transfer a licence would have to be submitted in advance to the Government, which would have to approve the intention to transfer within two months before the transfer could be executed.

The Government would, as a rule, have to approve the transfer if no special reason is evident as to why the transfer could not be approved. Such a special reason could relate, for example, to competition aspects or, on the other hand, national security, which the Government could assess by requesting, for example, statements on the intention to transfer the licence. If the Government decided in some individual case not to approve a licence transfer, no liability for compensatory damages would arise to the State from this.

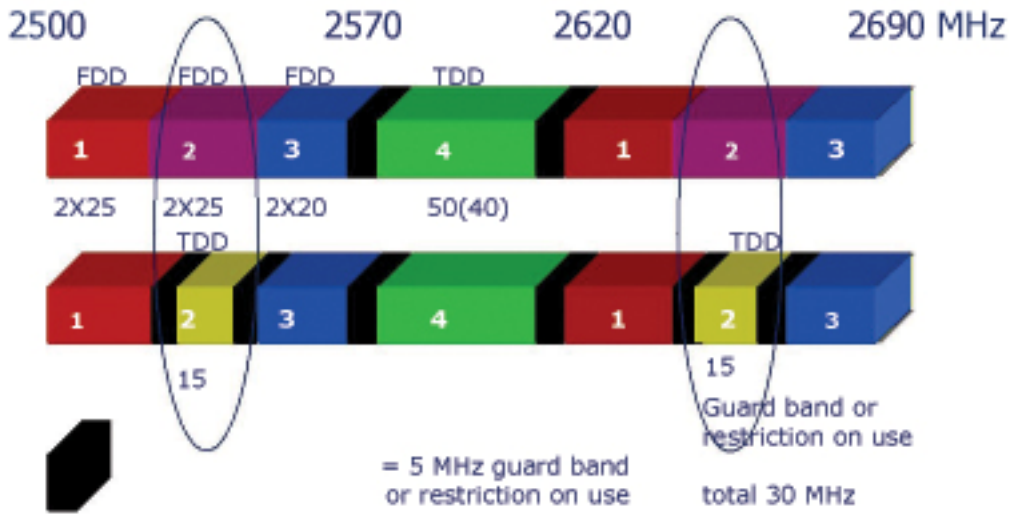
As stated in Chapter 5, frequency transfers could also be referred to the Finnish Competition Authority if frequencies are transferred as part of a company acquisition defined in the Act on Competition Restrictions. The transfer handling processes in the Government and the Finnish Competition Authority are separate, however, and parallel handling would not restrict the application of the provisions that are the basis of these processes.

Operating licence holders could also return their licence to the licence authority before the end of the licence period. In the event of this, the licence holder would not need to pay the annual licence fee for the years after the return of the licence. The purpose of the return option would be to promote the transferability of licences also towards the end of the licence period, when the commercial value of a licence – and thus the incentive to transfer it – would be low in the secondary market.

## 7.7. Technology and service neutrality

Licences would be granted following the principle of technology and service neutrality for the offering of electronic communications services. Most probably the frequencies of the 2.50–2.69 GHz frequency band would be used to offer wireless broadband services requiring high capacity.

An operating licence, moreover, would not require the use of any particular technology, even though, at least in the first stage of the licence period, the allocation presented by the working group in accordance with the CEPT recommendation and the future Europe Commission decision would lead to a situation in which the three licences planned for frequency-division technology (FDD) would be best suited to UMTS-LTE technology and the one planned for time-division technology (TDD) would be best suited for mobile WiMax technology.



**Figure 8.** Example of the impact of a technology change on the frequency capacity used by an operator.

If an operating licence holder wished to change the technology it uses, for example from frequency-division to time-division, the necessary guard bands would be taken from the frequency capacity of the licence holder who changes technology (see figure).

Any change of technology would have to be notified in advance to the Finnish Communications Regulatory Authority, which would assess whether the change would be implemented taking into account, for example, reasonable interference-free requirements. If a change of technology would adversely affect the operation or frequency capacity of other networks operating on the same or an adjacent frequency band, the Finnish Communications Regulatory Authority could, within a reasonable time of receiving the notification and the necessary technical information, inform the licence holder that the change of technology cannot be implemented or that the change of technology would require changes to restrictions imposed in the radio licence. No liability for compensatory damages would arise to the State from any change of technical restrictions by the authorities.

## 7.8. Duration of licence period

In both models, the licence period would be 15 years, which can be considered a reasonable time to amortise the necessary investments.

To ensure the efficiency of the secondary market for frequencies as well as the efficient use of frequencies, a decision on the continuation of the 15-year licence period proposed herein or on the other use of the frequencies after the licence period would have to be made at the earliest possible opportunity, and clearly before the end of the licence period.

## 7.9. Other market-based model limiting conditions

### *Conditions relating to interference-free use*

Licence holders should be bound to adhere to certain technical and non-technical conditions whose purpose is to ensure that spectrum use is adequately free of interference. These conditions could be prescribed in the operating licence or the radio licence. Conditions relating to interference-free use could be, for example, spectrum mask criteria, power restrictions and interference levels, particularly at licence-area boundaries, as well as conditions relating to geography. Similarly there could be conditions in respect of how much interference resulting from use of adjacent frequencies a frequency user would be obliged to tolerate.

### *Obligations arising from coordination agreements between states*

Operating licence and radio licences would in future, too, have to take into account obligations arising from coordination agreements between states as well as the need to amend the licences as a result of changes to such agreements. Similarly European Commission decisions on frequency harmonisation are binding on Finland as a member state of the European Union and such decisions may have an impact on the conditions of individual licences. No liability for compensatory damages would arise to the State from any alteration of licence restrictions arising from changes to international agreements.

### *Technology neutrality limiting conditions*

Although licences would be granted technology neutrally, i.e. a licence would not expressly require the use of any particular technology, licence holders would have to notify the Finnish Communications Regulatory Authority in advance of their choice of the technology, and similarly if, during the licence period, they intend to change the technology they previously used on a frequency to another. This is necessary because a change can have an impact on the operation and transmission capacity of other networks operating on the same or an adjacent frequency band.

If a change of technology would adversely affect the operation or frequency capacity of other networks operating on the same or an adjacent frequency band, the Finnish Communications Regulatory Authority could, within a reasonable time of receiving the notification, inform the licence holder that the change of technology cannot be implemented or that the change of technology would require changes to restrictions imposed in the operating licence.

### *Obligation to start operations*

Operating licences would include an obligation to start operations. If the licence holder does not start its operations within a specified time, the licence authority could cancel the licence.



### *Licence area*

All four operating licences would be national, because in this way it will most probably be possible to avoid fragmentation of the frequency band in a manner that would be harmful to efficient use of the spectrum.

Operating licence holders could, however, still transfer any free capacity they possess also partially (for example in terms of area, time or frequency band), provided that this does not cause harmful interference to other spectrum users and is in accordance with international coordination agreements. An obligation to negotiate on the sale/lease of unused capacity to other operators could be imposed in licences, if the licence holder does not itself use all the frequency capacity it possesses.

## **7.10. Roles of different authorities in a market-based model of frequency management**

The licence authority would continue to be the Government, which would initiate the licence application process, award the licences and decide on licence conditions. The Government would approve a decree on a utilisation plan for frequency bands reserved for both television and radio operations and licensed telecommunications, in which would be confirmed those frequency bands to which a market-based model of frequency management could be applied. When it announced the application process, the Government would notify more detailed procedures relating to the licence award method.

Although licence transferability would be the rule, licence holders would have to request the advance approval of the Government in respect of an intention to transfer a licence. The Government could request, if necessary, a statement from the Finnish Communications Regulatory Authority on technical limiting conditions relating to the transfer, and from the Finnish Communications Regulatory Authority and the Finnish Competition Authority on competition aspects of the transfer. If a transfer were considered to have a possible impact on national security, the Government could request an opinion from the defence forces and the security police. If the Government decided for some special reason not to approve a licence transfer, no liability for compensatory damages would arise to the State from this.

The Finnish Communications Regulatory Authority would grant the radio licences connected with the operating licences. The Finnish Communications Regulatory Authority would also supervise adherence to the conditions of operating licences and radio licences. The Finnish Communications Regulatory Authority could, on the application of the licence holder, approve a change of the technology used by the licence holder and impose the necessary technical restrictions for this. The Finnish Communications Regulatory Authority would determine the licence fees payable. The Finnish Communications Regulatory Authority together with the Finnish Competition Authority would supervise the implementation of competition in accordance with the present cooperation model and legislation.

### **7.11. Assessment of the impact of the possible introduction of market-based model on annual fees for frequencies and State revenue**

In the auction model (Model 1), determination of the size of the licence fee would be more straightforward, because the size of the fee would be determined unambiguously in the auction. On the other hand, the precise estimation of the level of the licence fee in advance would not be possible, because the size of the fee would depend, among other things, on the number of interested companies and their willingness to pay. Most countries use an auction model in which the entire auction sum is paid in one instalment before the licence period begins. In comparison, the model proposed by the working group, in which the sum raised in the auction would be paid annually in equal instalments, would reduce the licence holders' front-loaded payments in the maturing stage of the technologies. In the instalment model, it would also be possible to predict the impact on State revenue for many years ahead.

In the beauty contest (Model 2), an annual licence fee of fixed size would be specified, with its size being determined by the authorities, not by the frequency users. Accordingly, it would be possible to estimate in advance the impact of the model on annual fees for frequency use and on

State revenue, at a stage when the size of the administrative incentive fee is being decided. Determining the correct level of the fee would be challenging, however, because it would have to reflect well the market value of the frequencies so that the desired incentive effect could be obtained with the fee. If a licence fee determined on administrative grounds were set too low, the fee would not have the desired incentive effect on transferability. If, on the other hand, the fee were set too high, companies would be burdened by an excessive tax-like charge and the incentive effect would work in an unwanted way. In other countries (for example the UK) the AIP models in use have been applied to date only to frequencies used by the official bodies, so these models cannot be applied to frequencies of electronic communications services offered on commercial grounds.

The frequency band market value, based on which the size of the licence fee in Model 1 would be determined and reflecting which the licence fee in Model 2 would have to be determined, can be estimated using international examples. As the chapter of this report relating to the practices of other countries has discussed, the fees collected by frequency auctions have generally declined to a fraction of those paid in different countries' 3G auctions in 2000. While, for example, 634 euros per inhabitant was spent on the UK's 3G auctions in 2000, the corresponding figure in Sweden's 3.5 GHz auction in 2007 was only 0.05 euros per inhabitant.

In terms of the 250–2.69 GHz frequency band, the best point of comparison may be Norway, where the 2.50–2.69 GHz frequency band was auctioned in November 2007 and where operating licences were granted for 15 years, as is also proposed in this report. In the Norwegian auctions, three operators paid a total of 25 million euros for their licences. Frequency values varied between 129,000 euros per MHz and 181,000 euros per MHz. Relative to population, a total of around six euros per inhabitant was paid for the licences.

If the total sum paid in Norway is scaled in direct proportion to the Finnish population, the corresponding sum is around 30 million euros. By this formula, the annual licence fee of a single operating licence would be around 500,000 euros (4 network licences x 15 years x

500,000 euros = 30 million euros). An alternative estimate could be obtained by proportioning the licence fees paid in Norway for individual operating licences to the number of megahertz of the operating licences. In Norway the auction prices of single operating licences varied between 0.13 and 0.18 million euros per megahertz. Accordingly, the value of the 190 megahertz frequency band could vary between 24.7 and 34.2 million euros and the level of a single licence fee would vary between 412,000 euros and 570,000 euros per year.

In the comparison with Norway, it should be noted that the frequency allocation in the Norway auction was different from the frequency allocation proposed in this working group report. It can be assumed that the frequency allocation proposed in this report would be more attractive for the telecommunications operators, because in the allocation the frequencies would be granted in larger continuous segments. This would probably increase the companies' willingness to pay, other conditions being the same. It should also be noted that the market-based awarding of operating licences in Finland could take place at the earliest two years after Norway. It is to be expected that interest in the frequency band will increase over time as the technologies mature and less expensive devices become available. On the other hand, in Finland most frequencies have been awarded by beauty contest without fees exceeding administrative costs, which could have the effect of reducing companies' willingness to pay, particularly in the case of telecommunications operators who have existing frequency access rights in other frequency bands.

Another nearby example of a country where a decision was made to auction the 2.50–2.69 GHz frequency band is Sweden. The auction in Sweden began on 18 April 2008 and its results were announced around the time of publication of this report.

## **7.12. Revenue received from the possible introduction of a market-based model**

The working group has discussed the use of the licence fees collected by a possible market-based model. As the European comparison has revealed, the prevailing practice in other countries is the collection of spectrum fees for the State budget. There have also been some examples of the earmarking of licence fees e.g. for the development of IT operations or spectrum use. In terms of Finland, the working group has discussed the possibility of establishing a fund that could finance the provision of electronic communications services under a universal service obligation in areas where such activity is commercially unprofitable. The working group does not, however, make a proposal on the establishment of such a fund.

The position of the Ministry of Finance is that revenue obtained from the commercialisation of frequencies is revenue remitted to the State budget and that it will not be earmarked or reserved to fund individual items of State expenditure. Revenue received from frequency sales will not increase the level of allocations under the Government's overall spending limits.

### **7.13. Legislative amendments required by the possible introduction of a market-based model of frequency management**

#### *Act on Radio Frequencies and Telecommunications Equipment*

Chapter 1.2 of the working group's interim report describes the existing national legislation, particularly in respect of the powers prescribed for the Finnish Communications Regulatory Authority in the Act on Radio Frequencies and Telecommunications Equipment (1015/2001, hereinafter the Radio Act). Under Section 6 Subsection 1 of the Radio Act, the Finnish Communications Regulatory Authority shall prescribe the use of frequencies for different purposes, taking into consideration international decisions and recommendations. In the provisions, information shall be given on the purpose of each frequency band and on the main characteristics required of radio equipment using the frequency bands. Under Section 6 Subsection 5 of the Radio Act, the Finnish Communications Regulatory Authority shall act in cooperation with the Ministry of Transport and Communications when preparing these provisions.

Under Section 7 Subsection 1 of the Radio Act, a licence shall be acquired for the possession and use of a radio transmitter, excluding such situations separately mentioned Subsections 2, 3 or 5. Under Section 10 Subsection 1 of the Act, radio licences shall be awarded by the Finnish Communications Regulatory Authority. If the applicant aims to pursue telecommunications activities subject to licence referred to in Section 4 of the Communications Market Act (396/1997), no radio licence can be awarded unless the applicant has the appropriate licence granted by the Government.

A frequency fee is charged for radio licences awarded by the Finnish Communications Regulatory Authority. The fees collected by the Finnish Communications Regulatory Authority for radio administrative services are prescribed by a decree of the Ministry of Transport and Communications (964/2005). The size of the frequency fee is determined on the basis of the usability and applicability of the radio licence frequencies. In addition, an effort should be made to enhance frequency use with the frequency fee.

Under Section 6 Subsection 2 of the Radio Act, the Government shall confirm a utilisation plan for the frequency bands allocated to telecommunications activity requiring a licence referred to in Section 4 of the Communications Market Act (393/2003) as well as to television and radio operations subject to licence referred to in Section 7 of the Act on Television and Radio Operations. Under Section 6 Subsection 5 of the Radio Act, if a Finnish Communications Regulatory Authority order on the use of an individual frequency band may have a significant impact on the general development of the communications market, a utilisation plan for the frequency band in question shall be confirmed by the Government.

#### *Government decree on the utilisation plan for frequency bands allocated to television and radio operations as well as licensed telecommunications activity*

In June 2007, the Government issued a decree on the utilisation plan for frequency bands allocated to television and radio operations as well as licensed telecommunications activity (680/2007). The decree has provisions on the number of television, radio and mobile

networks, the frequency bands available for operations, and certain factors of a technical nature. The decree prescribes, among other things, the frequency bands available for second- and third-generation digital mobile communications as well as the frequency bands available for national digital broadband 450 MHz mobile network operations. The decree additionally prescribes the number of networks in use for each activity. Appended to the decree is a detailed listing of the frequencies available for different television and radio operations (utilisation plan).

### *Communications Market Act*

Chapter 2 of the Communications Market Act has provisions on practising telecommunications. Under Section 4 of the Act, a licence is required to provide a network service that uses radio frequencies in a digital terrestrial mass communications network or in a mobile network practising public telecommunications. Under Section 5 of the Communications Market Act, an announcement shall be made that a licence is available for application when frequencies that are technically appropriate as well as appropriate for the efficient use of frequencies become available for telecommunications subject to a licence. The availability of a licence for application is announced by the Government in accordance with the frequency band utilisation plan referred to in Section 6 of the Radio Act. Under Section 7 of the Act, a licence applicant is obliged to pay to the State an application fee of 1,000 euros for the application. The aim of the fee is mainly to prevent baseless and mischievous applications.

Licences are awarded by the Government for a fixed period of up to 20 years.

The requirements for the award of a licence are prescribed in Section 9 of the Communications Market Act. A licence shall be awarded if the applicant has sufficient financial resources to meet the network operator obligations, and the licence authority has no justifiable reason to suspect that the applicant will violate the provisions of this Act, the Radio Act, the Act on the Protection of Privacy in Electronic Communications or any other telecommunications act. The Communications Market Act requires that if a licence cannot be awarded to all applicants due to a scarcity of radio frequencies, it shall be granted to applicants whose operation best promotes the objectives prescribed in Section 1 of the Act.

Under Section 1 of the Communications Market Act, the objectives of the Act are to promote the provision and use of services within communications networks and to ensure that communications networks and communications services are available under reasonable conditions to all telecommunications operators and users throughout the country. A further objective of the Act is to ensure that the opportunities available for telecommunications in Finland accord with the reasonable needs of users and that the opportunities are competitive, technologically advanced, of high quality, reliable, safe and inexpensive.

Section 10 of the Communications Market Act prescribes the content of a licence. The geographical operating area of the licence holder shall be specified in the licence. Conditions promoting the objectives of the Act as well as network or service quality requirements may be incorporated into a licence. In addition, conditions supplementing the technical orders of the Finnish Communications Regulatory Authority referred to in the Act concerning the technical

characteristics of communications networks or the efficient use of frequencies may be incorporated into a licence.

Under Section 11 of the Act, a licence may be amended during its period of validity with the consent of the licence holder or otherwise if this is necessary for special reasons due to technical development or an essential change in the operating conditions of an activity subject to licence. Section 12 of the Act contains provisions on the cancellation or transfer of a licence. The Government may cancel the licence of a telecommunications operator in part or in full, if the telecommunications operator has repeatedly and seriously violated the provisions of the Act or the licence conditions, or the telecommunications operator no longer has sufficient financial resources to meet its obligations in view of the nature and extent of the operation, and if the telecommunications operator, despite being requested to do so, fails to rectify its conduct or replenish its financial resources to a sufficient level.

Under Section 12 Subsection 2 of the Communications Market Act, a licence is non-transferable. The Government may cancel a licence if effective control in respect of the licence holder changes. Any such change shall be notified immediately to the Government, who shall decide on whether to cancel the licence within two months of the notification. Under Section 12 Subsection 3, the internal transfer of a licence within a group between the parent company and a wholly owned subsidiary is not considered to be a licence transfer that would require cancellation. Such a transfer shall be notified immediately to the licensing authority.

Under Section 15 a of the Communications Market Act, a telecommunications operator subject to notification or licence shall pay an annual communications market fee to the Finnish Communications Regulatory Authority. The fee covers the costs incurred to the Finnish Communications Regulatory Authority for carrying out the duties provided in the Communications Market Act in respect of telecommunications operators.

Legislative amendments required by the possible introduction of market-based models of frequency management

The possible introduction of commercialisation models for frequency access rights proposed by the working group would require amendments to existing legislation. In connection with possible national legislative amendments, it will also be necessary to take into account the Commission's proposed changes to electronic communications directives currently being processed by EU bodies as well as other preparation of acts impacting on frequency management under way in the

EU, and international orders and recommendations relating to the use of radio frequencies that are binding on Finland.

An efficient and fast execution of the licence award process would require, as a preparatory first-stage action, the evaluation of supply and demand, which would not require changes to existing legislation. Moreover, planning of frequency allocation and conditions can be carried out without amending existing legislation. The selection of the licence award method and the licence award procedure itself, on the other hand, will require changes to legislation if there is a desire to introduce alternative models of awarding licences alongside the present beauty contest model. Introducing new models of awarding licences would not require changes to

regulations relating to the official supervision of licences, except for the insertion of Article 9(4) of the framework directive on electronic communication into the Communications Market Act. The framework directive requires the national body responsible for frequencies to ensure that transfers of frequency access rights do not result in a distortion of competition. The Communications Market Act currently has no corresponding provision.

The working group proposes that, in order to promote competition, when frequency access rights are awarded a condition would be imposed such that at least one of the four operating licences would be awarded to an operator other than those who have an existing second- or third-generation mobile network licence in Finland. In addition, a condition would be imposed that the same operator could receive only one of the four licences. Applicants could be notified of these conditions when the licence application process is initiated, and a need to amend legislation would not arise.

### *Model 1*

#### *Communications Market Act*

Model 1, where licences would be awarded to the party bidding most in an auction, would require the addition to the Communications Market Act of provisions on the possibility of awarding fixed-term access rights to certain frequencies using an auction. The matter could be enacted by adding a new subsection to Section 4 of the Act stating that a licence can be awarded by an auction in addition to the traditional beauty contest.

A new Subsection 3 would have to be added to Section 8 of the Communications Market Act 8 giving more detailed provisions on the auction procedure.

If the model were taken into use, a provision on the payment of the auction fee would have to be added to the Communications Market Act. Under the working group's proposal, the licence holder would pay an annual licence fee. To the Communications Market Act would therefore be added a new Section 12 a, by which a telecommunications operator to whom a licence had been awarded by auction for frequency bands separately specified in the decree referred in Section 6 of the Radio Act would be obliged to pay an annual licence fee. The annual instalment would be the auction price paid by the telecommunications operator divided by the length of the licence period. The fee would be determined by the Finnish Communications Regulatory Authority. To the Section 12 a would also have to be added provisions on the charging the fee, on appealing Finnish Communications Regulatory Authority decisions on the determination of the fee, and on situations in which a licence holder has transferred a licence to another operator or returned a licence to the licence authority.

*Model 2**Communications Market Act*

Model 2, in which licences would be awarded following the existing Government licensing procedure and at the same time an annual licence fee obligation incorporated into the licences, would require amendments to the Communications Market Act.

If the model were taken into use, a provision on the payment of an administrative incentive fee (licence fee) would have to be added to the Communications Market Act. Under the working group's proposal, the licence holder would pay an annual licence fee. To the Communications Market Act would therefore be added a new Section 12 a, by which a telecommunications operator, to whom a licence had been awarded pursuant of Section 8 of the Communications Market Act and for frequency bands separately specified in the decree referred in Section 6 of the Radio Act, would be obliged to pay an annual licence fee of fixed size. The fee would be determined by the Finnish Communications Regulatory Authority. To the Section 12 a would also have to be added provisions on the charging the fee, on appealing Finnish Communications Regulatory Authority decisions on the determination of the fee, and on situations in which a licence holder has transferred a licence to another operator or returned a licence to the licence authority.

*Other legislative amendments applicable to both commercialisation models**Communications Market Act*

Under Section 5 of the Communications Market Act, the Government would initiate the licence application process. If frequency access rights were awarded following the market-based procedures proposed by the working group, new provisions relating to this would have to be added to Section 5 of the Act. To Section 4 would therefore have to be added a new Subsection 3, by which the Government, when initiating the licence application, would have to state which model of awarding licences award will be applied, and the procedures relating to the award method to be used, such as, for example, auction conditions as well as provisions relating to any possible preliminary evaluation. In terms of the latter, the working group proposes that licence applicants should at the first stage provide information on their financial situation and background, when award procedures according to commercialisation models are used.

The limiting conditions of the possible commercialisation of frequencies have been outlined above. In so far as Section 10 of the Communications Market Act would not enable the inclusion of such conditions in the licence regulations, the Communications Market Act would have to be supplemented.

The working group proposes that a licence holder could transfer a licence it had been awarded to another operator. Under Section 12 Subsection 2 of the Communications Market Act, a licence is non-transferable. The prohibition on transferring a licence would still cover licences awarded by a traditional beauty contest. If commercialisation models were introduced, to Section 12 of the Communications Market Act would have to be added a new subsection containing provisions allowing the transfer of a licence awarded on market terms as



separately mentioned in the decree on the utilisation plan for frequency bands allocated to television and radio operations as well as licensed telecommunications activity. To Section 12 would also have to be added a provision on the telecommunications operator's obligation to notify the Government of its intention to transfer a licence it had been awarded to another operator, in situations where transferability would be permitted. The Government would have to approve an intention to transfer before its execution. If necessary, the Government could request a report from the Finnish Communications Regulatory Authority on technical limiting conditions relating to the transfer that are needed, for example, to ensure that radio communications are adequately free of interference, and from the Finnish Communications Regulatory Authority and the Finnish Competition Authority on the transfer's impact on competition in the communications market. Licence holders would also have to notify any possible change of the technology used, which would require the advance consent of the Finnish Communications Regulatory Authority.

The Communications Market Act does not contain provisions on a licence holder's obligation to begin activity in accordance with the licence awarded. In practice, a condition by which a licence holder is obliged to maintain activity in accordance with a licence has been added to operating licences awarded under Section 8 of the Government Act. The working group proposes for consideration that the Communications Market Act be amended in this respect such that an obligation to begin operations within a fixed period would be imposed on the licence holder. The obligation would also have to cover cases in which the holder of a licence awarded on market terms has transferred the licence to another operator.

*Government decree on the utilisation plan for frequency bands allocated to television and radio operations as well as to licensed telecommunications activity*

The frequencies covered by any market-based model of awarding licences frequency management could be confirmed in a Government decree on a utilisation plan for frequency bands reserved for both television and radio operations and licensed telecommunications. To the decree would therefore have to be added a provision according to which the 2.50–2.69 GHz frequency band could be used for the provision of electronic communications services. The provision would be service and technology neutral.

*Radio Act*

The radio licence regulations of the Radio Act will facilitate in ensuring that frequency use is adequately free of interference also in cases where frequency access rights have been awarded on market terms. Under Section 11 of the Radio Act, for example, a radio licence may be transferred from one company to another within a consolidated corporation referred to in the Companies Act (734/1978). The Finnish Communications Regulatory Authority must be informed of the transfer immediately. A radio licence can be transferred other than within a consolidated corporation only if the licence conditions contain such a provision. If an operating licence awarded by Government has been awarded on market terms, the Finnish Communications Regulatory Authority could incorporate a condition whereby the licence may be transferred to another operator. The view of the working group, however, is that an amendment to Section 11 of the Radio Act should also be considered in this respect.

The above proposal should not be considered exhaustive. If it should be decided to implement the working group's proposals for frequency commercialisation, the Ministry of Transport and Communications would immediately initiate a project necessary for the preparation of a Government proposal.

## **8. APPENDIX 1: Working Group Interim Report**

Radio Frequencies Development Working Group  
Interim Report 27 November 2007

To the Ministry of Transport and Communications

On 29 August 2007, Minister of Communications Suvi Lindén appointed a working group to examine the legislative amendments and other practical measures required to develop the use of radio frequencies available in the communications market. The working group's term of office is from 1 September 2007 to 1 May 2008.

Behind the establishment of the working group were measures prepared by the European Commission to increase the flexibility of frequency management and commercialise frequency access rights. By the commercialisation of frequencies is meant the granting of access rights either by auction or by some other selection procedure, in which the price payable for frequency access rights has the greatest influence on the selection, as well as the resale of access rights.

The working group was given the task of examining the measures required to facilitate the commercialisation and other development of radio frequencies in Finland. According to the assignment, the report should include, among other things:

- practices of European Union member states in the commercialisation and other development of frequency access rights
- its proposal for models for granting frequency access rights in Finland
- the frequencies to be used in possible commercialisation
- timetables by frequency band for possible introduction of commercialisation
- other limiting conditions for the possible commercialisation of frequencies
- the roles of different ministries and agencies in the possible commercialisation of frequency access rights
- the effects on annual fees for frequency access
- a proposal on the use of the revenue received from possible commercialisation
- an estimate of the impact of possible commercialisation on revenue
- other issues to be taken into consideration in the possible commercialisation of frequencies

Communications Counsellor Juhapekka Ristola of the Ministry of Transport and Communications was appointed chairman of the working group, Counsellor Olli-Pekka Rantala of the Ministry of Transport and Communications as secretary, and Unit Manager Kirsi Karlamaa of the Finnish Communications Regulatory Authority, Director Kari Koho of the Finnish Communications Regulatory Authority, Senior Advisor Tero Kuitunen of the Ministry of Trade and Industry (Ministry of Labour and Industry), Assistant Director Timo

Mattila of the Finnish Competition Authority, Deputy Director-General Kristiina Pietikäinen of the Ministry of Transport and Communications, and Budget Counsellor Esko Tainio of the Ministry of Finance as members.

**The working group was requested to submit an interim report by 1 December 2007 and a final report by 1 May 2008.**

Before the submission of this interim report, the working group met six times and, among other things, heard a wide range of operators in the sector. This interim report presents a review of the current situation of international and EU-level provisions on spectrum access, a summary of sector hearings, the frequency bands that may have potential and/or capacity to come within the sphere of possible commercialisation, and principles for restricting the working group's work, in view of the final report to be presented by 1 May 2008.

**The working group takes no position on whether or not the models proposed during the working group's continuation work should be taken into use. The Government decides on frequency operating licences.**

Having completed the first stage of its work, the working group respectfully submits its interim report to the Ministry of Transport and Communications.

Helsinki, 27 November 2007

Juhapekka Ristola  
Working Group Chair

Kirsi Karlamaa

Kari Koho

Tero Kuitinen

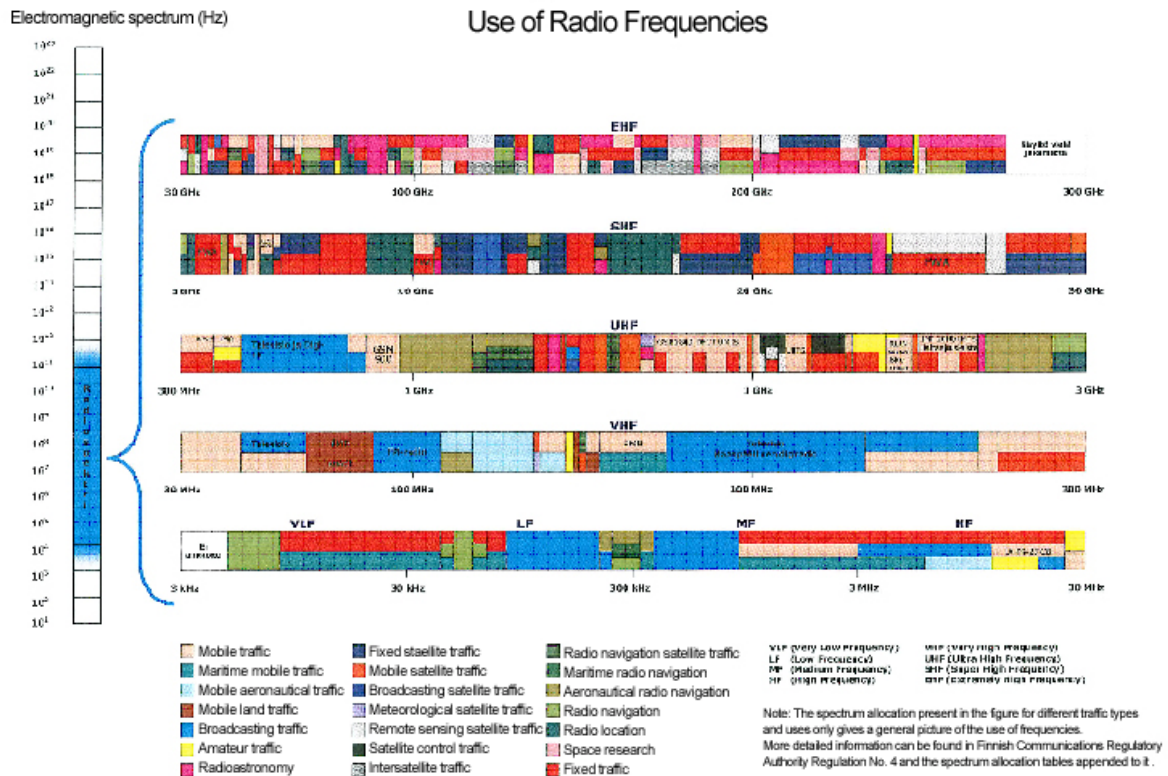
Timo Mattila

Kristiina Pietikäinen

Esko Tainio

Olli-Pekka Rantala

## 1. General about frequencies



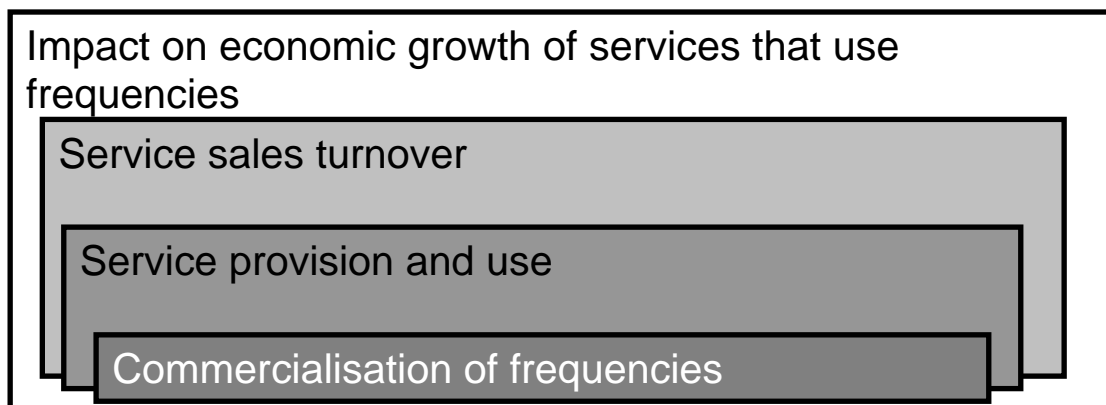
Radio frequencies are a limited natural resource that has a considerable social and economic significance. Radio frequencies are used for various purposes, including mobile communications and official networks, wireless broadband networks, wireless local area networks, mass communications networks, radio links (used by e.g. telecommunications operators, power companies, authorities), satellite traffic, private radio networks, maritime radio traffic, aviation radio traffic, amateur radio traffic and environmental remote sensing and monitoring.

Although frequencies are limited, they are not, however, consumed, nor do they decline in use. Many factors influence the usability of radio frequencies. A radio transmitter affects other radio devices within its coverage area. The effect is greater the closer the devices are in terms of frequency and geographical distance. If the interaction is sufficiently powerful, it may be evident as adverse interference, a decline in transmission capacity or a weakening of transmission quality. The characteristics of radio frequencies set limitations on their utilisation. The higher the frequency at which transmission takes place, the more difficult and expensive it becomes to manufacture radio devices. The propagation characteristics of radio waves also make the use of high frequencies difficult for most purposes. An estimated 95 per cent of radio devices subject to licence currently operate in Finland on frequencies below 10 GHz, and 99 per cent on frequencies below 25 GHz. When radio transmitters exempt from licensing are taken into consideration, more than 99 per cent of all radio devices are estimated to operate on frequencies below 10 GHz.

A practical example of the better usability of low frequencies is that around 60% fewer base stations are needed for building continuous coverage for a 3G mobile network in the 900 MHz frequency band than in the 2100 MHz 3G frequency band.

Frequency planning work for new radio systems is increasingly demanding because there are no unused frequencies below 25 GHz, and planning work is focusing more and more on compatibility of frequency use of different radio systems. The introduction of licence-exempt devices and the growth in the number of devices in many different applications is increasing the need for resources and frequency planning. They also require continuous development of frequency management.

Frequency management can be arranged in number of different ways. The alternatives include, for example, granting exclusive rights to frequencies through administrative decisions, a beauty contest or on a commercial basis, or by permitting frequency sharing. Alternative management methods may be used, and are used, often in parallel. In accordance with its assignment, the working group has focused in this interim report on evaluating the possible commercialisation of frequencies. When considering the possible commercialisation of frequencies, it is necessary to assess, on the one hand, the mechanisms of possible commercialisation and also, on the other hand, the wider impact of commercialisation on service provision and use and, ultimately, economic growth.



## 2. Current regulatory situation and future outlook

### 2.1 National legislation

The objective of the Communications Market Act (393/2003) is to promote the provision and use of services within communications networks and to ensure that communications networks and communications services are available under reasonable conditions to all telecommunications operators and users throughout the country. Under Section 4 of the Communications Market Act, a licence is required to provide a network service that uses radio frequencies in a terrestrial mass communications network or in a mobile network practising public telecommunications.

The purpose of the Act on Radio Frequencies and Telecommunications Equipment (1015/2001, hereinafter the Radio Act) is to promote efficient, appropriate and sufficiently interference-free use of radio frequencies, to safeguard the fair availability of radio frequencies, to create conditions that maximise the unrestricted mobility of radio equipment, and to promote efficiency in the public telecommunications market.

Under Section 6 of the Radio Act, the Finnish Communications Regulatory Authority shall decide on the allocation of frequency bands for certain purposes as well as on the allocation of the available frequencies between users, duly taking into consideration international decisions and recommendations on radio frequency use. Similarly under Section 6 of the Radio Act, the Government shall confirm a more detailed utilisation plan for radio frequencies allocated to television and sound broadcasting as well as to telecommunications subject to licence. The Finnish Communications Regulatory Authority shall act in cooperation with the Ministry of Transport and Communications when preparing these decisions. If a decision on the use of an individual frequency band may have a significant impact on the general development of the communications market, a utilisation plan for the frequency band in question shall be confirmed by the Government. Pursuant of Section 6 of the Radio Act, the Finnish Communications Regulatory Authority has issued a radio frequency order (4/2006) and Government a decree (680/2007).

The Finnish Communications Regulatory Authority awards access rights in a radio licence granted under Section 7 Subsection 1 of the Radio Act. Under Section 10 Subsection 7 of the Radio Act, if a licence can be awarded only to some of the applicants due to a scarcity of radio frequencies, it shall be granted to applicants whose operation best promotes the purpose of the Radio Act, namely to promote efficient, appropriate and sufficiently interference-free use of radio frequencies, to safeguard the fair availability of radio frequencies, to create conditions that maximise the unrestricted mobility of radio equipment, and to promote efficiency in the public telecommunications market.

Under Section 8 Subsection 1 of the Radio Act the Finnish Communications Regulatory Authority may incorporate in a radio licence conditions necessary to ensure efficient and appropriate use of radio frequencies, efficiency of the communication market and prevention or removal of interference in radio communications.

Under Section 7 of the Radio Act, the Finnish Communications Regulatory Authority may issue, in respect of the licence, orders relating to free use as well as orders on the acceptance in Finland of a licence (or other access right) granted by an administration of another country. Under Section 8 of the Radio Act, the Finnish Communications Regulatory Authority has also issued general orders on conditions necessary to ensure the prevention or removal of interference.

## *2.2 EU Draft Recommendation on Frequencies (WAPECS)*

Under Article 19 of the framework directive on electronic communications, the European Commission is preparing a recommendation, within the regulatory framework for electronic communications, on conditions that will be incorporated into the Wireless Access Policy for Electronic Communications (WAPECS). The Commission will issue the recommendation after hearing the Communications Committee. The recommendation has been under

preparation in various Commission committees and subworking groups for over a year and it is expected to enter into effect in early 2008.

Based on a draft (COCOM07-33, 15 June 2007), which has been considered by the Communications Committee, it can be stated that the recommendation would cover non-technical conditions relating to radio frequency access rights and it would be applied to access rights awarded or renewed after the recommendation enters into effect. The recommendation would cover television frequencies (UHF band, 470-862 MHz), frequencies reserved for second- and third-generation mobile communications (880–915 MHz, 925–960 MHz, 1710–1785 MHz, 1805–1880 MHz, 1900–1980 MHz, 2010–2025 MHz, 2110–2170 MHz) as well as the 2500–2690 MHz and 3.4–3.8 GHz frequency bands.

Under the draft recommendation, conditions to be incorporated into frequency access rights should be uniform in terms of end-user access, irrespective of frequency band. The number of conditions would be restricted to a minimum to ensure that use is as flexible and efficient as possible. As a rule, the service for which the said frequencies should be used would not be specified in the access rights, unless so required by an objective serving the general good. The member states would as far as possible allow market forces to decide the most efficient use of frequencies and thus permit the transfer of access rights from their original holder. The introduction of other market-based approaches will also be recommended. The specification of geographical coverage requirements would also be possible in future, but procedures would be open in terms of non-compliance with requirements. Access rights awarded would be as long as possible in terms of their duration, so that market forces would have time to influence the identification of an efficient purpose for the frequencies.

The recommendation would not directly obligate the member states, but under Article 19 of the framework directive the regulatory authorities of the member states would have to take the greatest possible account of the recommendation and in the event that it were decided not to comply with the recommendation, the national regulatory authority would have to notify the Commission of this and justify its position. In Finland, complying with the WAPECS recommendation would require amendments to national legislation on frequency access rights.

### *2.3 Proposals for electronic communications directives (in terms of frequencies)*

On 13 November 2007, the Commission submitted to the European Parliament and Council proposals for amendments to electronic communications directives as well as a regulation for the establishment of a European Electronic Communications Market Authority. The approval of the proposal requires the approval of both the Union's legislative bodies according to the codecision procedure. It is expected that the codecision procedure will take at least around

1 1/2 years, after which the member states will have 1–2 years to amend their national legislation to conform with the directive. When implemented, the proposals would have a significant impact on the management and use of radio frequencies.

Under the Commission's proposals, separate licences would be discontinued in frequency management unless the awarding of individual access rights is necessary to prevent adverse interference or is required by an objective serving the general good. As a rule, the principles



of technology and service neutrality would be applied in frequency management. Accordingly, frequency access rights would not as a rule be linked to a certain technology or to the provision of a certain service. Exceptions to the rule would be possible, but they should be applied only on a limited basis and they should be justified by an objective serving the general good.

Under the proposals, the reselling of frequencies would be permitted in certain specified frequency bands. The proposals do not specify, however, what these frequency bands would be like; this would be decided separately in a comitology procedure. In connection with the directive proposals, however, the Commission also issued a communication on the use of the digital dividend, namely what should be done with the frequencies liberated from use by analogue television channels. In its communication, the Commission proposes that the UHF frequency band would be divided into sub-bands, such that the lowest band would continue to be used for TV services, and their use would be coordinated nationally. The central part of the spectrum would also be coordinated nationally, but would include voluntary EU coordination. According to the Commission, these frequencies could be used for various mobile multimedia services. The upper frequency band would be coordinated flexibly on the EU level, e.g. for offering fixed and mobile broadband services. The Commission communication has no binding legal effect.

Under the directive proposals, the Commission would also be given the right to coordinate and harmonise frequency access rights, selection procedures and selection of companies in the case of the above-mentioned pan-European frequency bands being involved. In this the Commission would be assisted by the European Communications Market Authority, which is to be established.

#### *2.4 Radio Regulations of the ITU*

The Radio Regulations of the International Telecommunication Union (ITU) constitute an international agreement binding the spectrum decisions of member states. The Radio Regulations are amended at the ITU's World Radiocommunication Conferences (WRC), held every 3-4 years, which discuss the allocation of frequency bands for different purposes. As a result of changes made to the Radio Regulations, administrations may have to clear frequency bands of their old uses to make way for a new use that comes in their place or change the technical specifications of systems in a frequency band.

European joint positions and initiatives for the WRC are prepared within the sphere of the Conference of European Post and Telecommunications (CEPT). The Finnish Communications Regulatory Authority regularly participates in the preparations that takes place in CEPT. Within the sphere of CEPT, a number of recommendations relating to spectrum use have also been made which Finland is generally committed to follow.

#### *2.5 Other EU countries' practices on radio frequency commercialisation*

In connection with the work of the working group currently under way, the Ministry of Transport and Communications has initiated a research project "Models of Radio Frequency Commercialisation in EU countries". On the basis of a competitive tender, Nordic Adviser

Group IT & Telecom Oy were selected to carry out the research project. The intention is to complete the research project by 15 February 2008 and its results will be utilised in the working group's final report.

The research project was assigned the task of examining the practices of European Union member states in the commercialisation and other development of frequency access rights as well as the experiences obtained with them.

The research should describe in detail the commercialisation models in use in the EU member states in question. The research should reveal in particular,

- how commercialisation has been implemented (description of commercialisation models)
- the frequencies to which commercial models have been applied
- the nature of the terms and conditions imposed for licences granted on a commercial basis in respect of, for example, efficient use of frequencies, technical interference, cultural aspects and media diversity, duration of licences, area coverage of licences, and transferability, lease and sharing of access rights
- the grounds on which access rights granted on commercial terms have been priced and the nature of the experiences obtained about pricing
- the impact on annual user fees for frequencies
- how commercialisation has influenced the efficient use of frequencies
- how commercialisation has influenced investments in wireless technologies
- how commercialisation has influenced competition
- what the roles of different authorities are in the commercialisation of access rights to frequencies
- how large has been the revenue received from the commercialisation of access rights and what it has been used for.

### **3. Sector hearings**

#### *3.1 Organisation of the hearings*

The Spectrum Development Working Group arranged extensive hearings for sector operators and user groups on 21 and 28 September 2007. Those heard by the working group were:

Kari Risberg and Seppo Nieminen, Digita Oy,  
Riitta Tiuraniemi and Anna Tsakirakis, DNA Finland Oy,  
Jorma Miettinen, MTV Oy,  
Jukka Tuomaala, The Finnish Maritime Administration,  
Caspar Berntzen, C More Entertainment Oy,  
Tapio Karjalainen and Pertti Vepsäläinen, Elisa Corporation,  
Rose-Marie Skogster, Telemast Nordic Oy,  
Rauno Ruismäki, Nokia Corporation,

Leena Ryyänen, Pro Radio Oy,  
 Mari Österberg, The Finnish Consumer Agency,  
 Raimo Lehto, Michael Fletcher and  
 Jukka Heikinheimo, The Finnish Amateur Radio League,  
 Asko Huuskonen, The Finnish Meteorological Institute,  
 Kimmo Urhonen, The Finnish Civil Aviation Authority,  
 Olli-Pekka Heinonen, The Finnish Broadcasting Company,  
 Jukka-Pekka Joensuu, TDC Song Oy,  
 Reijo Svento and Marko Lahtinen, Ficom ry,  
 Kimmo Manni and Yrjö Pylvänäinen, Finland Erillisverkot Oy,  
 Ritva Partanen, Savonlinnan Puhelin Oy,  
 Jouko Seitakari, Defence Command Finland,  
 Antti Räisänen, Helsinki University of Technology,  
 Teemu Summanen, Finnet Association,  
 Tapani Pökkä, Timo Hietalahti and Tapio Haapanen, Teliasonera Finland Oyj,  
 Janne Holopainen, Digi TV Plus Oy,  
 Harri Kujala, Turun Paikallisradio Oy,  
 Nils Rostedt, Oy L M Ericsson Ab,  
 Veijo Turunen, The Confederation of Finnish Industries,  
 Antti Pakkala, NRJ Finland Oy and  
 Markku Lamminluoto and Anne Nuutinen, SW Television Oy.

A period of 15 minutes was reserved for each of the parties heard: 10 minutes for a prepared presentation and 5 minutes for more detailed questions from the members of the working group.

The parties heard had been requested to deliver a PowerPoint presentation of at most three slides, with which the working group members had an opportunity to acquaint themselves in advance. The written material received in the hearings is publicly available on the Ministry of Transport and Communications website ([www.mintc.fi](http://www.mintc.fi)).

### *3.2 Summary of the views presented*

#### *Mass communications operators*

Mass communications operators were particularly critical in their response to possible commercialisation of spectrum use. In this group, only one operator, a newcomer to the sector, considered that the commercial allocation of frequencies also had possibilities. All of the other television and radio companies heard as well as companies providing mass communications network and payment card services considered that frequencies intended for television and radio broadcasting should not be commercialised. Spectrum fees were considered to weaken operators' financial operating potential. The Finnish Broadcasting Company also emphasised its public service role, which is safeguarded in a supplementary protocol to the Treaty of Amsterdam and within whose sphere, in its view, the frequencies used in public radio broadcasting belong. Companies for whose business pay-television operations have a big significance considered that the possible commercialisation of frequencies needed by terrestrial television networks also represented a competition problem in relation to cable and satellite television. A number of television operators also considered that the UHF frequencies liberated from analogue television should continue to be reserved

for the use of television services. The frequencies needed for high-definition television were particularly used as justifications. According to different estimates, high-definition transmissions could begin in the terrestrial television network in the period 2008– 2010. Some of the mass communications operators considered that the criteria for awarding licences for frequency access should be clarified.

#### *Telecommunications operators*

Some telecommunications operators considered that frequencies should not be commercialised. The justifications presented included the fact that the efficient use of frequencies would not be promoted by commercialisation. In addition, a threat was thought to be presented by possible spectrum hoarding, which it was believed would impact particularly on the operating potential of small operators and operators of small member states. Those who respond critically to commercialisation consider that commercialisation will lead to a rise in customer prices as well as to a reduction in willingness to invest. One company also highlighted possible problems at the Russia interface in the commercialisation of frequencies. The telecommunications operators in question considered that if spectrum use were commercialised, the frequencies currently in mobile communications use should be safeguarded for the period of validity of the licences and that the present frequencies allocation model should be preserved alongside any new one. They further emphasised that sensible operating conditions for operators of different sizes should be safeguarded in any possible commercialisation.

Some of the telecommunications operators already had experiences of spectrum commercialisation from other countries in which the groups behind them had business operations. These companies did not consider spectrum commercialisation to be fundamentally problematic, and they also saw opportunities in commercialisation. One such telecommunications operator considered that commercialisation could particularly be of benefit to television companies in the form of inexpensive distribution paths. According to one other telecommunications operator, important factors in possible spectrum commercialisation would be the safeguarding and predictability of investments made as well as a sufficiently long transition period and carefully prepared details. One telecommunications operator emphasised efficiency and openness as well as the importance of good frequency planning in commercialisation. Companies within this group considered that commercialisation would not necessarily reduce regulation; regulation would also be needed after commercialisation.

The association representing communications sector and telecommunications operators responded critically to commercialisation, but assumed that, due to the development of the EU, a move towards commercialisation in some form would take place nevertheless. Accordingly, the focus should above all be on minimising adverse factors, for example commercialisation should not lead to concentration nor hoarding and, in conditions of commercialisation, companies' investment capacity should be maintained and the amount of regulation kept at reasonable level.

#### *Equipment manufacturers*

The equipment manufacturers at the hearings considered the present model of frequency management to be for the most part effective. One company stressed that the present model based on harmonisation of spectrum use has been open and transparent, and that it has brought with it economy of scale and sufficient business potential. The company in question

did not envisage problems with technology neutrality, provided that it did not give rise to technical interference. Neither equipment manufacturer had a position on commercialisation, but both emphasised that they will not support large front-loaded spectrum usage fees.

#### *Other spectrum users*

A common view of parties representing other uses for frequencies (shipping, aviation, meteorology, amateur radio activity, defence, official networks, spectrum research) was that they considered that the frequencies they need should not in any circumstances be commercialised nor must possible commercialisation elsewhere be allowed to disturb these public utility uses. In addition, Defence Command Finland highlighted the fact that the needs of national defence in emergency conditions must be safeguarded in the event of possible commercialisation.

#### *Use of fees receivable from possible commercialisation*

Some of the parties heard have a view on the use of the spectrum fees receivable from possible commercialisation. Possible uses proposed included development and innovation of wireless services in Finland, maintenance and development of national frequency management, radio technology education, development of critical infrastructure development, lowering of other spectrum fees, and support for diversity in public broadcasting.

## **4. Frequency bands with potential and/or capacity to be included in possible commercialisation**

### *4.1 Fixed access network systems: 3500 MHz WiMax*

The Finnish Communications Regulatory Authority has been awarding radio licences for fixed wireless access network radio systems since the end of the 1990s. A 180 MHz-wide frequency band 3410–3600 MHz, divided into three paired bands a) 3410–3438 MHz/3510–3538 MHz, b) 3438–3466 MHz/3538–3566 MHz and c) 3466–3490 MHz/3566–3590 MHz, has been allocated to these systems in Finland. In size, the frequencies segments are: a) 2 x 28 MHz, b) 2 x 28 MHz and c) 2 x 24 MHz. Nearly all use WiMax technology. On the other hand, manufacturer-specific older generation products, which are not mutually compatible, are also still in use.

Most of the existing valid radio licences were awarded during 2006. There are around 50 valid radio licences. All radio licences have been granted on a regional basis, but certain companies have a valid radio licence for a number of geographical areas. Radio licences have been awarded, as a rule, for five years at a time – but such that most of them are valid until 31 December 2010. The Finnish Communications Regulatory Authority is currently awarding new radio licences such that they are valid until 31 December 2010 at the latest.

Most of the licence holders have begun providing telecommunications services at least in some of the coverage areas specified in the technical licence conditions.

The most common reason for a delay in the start-up of operations has been slow progress in the technical standardisation of WiMax devices. This has led to a situation in which operators have to commit to one equipment manufacturer's products, which is not economically

sensible in the longer term. Different generation WiMax devices are not interoperable, which means that the investment in base stations must be repeated if some newer technology is adopted. On the other hand, some of the operators have already adopted a newer technology in which there is partial support for mobility, yet still relying on the products of only one manufacturer. The situation is quickly changing, however, as the WiMax Forum has begun certifying equipment for compatibility. Currently, certificates have been awarded for the products of more than 30 equipment manufacturers.

#### *Exclusion areas between WiMax networks*

The use of WiMax technology for fixed connections requires an exclusion area between radio networks to prevent interference. In the radio networks, providing a service in the exclusion areas is completely prohibited. In many cases, radio licence holders have, however, agreed on the use of an exclusion area that is smaller than normal. At the same time, operators have to commit to cooperate in the planning of their radio networks, so that interference can be minimised. Agreement on the reduction of exclusion areas between different operators has reached on many occasions (around 90). Through these agreements, it has been possible to reduce the 40 km exclusion or even remove it completely between the radio networks of different operators. This has significantly promoted the efficient use of radio frequencies.

Coverage areas have been specified in radio licences either by base station or by larger unit of area (municipality, region or otherwise specified area).

#### *Mobile WiMax*

The term mobile WiMax is included in standard IEEE 802.16–2005 (802.16e), which addresses the characteristics of mobile use, namely radio interface requirements when moving in interior and exterior spaces as well as the functions, including channel and cell switching, necessary to manage mobility.

The development of mobile WiMax technology has been assigned to a number of frequency bands, of which the 3400–3600 MHz and 2500–2690 MHz frequency bands can currently be allocated for use in Finland.

The mobile WiMax technology differs from fixed WiMax in that it uses a time-division duplex (TDD), in which the same frequency channel is used for transmission and reception. Fixed WiMax uses a frequency-division duplex (FDD), whereby transmission and reception channels use carrier waves of different frequencies (the same way as in GSM). Present radio licences have been awarded based on frequency-division use. The present three licences per geographical area does not hold true for mobile WiMax; in theory, more licences per area can be awarded for it.

The introduction of mobile WiMax technology would facilitate several parallel networks in the same geographical area and would promote the efficient use of frequencies.

A number of the present licence holders of fixed access network radio systems have still not begun the building of a network, because they are awaiting the development of mobile WiMax equipment and the preparation of standards. In the 3466–3490 MHz/3566–3590 MHz frequency band, mobile WiMax would possibly be affected by restrictions due to present radio link use. Radio link use is currently coordinated with fixed access networks such that no interference is caused for these systems.

### *Usability of 3.5 GHz frequency band*

The use of frequencies for fixed access network radio systems is fragmented, because radio licences have been awarded regionally according to demand. There is currently no uniform national frequency segmentation or one covering larger geographical areas. The restructuring of frequencies could be reassessed for the period after 31 December 2010.

### *4.2 2500–2690 MHz frequency band*

The World Radiocommunication Conference WRC allocated additional frequencies to IMT-2000/UMTS systems in 2000. According to the 2002 CEPT frequency decision, the 2500–2690 MHz band was also allocated to the IMT2000/UMTS mobile networks (ERC/DEC(0206)) from 2008, if there is a national need for this. A European decision (ECC/DEC/(05)05) was also made in 2005 for the harmonised introduction of IMT2000/UMTS.

Based on the utilisation plan for this harmonised mobile traffic, the 2500–2690 MHz frequency band will be reserved for other than radio link use after 2008. In Finland there are currently around 500 radio links still in use in the frequency band. The radio link licence holders have been informed about the change of the utilisation plan, and the removal of radio links from this band can be done gradually according to the frequency needs of the new networks. A frequency band is available in the 190 MHz band.

The harmonised frequency decision specifies frequencies 2500–2570 MHz and 2620–2690 MHz for use as paired frequencies (FDD technology) and frequencies 2570–2620 MHz as unpaired frequencies (TDD technology). In FDD, namely frequency-division duplexing, the transmission and reception channels use carrier waves of different frequencies. In TDD, namely time-division duplexing, the same frequency channel is used for transmission and reception. Third-generation UMTS technology uses FDD technology, as does the present WiMax technology in the 3500 MHz frequency band, which is based on the fixed location of the terminal device. Mobile WiMax, on the other hand, is based on TDD technology.

It should be noted that the CEPT decisions outlined above are recommendations and are therefore not binding on member states. The 2500–2690 MHz frequency band can be introduced in Finland on a technology neutral basis also for other than IMT-2000/UMTS use.

### *Usability of the frequency band*

The frequency band is harmonised Europe-wide and in a number of countries the band has been taken, or will be taken, within the sphere of commercialisation. In Finland the whole band could be taken into use in 2009, after the removal of radio link use, and regionally restricted use would be possible even earlier. The available 190 MHz corresponds to 475 GSM channels or 24 UMTS channels.

In Sweden, for example, it has been decided to auction the said frequency band, such that 14 separate 2 x 5 MHz frequency segments will be awarded for FDD use (for example UMTS, fixed WiMax; 2500–2570 MHz and 2620–2690 MHz) and one 50 MHz frequency segment for TDD use (e.g. mobile WiMax; 2570–2620 MHz). In Norway, correspondingly, the plan is to award 11 separate frequency segments, each 10 MHz in size (2540–2620 MHz and 2660–

2690 MHz), a total of 110 MHz, and 8 separate frequency segments 2 x 5 MHz (2500–2540 MHz and 2620–2660 MHz), a total of 80 MHz. It is to be noted that in Norway the frequency band to be applied to mobile WiMax is larger than that specified in the CEPT recommendation (110 MHz v. 50 MHz).

#### *4.3 1805–1880 / 1710–1785 MHz frequency band*

The frequency band has available for mobile communications 2 x 75 MHz frequency band, corresponding to 374 channels. A guard band is needed between the GSM 1800 frequency band and DECT. Currently the guard band size is, as a rule, 5 MHz at the upper edge of the GSM 1800 band. The band has nearly 100 channels free, which corresponds, for example, to four UMTS channels. Of the channels which are free, 36 of them are used for research.

##### *Usability of the GSM 1800 frequency band*

It would be possible to reserve part of this frequency band for industry, research and education use, and also to award additional channels for mobile communications use.

#### *4.4 2110–2170 / 1900– 1980 MHz frequency band*

The amount of frequency available in this frequency band is 2 x 60 MHz. TeliaSonera, DNA and Elisa each have available 2 x 15 MHz (TDD) and 5 MHz (TDD) in this frequency band.

##### *Usability of the UMTS frequency band*

The frequency segment 2 x 15 MHz (FDD) and 5 MHz (TDD), liberated from the company Finland 3G, is immediately available in the frequency band.

#### *4.5 New frequency bands for public telecommunications operations possibly decided by WRC 2007*

The 2007 World Radiocommunication Conference allocated frequencies from four different frequency segments for future mobile communications systems.

In European and African countries, 72 MHz from the present TV-UHF band, i.e. the 790–862 MHz upper band of the TV-UHF band, will be allocated to mobile network (IMT) use as of 2015. For European and African countries, this band will be the primary mobile allocation for IMT, although other mobile uses have not been excluded. An absolute obligation to protect neighbouring countries' primary traffic is attached to the use of 790–862 MHz, however. Finland must therefore protect the frequencies allocated for the use of TV stations in the neighbouring countries' digital TV plan (GE-06).

The frequency range between 3.4 – 3.6 GHz frequency band will be allocated as mobile network capacity bands. The frequency solution is regional, encompassing 80 European and African countries as well as Japan and Korea. Using the frequency range for mobile networks (IMT) will require the protection of satellite systems currently in use in the frequency band. The protection obligation also requires an agreement to be concluded with neighbouring countries, so that satellite use in border areas between countries will also not be restricted in



future. Restrictions on mobile networks in Finland required by the protection of neighbouring countries' radio and satellite traffic cannot yet be estimated. The frequency band will be allocated to mobile traffic as of 2010.

In terms of the 450–470 MHz and 2300–2400 MHz frequency bands, IMT identification will come into effect immediately when the changes to the Radio Regulations enter into force on 1 January 2009. In the Radio Regulations the primary mobile allocation was already in these bands before this conference. In Finland and elsewhere in Europe, these frequencies already had an existing other use, and the use of the frequencies will not change, at least in the near future, because of IMT identification in Finland and Europe.

#### *4.6 TV-VHF band*

The band has immediately available GE-O6 frequencies for two national networks, with one possible use being, for example, high-definition television HDTV. Depending on compression technology development and the HDTV resolution used (720p/1080i/1080p), it is estimated that 2-4 HDTV programmes will occupy one channel bundle in 2009. For viewers, the use of HDTV in this band would mean the acquisition of new antennas and digital set-top boxes.

#### *4.7 TV-UHF band*

In addition to the present terrestrial digital television channel bundles and the mobile television channel bundle (DVB-H), Finland has available frequencies in the UHF band for two national television networks. Theoretically, it would be possible to allocate frequencies from the frequency band also for mobile traffic, namely channels 62–69. This would require replanning of the frequencies. Finland's use of the said channels is restricted by radio navigation use in Russia. Europe-wide technical compatibility work for this frequency band is still incomplete. As described in Chapter 4.5 above, the WRC 2007 allocated the 790–862 MHz frequency band to future mobile communication systems as of 2015. At the same time, the WRC 2007 requests ITU-R to study the compatibility of public broadcasting and new mobile applications, so that present and future use of public broadcasting is safeguarded.

The use of DVB-H is currently restricted by the fact that DVB-H terminal devices are only able to access TV channels up to around 750 MHz. For example, a new national DVB-H network could therefore not be awarded at the present time without the replanning of frequencies. Regional networks could be allocated to DVB-H. In terms of DVB-H, a suitable compromise between quality and efficiency may be to have 30 multimedia programme channels per channel bundle.

### **4. Proposal for restricting further work**

In the working group's letter of appointment, the working group was requested to prepare a proposal for models of awarding frequency access rights in Finland, and to identify the frequencies usable in possible commercialisation as well as other conditions relating to possible commercialisation. The working group began its work with hearings of operators in

the sector, after which the Finnish Communications Regulatory Authority presented from a technical perspective the frequencies which would have the potential and/or the capacity to come within the sphere of possible commercialisation.

The working group in its discussions has taken into account the Government Programme item by which frequency access would be reformed moderately in a more flexible and efficient direction. The working group has also taken into account the views presented in the hearings of operators in the sector. The working group in its discussions has decided to propose that further work should be focused on those frequencies that in the event of possible commercialisation would be free from other use, in which case the uninterrupted continuity of all existing services and other purposes could be guaranteed in accordance with existing access rights. The 2.50–2.69 GHz frequency band, which will be liberated from radio link use by the beginning of 2009, would be best suited as a focus for further work, in the view of the working group. The working group has also discussed the spectrum reforms under way in the European Union, particularly the spectrum recommendation (WAPECS) and the Commission's proposals for amending the electronic communications directives.

The working group, having taking into account the above-mentioned aspects in its discussions, has decided to propose that its further work be restricted in accordance with the following principles:

- a. Uninterrupted continuity is guaranteed for frequencies currently used in official and research activity in accordance with existing access rights
- b. Public service television and radio activity is safeguarded, as is television and radio activity under software licences awarded by the Government, in accordance with existing access rights
- c. Frequencies currently in mobile communications or wireless broadband use are safeguarded in accordance with existing access rights
- d. The Europe Commission's spectrum recommendation (WAPECS), which will probably come into force in early 2008, is taken into account where applicable
- e. A full-scale access rights commercialisation process is planned for the 2.50–2.69 GHz frequency band (see figure), whose key principles would be
  - i. promoting competition and new investments,
  - ii. the right to transfer access rights and
  - iii. service and technology neutrality.

The frequency band will be liberated from the beginning of 2009 and may be included in the European Commission's WAPECS recommendation as well as the band allocated for the ITU's IMT framework. The various decisions and necessary legislative amendments have been made, the award of access rights on a commercial basis could take place at the earliest at the end of 2009.
- f. The working group takes no position on whether or not the models prepared by the working group should be taken into use. Frequency access operating licences are decided by the Government.