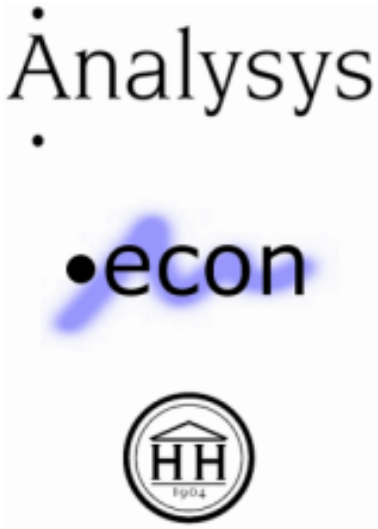
Final Report for the European Commission

Study on conditions and options in introducing secondary trading of radio spectrum in the European Community

Annexes to Report



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The opinions expressed in these annexes are those of the authors (Analysys Consulting Ltd and its partners) or of the spectrum stakeholders participating in the study, and do not represent the views or official position of the European Commission.

Annexes to final spectrum trading report

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Preface

This annex forms part of the *Study on Conditions and Options in Introducing Secondary Trading of Radio Spectrum in the European Community*, written for the European Commission by Analysys Consulting Ltd, DotEcon Ltd and Hogan & Hartson LLP.. It contains case studies of a five non-European countries (Australia, New Zealand, Guatemala, the USA and Canada) and describes the regulatory and market situation regarding spectrum trading in those countries. At the end of each case study, lessons are drawn for spectrum trading in Europe.

1 Australia

1.1 General framework

Before the reforms of the 1990s, all spectrum licences were assigned and reassigned through administrative means. The 1992 Radiocommunications Act included the introduction of spectrum licences. The Act allows for a licensee to assign part or all of the licence to another party, compliant to the Australian Communications Authority (ACA) Determination.[1]

Two considerations prompted the reforms: the Australian Communications Authority (ACA) regarded businesses better able to make decisions on technology selection and system design than government; they also took the view that resources should be allocated to those who value them the most.

Two types of tradable licences exist:

- spectrum licences – which are initially auctioned
- apparatus licences – which are site, service and technology specific.

1.2 Frequency bands

All spectrum licences are tradable. Thus trading appears to be permitted in all frequency bands.

[1] Radiocommunications (Trading Rules for Spectrum Licences) Determination 1998.

1.3 Specification of rights

Spectrum licences are a tradable, technology-neutral (i.e. not related to any particular technology, system or service) spectrum access right for a fixed non-renewable term. Within the bounds of spectrum space and the technical co-ordination framework, licensees are free to operate whatever type of communications service they choose. Licensees are able to change their usage in response to technical improvements or changes in consumer demand. This flexibility is conditional on ACA technical approval of some types of devices.[2]

The Spectrum Management Authority devised a spectrum map grid covering the whole of Australia. Depending on population density, the 21 998 cells range from 3 degrees of arc to 5 minutes of arc in size.[3] Standard Trading Units (STUs) are commodity blocks of spectrum, and are the minimum unit of spectrum space for which the ACA issues a spectrum licence or will allow trading. STUs are finite and indivisible and are defined by geographical area and radio frequency bandwidth; thus STUs can be stacked horizontally to enable greater coverage, or vertically to provide greater bandwidth. The geographical coverage is constant for all bands, while the frequency bandwidth varies by spectrum band.[4] Spectrum licences are made up of one or more STUs.

The amount of spectrum that may be traded is also restricted to the minimum contiguous bandwidth that is less than the bandwidth for that band, as specified by the ACA. Minimum bandwidths range from 1MHz to 5MHz depending on the frequency band.

Spectrum licences are for a fixed term of up to 15 years. Apparatus licences have a set period of between one and five years, with some scope for renewal.

Ownership of an STU cannot be shared, which guarantees exclusivity of access. But spectrum licence holders may subdivide their holdings into the component STUs and sell them on. Additionally, spectrum and apparatus licence holders may authorise other third

2 ACA website.

3 UK Radiocommunications Agency (2002).

4 ACA (2002).

parties to operate devices under their licences. Records of third-party licences must be held by the licensees.

1.4 Interference management

Emission limits are set at boundaries in order to limit interference. In-band emissions are regulated at a set strength dependent on the topography of the area. Out-of-band interference is mitigated by maximum radiated power levels. Licensees must register their devices and self-certify that they will not cause unacceptable interference.

1.5 Competition issues

Spectrum is considered an asset. Competition concerns regarding spectrum holdings are the remit of the ACA. So far no significant concerns have been raised. The 1974 Trade Practices Act protecting against anti-competitive practices is the relevant regulatory instrument.

1.6 Mechanisms to enable trading

Licence trades may be negotiated directly or via a broker. Price is negotiable, but licence conditions cannot be altered without recourse to the ACA. The majority of licences traded have changed hands via bilateral or brokered negotiations.[5] There are few active spectrum trading brokers. The Australian Productivity Commission (APC) has expressed the view that, given their industry knowledge, the 40 persons who are accredited spectrum assigners would be ideally placed to act as brokers.[6]

A private online spectrum trading desk (Spectrum Desk) was established in March 2001 by Macquarie Bank.[7] Until December 2002, only one auction was held by the desk.[8]

5 Australian Productivity Commission (2002).

6 Australian Productivity Commission (2002).

7 http://personal.macquarie.com.au/au/aboutus/pressrelease/20010314.htm

However, the exchange has been criticised as being unsuccessful, due to lack of sanction or support by the regulator. Moreover, "*it was poorly constructed and not well run because of a lack of technical expertise in spectrum management. For this and other reasons it was treated with suspicion and perhaps even derision by licensees and therefore attracted little custom*."[9]

1.7 Publication of information

A searchable public online register, with a graphic presentation of licence numbers and market areas for all spectrum licences issued via auction or conversion, is maintained by the ACA in order to reduce information costs and to facilitate trading. Informal intermediaries, such as Market Dynamics, also exist. However, information on confidential users is withheld, and pricing information is not collected or published by the ACA.

Spectrum trades must be registered with the ACA, but financial information on spectrum traded does not have to be submitted. Thus the value of spectrum changing hands is not publicly known. Concerns exist regarding the publication of commercially sensitive information that may reveal parties' cost advantages, but the APC has suggested that details of spectrum prices paid could be passed to it in confidence, and only average prices published.[10]

1.8 Trading volumes

The APC calculated turnover rates for spectrum on the basis of total licence numbers. However, these numbers do not indicate the amount or value of spectrum traded and so are, at best, a crude indicator. Turnover rates are as shown in Exhibit 1.1 below.

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8 In May 2001, Spectrum Desk auctioned 100kHz of spectrum in the 500MHz band over the Newcastle metropolitan and surrounding regions (Australian Productivity Commission, 2002).

9 Market Dynamics (2003).

10 Australian Productivity Commission (2002).

Year	*Licences traded (no.)*	*Turnover rate (%)*
1998–99	50	13.8
1999–2000	22	5.4
2000–01	47	7.7
2001–02	51	8.4

***Exhibit 1.1**: Australian spectrum licence turnover rates [Source: Australia Productivity Commission, 2002]*

Trades in apparatus licences have also taken place, although to a lesser degree than for spectrum licences. Moreover, trading in an apparatus licence most commonly results through a change of ownership of the licence holder.[11]

From July 2001 to July 2002, fewer than 100 spectrum licences had been traded. Approximately 2000 apparatus licences were traded per year, mainly in private business radio.[12]

1.9 Lessons gained from trading experience

Despite the implementation of legislation supporting spectrum trading, and the existence of marketplaces bringing buyers and sellers into one arena, bilateral trading forms the majority of secondary market activity in Australia.[13] However, lack of trading does not necessarily signify faults in the construction of the secondary market, as spectrum is relatively plentiful for both existing and potential services.[14]

The payment of stamp duty (an ad valorem tax) on radio communications licences varies across States and Territories. The duty on statutory licences is usually equal to that on real property transfers and can be up to nine times the duty payable on transferring unlisted marketable securities. Some commentators believe that stamp duties impede secondary

11 Australian Productivity Commission (2002).

12 Radiocommunications Authority (2002).

13 Market Dynamics (2003).

14 Aegis (2001).

trading in spectrum licences.[15] In addition, Vodafone Australia has stated that potentially large capital gains tax liabilities discourage swapping spectrum (for zero monetary fee) in order to create contiguous spectrum holdings.[16]

Spectrum trading is credited with: assisting the introduction of a broadband interactive wireless service; enabling a company to propose aggregating private business radio licences to form a national network; and providing additional spectrum on a short-term basis for coverage of the Sydney Olympics.[17]

15 Australian Productivity Commission (2002).

16 Australian Productivity Commission (2002).

17 UK Government, Spectrum Trading – Regulatory Impact Assessment.

2 New Zealand

2.1 General framework

New Zealand was the first country in the world to allow the trading of spectrum rights.

Spectrum management initially evolved as a centrally administrated system. Legislation in 1989 introduced a scheme of tradable spectrum property rights. This legislation was initially aimed at the broadcasting sector, in which the need for reform was perceived the greatest.

Market reform prompted the adoption of a more flexible system, suited to the more open and competitive marketplace, especially with regard to telecoms.

The government favoured a progressive conversion of licences to a spectrum rights regime. As the initial owner of all management rights, the government has used auctions as its favoured primary assignment mechanism since 1995.

2.2 Frequency bands

All spectrum licences are tradable. Thus trading appears to be permitted in all frequency bands.

2.3 Specification of rights

Legislation provides for the creation and registration of three types of property rights: management rights, spectrum licence rights and existing apparatus licences.

- Management rights: within certain interference limits, the exclusive right to the management of a nationwide band of frequencies for a period of up to 20 years. Within this band the manager can issue (typically local) sub-licences.

- Licence rights: spectrum (usage) licences, issued by the manager, afford the holder the right to use spectrum within the band specified within a defined area. The range of uses to which spectrum can be put is unlimited, other than by interference constraints.

- Apparatus licences: in blocks of spectrum where management rights have not (yet) been created, the system of (non-tradable) apparatus licences continues.

Management rights and usage rights are typically auctioned simultaneously, allowing market participants to determine whether one user controls both management and user responsibilities for that band, or whether more than one user sits under a band manager. Following the primary assignment, rights can be traded freely. It is a matter for the spectrum managers concerned whether or not to trade their rights and, if so, on what basis. There are no restrictions on the activities of operators or on the number of entrants into the market, or specialised licensing requirements. At October 2001, private sector interests owned 63 licences out of a total of 81. Private management rights cover various spectrum areas including cellular telephone, MDS, IMS (LMDS) and fixed link services. Managers in these bands are free to issue licences according to their own policies.

The New Zealand Ministry of Economic Development (MED) is considering the practical issues surrounding the fixed tenure of management rights.[18] The options considered included allowing perpetual rights or a mechanism allowing for statutory presumption of renewal on a five-year term, with a minimum five-year notice period of a non-renewal decision. The MED decided that, five years before a management right is due to expire, the existing right holder will "*be offered a replacement spectrum right at a price that reflects its current market value*". A report was commissioned in the summer of 2003 on an appropriate price-setting formula.

18 MED website (July 2003).

2.4 Interference management

Regarding interference: "*Management rights are defined in emission mask parameters, not services. The emission mask characteristics are set on probable end use but even if the end use is different, adjacent managers are able to transact to their mutual benefit to change their emission masks. Spectrum licences are more specific.*"[19] A three-stage test on interference is used in New Zealand which tests whether:

- "*The emission is in the licensee's band and area. If so, then no further action is required; otherwise it considers if:*
- "*The emission is below background noise. If the emission is below acceptable levels of interference then everything would be fine; otherwise this would imply that:*
- "*A third party user suffers from interference.*"[20]

Management rights are under the protection of limits on frequency emissions from adjacent licensees that define the strength of out-of-band emissions. Management right holders are not responsible for ensuring that their licence right holders comply with the interference limits.[21]

2.5 Competition issues

There are no sector-specific competition rules. Instead, such concerns within the industry are dealt with relying on general competition law.

2.6 Publication of information

The New Zealand Register of Frequencies is available online. The specified purposes of the Register are to facilitate two activities – spectrum trading and spectrum engineering.

19 Valetti (2001) footnote 4.

20 Valetti (2001).

21 Radiocommunications Agency (2002).

Persons interested in dealing with a spectrum licence or a management right can use the Register to establish with certainty the nature of the right and its legal owner. The Register also provides for the registration of charges over rights ('mortgages') and claims of legal interests in rights ('caveats'). These provisions apply to spectrum licences only. Radio licences cannot be traded or be made subject to charges or caveats.

2.7 Trading volumes

There have so far been relatively few examples of the use of the secondary market mechanism: Telstra, an original holder of GSM spectrum, has sold its licence to BellSouth (now Vodafone) in a private deal. Similarly, the original purchasers of New Zealand's 28GHz LMDS spectrum have sold on their rights. A low volume of spectrum trading has been seen overall. The majority of trades that have occurred were for spectrum licences within AM and FM sound broadcasting.[22]

2.8 Lessons gained from trading experience

Overall, spectrum trading is not used extensively, for a number of reasons.

- The secondary market has less impact when the primary assignment mechanism is already market-based (i.e. an auction).
- As purchasers of spectrum are often operators intending to build out networks, they have little intention to sell this spectrum on in the short term.
- There are few operators vying for spectrum in New Zealand: in the recent 3G spectrum auction six blocks of spectrum were offered and only four bids received.
- Uncertainty regarding the timing of future primary allocations of spectrum leads to uncertainty regarding future primary availability, and thus the scarcity and related value of spectrum on secondary markets.

22 Radiocommunications Agency (2002).

- Availability of information regarding both current legislation and current spectrum allocations, by frequency and geographical locations, is important for prospective buyers of spectrum. The lack of a publicly searchable register of management rights and licences has been highlighted as a potential reason for lack of secondary trading. In addition, as existing holders have an informational advantage, lack of transparency can have an anti-competitive effect.[23]

- There is also concern about the adequacy of competition safeguards, particularly for commercially valuable spectrum.

- The secondary market has no formal structure and thus trades evolve from bilateral negotiations. Information regarding spectrum valuations is thus scarce.

The MED acknowledges the thinness of the secondary market. It admits that the lack of information necessary to trade rights and the lack of a formal exchange may both be a problem were there more parties wishing to trade. An investigation into the adequacy of competition safeguards in relation to radio spectrum comprises part of the MED's ongoing work programme.[24]

2.9 Concluding remarks

The overall volume of trading has been described by some commentators as "low"[25] and the majority of trades have been for spectrum licences within AM and FM radio broadcasting. However, there have been some much larger trades. Most notably, Telstra, an original holder of GSM spectrum, sold its licence to BellSouth (now Vodafone) in a private deal; and the original purchasers of 28GHz LMDS spectrum have all sold on their rights.

23 Market Dynamics (2003).

24 New Zealand Ministry of Economic Development (2003).

25 See, for example, Radiocommunications Agency (2002).

3 Guatemala

3.1 General framework

Before the 1996 reforms, article 121 of the Guatemalan Constitution designated radio spectrum as the property of the state. The spectrum was allocated by block to specific uses by an office within GUATEL, the state telecoms operator, following the table of frequency allocations used by the USA's FCC. These spectrum blocks were further subdivided and assigned to individual licensees. Only Guatemalan nationals were able to apply for a licence. While licences were allocated free of charge, the process was not transparent, and, as demand outstripped supply, an informal market including bribery developed.[26]

The Ley General de Telecomunicaciones, enacted in 1996, represented the most radical overhaul of spectrum property right assignment and allocation system in the world. More than 40 spectrum auctions have been held since 1996, with trading permitted afterwards.[27]

Rather than following the top-down approach common in almost every other country, the Guatemalan system was based on a bottom-up approach, within which any individual, foreign or national, could request a usage title (TUF[28]) for a frequency band not yet allocated to a user. Competing claims are settled by auction.

3.2 Specification of rights

Each radio licence authorised the use of a given frequency in a specified manner, including the technologies deployed and the location of transmission equipment. The licences were

26 Ibarguen (2003).

27 Radiocommunications Agency (2002).

28 Titulos de Usufructo de Frecuencias.

non-transferable and valid for a specified period of between two and 25 years. The government reserved the right to revoke the licence at any point.

While ownership of the spectrum remains with the state, holders of these usage titles are able to lease, sell, divide or consolidate titles for a limited period of 15 years. The rights are freely tradable and, on request, can be extended for a further 15 years. Spectrum titles are property titles that can be put up as equity for investment capital.

3.3 Interference management

Interference is managed by each right having a maximum power that may be emitted at the border of adjacent frequencies. In the case of conflicts arising due to interference between adjacent users, private mediation is first advocated, and only where necessary does the telecoms regulator (SIT) intervene. Indeed, intervention is generally limited to interference disputes and setting aside certain spectrum blocks for state use. The need for SIT intervention has been minimal, with the largest spectrum owner reporting only one interference problem since 1996.[29] Spectrum users have established a private arbitration office, the Cámera de Radio Difusión de Guatemala, which itself has spectrum-monitoring equipment.

3.4 Competition issues

No information has been found so far on competition law governing spectrum holdings in Guatemala.

3.5 Publication of information

The SIT retains a publicly accessible computerised database of TUFs, vital to ensure ease of access to information for prospective spectrum users. The application for spectrum usage is described by Ibarguen (2003) as “simple” and is implemented as follows.

[29] Ibarguen (2003).

1. An interested party surveys existing spectrum use in the spectrum registry of SIT.
2. The party applies to SIT for the right to use an unoccupied frequency as specified in the application form.
3. The application is evaluated by SIT, which deems it accepted, incomplete or rejected in three days or less. Grounds for rejection include technical interference and request for reserved or radio amateur bands. Reserved bands are for government use only.
4. If the application is accepted, public notice is issued. Parties objecting to the new use file formal complaints. Grounds for opposition are limited to technical interference.
5. Complaints are adjudicated via binding arbitration, a process that cannot exceed ten days.
6. Other interested parties are allowed to file competing claims to requested spectrum rights.
7. If no competing claims are filed, then the petitioner receives rights without payment (gratis).
8. If competing claims are filed, then SIT must schedule an auction within 35 days of the end of the opposition period.[30]

3.6 Trading volumes

Since liberalisation in 1996, the SMA has held more than 40 spectrum auctions and has issued around 5000 TUFs (usage titles to spectrum) to more than 1000 users. TUFs may be leased, sold, subdivided or consolidated for a limited period of 15 years, and there appears to be a vibrant secondary market. Approximately 26% of TUFs have been 'endorsed' (indicating that they have been exchanged between undertakings rather than assigned by the regulator), but this figure underestimates the true scale of trading, since leases are not recorded in this way.[31]

It is not clear what the breakdown of trades in terms of end use is, but FM radio broadcasting appears to account for a significant proportion. The going market price for a TUF covering an FM radio frequency in Guatemala City is upwards of USD600 000;

30 Ibarguen (2003).

31 Ibarguen (2003), pp. 546–548

similar rights are leased for about USD4000 a month. TUFs are also increasingly used as collateral for loans.[32]

3.7 Lessons gained from trading experience

Hazlett and Ibarguen (2002) deem Guatemala's open access rules a success. Transaction costs have not increased, investment by service providers has risen, and the interference dispute resolution mechanisms have produced "orderly developments". Guatemala saw a massive increase in the number of wireless telephony subscribers, and competition in the wireless sector is above that of all other South American countries, as a result of free entry to the market in terms of spectrum access.

32 Ibarguen (2003), p. 548.

4 USA

4.1 General framework

The Federal Communications Commission (FCC) has been introducing measures to promote secondary markets since 1996. The ultimate administrative rights remain with the US government. Licences are either exclusive authority, spectrum (i.e. area) or apparatus (site-by-site) licences. Transfer of spectrum is subject to approval by the FCC.

In June 2002, an FCC Special Task Force recommended that the FCC give users more autonomy in the "*[r]ight to transfer, lease, or subdivide spectrum rights*". Further, "*[a]n efficient secondary markets regime should be in place to facilitate the negotiated movement of spectrum rights from one party to another. In more narrowly-defined services (e.g., public safety), spectrum users should have the ability to lease excess capacity for other uses through time sharing of spectrum or other mechanisms*."[33]

In May 2003, the FCC passed a Report and Order and a Further Notice of Proposed Rulemaking (the 'Report') authorising most wireless radio licensees with exclusive rights to their assigned spectrum to enter into spectrum-leasing arrangements, creating quicker processes for licence transfers and seeking comment on future possible steps to improve the functioning of secondary spectrum markets. Thus the FCC has embraced the concept of secondary markets bringing efficiency gains.

33 'Spectrum Policy Task Force Seeks Public Comment on Issues Related to Commission's Spectrum Policies', *Public Notice,* ET Docket No. 02-135 (rel. June 6, 2002).

The Report authorises two types of leasing arrangement, described by the FCC as:

- " *'spectrum manager' leasing – enables parties to enter into spectrum leasing arrangements without obtaining prior Commission approval so long as the licensee retains both de jure control (i.e., legal control) of the license and de facto control (i.e., working control) over the leased spectrum pursuant to the updated de facto control standard for leasing.*

- *de facto transfer leasing – permits parties to enter into long-term or short-term leasing arrangements whereby the licensee retains de jure control of the license while de facto control is transferred to the lessee for the term of the lease. De facto transfer leases under this option will require prior Commission approval under a streamlined approval process. Under the de facto transfer leasing option, the Report and Order establishes different rules and procedures for long-term and short-term leases ('short-term' leases are defined as leases of 360 days or less in duration).*"[34]

Spectrum lessees are permitted to sublease their spectrum usage rights, subject to the sub-lessee complying with the Commission's rules and regulations imposed on the licensee. The sub-lessee is responsible for ensuring this compliance.

In addition to the FCC's October 2003 Report and Order on spectrum leasing, the Commission adopted a Further Notice of Proposed Rulemaking requesting comment on additional streamlining and market-based options. For example, the Commission has asked:

- "*whether the new rules will spawn 'market-maker' intermediaries and what role the FCC should play in regulating such entities;*
- "*whether there will be a need for a clearinghouse mechanism to provide real-time spectrum access information for new 'opportunistic' devices and what related regulation may be needed;*
- "*whether the FCC should further relax its rules and forbear from requiring prior approval for certain de facto transfer leases and for transfers of control and assignment of spectrum licenses that do not raise public interest issues;*

34 FCC (2003).

- "*whether the FCC should extend its spectrum leasing policies to services not currently within the scope of the Report and Order; and*
- "*whether the new de facto control standard should be applied in other regulatory contexts*."[35]

4.2 Frequency bands

Decisions regarding the type of service and technology that can be applied in a certain band are taken on a case-by-case basis. This has led to differences between the USA and Canada as regards which services are offered in particular bands.

The spectrum leasing allowed by the recent Report authorises most wireless radio licensees with 'exclusive' rights to their assigned spectrum to enter into spectrum-leasing arrangements. These policies and rules affect both mobile and fixed services, including (but not limited to) cellular, personal communications services (PCS), specialised mobile radio (SMR), local multipoint distribution service (LMDS), fixed microwave, 24GHz and 39GHz.

4.3 Specification of rights

Licences allocated by the FCC by auction are valid for ten years.

Under the leasing rules adopted in the Report, licensees in the specified services may lease some or all of their spectrum usage rights to third parties, for any amount of spectrum, for any geographical area covered by the licence and for any period of time within the original licence's term, without complete and permanent transfer of control. Control stays with the original licensee. Under the de facto leasing option adopted in the Report, spectrum may be leased without prior Commission approval, but the licensee must continue to maintain effective working control over use of the spectrum it leases.

Band manager licensing has been introduced where leasing is the core function.[36]

35 Hogan & Hartson (2003).

Licensees are subject to usage restrictions, as specified in the licensee's licence authorisation. Such usage restrictions also apply to spectrum lessees.

4.4 Interference management

Interference issues are dealt with by the FCC. General emissions limits are set by the FCC. The licensee is responsible for ensuring interference conditions are met. Where spectrum is leased to third parties, the original licensee is responsible for ensuring that interference limits are upheld. In addition, the licensee is responsible for ensuring that the lessee complies with the FCC's safety guidelines relating to human exposure to radio frequency radiation. Such control of lessees may be exercised by a third-party agent contracted by the licensee.

4.5 Competition issues

In order to protect against anti-competitive spectrum allocations, spectrum caps were implemented. However, these are being phased out.

4.6 Publication of information

Licensing information is available online, including maps showing licensee areas and service providers. The private sector provides most of this information: for example, Comsearch maintains a commercial spectrum database.

4.7 Trading volumes

Transfers though the partitioning and disaggregation mechanisms are very low. Three main reasons are given for lack of this activity. Firstly, carving up spectrum may devalue the asset and hinder future sales; secondly, licensees may wish to hold on to unused spectrum

36 Aegis (2001).

to retain the option of future use; and, lastly, transaction costs of trading may outweigh any benefits. Transfers via leasing amount to over 1000 a year.[37]

4.8 Concluding remarks

The FCC has been introducing measures since 1996 to promote spectrum trading in a number of bands designated for commercial services. These provide scope for partitioning and disaggregation of licences and for spectrum leasing. In the case of the former, the measures have not had much impact – "*less than one-tenth of one percent of licences auctioned by the FCC have been through the partitioning or disaggregation process*"[38] – but upwards of 1000 lease trades now take place annually,[39] many under the auspices of private band managers.

Trades involving the transfer of a whole licence were permitted for many years before 1996, subject to individual FCC approval. An important precedent was set in 1991 when the FCC granted permission to Nextel to launch a national mobile telephony network by aggregating local area specialised mobile licences that it had acquired through a combination of secondary market trades and applications. However, the necessary permission for the change of use was obtained only after a prolonged process.[40]

37 ERO EEC RR8 (2002).

38 Aegis (2001), p. 53.

39 ERO EEC RR8 (2002).

40 Cave (2002), p. 106.

5 Canada

5.1 General framework

Licences allocated through auctions are tradable. However, no trades appear yet to have taken place.

5.2 Frequency bands

Spectrum licences for which post-auction trading is permitted include the 2002 PCS auction in the 2GHz frequency, and those available via the forthcoming 2300MHz and 3500MHz auction.

5.3 Incumbent users

Incumbent licences are not subject to the transferability regime. Thus only licences allocated recently are transferable.

The Canadian government retains sovereign rights over radio spectrum. The government may reallocate spectrum in line with ITU regulations, and can, under Section 40 of the Radiocommunication Act, implement any reallocation required under international regulations. Since January 2001, all frequency assignments of fixed station subject to displacement are afforded a minimum of a two-year notification period.

Incumbent holders of PCS spectrum that had been operating for less than ten years were given a four-year notification, and others a two-year notification of displacement. Service providers covering urban areas with populations exceeding 25 000 were given a one-year notification period of displacement. In the 2300MHz bands, all incumbent holders of licences for fixed microwave point-to-point systems are subject to the transition policy provisions. All fixed point-to-multipoint systems are protected from displacement by WCS.

5.4 Specification of rights

Licences assigned by auction are transferable, and divisible by geography and frequency bandwidth. Spectrum grid cells are the smallest permitted geographical unit, whereas there is no minimum frequency division. A spectrum grid cell is a six-sided figure with an area of 25km^2. For the 24GHz and 38GHz spectrum, the amount of spectrum transferred in the bandwidth dimension may be no smaller than the spectrum block size (40MHz + 40MHz in the 24GHz band and 50MHz + 50MHz in the 38GHz band).

2GHz PCS spectrum licensees can have a high expectation of renewal at the end of the initial ten-year term, conditional on no serious licence breach having occurred, and subject to no fundamental reallocation of spectrum for new services or overriding policy need arising.[41] However, "*[t]he assignment of a frequency or frequencies to a holder of a radio authorization does not confer a monopoly on the use of the frequency or frequencies, nor shall a radio authorization be construed as conferring any right of continuing tenure in respect of the frequency or frequencies*."[42] Industry Canada's Spectrum Policy provides for a "reasonable" notification period, yet for spectrum users to relocate at their own cost. Specifically, "*[t]here is no liability or responsibility or intent by the Department to financially compensate spectrum users being displaced*."[43]

Proposed licence transfers must be notified in writing to Industry Canada. Upon transfer the licence retains its original term to expiry and conditions of renewal. The licence buyer must meet the eligibility criteria. For each proposed transfer of this licence, the licensee must provide a written notification to the Department. The duration of 'new' licences is that time remaining on the original licence.

5.5 Interference management

Bilateral co-ordination with the USA takes two forms:

41 Industry Canada (2001),

42 Canadian Radio Regulations.

43 Industry Canada (2002).

- 'Block and zone', whereby for (typically) 120km on either side of the border, spectrum blocks are allocated for exclusive use of each country. Spectrum is typically shared equally between the two countries except for where determined by significant differences in population density on one side.

- Power flux density (PFD) limit at the border.

The relevant agencies (FCC and Industry Canada) oversee the resolution of any disputes arising between operators at the border.

Domestic co-ordination of radio station frequencies is the responsibility of the applicant with parties or agencies operating existing and proposed terrestrial radio facilities. For satellite earth stations, the co-ordination area around the earth station is determined by ITU Radio Regulations. The procedures for international co-ordination between stations in the fixed service are established by bilateral agreements. For co-ordination between a station in the fixed service and a station in the space radio communication service, ITU Radio Regulations apply. Criteria for co-ordination are specified in the Terrestrial Radiocommunication Agreements and Arrangements (TRAA). Notwithstanding the need to consult with the TRAA, generally, for frequencies under 18GHz, the co-ordination distance is 120km from the US border; for frequencies over 18GHz, the co-ordination distance is 60km from the US border.

Licence holders must comply with the technical requirements set forth in Standard Radio System Plan 510 (SRSP-510) – which provides information on channelling plans, out-of-block emission limits, permissible EIRPs (effective isotropic radiated power) and antenna heights. PCS operators must adhere to the Technical Requirements for Personal Communications Services in the Bands 1850–1910MHz and 1930–1990MHz, and must deploy equipment certified under Radio Standards Specification 133 (RSS-133), which sets out standards for transmitters and receivers for PCS in the 2GHz band.

5.6 Competition issues

Competition concerns in spectrum licence transfers would fall under the Competition Act.

The auction of 2300MHz and 3500MHz spectrum licences scheduled for spring 2004 include a provision for introducing spectrum caps in the following circumstances:

- "*a bidder that acquires a significant amount of spectrum would not face effective competition from providers of services that use infrastructure other than the spectrum being auctioned; and*
- "*the anti-competitive effects arising from the acquisition of a significant amount of spectrum by a single bidder would not be offset by lower costs or higher valued services resulting from holding this amount of spectrum.*"[44]

5.7 Mechanisms to enable trading

While trading is permitted, no structured trading mechanisms appear to exist.

5.8 Publication of information

A publicly accessible database of spectrum holdings is accessible via Industry Canada's Spectrum Direct website. A searchable tool of Industry Canada's Assignment and Licensing System (ALS) database is available. The ALS database contains technical, administrative and financial data pertaining to all radio licences in Canada.[45]

5.9 Trading volumes

No trading appears to have taken place to date.

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44 Industry Canada (2003).

45 At http://sd.ic.gc.ca/engdoc/main.jsp

5.10 Concluding remarks

Licences appear to be transferable only within certain spectrum bands. Thus it seems there is very little flexibility of usage, and little scope for market forces to allocate spectrum according to who actually values it the most. Additionally, only recently auctioned licences are transferable.

Annex B: Preliminary hearing with European SMAs: analysis of results

Contents

1 Introduction

This annex forms part of the *Study on Conditions and Options in Introducing Secondary Trading of Radio Spectrum in the European Community*, written for the European Commission by Analysys Consulting Ltd, DotEcon Ltd, and Hogan & Hartson LLP.

At the start of this study, during October 2003, an extensive piece of primary research was carried out to obtain an initial insight into the views of regulatory spectrum authorities on spectrum trading and related issues. We approached the spectrum management authority (SMA) – either the national regulatory authority (NRA) or the Ministry responsible for spectrum management – in all 28 EEA countries.[46] Five of these countries[47] declined to participate in the study, and thus the total number of countries included in this research is 23, as listed in Exhibit 1.1 below. Throughout this annex, these 23 countries are referred to as the 'countries studied'.

Austria	Italy
Belgium	Liechtenstein
Cyprus	Luxembourg
Czech Republic	Malta
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Iceland	UK
Ireland	

***Exhibit 1.1**: The 23 European countries participating in the preliminary hearing*

46 The European Economic Area (EEA) includes all EU Member States plus Norway, Iceland and Liechtenstein. Prior to 1 May 2004 there were 15 EU Member States: Austria, Belgium, Denmark, Finland, France, Greece, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom. A further ten countries (the 'Acceding Countries') joined the EU on 1 May 2004: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic and Slovenia. For a detailed explanation, see http://europa.eu.int/comm/enlargement/index.htm.

47 Estonia, Latvia, Lithuania, Poland and the Slovak Republic.

Chapters 2 to 6 of this annex summarise in tabular form the results of this interview programme (the 'preliminary hearing'). The situation in each country, and the policies and views of the authorities, are described under a number of headings. These topic areas, which reflect the structure of the interview questions, are as follows:

General	• Responsibilities of the national spectrum authorities • Public availability of information on spectrum ownership
Nature and duration of licences	• Service and technology dependence • Duration of licences
Mechanisms, objectives and trends in spectrum assignment	• Primary assignment and pricing mechanisms • Policy objectives • Trends in approaches to spectrum assignment
Status of spectrum trading	• Legal status of spectrum trading • Extent of licence transfers and changes of use • Developments in spectrum trading
Need for harmonised approach and EC role	• Need for a harmonised approach to trading • EC role in such an approach

A separate annex to the report, Annex E, contains detailed write-ups of all the interviews, information on the individuals that participated and the interview script used.

2 Authorities responsible for spectrum and availability of information on spectrum ownership

2.1 Responsibilities of the national spectrum authorities

Which regulatory authorities are responsible for what aspect of spectrum management varies somewhat between the countries studied. Three main spectrum management tasks have been identified:

- *policy making*: defining legislation regarding radio spectrum management
- *licensing*: assigning licences to spectrum users
- *enforcement*: monitoring adherence to licence conditions and ensuring no harmful interference results.

Exhibit 2.1 below indicates the authority that has the *main* responsibility for each of these spectrum-management tasks.

	Policy making	*Licensing*	*Enforcement*
Austria	Ministry of Transport and Innovation Technology	Regulator TCC Broadcasting: KommAustria Support: RTR	Regulator TCC Broadcasting: KommAustria Support: RTR
Belgium	Ministry of Telecommunications Regulator BIPT Broadcasting: the three Communities.	Regulator BIPT Broadcasting: the three Communities.	Regulator BIPT Broadcasting: the three Communities.
Cyprus	Ministry of Communications and Works	Regulator: OCTPR Broadcasting: Radio and Television Authority	Regulator: OCTPR
Czech Republic	Ministry	Regulator: CTO Broadcasting: Council for Broadcasting	Regulator: CTO
Denmark	Ministry of Science, Technology and Innovation	Regulator NTA Broadcasting: Ministry of Culture	Regulator NTA
Finland	Ministry of Transport and Communications	Regulator FICORA	Regulator FICORA
France	Ministry - DIGITIP Input from ANFR	Regulator ART Broadcasting: CSA	Regulator: ART Broadcasting: CFA
Germany	Ministry of Economics and Labour	Regulator RegTP	Regulator RegTP
Greece	Ministry of Transport and Communication	Regulator EETT Broadcasting: Ministry of News, Council of Broadcasting	Regulator EETT Broadcasting: Council of Broadcasting
Hungary	Ministry of Informatics and Communications	Regulator: CAH	Regulator: CAH
Iceland	Ministry of Transport and Communications	Regulator PTA	Regulator PTA
Ireland	Ministry for Communications, Marine and Natural Resources	Regulator: ComReg Broadcasting: Broadcasting Commission of Ireland	Regulator: ComReg
Italy	Ministry of Communications	Regulator Agcom	Regulator Agcom
Liechtenstein	Office for Communications	Office for Communications	Office for Communications
Luxembourg	Ministry of Communications	Regulator ILR Broadcasting: independent Commission	Regulator ILR

	Policy making	*Licensing*	*Enforcement*
Malta	Ministry of Transport and Communications	Regulator: MCA Broadcasting: Broadcasting Authority	Regulator: MCA
Netherlands	Ministry of Economic Affairs Broadcasting: Ministry of Culture	Ministry of Economic Affairs – Agentschap Telecom Broadcasting: Commission for Media	Ministry of Economic Affairs – Agentschap Telecom
Norway	Ministry of Transport and Communications	Regulator NPT Broadcasting: Ministry of Cultural and Church Affairs	Regulator NPT
Portugal	Ministry of Economy Regulator ANACOM	Regulator ANACOM	Regulator ANACOM
Slovenia	Ministry of Information Society	Regulator: ATRP	Regulator: ATRP
Spain	Ministry of Science and Technology	Ministry of Science and Technology	Ministry of Science and Technology
Sweden	Ministry of Trade	Regulator PTS Broadcasting: RTVV	Regulator PTS Broadcasting: RTVV
UK	Regulator Ofcom	Regulator Ofcom Broadcasting: ITC and Radio Authority	Regulator Ofcom

Exhibit 2.1: *Authority with main responsibility for each spectrum-management task*

In most countries, the Ministry focuses on policy making, whereas independent regulators are responsible for licensing and enforcement of spectrum rights. In some countries, such as Spain and the Netherlands, the Ministry has a more important role in the management of spectrum, whereas in others, such as Belgium and the UK, the independent regulator claims a larger role.

The management of broadcasting frequencies is usually complicated by the involvement of another Ministry or regulator which has an input into the licensing process by defining additional restrictions on licensees in terms of broadcast content. In over half of all countries studied, an independent authority or commission is formed just for this purpose.

Government-owned spectrum is usually managed by the respective Ministries. For example, the Ministry of Defence manages the spectrum it obtains for national security.

2.2 Public availability of information on spectrum ownership

If a secondary market for spectrum trading were to be implemented, it would be beneficial to have a public register specifying not only the allocations of frequencies (i.e. what *uses* are allocated to a spectrum band) but also their assignment (i.e. what *users* are assigned to a spectrum bands). All countries studied publish an electronic national allocation table – but do they also publish information on the actual owners of different spectrum bands, i.e. a national assignment table? The situation is summarised in Exhibit 2.2 below.

	Availability of a national assignment table
Austria	Limited information is publicly available; RTR publishes information on mobile and broadcasting licences.
Belgium	Limited information publicly available on the public mobile licensees.
Cyprus	No assignment register is publicly available
Czech Republic	No assignment register is publicly available Information on vacant bands is published at the regulator's website
Denmark	Complete information on frequency allocation and licences has been published since 1997/98
Finland	Information on assignments in only available upon request
France	Limited information is publicly available; ART publishes licensee's details in the telecom spectrum.
Germany	Limited information is publicly available; mobile licences (GSM, UMTS) are publicly available.
Greece	Information on assignments in only available upon request
Hungary	Information is available upon request only for licences assigned by FCFS. Available information includes: the licensee, frequencies assigned, details of the base stations and the power level
Iceland	No assignment register is publicly available
Ireland	Limited information is publicly available; information on mobile licences (GSM, UMTS) is online available.
Italy	Limited information is publicly available; information on mobile and WLL licences are available
Liechtenstein	There is no public information on spectrum licences
Luxembourg	No assignment register is publicly available
Malta	No assignment register is publicly available

	Availability of a national assignment table
Netherlands	Limited information is publicly available; mobile licences (GSM).
	Information on assignments in only available upon request
Norway	Information on assignments in only available upon request
Portugal	Regulator publishes online database containing all licences and registrations of telecom operators and service providers.
	Annual publication on the effective use of spectrum and spectrum availability will be published for the following year.
Slovenia	No assignment register is publicly available
Spain	Limited information is publicly available; licences assigned by contest (no details of the individual sub-bands)
	Information on assignments in only available upon request
Sweden	Information on assignments in only available upon request
UK	Information on assignments in only available upon request

***Exhibit 2.2**: Public availability of a national assignment table*

There is only one country – Denmark – that has a complete register of assigned licences available online (see www.itst.dk). Since 1997, the regulator has been required to maintain a public register of frequencies and their licensed holders. The purpose of this provision is to give users of spectrum as much information as possible about the use of the frequencies.

Most other countries only make information on assignments available upon request, while some (such as GSM and UMTS) are publicly known due to the nature of the assignment.

Almost a third of all interviewed countries have plans to publish an online assignment database, as shown in Exhibit 2.3.

	Plans to publish an online frequency assignment database
Cyprus	Plans to make a licence registry available by the end of 2003, which will keep a record of all licence details – including individual licences and equipment licences
Finland	Plans to include all assignments in the frequency allocation table in the future – as this would be easier for customers and other interested parties
Ireland	Plans to put all the information on spectrum licences online in the future
Luxembourg	It is foreseen in the new regulatory framework that the regulator will be in charge of a register of 'who operates which frequencies', which will be publicly available
Netherlands	Thinking about setting up an assignment register, as it may be desirable if the market were to move to a property rights regime
Norway	The Norwegian regulator is in the process of upgrading its information system into a web-based system with an overview of spectrum assignments. This system will be available next year
Sweden	Information might go online and spectrum users might be able to apply for licences online in the future

Exhibit 2.3: *Plans to publish an online frequency assignment database*

3 Nature and duration of licences

3.1 Service and technology dependence

Spectrum rights can be service dependent – meaning that within the terms of the licence it is determined what service should be provided by the licensee. Rights may also be technology dependent – meaning that the terms of the licence specify what technology should be used to provide a service with that licence. Exhibit 3.1 below indicates to what extent countries assign service dependent and technology dependent licences.

	Service dependence	*Technology dependence*
Austria	The majority of licences are service dependent	The majority of licences are technology neutral (apart from the GSM licences)
Belgium	The majority of licences are service dependent	Licences are moving to technology neutral
Cyprus	The majority of licences are service dependent	Licences are generally technology neutral
Czech Republic	The majority of licences are service dependent	Licences are generally technology neutral
Denmark	The majority of licences are service dependent	Licences are generally technically neutral
Finland	The majority of licences are service dependent	The majority of licences are technology neutral (apart from the GSM licences)
France	The majority of licences are service dependent	Technology is specified in the licence and change requires authorisation
Germany	The majority of licences are service dependent	The majority of licences are technology neutral (apart from the GSM licences)
Greece	The majority of licences are service dependent	The majority of licences are technology neutral (unless in specific cases)

	Service dependence	*Technology dependence*
Hungary	The majority of licences are service dependent	Licences are either technology neutral (fixed link digital system) or dependent (broadcasting, 3G)
Iceland	The majority of licences are service dependent	Licences are technology dependent
Ireland	The majority of licences are service dependent	Licences aim to be technology neutral Only one 3G licence was technology dependent (had to use UMTS)
Italy	The majority of licences are service dependent	Licences are generally technology neutral
Luxembourg	The majority of licences are service dependent	The majority of licences are technology neutral (apart from the GSM licences and one of the UMTS licences)
Malta	The majority of licences are service dependent	Licences are either technology neutral (mobile licences) or dependent (radio licences)
Netherlands	The Ministry is striving to make licences more service independent in the near future	Licences are moving to technology neutral
Norway		Generally technology dependent, but licences are moving to technology neutral
Portugal	The majority of licences are service dependent	Licences are generally technology neutral to promote innovation
Slovenia	The majority of licences are service dependent	Licences are generally technology neutral
Spain	The majority of licences are service dependent	Licences are increasingly technology neutral
Sweden	PTS is striving to make licences more service independent in the near future	Generally technology dependent, but licences are moving to technology neutral
UK	The majority of licences are service dependent	Licences are generally technology dependent

Exhibit 3.1: *Service dependence and technology dependence of licences*

As can be seen, licences are generally service dependent, although some countries like the Netherlands and Sweden have indicated they want to move to more service independent licences as the national allocation plan leaves room for licences with more flexible conditions.

The majority of countries studied also claim to have technology independent licences, or are actively working to move towards more technology neutral licences. Some countries that are studying the issue of technology neutrality, find that the principle of neutrality is not yet well defined (such as Spain) or that it will never be possible to be 100% technology neutral (Norway). The Norwegian regulator, for example, was surprised to find that technology neutral licences overseas[48] are actually a lot *more* complicated (including more sophisticated technical requirements) – which seems to be in direct contrast to the intention of technological neutrality.

A noticeable exception is GSM licences, which were technology dependent.

Some countries, like Iceland and France, have technology dependent licences as the technology is described in the licence and change is not possible. Hungary and Malta also have technology licences in certain broadcasting bands.

3.2 Duration of licences

Exhibit 3.2 below gives a summary of the duration of typical licences in the countries studied.

Austria	Duration of mobile licences is about 15-20 years
Belgium	Duration of licences varies depending on the spectrum band: PMR until the licences are revoked, GSM 15 years, UMTS 20 years, PAMR not defined, broadcasting varies.
Cyprus	The duration of licences depends on the assignment mechanism: typically 20 years for licences awarded by auction and one year for other licences.
Czech Republic	Licences typically last for 20 years (GSM, UMTS and FWA) For broadcasting licences, the duration is decided upon by the Council for Broadcasting
Denmark	The typical duration of licences varies: FCFS: 5 years, 3G: 20 years, both GSM and FWA: 10 years
Finland	Duration of licences is usually 20 years. PMR licences are typically 5-6 years and renewable after this period.
France	Duration of licences cannot exceed 15 years, though as an exception, the duration of the 3G licences are 20 years. Most licences are in between 10-15 years.

48 Based on its studies of the definition of technology neutral licences in New Zealand and Australia.

Germany	Duration of licences is about 15-20 years, depending on the size of the market, the technology, the market demand and the infrastructure investment involved. UMTS and GSM licences last for 20 years. PAMR licences last for either 10 or 15 years.
Greece	Duration of 3G and GSM licences are 15 years, whereas that for PMR are 3 years
Hungary	The duration of licences depends on the assignment mechanism: FCFS: 5 years, Auction: 15 years with a concessionary renewal period of 7.5 years, Broadcasting: 10 years with a renewal period of 5 years
Iceland	10 years for telecommunications licences and 8 years for broadcasting licences
Ireland	The duration of 3G licences is 20 years and 15 years for the GSM licences
Italy	20 years for all licences
Luxembourg	The duration of telecom licences is 15 years on average. 10 years for local broadcasting, and 20 years for national broadcasting
Malta	The duration of licences is typically 10 years
Netherlands	Duration of GSM and UMTS licence is 15 years. Duration of PMR licence is 5 years, 10 years Public PAMR systems (shared use). FWA licences are fixed 12 years (3.5 GHz band) or 4 years (2.6 GHz band). Commercial radio licences are fixed 8 years.
Norway	Usually 15 years. PMR licences are renewable annually subject to payment of fees.
Portugal	The duration of licences is typically 15 years
Slovenia	The duration of licences is typically 10 years
Spain	Licences awarded through beauty contest usually last for 20 years. Self-provision licences last for 5 years (Authorisations)
Sweden	The principle is to allow cost coverage and profit making for the company. UMTS: 15 yrs, GSM: 10 – 15 yrs
UK	Duration of GSM and UMTS licences is 20 years. PMR licences are renewable annually subject to payment of fees. Digital TV licences are awarded for a 12 year period.

Exhibit 3.2: *Duration of telecoms and broadcasting licences*

The duration of licences varies depending on the services that are offered through them:

- Most countries assign their *GSM and UMTS* licences with a fixed duration of 15 or 20 years – with some 10 year GSM licences in Denmark, Iceland and Sweden.
- Licences assigned by *FCFS* generally have a shorter duration: 5 years in Denmark, Hungary and Spain or one year in Cyprus.

- *Broadcasting* licences also vary in duration, with 8 years in Iceland, 10 years in Hungary, 12 years in the UK for digital TV, and up to 20 years for national broadcasters in Luxembourg.
- *PMR* licences tend to be 5 years on average, though in some countries (such as Norway and the UK) they are renewable annually.

4 Mechanisms, objectives and trends in spectrum assignment

4.1 Primary assignment and pricing mechanisms

In spectrum bands where there is no scarcity, all countries studied apply the first-come-first-served (FCFS) principle. In assigning more scarce spectrum, where demand exceeds supply, the two main mechanisms used are beauty contests and auctions. Exhibit 4.1 below shows the primary assignment mechanisms used in the countries studied.

Three types of mechanism for pricing spectrum have been distinguished:

- *free of charge*
- *administrative fees* – aimed to recover the costs of the assignment process
- *market-value fees* – aimed to reflect the market value of the spectrum.

The pricing mechanisms used in the countries studied are shown in Exhibit 4.2 below. Fees resulting from auctions obviously reflect a market-based value, and therefore the Exhibit only shows the mechanism used for beauty contests and FCFS – i.e. assignments whereby the spectrum authority determined the licence fee.

In addition to the above-mentioned fees, all the countries studied charge an annual administrative fee to recover the cost of the operation of the spectrum management authorities. This annual fee is not mentioned in the tables below.

	Primary assignment mechanism	*Pricing mechanism*
Austria	Beauty contest: broadcasting spectrum	Administrative fee for FCFS
	Auction: mobile spectrum	Free of charge for beauty contest
Belgium	Beauty contest: GSM, GSM 1800 and BFWA	Market-value fee for beauty contest
	Auction: UMTS	
Cyprus	Beauty contest: broadcasting	Administrative fee
	Auction: GSM, UMTS	
	Also used: negotiation procedures	
Czech Republic	Beauty contest: used prior to UMTS	Administrative fee
	Auction: UMTS	
Denmark	Beauty contest: GSM and FWA	Free of charge for FCFS
	Auction: 3G	Administrative fee for beauty contest
Finland	Beauty contest only	Administrative fee
France	Beauty contests only	Market-value fee
Germany	Beauty contests: PAMR, GSM, Paging, TFTS and WLL	Administrative fee
	Auction (preferred): paging, GSM and UMTS	
Greece	Auction: FWA, GSM, UMTS	Market-value fee for FCFS
Hungary	Auction: generally used	Market-value fee as well as administrative fee
	Mixture of auction and beauty contest: GSM	
Iceland	Beauty contest only	Administrative fee
Ireland	Beauty contest: FWA, 3G, GSM, broadcasting	Market-value fee
Italy	Beauty contest: broadcasting spectrum	Administrative fee
	Auctions: 3G	
Liechtenstein	FCFS and 'Consultation'	Market-value fee
Luxembourg	Beauty contest: GSM and 3G	Market value fee plus administrative fees
Malta	Beauty contest (once)	Market-value fee (annual fee based on the market value of the spectrum plus 2% of the revenue)
Netherlands	Auctions (preferred): UMTS, GSM and WLL	Market value fee
	Beauty contests: GSM and commercial radio	

	Primary assignment mechanism	*Pricing mechanism*
Norway	Beauty contest: broadcasting and public cellular Auction Other mechanisms that are hybrids between FCFS and auctions	Administrative fee for FCFS Market-value fee for beauty contest
Portugal	Beauty contest: BFWA, FWA, GSM, UMTS, paging and DECT	Administrative fees as well as market-based fee for some licences (UMTS).
Slovenia	Auction: 3G (only 1 bidder) Beauty contest: broadcasting and all previous assignments	Administrative fee Market-value fee for UMTS
Spain	Beauty contest only	Administrative fee
Sweden	Beauty contests: UMTS, GSM, FWA, broadcasting Auction: local commercial radio licences	Free of charge for FCFS Administrative fee for beauty contest
UK	Auction: 3.4 GHz FWA, 28 GHz Broadband, UMTS Beauty contest: broadcasting	Digital TV: no payment for first term of licence period, percentage of revenue could be payable for second term of the licence period

Exhibit 4.1: *Primary assignment mechanism and pricing mechanism used*

As many as eight countries – Finland, France, Iceland, Ireland, Luxembourg, Malta, Portugal and Spain – have thus far only used beauty contests. Just over half of the countries have experience with both beauty contests and auctions as primary assignment mechanisms. Auction is the more recent mechanism: four countries have used it for the first time for assigning 3G licences.

Often, auction is specified in national legislation as the preferred mechanism for assigning spectrum rights for telecommunications services, whereas beauty contests are preferred for broadcasting assignments. Sweden auctioned its commercial radio licences but moved back to beauty contests after a negative experience (although auctions are allowed as an assignment tool according to the new national framework).

The majority of countries charge administrative fees – based on cost-recovery principles – for the assignment of spectrum rights via FCFS or beauty contest. Half of the countries studied (including Belgium, France, Greece, Hungary, Ireland, Luxembourg, Malta, the Netherlands, Norway, Portugal and Slovenia) have introduced pricing mechanisms which

aim to reflect the true market value of spectrum – although some of these have so far only used a market-value fee for UMTS licences. Some countries, like Denmark and Sweden, assign licences free of charge on a FCFS basis. The recent increase in the use of auctions of course implies that fees for spectrum rights are becoming increasingly market-based.

4.2 Policy objectives

Regulators may have a variety of objectives in choosing a certain primary assignment mechanism. The objectives for auctions and beauty contests vary, as shows in Exhibit 4.2 below.

Austria	Beauty contest: diversity of opinions (i.e. broadcast content) and efficient use of spectrum
	Auction: economic efficiency and efficient use of spectrum
Belgium	Beauty contest: choose the best operator to offer the best network and services
	Auction: generate as much revenue as possible
Cyprus	Auction: efficient use of spectrum
	Administrative fees: cost recovery calculations should be done in a simple way and should reflect the cost of managing the spectrum
Czech Republic	Principles of transparency, efficiency and non exclusivity as set down by legislation
Denmark	No guidelines
Finland	Beauty contest: ensure the licence fee is as low as possible.
France	Beauty contest: efficient management of spectrum, based on scarcity, and efficient competition. Also, geographical coverage, national security and protection against interference
Germany	Auction: transparent, objective and non-discriminative. The highest bidder has the best reason to go to market and be successful.
	Beauty contest: when auctions are inappropriate
Greece	Auction: efficient use of spectrum, transparency, speed of assignment process
Hungary	Ensure supply of secure communications services of good quality and price to the consumers • Ensure development and protection of the communications market • Secure competition • Ensure efficient interoperation between the communications networks
Iceland	Beauty contest: spectrum prices should not be a tax
Ireland	Beauty contest: guarantee the quality of service provided – to ensure there is adequate rollout of coverage network, and general quality of service.

Italy	Primary objectives: maintain spectrum efficiency and transfer maximum benefits to citizens
	Beauty contest: select the best candidate to fulfil coverage obligations
Liechtenstein	Objectives are both economical and political
Luxembourg	Auction: tool for deciding between licensees in spectrum for private communication systems
	Beauty contest: preferred as they do not result in high licence fees, which have to be paid by consumers eventually
Malta	Beauty contest: one assignment has taken place with market liberalisation
Netherlands	Auction: select the most efficient parties so that spectrum is used efficiently
	Beauty contest: additional cultural goals
Norway	Beauty contests: coverage, quality of service
	Auctions: efficient use of the spectrum, promote competition, reduce the administrative burden
Portugal	Beauty contest: based on consideration of spectrum scarcity, effective and real market competition on the relevant markets, effective and efficient use of the frequencies
Slovenia	Assign spectrum through public tender when it is deemed scarce. For broadcasting spectrum, only beauty contests are allowed – for mobile public communications both auction or beauty contest can be used.
Spain	Beauty contest: seek infrastructure competition and social welfare
Sweden	Beauty contest: effective use of the spectrum, allow as many people to use spectrum as possible without interference. Geographical coverage is the main driver behind beauty contests
UK	Auction: secure optimal use of the spectrum

Exhibit 4.2: *Objectives in using auctions and beauty contests*

Beauty contests are often chosen for their ability to keep prices for spectrum rights low – as spectrum authorities do not want to impose too high a tax on these licensees. Another major reason relates to the authorities' ability to 'choose the best operator' and in this way guarantee a quality of service – especially with an eye on geographical coverage obligations. For broadcasting spectrum, a beauty contest also enables the regulator to guarantee a diversity of broadcast content.

Policy objectives behind auctions all focus on the efficient use of spectrum, with some authorities also mentioning revenue maximisation and the transparency and speed of the assignment process.

4.3 Trends in approaches to spectrum assignment

Spectrum authorities were asked about trends they expected to see in the use of primary assignment mechanisms. Their views are summarised in Exhibit 4.3 below (note that these are expectations only, and do not represent certain future decisions on the part of the authorities).

Austria	Auction is the preferred mechanism for all scarce frequencies. Beauty contest for broadcasting.
Belgium	Not decided
Cyprus	Not decided
Czech Republic	There is no preferred primary assignment mechanism for the future
Denmark	Tools that are more market-based will be employed in the future. Auction is likely to be used next time
Finland	Auctions are not being considered as a future assignment mechanism.
France	There is no preference between beauty contest and auction. Although auction has never been used before, the new law introduces it as a tool.
Germany	Auction is the preferred assignment mechanism.
Greece	Auction will continue to be used as the primary assignment mechanism
Hungary	There is no specific future preference for assignment and pricing mechanisms
Iceland	Beauty contest will continued to be used as the primary assignment mechanism
Ireland	There is no preference for the future assignment mechanism – both beauty contests and auctions could be used
Italy	Auction will be used for the assignment of telecommunications spectrum. No mechanism is chosen for the broadcasting spectrum
Liechtenstein	No changes are planned for the near future for the assignment and pricing mechanism
Luxembourg	Beauty contests are preferred given the high licence fees that may result from auctions
Malta	Future primary assignment mechanism is not decided yet
Netherlands	Auctions are the preferred assignment mechanism for scarce frequencies – no preference has been defined for broadcasting spectrum. Hybrid forms may be used in future.
Norway	Future objective is to use tools which are market-based and based on economic theory. Beauty contests will stay as they make it easier to achieve political goals.
Portugal	Still under discussion

Slovenia	Not decided
Spain	Move toward more market-driven mechanism – auctions can improve the objectivity and transparency of the licensing process. Auctions are not considered suitable for the broadcasting service bands.
Sweden	Undecided – the new national law allows auction as a tool, though it has not yet been tried.
UK	A more market-orientated approach will be the future preference

Exhibit 4.3: *Expected trends in the primary assignment mechanisms used*

There is a general trend towards more market-based assignment mechanisms. Over half of the regulatory authorities confirmed they are planning to use auctions as the preferred assignment mechanism. However, another large group of countries (including most of the Acceding Countries, as well as Belgium, France, Ireland and Sweden), have not defined a preferred assignment mechanism for the future and may use either beauty contests or auctions, or both. Iceland, Finland and Luxembourg continue to prefer beauty contests and do not plan to increasingly use auctions for assignments.

This picture looks different for broadcasting frequencies. Even those countries that plan to use more market-based mechanisms, are either weary about using auctions for broadcasting (Austria, Norway, Spain) – or are undecided as to the mechanism preferred for broadcasting spectrum (Italy, Netherlands).

5 Status of spectrum trading

5.1 Legal status of spectrum trading

Exhibit 5.1 below summarises the legal status of spectrum trading in the countries studied. the table indicates whether the new EC Directive has already been incorporated into national legislation – and if so, whether this legislation allows for the possibility of a secondary spectrum market.

	Date of new national legislation	*Spectrum trading allowed?*	*Details*
Austria	August 2003	Yes	
Belgium	Delayed until middle 2004	No	
Cyprus	Expected May 2004	Uncertain	
Czech Republic	Expected May 2004	Yes	The possibility of spectrum trading at some level is envisaged
Denmark	June 2002	No	
Finland	July 2003	No	
France	In the next few months	Yes	Frequency trading is not allowed, but the rights of use are allowed to be traded.
Germany	In 2004	Yes	
Greece	Uncertain – potentially 2004	Depends on consultation	

	Date of new EU framework	*Spectrum trading allowed?*	*Details*
Hungary	Expected November 2003	Yes	Not practised in reality – waiting on outcome of RSPG meeting to decide on introduction of spectrum trading
Iceland	July 2003	No	
Ireland	July 2003	No	
Italy	September 2003	Yes	
Liechtenstein	Expected 2004	No	
Luxembourg	Before the end of 2003	No	
Malta	Expected March 2004	Yes	Details of spectrum trading will be described in subsidiary legislation
Netherlands	Within a few months	Yes	Additional article on spectrum trading to be added soon.
Norway	July 2003	Yes	
Portugal	Expected soon	Yes	
Slovenia	Expected by 2004	No	The possibility of a secondary spectrum market has not been detailed
Spain	October 2003	Yes	Detailed legislation will not be in place until early 2004.
Sweden	July 2003	Yes	
UK	July 2003	Yes	Regulator will draft detailed regulations in 2004.

Exhibit 5.1: *Legal status of spectrum trading*

Seven Member States have not yet implemented the new EU regulatory framework. The same number of countries had already implemented the framework on before its initial deadline of July 2003. The Acceding Countries studied all plan to implement the new EU framework by either March or May 2004.

Almost two-thirds of the countries studied allow for the possibility of spectrum trading in their new national legislation, although as many as seven countries (Belgium, Denmark, Finland, Iceland, Ireland, Luxembourg and Slovenia) have decided not to implement this in their legislation. A number of countries (including Cyprus and Greece) are not sure yet whether spectrum trading will be allowed.

Most countries that do allow spectrum trading are still in the process of drafting more detailed regulation regarding this new market, as well as conducting internal studies on the topic. In general, the following regulatory issues are being considered regarding a secondary spectrum market:

Applicability in specific bands

Some spectrum authorities have already in their national legislation explicitly identified some areas in the spectrum bands where trades can or cannot take place.

- In Austria, trading will only be allowed on spectrum assigned by the regulator TCC. This implies that trading can take place in mobile telecom spectrum bands where licences are auctioned, and in other frequency bands where licences have been auctioned since the passing of the new law. This also implies that trades are not allowed in broadcasting spectrum bands, as the TCC does not assign these.
- In Italy, trading is restricted to bands that are considered scarce by the Ministry and bands that were assigned to a limited number of operators (either through auction or beauty contest).

Approval prior to trade

Many countries (including Austria, France, Germany, Italy, Netherlands, Norway, Portugal and Sweden) have explicitly specified that approval of the Ministry or regulator is needed prior to every trade. The EC framework only requires the Ministry or regulator to be *notified*, either prior to or after a trade has occurred. Some countries, like Germany, expect that although trades need regulatory approval, most trades will not require any intensive involvement on the part of the regulator.

Case-by-case approach

Most countries are not intending to predefine any detailed ruling as to the circumstances under which a trade will or will not be approved. Instead, most trades will be dealt with on a case-by-case basis – meaning that regulators intend to deal with trades as and when they occur (Austria, Germany, Netherlands). Many countries have given some thought already to the criteria they would take into

account when approving a trade. These criteria mainly focus on the effect of the trade on competition and the technical impact (i.e. effect on interference).

Countries that may consider more detailed rulings, such as Spain and the UK, have not yet finalised these rulings.

Type of trade allowed

Some countries have also given thought to the extent to which they allow reconfigurations and change of use. Although current national legislation tends to still be open to different interpretations on the topic, some countries have decided to

- allow reconfigurations (Czech Republic, France, Netherlands and Sweden)
- allow change of use *only* within the national allocation table (Czech Republic, France, Portugal and Sweden)
- do not allow any change of use – although national allocations can be flexible (Austria, Germany).

Size of secondary market

None of the regulatory authorities expected a surge in spectrum trades now that the possibility of a secondary spectrum market has been introduced in their national legislation. Rather, they anticipate a slow growth of trades over the next few years.

5.2 Extent of licence transfers and changes of use

Exhibit 5.2 below indicates to what extent licence transfers and changes of use have already occurred – even though legally no secondary market for spectrum officially existed. This information gives an insight into the potential size of such a secondary market, if transfers and change of use were to be made easier by the implementation of spectrum trading.

	Licence transfers	*Changes of use*
Austria	Licence transfers are only allowed with change of ownership.	Currently change of use is not allowed – requests go to the Ministry
Belgium	Experience with temporary transfers was negative – discontinued	
Cyprus	There have been no requests.	There have been no requests.
Czech Republic	There are on average one to two requests per year due to change of ownership	Change of use outside harmonized allocations set by the ITU is not allowed
Denmark	Licence transfers are only allowed with change of ownership – subject to approval Transfer of licences occurs rarely, usually on an internal basis. Recent transfers include a TETRA licence	Change of use is not allowed. Requests for a change of use involve 'calculations' of effects on interference and compatibility to the national frequency plan.
Finland	Licence transfers are only allowed with change of ownership – subject to approval of the Ministry. Merger of two licensees led to new licence coverage conditions.	Change of use has been allowed although licences are re-assigned (transition from NMT900 to GSM900)
France	Requests for licence transfer only happens very rarely, usually on spectrum assigned by FCFS – regulator deals with these requests. Direct transfer was not possible – licence needs to be re-assigned.	Change of use is usually allowed as long as it is within the frequency allocation table – licence needs to be re-assigned. Most requests are in FCFS bands – in FWA
Germany	Licence transfers are only allowed with change of ownership. Requests from WLL licensees were rejected.	The existing framework does not allow change of use. Requests from WLL licensees were rejected – but in future WLL licensees will be able to change the use for alternative uses, e.g. microwave links.
Greece	Rare transfer of licences: 3 cases in the past few years (FWA and LMDS licences) were requested and granted by regulator.	It is not practice to allow change of use, but regulator is tolerant
Hungary	There has only been one request relating to fixed and PMR services	There have been no requests.
Iceland	Licence transfers are only allowed with change of ownership – subject to approval of the regulator	Change of use within the same radio service is normally approved
Ireland	Request for licence transfer occur only very rarely. Transfers with the change of ownership are generally granted by the regulator. Usually in the PMR bands.	Request have only occurred a couple of times, usually in relations to extending use on the existing licence: FWA services in GSM licence was not granted. Data on top of existing MMDS service is still under discussion

	Licence transfers	*Changes of use*
Italy	Licence transfers are only allowed with change of ownership	Change of use or technology is allowed, judged on case by case basis Change of service is not allowed
Liechtenstein	There have been very few requests for licence transfers (2 in 2003)	There has not been any request for change of use between users
Luxembourg	There are occasional request for transfers, and they are administered by the regulator with the approval from the Ministry. Normally, approval is granted	There have been no requests
Malta	There are on average 100 requests annually for PMR There are on average 1000 requests annually for transfer of equipment in maritime bands	There have been no requests
Netherlands	Several requests have been received and granted by the Ministry: change of ownership, reconfiguration and transfer	Generally not allowed – flexible licence conditions should deal with this
Norway	Transfers already happen on a weekly basis, with the approval of the regulator. Transfers are only refused due to interference issues.	Change of use is allowed in some cases – licences are written to be as open as possible
Portugal	Transfers of licence due to change of ownership happen quite often	There have been no requests
Slovenia	Requests are almost never made. Limited number of transfers due to the change of company, or usage of equipment in analogue FM links	There have been no requests
Spain	Licence transfers are only allowed with change of ownership – subject to administrative approval. All the licence rights and obligations are maintained	Not allowed
Sweden	Licence transfers are only allowed with change of ownership Quite a few requests for transfer were made for radio amateur licences. The licence is first given back to PTS and before it is reissued There has not been much trade since new spectrum legislation – only 2–3 transfers of general fixed links.	The change of use is granted as long as it is within the national allocation plan Change of use occurred very frequently as new technologies emerged in technology-based old licences
UK	Licence transfers are not legal. There are frequent requests (e.g. hundreds each year for PMR) to transfer by re-assignment	

Exhibit 5.2: *Status of licence transfers and changes of use*

► *Licence transfers*

Although licence transfers are not approved in national legislation, most countries allow them in the case of a change of ownership. In most cases, such a transfer of the spectrum right involves approval from either the Ministry or regulator. Generally the licence cannot be directly transferred between spectrum users, but needs to be re-assigned by the Ministry or regulator to the new licence holder.

The reported frequency of such transfer requests varies between countries; in most countries licence transfers occur only rarely (1–3 times per year). Overall, the range of responses is as follows:

- *None at all*: Cyprus
- *Only rarely* (1-3 per year): Czech Republic, Denmark, Finland, France, Greece, Hungary, Ireland and Slovenia
- *Regularly* (4–50 per year): Luxembourg, the Netherlands, Portugal and Sweden
- *Very frequently* (weekly, or up to thousands per year): Malta, Norway and the UK.

Bands in which licence transfers are requested vary as well, although most requests for change of use come from licences in PMR bands (Denmark, Hungary, Ireland, Norway and the UK), from FWA licences (Germany, Greece and Norway), or from fixed link licences (Hungary, Norway and Sweden).

► *Change of use*

Change of use is not allowed in half of the countries studied – although some countries, like Greece, claim to be tolerant, whereas others, like the Netherlands, claim to have flexible licence conditions making change of use unnecessary. The other half of the countries allow change of use within certain conditions. In general, the change of use should be compatible with the national allocation table (or stay within the same service definition), should not cause any interference issues, and the licence has to be re-assigned by either the Ministry or the regulator.

Overall, requests for change of use were reported to be either non-existent or rare, except for Sweden, which reported receiving frequent requests as new technologies emerge and licensees with licences based on old technologies want to innovate.

In France, Germany and Ireland, there were requests for change of use in the FWA band. Germany plans to allow future requests from FWA licensees to change their licences to cover alternative uses, such as microwave links. Ireland did not grant a request for providing FWA services in a GSM band.

5.3 Developments in spectrum trading

5.3.1 Benefits and concerns regarding spectrum trading

Exhibit 5.3 below summarises the benefits and concerns that spectrum regulators associate with the implementation of spectrum trading.

	Benefits	*Concerns*
Austria	Economic efficiency	Fragmentation – impact on interference
	Efficient use of spectrum (optimal capacity utilisation)	Negative impact on competition
	A more effective competition environment	Less efficiency from harmonised use – risk of cross-border interference.
	Encourages the introduction of innovative services	Lack of a common technology platform - hindrance in the rapid development of technology
Belgium	Reduction of administrative workload	Loss of control
		Reduces efficiency of usage
		Creates unfair competition
		Windfall gains
		Interference
		International obligations
		Government's public objectives
Cyprus	Greater spectrum efficiency	Potential negative impact on competition (hoarding)
	Mechanism for market to adjust itself (flexibility)	Interference (not major)
		Loss of revenue for the government

	Benefits	*Concerns*
Czech Republic	Not yet considered	Not yet considered
Denmark	Greater flexibility in spectrum management Better evaluation of the licensee's asset value	Hoarding – effect on competition, Interference – depends on type of spectrum trading implemented Price for access to spectrum will increase for some bands.
Finland	Possibly more efficient use of spectrum	Difficulties in international harmonisation Difficulties in fair treatment of operators May lead to competition issues Might deter foreign investment as licences would be more expensive
France	Additional tool for spectrum management More flexible framework Allows spectrum to be used more efficiently Gives the public authority information on the economic value of the spectrum	Interference – necessary to follow the international allocation table in order to achieve harmonisation Competition issues Windfall gain – although trading will give good information on pricing The resulting market transparency and access might create an entry barrier
Germany	More flexibility in the market More appropriate mechanism to meet market demand	Complex procedures involved when the transfer has competition implications Interference is only a concern when technical parameters change
Greece	Increased competition More optimised use of spectrum	Quality of service due to transfer of specific licence obligations Interference issues, resulting in a general quality problems
Hungary	Greater flexibility for businesses More efficient spectrum use	Quality of service may not be guaranteed Financial concerns
Iceland	Not yet considered	Not yet considered
Ireland	Efficient process for spectrum assignment in a reasonable timeframe and at a reasonable cost Facilitates technology change – encourages introduction of new technology	Lack of clear definition and objectives of allowing spectrum trading Hoarding of spectrum Obligations (roll-out and coverage) may not be transferred with spectrum rights Increased difficulties in international co-ordination (esp. with change of use)
Italy	Better valuation of spectrum Greater efficiency	Extra burden for Ministry and regulator to keep track of the trades Hoarding – can be dealt with by the Ministry during the authorisation stage

	Benefits	*Concerns*
Liechtenstein		National requirements may not be considered adequately, or at all Loss of regulatory influence Issues regarding how to handle different national radiation limits
Luxembourg	Operators will be able to value spectrum licences Greater legal certainty as to the possibility of transferring spectrum assets	Potentially hoarding of spectrum may have adverse effect on competition Interference might be a problem if reconfiguration is allowed
Malta	More efficient spectrum management Reduced administrative problems	Adverse effect on competition (hoarding) Transfer of obligation may not follow from the transfer of rights
Netherlands	A logical tool for the process of making spectrum management more flexible. Speedy correction mechanisms Enables new technological developments and economic market developments.	Hoarding – though competition law will deal with this Consequences for primary assignment mechanisms: auction design Interference – reconfigured licences may pose a problem
Norway	A tool to improve efficiency The authority would not be involved in the refarming of spectrum	The handling and administration of information on spectrum trading The effect of harmonisation on technology mobility Extensive and costly negotiations in bands with large number of licences
Portugal	Under discussion	Under discussion
Slovenia	Not yet considered	Not yet considered
Spain	Spectrum refarming Removal of the rigidities associated with assignments from contests	Risk of spectrum hoarding which may distort competition Windfall gains
Sweden	More efficient use of spectrum Handling of licences placed with the owner of the licences Barrier to market entry lowered Market value assigned to licence Drive new technology	Interference and risk of fragmentation Possibly hoarding
UK	Better spectrum management Better support for innovation and entrepreneurs. Better and faster decisions made by those with better information	Detailed trading rules Interference Anti competitive outcomes

Exhibit 5.3: *Perceived benefits and concerns regarding spectrum trading*

► *Main perceived benefits*

The main benefits of introducing spectrum trading identified by the spectrum authorities are the following (in order of importance, with at least three countries per benefit):

- More efficient use of spectrum.
- More flexibility in spectrum management, removal of rigidities in primary assignments.
- Ability to evaluate spectrum licences, and gain knowledge of market value of spectrum.
- Encourages innovation, enabling new technologies and market developments.
- Speedier process, with better and faster decision-making by those with information.
- Increases competition and reduces barriers to market entry.
- Reduces administrative workload.

► *Main concerns*

The main concerns voiced by the spectrum authorities are listed below (in order of importance, with at least three countries per concern). They focussed mainly on competition and interference issues, although a range of other topics also emerged in several interviews.

- Negative effect on competition, hoarding of licences – although many authorities believe this can be dealt with through prior approval of trades and spectrum caps.
- Interference issues – although this is only a concern when reconfiguration or change of use is allowed.
- International harmonisation, less efficiency from harmonised use, increased difficulty to co-ordinate internationally (needed to facilitate international roaming).
- Quality of service may not be guaranteed; transfer of obligations (such as roll-out and coverage obligations) may not follow from the transfer of rights.
- Windfall gains – although most authorities, when prompted, indicated they were not worried about any potential gains accruing to spectrum users. It would be impractical to wait with the introduction of trading until all licences had expired: *"So some people make some money. So what?"*
- Loss of control over licensees, a decreased ability to reach the public objectives of the government.

- Fragmentation, lack of a single technology platform, which may hinder technological development.
- Barriers to entry raised through increased access price for spectrum, and decreased transparency of the market.
- Greater burden on the authority to regulate the market.

5.3.2 Scarcity of spectrum, and the most appropriate bands for the introduction of trading

Exhibit 5.4 below indicates which spectrum bands authorities expect to be the first areas where trades in spectrum rights will occur, and which spectrum bands are deemed inappropriate for any trading to occur. In addition, authorities were asked in which bands they thought spectrum scarcity exists.

	First areas for trading	*Inappropriate areas*	*Scarcity*
Austria	UMTS and GSM. Other spectrum in the long term	Broadcasting spectrum	Mobile and broadcasting (TV + radio) spectrum
Belgium	Certain radio services	Private mobile network, public safety services and defence, scientific and military purposes	Scarcity is generally not a problem - and confined to FM broadcasting and PMR
Cyprus		Mobile market, FWA, digital terrestrial TV	Broadcasting spectrum
Czech Republic	Harmonised commercial bands	Public service and military bands	Cannot be identified
Denmark	Cellular bands and FWA.	Broadcasting spectrum	Cellular (GSM, 3G), FWA and broadcasting
Finland	Private mobile network	Aeronautical, space, military, scientific research, and many others	Mainly in the mobile spectrum (GSM)
France	Reuse of GSM spectrum for 3G, PMR and PAMR network	Broadcasting spectrum, frequencies managed by the Ministry of Defence	Scarcity in most telecommunications bands, especially around 400 to 800MHz and in GSM spectrum.
Germany	No need to identify certain areas		GSM and UMTS, though spectrum is generally not scarce
Greece	Individual licences: GSM and FWA	Assigned spectrum: PMR and fixed services	Broadcasting, PMR, wireless microphones

	First areas for trading	*Inappropriate areas*	*Scarcity*
Hungary	Fixed and mobile, including PMR and PAMR systems	Broadcasting spectrum (radio and television)	Severe scarcity below 1GHz: fixed services and broadcasting
Iceland	Not yet evaluated	Not yet evaluated	GSM and some of the broadcasting bands
Ireland	3G expansion bands	Harmonised spectrum (GSM, fixed service bands) and broadcasting (content control)	Few bands with scarcity problem, mainly in the fixed-link bands in Dublin area
Italy	UMTS, PAMR	WLL and GSM bands	Hard to define, not in the 3G spectrum
Liechtenstein	Harmonised bands, e.g. SRD, R-LAN's and automotive SRR	Broadcasting, GSM and UMTS	
Luxembourg	2G, 3G and DCS	Broadcasting and Satellite bands	No spectrum scarcity
Malta		Broadcasting	PMR, VHF, microwave links in the lower frequency bands and broadcasting
Netherlands	Will be determined by the market	Public broadcasting services, defence, vital government services	Commercially interesting spectrum in the GHz band
Norway	All bands (including broadcasting) are appropriate	Bands reserved for government use, global system, health and safety	Mobile and broadcasting spectrum
Portugal	Still under discussion	Still under discussion	Scarcity in spectrum is not certain
Slovenia	Not certain	Not certain	Mobile spectrum (UMTS, GSM)
Spain	Mobile, PAMR, LMDS – although no scarcity in LMDS yet	Broadcasting bands	GSM, PMR/PAMR, fixed links, TV bands, emergency bands and radio broadcasting (FM band)
Sweden	Taxi licences, FWA, block assignment	Defence, medical, police and TETRA applications	GSM, UMTS bands, radio links and local radio frequencies in large cities
UK	Public wireless networks, broadband FWA, private business systems, terrestrial fixed links	Spectrum for essential public services (though leasing may be possible)	3G, 3.4GHz and 28GHz, PMR in urban areas, VHF High Band

Exhibit 5.4: *Views on bands where trading is likely, where it is inappropriate, and where there is spectrum scarcity*

► *Bands where spectrum trading is most likely to occur*

Cellular or public mobile bands have most frequently been quoted as bands where trades of spectrum rights are likely to occur soon – half of the countries studied believe trading would be appropriate here. Other bands mentioned by several countries are FWA, PMR and PAMR. Some countries, like Germany, the Netherlands and Norway, pointed out that there is no need to identify such bands, as spectrum should be allowed to be traded freely for all bands and it will be up to the market to decide where trades take place (provided there is no effect on competition).

► *Bands inappropriate for trading*

Most countries stated that the bands inappropriate for trading included spectrum reserved for the use of government, public safety and health, defence and the military, scientific research, aeronautical and space. On top of these, half of the countries studied believe that broadcasting frequencies are inappropriate for trading – mostly due to difficulties with the content licences that are required for broadcasting. The GSM band is also deemed inappropriate by Cyprus, Ireland and Italy, as there is currently significant international harmonisation in this band. Some countries also described as inappropriate for trading bands without scarcity, and bands where the primary assignment mechanism is non-market based (i.e. by beauty contest).

► *Spectrum scarcity*

Belgium, Germany, Ireland, Luxembourg and Portugal did not consider scarcity to be an issue overall. Here scarcity is a very localised problem, occurring mainly in densely populated areas. Most countries, however, identified certain bands as being more scarce than others, namely:

- mobile bands, particularly GSM (in 10 countries)
- broadcasting bands, particularly FM radio (in 11 countries)
- to a lesser extent: PMR (Belgium, Greece, Malta and Spain)
- to a lesser extent: fixed links (Hungary, Ireland and Spain).

In theory, it might be expected that bands where scarcity exists would also be bands where spectrum trading will be introduced first. This is indeed the case in the public mobile bands

(GSM and UMTS), but not for broadcasting bands because here control over broadcast content remains an overriding argument for not allowing spectrum trading.

5.3.3 The attitude of spectrum stakeholders to trading

In the debate over the introduction of spectrum trading, stakeholders can be classified into three broad categories: Regulator, Ministry and Industry (mostly represented by the mobile operators). Exhibit 5.5 below indicates whether these stakeholders are considered by the interviewed authorities to be supporters or opponents of spectrum trading. The table also gives a general indication of the general interest in the market. It should be noted that this picture represents the view of the authorities interviewed and may deviate from the actual situation. No attempt has been made at this point to validate these opinions.

	Supporters	*Opponents*	*Overall market interest*
Austria	UMTS new entrants Regulator and Ministry	No strong opposition	
Belgium		Regulator	Little response from market
Cyprus	[Not a lot of interest generated among the stakeholders]		
Czech Republic	[No information on stakeholders available]		
Denmark	Industry, Ministry and Regulator		Gradually generating more interest in the market
Finland		Industry, Ministry and Regulator	
France	Ministry	Mobile operators, Regulators	
Germany	Ministry, Regulator, Industry.		All stakeholders favour spectrum trading – though its definition varies
Greece	Regulator, Industry		
Hungary	[No information on stakeholders available]		
Iceland	[The possibility will be evaluated later on]		

	Supporters	*Opponents*	*Overall market interest*
Ireland	One mobile operator	Ministry	General public opinion is unknown as there has not been a public consultation
Italy	Industry	No strong opposition	
Luxembourg		Ministry and regulator	Operators are not interested
Malta	[Not actively discussed amongst the stakeholders]		
Netherlands	Ministry	Some UMTS operators	
Norway	Industry, Regulator	Ministry	
Portugal	[No strong views voiced yet]		
Slovenia	[Stakeholders are neutral]		
Spain	[Not high in the agenda of various stakeholders]		
Sweden	[No strong response from the market]		
UK	Regulator, Industry		Consultation by regulator is ongoing

Exhibit 5.5: *Attitudes to spectrum trading amongst the various groups of stakeholders*

As can be seen from the Exhibit above, there is a wide variety of attitudes to spectrum trading in the countries studied, with the industry, regulators and ministries equally supporting, opposing or voicing no interest in the implementation of spectrum trading. Overall, the interviews reveal a picture of all three stakeholder groups in one country mostly either supporting or opposing trading – although, of course, this may reflect the particular view of the interviewees rather than the actual situation.

In Austria, Denmark, Germany, Greece, Italy and the UK – the majority of countries where there are active stakeholders – stakeholders are mostly supporters of spectrum trading. In contrast, stakeholders in Finland and Luxembourg mostly oppose trading. In France, the Netherlands and Norway the major interested groups count both supporters and opponents.

There is also a large group of countries where the position of the stakeholders is not clear (yet). In Belgium, Iceland, Ireland, Portugal, Spain, Sweden, not much debate – or no public consultation – on the topic of spectrum trading has yet taken place. The Acceding Countries that were interviewed reported that spectrum trading is not (yet) actively discussed amongst stakeholders.

6 Need for harmonised approach to trading, and the EC's role

A final set of questions in the preliminary hearing focussed on the extent to which interviewees thought a harmonised approach to the implementation of spectrum trading is necessary, and if so, what role the European Commission could play. The results of the interviews are summarised in Exhibit 6.1.

	Need for harmonised approach	*EC Role*
Austria	A harmonised approach is needed for spectrum trading to be successfully implemented in Europe – especially if change of use is allowed. The different opinions in the different Member States should be overcome.	The EC can play a big role in reaching a harmonised approach, but not sure how.
Belgium	EC harmonisation is not necessary – though a harmonised approach is not excluded.	The EC should not oblige Member States to introduce spectrum trading.
Cyprus	A harmonised approach is important, but should not be mandated	General guidelines from EC would be sufficient, with the implementation left to individual countries. This is to accommodate the individualities and the differences in competitive situations in different countries
Czech Republic	Hard to say if a harmonised approach is required	The EC should be responsible for the overall market conditions and the general harmonisation rules, with the details of implementation left to individual countries. Pan-European market would not be possible without the organisation and regulation driven by the EC

	Need for harmonised approach	*EC Role*
Denmark	Some kind of harmonised approach will be useful and welcomed – to make sure different companies from different countries are not treated very different from one country to another	EC has a role to play at some level. No need to make the same detailed rules for all countries, due to the large differences amongst countries
Finland	A harmonised approach to spectrum trading is needed – but countries should the option whether or not to implement trading. It is very useful to discuss the issues in the RSPG. New ideas on implementation might be conceived – or even harmonised.	The EC can help harmonising the approach if countries opt for spectrum trading. It is the only body which can do so in Europe.
France	No need for further harmonisation as the Directive is already there – the implementation of spectrum trading is a national issue	The EC could spread common principles, best practices (e.g. monitoring), and knowledge of the benefits of spectrum trading
Germany	It is important to have a harmonised approach to spectrum trading – through discussion in the RSPG to come together in thinking. It is important to have a flexible approach in spectrum management due to the differences between countries.	EC's role is limited to the role of mediator in bodies such as the RSPG and RSC The EC restricted itself through its vague definitions in the new EC framework.
Greece	Recommendation and guidance from the EC on how to handle spectrum trading issues is welcomed Member States should be given room to accommodate differences in local circumstances and conditions	The EC should adopt a voluntary approach as the market will move towards the 'best' way for implementation Precise actions should be left to individual states to decide and carry out
Hungary	Harmonisation should occur at a high level, with details to be decided by individual countries.	The EC has an important role through the RSPG and its spectrum trading sub-group
Iceland	Member states should be free to choose whether spectrum trading should be allowed	The EC should form a set of common guidelines and rules in order to promote the pan-European telecommunications market
Ireland	It is not sure if there is a need for a harmonised approach	It is difficult to see the EC's role at this point
Italy	A harmonised approach is not considered necessary, and the EC should cater for the differences amongst European countries	Member States should form a network of contacts in order to form a platform for the sharing of best practices
Luxembourg	It is too early to tell whether a harmonised approach is needed	There is no view on this currently.

	Need for harmonised approach	*EC Role*
Malta	A harmonised approach would be easier for administration	General guidelines from the EC are welcome, with details left to be specified by individual countries. Local legislation should transpose EC Directives as countries are inherently different in terms of market size and competition.
Netherlands	A harmonised approach is not a necessity – each nation can implement its own legislation, although it would be good if neighbouring countries would do the same.	The EC certainly plays a role in those areas that will be harmonised – it could think about the issues involved in spectrum trading and possible approaches.
Norway	A clear improvement in the market place needs to be established to see a case for a harmonised approach. Harmonisation could enhance the transparency of information on the secondary market	EC's involvement should not result in more bureaucracy, inefficiency and more administrative work
Portugal	No official view yet. The outcome of the RSPG meeting will be closely observed.	No official view yet.
Slovenia	The harmonisation of frequency spectrum for services covered by licence free regulation (through CEPT) is supported	The EC should give general guidelines, which will then be implemented by individual countries to accommodate difference in regional policies
Spain	Harmonisation is important now that operators play at a pan-European level.	Inputs from the EC will be welcome, for instance in terms of developing the new spectrum regulations.
Sweden	Harmonisation should be done in the form of discussion on European level in the various spectrum groups like RSPG. This is to inform everyone and gather an idea of what how spectrum trading is being carried out.	EC's role is as an intermediary in the RSPG, driving these issues forward
UK	No support for any proposal for a harmonised introduction of spectrum trading going beyond the Framework Directive requirements	There is considerable value in regular exchanges of information and experience at EU level

Exhibit 6.1: *Views on need for a harmonised approach to trading, and the EC's role*

► *Need for harmonised approach to trading*

In summary, the authorities interviewed generally have a cautious view regarding the need for a harmonised approach towards introducing spectrum trading. About half of the countries studied do not feel there is a need for any further harmonisation. Issues brought forward include:

- The Directive concerning spectrum trading is already in place and no more detailed regulation is needed.
- Individual countries all have very different local circumstances and these differences need to be catered for.
- Spectrum management is a national issue.

Although the other half of the countries do believe a harmonised approach would be beneficial, even they are careful to state that such harmonisation is only needed at a certain level:

- A flexible approach is needed to cater for differences in individual countries.
- Several interviewees suggested that countries should be left free to decide whether or not to implement spectrum trading – and that guidelines would only apply if a country decides to indeed implement spectrum trading.
- Harmonisation is increasingly necessary as pan-European companies should not be treated differently in different countries.

In discussing how a harmonised approach could be reached, interviewees focused to a great extent on discussions between countries in pan-European groups such as the Radio Spectrum Policy Group (RSPG). Through frequent discussions, different opinions can be overcome.

► *Role of the European Commission*

According to most of the authorities interviewed, the potential role of the EC within these discussions is mainly that of an intermediary, a mediator who drives issues forward. Most of the countries studied welcome input from the EC, for example to the spread common principles, examples of best practice, and guidelines on possible approaches and issues involved in implementing spectrum trading.

It was recognised that the EC is the 'only body that can help' in reaching a more harmonised approach towards spectrum trading. However, no interviewee voiced a need for any detailed rulings on spectrum trading. Some countries were of the opinion that the EC has already restricted its role in that respect through its 'vague' Directive on spectrum trading.

Annex C: Questionnaire results

Contents

Preface

This study involved the publication online of three questionnaires designed to elicit the views of a range of spectrum stakeholders on issues related to secondary trading of spectrum, and also to obtain information on current activities such as licence transfers. Questionnaires were completed by 74 organisations. This annex presents the results from these questionnaires, and is structured as follows:

- Chapter 1: copies of the three online questionnaires
- Chapter 2: list of the three categories of respondents
- Chapter 3: summary and analysis of questionnaire responses

1 The three questionnaires on spectrum trading

Three different questionnaires were developed for three different types of stakeholders in the radio communications market:

- *spectrum management authorities*: national regulators, ministries and pan-European bodies
- *spectrum users*: incumbent, mobile and satellite operators, and broadcasters
- *other stakeholders*: manufacturers, industry bodies and other interested parties.

These questionnaires were available from www.analysys.com/spectrumtrading for several months, and copies are included below.

Questionnaire for regulatory authorities

This questionnaire forms part of a major project entitled “Study on conditions and options in introducing secondary trading of radio spectrum in the European Community” conducted by Analysys Consulting, DotEcon and Hogan & Hartson for the European Commission. A key component of this study is gathering feedback from all stakeholders in the radio communications market on their views regarding the introduction of spectrum trading. It is therefore important for this study to collect the opinions of national and pan-European authorities relating to the management of radio spectrum.

This questionnaire aims to capture your views on the legal and practical status of spectrum trading, benefits and concerns, potential size of the market, implementation issues, and the role of harmonisation. There is an opportunity to elaborate further on specific concerns at the end of the questionnaire (question 31), or you can email us at spectrumtrading@analysys.com.

As part of this project, there will be a spectrum trading workshop in Brussels (provisionally scheduled on 11 December 2003). A limited number of guest speakers will be formally invited to express their opinions for up to five minutes on particular issues of interest to them. If you are interested in participating in this way, please indicate this at the end of the questionnaire.

Related links

- Spectrum management
- Spectrum trading study
- News: EC appoints Analysys, DotEcon ...
- Spectrum trading questionnaire
- Spectrum trading workshop
- Workshop programme
- Workshop registration

Newsletter: Aug/Sept 2003

Telecoms Virtual Library

Your details

Name

Organisation

Title/Responsibility

Email

Area of responsibility of organisation

Geographical area: Please select

Services area (such as broadcasting or all radio communications services)

Spectrum trading

Legal and practical status of spectrum trading

1. Do you have any plans to introduce spectrum trading in your country? Please select

2. If so, when do you plan to introduce spectrum trading?

3. What type of transfers of spectrum rights or changes in spectrum rights do you plan to implement?

- ☐ Full change of ownership more
- ☐ Leasing of spectrum rights more
- ☐ Reconfiguration more
- ☐ Change of service more
- ☐ Change of technology more
- ☐ Other, namely...

4. In practice, how often do licence transfers already occur – other than through change of ownership of the entire company? more Please select

5. For which service bands?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

6. In practice, how many change of use (eg service, technology) requests from Please select

spectrum users are granted each year? more

7. For which service bands?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

8. Approximately how many licences to use the spectrum (active spectrum rights) are there in your country today? (Any further breakdown of information on licences, such as band-by-band, will be appreciated) more

Benefits and concerns

9. What benefits do you expect spectrum trading will bring?

- ☐ More efficient usage of spectrum
- ☐ Enhanced competition in the market for provision of wireless services
- ☐ Enhanced competition in the equipment market
- ☐ More innovation as new technologies have better access to spectrum
- ☐ More flexibility in allocation and assignment of spectrum more
- ☐ Reduced transaction cost of acquiring spectrum
- ☐ Less administrative workload for regulator
- ☐ Other, namely...

10. What are your main concerns related to the introduction of spectrum trading?

- ☐ Distortion of competition as players may hoard spectrum more
- ☐ Risk of harmful interference
- ☐ Risk of fragmentation of spectrum bands
- ☐ Problems in enforcing international harmonisation of allocation more
- ☐ Greater difficulty with international coordination more
- ☐ Windfall gains to current holders of spectrum rights more
- ☐ Other, namely...

Potential size of the secondary market

11. How large do you believe the European secondary spectrum market could be in terms of volume of trades?

(a) if reconfiguration (sub-division etc) and change of use (service or technology) is allowed — Please select

(b) if only change of ownership is allowed (no configuration/change of technology etc) — Please select

12. In which service bands do you believe the largest volume of spectrum trades will take place?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

Implementation issues of spectrum trading

These questions relate to the process through which spectrum trading will be implemented. **We would appreciate your opinion on these issues** ***even if you are not planning to implement spectrum trading*** .

13. Do you plan to implement spectrum trading in all frequency bands at once or progressively? Please select

14. In case of progressive introduction, in which bands are you planning to introduce spectrum trading first?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

15. In which service bands do you think it is inappropriate to introduce spectrum trading?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

16. Do you intend to allocate more spectrum into 'licence-exempt' spectrum bands? Please select

17. Do you believe the leasing of spectrum will be an important component of the secondary market? Please select

18. Do you plan to define a standard spectrum trading unit? more Please select

19. If so, what elements do you plan to include in a trading unit?

- ☐ Minimum amount of frequency per spectrum right
- ☐ Minimum anount of geographical area per spectrum right
- ☐ Other, namely...

20. What do you plan to be the terms of the tradable spectrum rights? more

- ☐ Fixed number of years more
- ☐ Rolling period with assumed renewal more
- ☐ In perpetuity, with possibility of compulsory purchase
- ☐ Other, namely...

21. When a secondary market for spectrum rights is implemented, do spectrum users have to notify the regulator before a trade occurs?

- ☐ Approval needed before every trade more
- ☐ Notify prior to trade more
- ☐ Notify after trade more

22. How do you plan to deal with interference issues on tradable rights?

- ☐ A detailed standard threshold level should be defined
- ☐ Negotiations between adjacent users should be allowed
- ☐ The licensee who changes the use of a spectrum right or buys a new spectrum right needs to technically demonstrate no additional harmful interference is caused to existing licensees
- ☐ Other, namely...

23. How do you plan to resolve interference disputes?

- ☐ Courts can make binding decisions
- ☐ The NRA can make binding decisions
- ☐ Non-binding arbitration through trusted third party
- ☐ Other, namely...

24. What trading mechanisms are you planning to implement, or would you expect to emerge, to facilitate the secondary spectrum market?

- [ ] Online registry maintained and published by regulator
- [ ] Independent spectrum brokers, market makers or resellers
- [ ] Other, namely...

25. What information are you planning to make publicly available?

- [ ] Assignment table - who owns which frequencies
- [ ] Trades register - who traded which frequencies
- [ ] Price database - who paid what for which frequencies
- [ ] Interested participants - licensees who are interested in doing a trade
- [ ] Information about measurements of efficient use of spectrum
- [ ] Other, namely...

Role of harmonisation in spectrum trading

26. Do you believe there is a need for a harmonised approach regarding implementing spectrum trading across the European Community? Please select

27. Why?

28. What are your main concerns with such harmonisation or absence of such harmonisation?

29. If there is a need for a harmonised approach, what aspects of spectrum trading do you believe could be harmonised?

- [ ] Spectrum property rights more
- [ ] Trading units more
- [ ] Duration of the spectrum rights more
- [ ] Trading mechanisms more
- [ ] Interference conditions more
- [ ] Bands suitable for harmonisation
- [ ] Competition measures
- [ ] General framework for spectrum trading more
- [ ] Other, namely...

30. Which pan-European institutions should play a role in achieving such an approach, and what role would that be?

Other comments

31. Do you have any other comments regarding spectrum trading?

- [ ] Please tick this box if you are interested in speaking briefly during the spectrum trading workshop provisionally scheduled on 11 December 2003, in order to publicly voice your view on a particular issue. Specify below the particular topic you would like to address (each slot will be a maximum of five minutes in duration).

We will contact you shortly to let you know whether you have been selected to speak at the workshop.

Send

Questionnaire for spectrum users

Related links

- Spectrum management
- Spectrum trading study
- News: EC appoints Analysys, DotEcon ...
- Spectrum trading questionnaire
- Spectrum trading workshop
- Workshop programme
- Workshop registration

Newsletter: Aug/Sept 2003

Telecoms Virtual Library

This questionnaire forms part of a major project entitled "Study on conditions and options in introducing secondary trading of radio spectrum in the European Community" conducted by Analysys Consulting, DotEcon and Hogan & Hartson for the European Commission. A key component of this study is gathering feedback from all stakeholders in the radio communications market on their views regarding the introduction of spectrum trading. It is therefore important for this study to collect opinions of providers of radio spectrum services.

The questionnaire aims to capture your views on licensing mechanisms, experience with licence transfers, benefits and concerns of spectrum trading, implementation issues, and the role of harmonisation. There is an opportunity to elaborate further on specific concerns at the end of the questionnaire (question 38), or you can email us at spectrumtrading@analysys.com.

As part of this project, there will be a spectrum trading workshop in Brussels (provisionally scheduled on 11 December 2003). A limited number of guest speakers will be formally invited to express their opinions for up to five minutes on particular issues of interest to them. If you are interested in participating in this way, please indicate this at the end of the questionnaire.

Your details

Name

Organisation

Title/Responsibility

Email

1. In what countries do you operate radio communications systems?

- ☐ Austria
- ☐ Belgium
- ☐ Cyprus
- ☐ Czech Republic
- ☐ Denmark
- ☐ Estonia
- ☐ Finland
- ☐ France
- ☐ Germany
- ☐ Greece
- ☐ Hungary
- ☐ Iceland
- ☐ Ireland
- ☐ Italy
- ☐ Latvia
- ☐ Liechtenstein
- ☐ Lithuania
- ☐ Luxembourg
- ☐ Malta
- ☐ Netherlands
- ☐ Norway
- ☐ Poland
- ☐ Portugal
- ☐ Slovakia
- ☐ Slovenia
- ☐ Spain
- ☐ Sweden
- ☐ Switzerland
- ☐ UK
- ☐ Pan-European

2. In which bands do you hold spectrum rights to provide services?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

3. Do you believe spectrum scarcity exists in the band(s) in which you operate? Please select

Licensing mechanisms

4. Through what primary assignment mechanisms have you obtained your spectrum rights?

- ☐ Beauty contests
- ☐ Auctions
- ☐ First-come-first-served
- ☐ Other, namely...

5. What type of fee did you have to pay for these spectrum rights?

- ☐ Administrative price more
- ☐ Value-based price more
- ☐ Other, namely...

6. What is your preferred type of assignment mechanism? Please select

Why?

Spectrum trading

Experience with licence transfers

7. Have you ever requested a licence transfer? more Please select

8. For which service bands?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

9. Was your request granted by the regulator? Please select

10. Have you ever requested a change to the allowed service/technology for a spectrum right? more Please select

11. For which service bands?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

12. Was your request granted by the regulator? Please select

13. What proportion of the total spectrum rights that you hold do these requests represent?

- ☐ 0-5%
- ☐ 5-20%
- ☐ 20%+

Benefits and concerns

14. What benefits do you expect spectrum trading will bring?

- ☐ More flexibility in business planning
- ☐ More innovation as new technologies have better access to spectrum
- ☐ More efficient use of spectrum
- ☐ Financial gains from existing spectrum rights
- ☐ Reduced transaction cost of acquiring spectrum
- ☐ Other, namely...

15. What are your main concerns related to the introduction of spectrum trading?

- ☐ Risk of harmful interference
- ☐ More uncertainty in business planning
- ☐ Increased competition as barriers to entry are lower
- ☐ Distortion of competition as players may hoard spectrum
- ☐ Windfall gains to current holders of spectrum rights more

- [ ] Greater difficulty with international coordination more
- [ ] Problems in enforcing international harmonisation of allocation more
- [ ] Higher equipment prices due to fragmented standards and lack of economies of scale
- [ ] Other, namely...

Expected usage of secondary spectrum market

16. If spectrum trading were available in countries you operate in, would you consider using this possibility to buy or sell license rights? Please select

17. If so, how often would you expect to trade spectrum rights?

18. Do you expect a large volume of trades (over 10 trades per annum) in spectrum rights in the bands you are active in? Please select

Why?

Implementation issues of spectrum trading

19. What type of transfers of spectrum rights or changes in spectrum rights do you support?

- [ ] Full change of ownership more
- [ ] Leasing of spectrum rights more
- [ ] Reconfiguration more
- [ ] Change of service more
- [ ] Change of technology more
- [ ] Other, namely...

20. Do you think spectrum trading should be implemented in all frequency bands at once or progressively? Please select

21. In case of progressive introduction, in which bands do you think spectrum trading should be implemented first?

- [ ] Aeronautical
- [ ] Broadcasting – satellite
- [ ] Broadcasting – terrestrial
- [ ] Fixed links
- [ ] Fixed wireless access
- [ ] ISM/short-range devices more
- [ ] Land mobile - private mobile radio
- [ ] Land mobile - public mobile networks more
- [ ] Amateur radio & citizens band
- [ ] Maritime
- [ ] Radionavigation
- [ ] Satellite (fixed and mobile)
- [ ] Scientific more

22. In which service bands do you think it is inappropriate to introduce spectrum trading?

- [ ] Aeronautical
- [ ] Broadcasting – satellite
- [ ] Broadcasting – terrestrial
- [ ] Fixed links
- [ ] Fixed wireless access
- [ ] ISM/short-range devices more
- [ ] Land mobile - private mobile radio
- [ ] Land mobile - public mobile networks more
- [ ] Amateur radio & citizens band
- [ ] Maritime
- [ ] Radionavigation
- [ ] Satellite (fixed and mobile)
- [ ] Scientific more

23. Do you think regulators should allocate more spectrum into licence-exempt' spectrum bands? Please select

24. Do you believe the leasing of spectrum will be an important component of the secondary market? Please select

25. Do you believe a standard spectrum trading unit should be defined? more Please select

26. If so, what elements do you think should be included in a trading unit?

- [ ] Minimum amount of frequency per spectrum right
- [ ] Minimum anount of geographical area per spectrum right

- [ ] Other, namely...

27. What do you think the terms of the tradable spectrum rights should be? more

- [ ] Fixed number of years more
- [ ] Rolling period with assumed renewal more
- [ ] In perpetuity, with possibility of compulsory purchase
- [ ] Other, namely...

28. When a secondary market for spectrum rights is implemented, do you believe spectrum users should have to notify the regulator before a trade occurs?

- [ ] Approval needed before every trade more
- [ ] Notify prior to trade more
- [ ] Notify after trade more

29. How do you believe interference issues on tradable rights should be dealt with?

- [ ] A detailed standard threshold level should be defined
- [ ] Negotiations between adjacent users should be allowed
- [ ] The licensee who changes the use of a spectrum right or buys a new spectrum right needs to technically demonstrate no additional harmful interference is caused to existing licensees
- [ ] Other, namely...

30. How do you think interference disputes should be resolved?

- [ ] Courts can make binding decisions
- [ ] The NRA can make binding decisions
- [ ] Non-binding arbitration through trusted third party
- [ ] Other, namely...

31. What trading mechanisms do you think should emerge to facilitate the secondary spectrum market?

- [ ] Online registry maintained and published by regulator
- [ ] Independent spectrum brokers, market makers or resellers
- [ ] Other, namely...

32. What information do you think should be made publicly available in the spectrum market?

- [ ] Assignment table - who owns which frequencies
- [ ] Trades register - who traded which frequencies
- [ ] Price database - who paid what for which frequencies
- [ ] Interested participants - licensees who are interested in doing a trade
- [ ] Information about measurements of efficient use of spectrum
- [ ] Other, namely...

Role of harmonisation in spectrum trading

33. Do you believe there is a need for a harmonised approach regarding implementing spectrum trading across the European Community? Please select

34. Why?

35. What are your main concerns with such harmonisation or absence of such harmonisation? more

36. If there is a need for a harmonised approach, what aspects of spectrum trading do you believe could be harmonised?

- [ ] Spectrum property rights more
- [ ] Trading units more
- [ ] Duration of the spectrum rights more
- [ ] Trading mechanisms more
- [ ] Interference conditions more
- [ ] Bands suitable for harmonisation
- [ ] Competition measures

☐ General framework for spectrum trading more

☐ Other, namely...

37. Which pan-European institutions should play a role in achieving such an approach, and what role would that be?

Other comments

38. Do you have any other comments regarding spectrum trading?

☐ Please tick this box if you are interested in speaking briefly during the spectrum trading workshop provisionally scheduled on 11 December 2003, in order to publicly voice your view on a particular issue. Specify below the particular topic you would like to address (each slot will be a maximum of five minutes in duration).

We will contact you shortly to let you know whether you have been selected to speak at the workshop.

Send

Thank you very much for your time

We are organising a spectrum trading workshop in Brussels provisionally scheduled on 11 December 2203. Interim results from this study will be presented at this workshop. For more information, please visit www.analysys.com/spectrumtrading

The results of the entire study will be publicly available during the summer of 2004.

Questionnaire for spectrum stakeholders

This questionnaire forms part of a major project entitled "Study on conditions and options in introducing secondary trading of radio spectrum in the European Community" conducted by Analysys Consulting, DotEcon and Hogan & Hartson for the European Commission. A key component of this study is gathering feedback from all stakeholders in the radio communications market on their views regarding the introduction of spectrum trading. It is therefore important for this study to collect the opinions of manufacturers, industry bodies and other interested parties relating to the management of radio spectrum.

The questionnaire aims to capture your views on licensing mechanisms, benefits and concerns of spectrum trading, the potential size of the market, implementation issues, and the role of harmonisation. There is an opportunity to elaborate further on specific concerns at the end of the questionnaire (question 27), or you can email us at spectrumtrading@analysys.com.

As part of this project, there will be a spectrum trading workshop in Brussels (provisionally scheduled on 11 December 2003. A limited number of guest speakers will be formally invited to express their opinions for up to 5 minutes on particular issues of interest to them. If you are interested in participating in this way, please indicate this at the end of the questionnaire.

Related links

- Spectrum management
- Spectrum trading study
- News: EC appoints Analysys, DotEcon ...
- Spectrum trading questionnaire
- Spectrum trading workshop
- Workshop programme
- Workshop registration

Newsletter: Aug/Sept 2003

Telecoms Virtual Library

Your details

Name

Organisation

Title/Responsibility

Email

Area of responsibility of organisation

Geographical area — Please select

Type of organisation

Spectrum band/service area of particular interest

Licensing mechanisms

1. In which service bands do you believe spectrum scarcity exists?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

2. What kind of licensing mechanism do you think is appropriate in cases where scarcity exists?

- ☐ Beauty contests
- ☐ Auctions
- ☐ Other, namely...

3. What are the objectives for choosing such mechanisms?

- ☐ Efficiency
- ☐ Objectivity
- ☐ Simplicity
- ☐ Transparency
- ☐ Equality
- ☐ Revenue maximisation
- ☐ Maximisation of value to society
- ☐ Coverage
- ☐ Regional objectives
- ☐ Other, namely...

Spectrum trading

Benefits and concerns

4. What benefits do you expect spectrum trading will bring?

- ☐ Increased flexibility for spectrum users
- ☐ More efficient usage of spectrum
- ☐ Enhanced competition due to lower barriers to entry
- ☐ More innovation as new technologies have better access to spectrum
- ☐ More flexibility in allocation and assignment of spectrum more
- ☐ Other, namely...

5. What are your main concerns related to the introduction of spectrum trading?

- ☐ Fragmentation of standards, resulting in more uncertainty for R&D
- ☐ Risk of reduced economies of scale in equipment production
- ☐ Risk of decreased international equipment roaming and access to export markets
- ☐ Risk of harmful interference
- ☐ Problems in enforcing international harmonisation of allocation more
- ☐ Greater difficulty with international coordination more
- ☐ Windfall gains to current holders of spectrum rights more
- ☐ Other, namely...

Potential size of the secondary market

6. How large do you believe the European secondary spectrum market could be in terms of volume of trades?

(a) if reconfiguration (sub-division etc) and change of use (service or technology) is allowed — Please select

(b) if only change of ownership is allowed (no reconfiguration/change of technology etc) — Please select

7. In which service bands do you believe the largest volume of spectrum trades will take place?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ ISM/short-range devices more
- ☐ Land mobile - private mobile radio
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)
- ☐ Scientific more

Implementation issues of spectrum trading

8. What type of transfers of spectrum rights or changes in spectrum rights do you support?

- ☐ Full change of ownership more
- ☐ Leasing of spectrum rights more
- ☐ Reconfiguration more
- ☐ Change of service more
- ☐ Change of technology more
- ☐ Other, namely...

9. Do you think spectrum trading should be implemented in all frequency bands at once or progressively? — Please select

10. In case of progressive introduction, in which bands do you think spectrum trading should be implemented first?

- ☐ Aeronautical
- ☐ Broadcasting – satellite
- ☐ Broadcasting – terrestrial
- ☐ Fixed links
- ☐ Fixed wireless access
- ☐ Land mobile - public mobile networks more
- ☐ Amateur radio & citizens band
- ☐ Maritime
- ☐ Radionavigation
- ☐ Satellite (fixed and mobile)

- [ ] ISM/short-range devices more
- [ ] Land mobile - private mobile radio
- [ ] Scientific more

11. In which service bands do you think it is inappropriate to introduce spectrum trading?

- [ ] Aeronautical
- [ ] Broadcasting – satellite
- [ ] Broadcasting – terrestrial
- [ ] Fixed links
- [ ] Fixed wireless access
- [ ] ISM/short-range devices more
- [ ] Land mobile - private mobile radio
- [ ] Land mobile - public mobile networks more
- [ ] Amateur radio & citizens band
- [ ] Maritime
- [ ] Radionavigation
- [ ] Satellite (fixed and mobile)
- [ ] Scientific more

12. Do you think regulators should allocate more spectrum into 'licence-exampt' spectrum bands?? Please select

13. Do you believe the leasing of spectrum will be an important component of the secondary market? Please select

14. Do you believe a standard spectrum trading unit should be defined? more Please select

15. If so, what elements do you think should be included in a trading unit?

- [ ] Minimum amount of frequency per spectrum right
- [ ] Minimum anount of geographical area per spectrum right
- [ ] Other, namely...

16. What do you think the terms of the tradable spectrum rights should be? more

- [ ] Fixed number of years more
- [ ] Rolling period with assumed renewal more
- [ ] In perpetuity, with possibility of compulsory purchase
- [ ] Other, namely...

17. When a secondary market for spectrum rights is implemented, do you believe spectrum users should have to notify the regulator before a trade occurs?

- [ ] Approval needed before every trade more
- [ ] Notify prior to trade more
- [ ] Notify after trade more

18. How do you believe interference issues on tradable rights should be dealt with?

- [ ] A detailed standard threshold level should be defined
- [ ] Negotiations between adjacent users should be allowed
- [ ] The licensee who changes the use of a spectrum right or buys a new spectrum right needs to technically demonstrate no additional harmful interference is caused to existing licensees
- [ ] Other, namely...

19. How do you think interference disputes should be resolved?

- [ ] Courts can make binding decisions
- [ ] The NRA can make binding decisions
- [ ] Non-binding arbitration through trusted third party
- [ ] Other, namely...

20. What trading mechanisms do you think should emerge to facilitate the secondary spectrum market?

- [ ] Online registry maintained and published by regulator
- [ ] Independent spectrum brokers, market makers or resellers
- [ ] Other, namely...

21. What information do you think should be made publicly available in the spectrum market?

- [ ] Assignment table - who owns which frequencies
- [ ] Trades register - who traded which frequencies
- [ ] Price database - who paid what for which frequencies
- [ ] Interested participants - licensees who are interested in doing a trade
- [ ] Information about measurements of efficient use of spectrum

☐ Other, namely...

Role of harmonisation in spectrum trading

22. Do you believe there is a need for a harmonised approach regarding implementing spectrum trading across the European Community? Please select

23. Why?

24. What are your main concerns with such harmonisation or absence of such harmonisation?

25. If there is a need for a harmonised approach, what aspects of spectrum trading do you believe could be harmonised?

- ☐ Spectrum property rights more
- ☐ Trading units more
- ☐ Duration of the spectrum rights more
- ☐ Trading mechanisms more
- ☐ Interference conditions more
- ☐ Bands suitable for harmonisation
- ☐ Competition measures
- ☐ General framework for spectrum trading more
- ☐ Other, namely...

26. Which pan-European institutions should play a role in achieving such an approach, and what role would that be?

Other comments

27. Do you have any other comments regarding spectrum trading?

☐ Please tick this box if you are interested in speaking briefly during the spectrum trading workshop provisionally scheduled on 11 December 2003, in order to publicly voice your view on a particular issue. Specify below the particular topic you would like to address (each slot will be a maximum of five minutes in duration).

We will contact you shortly to let you know whether you have been selected to speak at the workshop.

Send

Thank you very much for your time

We are organising a spectrum trading workshop in Brussels provisionally scheduled on 11 December 2003. Interim results from this study will be presented at this workshop. For more information, please visit www.analysys.com/spectrumtrading

The results of the entire study will be publicly available during the summer of 2004.

2 Questionnaire respondents

As described above, three questionnaires were published, for SMAs, spectrum users and other stakeholders. These questionnaires were completed by 74 organisations. Exhibit 2.1 shows the split between the three broad categories and also indicates the types of organisations that responded.

Category of questionnaire	*Number of respondents*	*Types and examples of respondents*
SMA	22	**National regulators**: Australia, Austria, Czech Republic, Denmark, Finland, Germany, Ireland, Italy, Lithuania, Malta, Norway, Spain, Sweden, Switzerland, UK
		National ministries: Belgium, Cyprus, Finland, Greece, Hungary
		Pan-European bodies: European Radiocommunications Office, European Commission
Spectrum user	30	**Incumbent operators**: BT, Belgacom, Kingston Communications
		Satellite operators: Eutelsat, Inmarsat, SES Global, ESA
		Mobile operators: Bouygues Telecom, Orange, Telefónica, Vodafone
		Broadcasters: ZDF, Radiolinja, ARD
Other stakeholder	22	**Manufacturers**: Alcatel, Siemens, IBM, Nokia, EDAS ASTRIUM
		Industry bodies: Association européenne des radios, International Union of Railways, Civil Aviation Authority UK
		Other stakeholders: Cantor Fitzgerald, Leuven University, Nomura, Olswang, Qualcomm, Rose Communications

***Exhibit 2.1**: Questionnaire respondents*

Of these respondents, the 30 spectrum users operate radio communications systems in almost all European countries, with the greatest number operating in the UK (13), followed by Germany (8) and Italy (7). No spectrum users have operations in Iceland, Latvia, Liechtenstein, Lithuania, Slovakia or Slovenia.

County	*Spectrum user operations*	*Country*	*Spectrum user operations*
Austria	6	Italy	7
Belgium	6	Luxembourg	3
Cyprus	2	Malta	2
Czech Republic	3	Netherlands	5
Denmark	4	Norway	3
Estonia	3	Poland	2
Finland	2	Portugal	3
France	6	Spain	6
Germany	8	Sweden	4
Greece	2	Switzerland	5
Hungary	3	UK	13
Ireland	5		

Exhibit 2.2: *European countries in which spectrum-user respondents have operations*

Of these users, 28 provided information on the bands in which they operate. Together, these organisations hold spectrum rights to provide services in a wide variety of spectrum bands, especially public mobile (57%), fixed links (43%), satellite (32%) and FWA (29%). None of the spectrum users are active in aeronautical, amateur radio and citizen's band, or radio-navigation bands.

Bands	*Spectrum users*	*Bands*	*Spectrum users*
Public mobile	57%	Broadcasting terrestrial	18%
Fixed links	43%	Broadcasting satellite	11%
Satellite	32%	ISM	11%
FWA	29%	Maritime	7%
PMR	21%	Scientific	4%

Exhibit 2.3: *Bands in which spectrum-user respondents have operations (from a total of 28 respondents that provided this information)*

3 Summary of responses to the questionnaires

This chapter summarises the responses of the three types of respondents, grouped into the following topic areas:

- current transfers of usage rights and changes of use
- benefits and limitations of spectrum trading
- the potential size of the secondary market
- rights and obligations
- systems for managing and monitoring trading
- timing of the transition
- applicability of spectrum trading in different bands
- need for a co-ordinated approach.

3.1 Current transfers of usage rights and changes of use

Situation as reported by SMAs

The questionnaire for SMAs asked spectrum managers how often requests for licence transfers and change of use within licences are already granted in practice. Although around 43% of SMAs claim that such requests have never been made, a similar number of respondents report that such requests are made – and granted – about 1-10 times per year. The remaining 15% of respondents report an even higher number of requests – up to over 100 per year.

Spectrum users in the FWA spectrum bands make the most requests for such licence transfers (55%), as well as for changes of use (63%). Users in PMR, satellite, fixed-link and public mobile bands also frequently make, and are granted, such requests.

Exhibit 3.1 summarises the responses to the following three questions:

- In practice, how often do licence transfers already occur – other than through change of ownership of the entire company?
- For which service bands?
- In practice, how many requests for change of use (e.g. changes of service or technology) from spectrum users are granted each year?

	Licence transfers	*Changes of use*
Never	43%	39%
1-10	43%	39%
10-100	5%	11%
More	10%	11%
Number of respondents	21	18
Spectrum bands		
FWA	55%	63%
PMR	45%	50%
Satellite	36%	25%
Fixed links	27%	38%
Public mobile	27%	38%
Broadcasting terrestrial	45%	13%
ISM	9%	13%
Broadcasting satellite	9%	
Number of respondents	11	8

Exhibit 3.1: *Situation regarding licence transfers and changes of use as reported by SMA respondents*

Situation as reported by spectrum users

Spectrum users paint a slightly different picture. Although few spectrum users (23%) have ever requested a licence transfer, almost half of all spectrum users have requested a change of use for a licence (46%). Users that did request a licence transfer mostly had operations in the public mobile spectrum band (83%)[49] and these requests were mostly granted (89%).

49 Although it should be noted that a relatively high proportion of the questionnaire respondents are active in this band.

There is more variety for spectrum users that requested a change of use: requests were made by operators providing services in the public mobile (23%), fixed-link (23%) and terrestrial broadcasting bands (23%). Requests for change of use were granted less often – in 77% of all requests.

Exhibit 3.2 summarises the responses to the following questions:

- Have you ever requested a licence transfer?
- For which service bands?
- Was your request granted by the regulator?

- Have you ever requested a change to the allowed service/technology for a spectrum right?
- For which service bands?
- Was your request granted by the regulator?

	Licence transfers	*Change of use*
Yes	23%	46%
No	77%	54%
Number of respondents	30	26
Spectrum bands		
Public mobile	83%	23%
Fixed links	17%	23%
Broadcasting satellite	17%	15%
Satellite	17%	15%
Broadcasting terrestrial		23%
FWA		8%
Number of respondents	6	14
Granted request		
Yes	89%	77%
No	11%	23%
Number of respondents	9	13

Exhibit 3.2: *Situation regarding licence transfers and changes of use as reported by spectrum users*

These requests represent a varying proportion of the total spectrum rights that these organisations hold, ranging from 0-5% (54%) through 5-20% (23%) up to 20+% (23%).

3.2 Benefits and limitations of spectrum trading

3.2.1 Benefits of spectrum trading

All three questionnaires asked what benefits the respondent expected spectrum trading to bring, though each questionnaire offered a slightly different set of options as the response to the question. For that reason, direct comparison of answers is difficult. Overall, improvement in the efficiency of spectrum use is perceived as the main benefit by all respondents, and to a lesser extent increased flexibility and innovation. SMAs and other stakeholders also consider increased competition to be important. This picture is represented in Exhibit 3.3.

Benefit	*SMAs*	*Spectrum users*	*Other stakeholders*
Efficient usage	79%	63%	79%
More flexibility	63%	29%	53%
More innovation	47%	38%	53%
Competition	47%		68%
Reduced cost	37%	29%	
Gains from existing rights		33%	
Number of respondents	19	24	19

Exhibit 3.3: *Expected benefits from spectrum trading*

3.2.2 Possible limitations of spectrum trading

As for benefits, the three questionnaires all asked what were the respondent's main concerns related to the introduction of spectrum trading, but offered slightly different answer options. Once more, therefore, direct comparison is difficult. Overall, co-ordination difficulties, fragmentation of spectrum, interference and problems in enforcing allocation

are concerns with a majority of all respondents. The responses are summarised in Exhibit 3.4.

Concerns	*SMAs*	*Spectrum users*	*Other stakeholders*
Co-ordination difficulties	60%	66%	65%
Fragmentation	70%		55%
Distortion of competition	65%	69%	
Problems in enforcing allocation	60%	55%	65%
Interference	55%	62%	50%
Windfall gains	45%	10%	30%
Reduced economies of scale			55%
Uncertainty		45%	
Higher equipment prices		38%	
Number of respondents	20	29	20

Exhibit 3.4: *Concerns regarding spectrum trading*

3.2.3 The role of trading alongside other distribution systems

Licence-exempt spectrum

Most SMAs (90%) and other stakeholders (72%) believe more spectrum should be allocated to licence-exempt bands; spectrum users are equally divided on this topic.

Exhibit 3.5 below summarises the responses to the following questions:

- Do you intend to allocate more spectrum into 'licence-exempt' spectrum bands? [SMA questionnaire]
- Do you think regulators should allocate more spectrum into 'licence-exempt' spectrum bands? [other questionnaires]

More licence exempt spectrum	*SMAs*	*Spectrum users*	*Other stakeholders*
Yes	90%	50%	72%
No	10%	50%	28%
Number of respondents	20	28	18

Exhibit 3.5: *Views on licence-exempt spectrum*

3.3 Potential size of the secondary market

Expected volume of trades

Respondents are quite conservative regarding the expected size of the secondary spectrum market. Most SMAs do not expect more than 10 trades per year in their jurisdiction, whereas other stakeholders are slightly more optimistic, expecting 10–100 trades per year.

Spectrum users were only asked their view on the number of trades *in the bands in which they are active*. Once more, their estimates are quite conservative, with the great majority (96%) of users expecting no more than 10 trades per year.

Exhibit 3.6 summarises the responses to the following questions:

- [Questionnaire for SMAs and other stakeholders] How large do you believe the European secondary spectrum market could be in terms of volume of trades (with reconfiguration and change of use allowed)?
- [Questionnaire for spectrum users] Do you expect a large volume of trades (over 10 trades per annum) in spectrum rights in the bands you are active in?

Trades per year	*SMAs*	*Spectrum users*	*Other stakeholders*
None	0%	96%	17%
1-10	43%		17%
10-100	21%	4%	42%
More	36%		25%
Number of respondents	14	23	12

Exhibit 3.6: *Expected volume of trades*

Interest in trading

There is reasonable interest amongst spectrum users in participating in spectrum trades. When asked whether they would consider the possibility of buying or selling spectrum rights, almost half (46%) of the 28 respondents indicated that they would.

Expected volume of trade in different bands

The volume of trades that SMAs and other spectrum stakeholders[50] expect to see varies considerably for the different service bands, with public mobile (72% of all respondents) and FWA (69%) expected to have the highest volume of trades. PMR (62%) and fixed links (44%) are also expected to see significant trading activity.

Exhibit 3.7 summarises the responses to the following question:

- In which service bands do you believe the largest volume of spectrum trades will take place?

Bands	*SMAs*	*Other stakeholders*
Public mobile	68%	75%
FWA	64%	75%
PMR	55%	69%
Fixed links	50%	38%
Broadcasting terrestrial	32%	25%
Satellite	18%	13%
Number of respondents	22	16

Exhibit 3.7: *Volume of trades expected per band*

50 Spectrum users were not asked about their expectations on future trading volumes throughout Europe.

3.4 Rights and obligations

The questionnaires asked for respondents' views on a range of implementation issues:

- whether a standard trading unit should be defined
- the optimal duration of spectrum usage rights
- how interference management issues should be dealt with
- forms of trading; such as spectrum leasing

The respondents' views on these issues are summarised below.

3.4.1 Standard trading unit (STU)

Most respondents do not believe a standard trading unit needs to be defined: only 31% of spectrum users and 40% of SMAs favour such a unit. However, if a standard trading unit were to be defined, then most respondents agree that a minimum geographical area and a minimum amount of frequencies should be included in its definition.

Exhibit 3.8 below summarises the responses to the following questions:

- [SMA questionnaire] Do you plan to define a standard spectrum trading unit?
- [Other questionnaires] Do you believe a standard spectrum trading unit should be defined?
- If so, what elements do you think should be included in a trading unit?

Standard trading unit	*SMAs*	*Spectrum users*	*Other stakeholders*
Yes	40%	31%	48%
No	60%	69%	52%
Number of respondents	20	26	21
Elements included			
Minimum frequency	70%	89%	63%
Minimum area	60%	67%	88%
Number of respondents	10	9	8

Exhibit 3.8: *Views on need for, and preferred definition of, a standard trading unit*

3.4.2 Duration of usage rights

There is a divergence of opinion on the optimum duration of a spectrum right. Most SMAs (65%) would prefer rights to be for a fixed number of years, the majority (60%) of other stakeholders prefer a rolling period, while for spectrum users the most popular option (50% of users) is a rolling period – or even licence in perpetuity (32%).

Exhibit 3.9 below summarises the responses to the following questions:

- [SMA questionnaire] What do you plan to be the terms of the tradable spectrum rights?
- [Other questionnaires] What do you think the terms of the tradable spectrum rights should be?

Spectrum right duration	*SMAs*	*Spectrum users*	*Other stakeholders*
Fixed number years	65%	14%	25%
Rolling period	41%	50%	60%
In perpetuity	12%	32%	15%
Number of respondents	17	22	20

Exhibit 3.9: *Duration of spectrum rights*

3.4.3 Interference management

Most respondents (63%) believe that the best way of dealing with interference issues arising through trades should is by demonstrating that no harmful interference will be caused (that is, they chose the questionnaire option "The licensee who changes the use of a spectrum right or buys a new spectrum right needs to technically demonstrate no additional harmful interference is caused to existing licensees"). There was also support for settling interference issues through negotiations between adjacent users (chosen by 47% of all respondents).

Exhibit 3.10 summarises the responses to the following questions:

- [SMA questionnaire] How do you plan to deal with interference issues on tradable rights?

- [Other questionnaires] How do you believe interference issues on tradable rights should be dealt with?

Handling of interference	*SMAs*	*Spectrum users*	*Other stakeholders*
Standard threshold	42%	35%	21%
Negotiations	63%	42%	37%
Demonstrate no interference	63%	73%	53%
Number of respondents	19	26	19

Exhibit 3.10: *Views on how interference issues on tradable rights should be dealt with*

By a clear margin (78%), all types of respondent agree that the SMA should be involved in resolving interference disputes – and 100% of SMAs are of this opinion. There is some limited support (24%) for third-party arbitration, especially with other stakeholders.

Exhibit 3.11 summarises the responses to the following questions:

- [SMA questionnaire] How do you plan to resolve interference disputes?
- [Other questionnaires] How do you think interference disputes should be resolved?

Handling of interference disputes	*SMAs*	*Spectrum users*	*Other stakeholders*
NRA	100%	64%	70%
Third-party arbitration	11%	20%	40%
Courts	17%	4%	15%
Number of respondents	18	25	20

Exhibit 3.11: *Views on how interference disputes should be resolved*

3.4.4 Forms of trading

73% of the SMA respondents indicate that they plan to implement spectrum trading in their country. All three questionnaires elicited information on the types of transfers of rights supported, the importance of spectrum leasing and views on licence-exempt bands. The responses are summarised below.

Types of transfers

For all respondents, simple types of transfers (such as change of ownership) have more support then the more complex types (such as change of service or technology). Over 70% of all respondents support a change of ownership, the simplest form of transfer of a spectrum right. Leasing gets a similar level of support from spectrum users and other stakeholders, but not SMAs. More complex types of spectrum trading (reconfiguration, change of service or change of technology) have less support amongst all types of respondents.

Exhibit 3.12 summarises the responses to the following questions:

- [SMA questionnaire] What type of transfers of spectrum rights or changes in spectrum rights do you plan to implement?
- [Other questionnaires] What type of transfers of spectrum rights or changes in spectrum rights do you support?

Types of transfers	*SMAs*	*Spectrum users*	*Other stakeholders*
Change of ownership	69%	79%	71%
Leasing	50%	71%	71%
Reconfiguration	50%	50%	33%
Change of service	31%	33%	24%
Change of technology	44%	58%	38%
Number of respondents	16	24	21

Exhibit 3.12: *Views on types of transfers that should be allowed*

Spectrum leasing

63% of the SMAs and 58% spectrum users believe spectrum leasing will be an important component of a secondary spectrum market, whereas a high proportion (85%) of other stakeholders believe this to be true.

Exhibit 3.13 summarises the responses to the following question:

- Do you believe the leasing of spectrum will be an important component of the secondary market?

Spectrum leasing important	*SMAs*	*Spectrum users*	*Other stakeholders*
Yes	63%	58%	85%
No	36%	42%	15%
Number of respondents	19	24	20

Exhibit 3.13: *Views on relevance of spectrum leasing*

3.5 Systems for managing and monitoring trading

3.5.1 Notification of the SMA

Although the majority of SMAs (80%) believe their approval should be required for every trade, most spectrum users (77%) would prefer only to have to notify the regulator of a trade, either before (50%) or after (27%) the trade occurring. Some spectrum users specified that prior notification or approval is only necessary for trades with a change of use.

Exhibit 3.14 below summarises the responses to the following questions:

- [SMA questionnaire] When a secondary market for spectrum rights is implemented, do spectrum users have to notify the regulator before a trade occurs?
- [Other questionnaires] When a secondary market for spectrum rights is implemented, do you believe spectrum users should have to notify the regulator before a trade occurs?

Type of notification	*SMAs*	*Spectrum users*	*Other stakeholders*
Approval needed	80%	38%	63%
Notify before	20%	50%	37%
Notify after	5%	27%	
Number of respondents	20	26	19

Exhibit 3.14: *Views on whether SMA should have to approve trades*

3.5.2 Appropriate trading mechanisms

An online registry is the preferred trading mechanism for all types of respondents (79%). The use of independent agents as a trading mechanism does not have much backing.

Exhibit 3.15 below summarises the responses to the following questions:

- [SMA questionnaire] What trading mechanisms are you planning to implement to facilitate the secondary spectrum market?
- [Other questionnaires] What trading mechanisms would you expect to emerge to facilitate the secondary spectrum market?

Trading mechanisms	*SMAs*	*Spectrum users*	*Other stakeholders*
Online registry	76%	92%	69%
Independent agents	24%	21%	53%
Number of respondents	17	24	16

Exhibit 3.15: *Trading mechanisms*

3.5.3 Ensuring availability of information

The different categories of respondents differed in their views on what information should be made publicly available to assist the development of the secondary spectrum market. SMAs appear to have reservations about making information available, and only give significant support (79% of SMAs) for an assignment table stating who owns rights for which frequencies. In addition to an assignment table, spectrum users and other stakeholders would also appreciate the publication of a trades register (who traded which frequencies) and a list of interested participants (licensees who are interested in doing a trade). Other stakeholders, but not spectrum users, also show interest in a price database (who paid what for which rights) and spectrum use measurements (information about measurements of efficient use of spectrum).

Exhibit 3.16 below summarises the responses to the following questions:

- [SMA questionnaire] What information are you planning to make publicly available in the spectrum market?

- [Other questionnaires] What information do you think should be made publicly available in the spectrum market?

Public information	*SMAs*	*Spectrum users*	*Other stakeholders*
Assignment table	79%	93%	90%
Trades register	37%	63%	76%
Interested participants	21%	48%	62%
Spectrum use measurements	37%	30%	57%
Price database	26%	33%	48%
Number of respondents	19	27	21

Exhibit 3.16: *Views on information to be made publicly available*

3.6 Timing of the transition

The majority of all respondents prefer a progressive introduction of spectrum trading in all spectrum bands, rather than an all-at-once approach. In particular, 95% of other spectrum stakeholders favour a gradual introduction.

Exhibit 3.17 below summarises the responses to the following questions:

- [Questionnaire for SMAs] Do you plan to implement spectrum trading in all frequency bands at once or progressively?
- [Other questionnaires] Do you think spectrum trading should be implemented in all frequency bands at once or progressively?

Transition method	*SMAs*	*Spectrum users*	*Other stakeholders*
Progressively	81%	81%	95%
All at once	19%	19%	5%
Number of respondents	16	26	20

Exhibit 3.17: *Transition method*

3.7 Applicability of spectrum trading to different bands

Respondents were asked for their views on whether trading should be introduced gradually or all at once, and the bands that are particularly appropriate or inappropriate for trading. The responses are discussed below

Bands that are appropriate for initial implementation

Over half of the respondents believe FWA (57%) and public mobile (59%) should be the first bands in which spectrum trading should be allowed– this view is supported especially by SMAs (71%). 50% of the respondents mention PMR and 46% mentioned fixed-link bands as appropriate for the implementation of trading.

Exhibit 3.18 summarises the responses to the following questions:

- In case of progressive introduction, in which bands do you think spectrum trading should be implemented first?

Spectrum bands	*SMAs*	*Spectrum users*	*Other stakeholders*
FWA	71%	41%	59%
Public mobile	64%	55%	59%
PMR	50%	36%	65%
Fixed links	50%	36%	53%
Broadcasting terrestrial	29%	23%	24%
Broadcasting satellite	29%	5%	18%
Maritime	7%	9%	6%
Number of respondents	14	22	17

Exhibit 3.18: *Bands considered appropriate for initial implementation of trading*

Bands that are not appropriate for initial implementation

Service bands such as aeronautical, leisure, maritime and scientific are considered inappropriate for trading by more then half the respondents. Overall, SMAs and other spectrum stakeholders find more bands inappropriate for trading then spectrum users. The bands that are most commonly considered inappropriate are: aeronautical (62%),

radionavigation (60%), leisure (56%), and maritime (55%). Scientific and ISM are also deemed inappropriate by more than half of the SMAs (68% and 79% respectively).

Overall, spectrum users have less reservations about the applicability of spectrum trading – never more then half of the respondents find any band inappropriate.

Exhibit 3.19 summarises the responses to the following question:

- In which service bands do you think it is inappropriate to introduce spectrum trading?

Spectrum bands	*SMAs*	*Spectrum users*	*Other stakeholders*
Aeronautical	74%	45%	67%
Radionavigation	68%	40%	73%
Leisure	84%	25%	60%
Maritime	63%	35%	67%
Scientific	68%	35%	40%
ISM	79%	30%	33%
Broadcasting satellite	5%	30%	33%
Satellite	21%	20%	27%
Broadcasting terrestrial	16%	10%	13%
Fixed links	11%		13%
Public mobile	5%	20%	
PMR	5%		13%
Number of respondents	19	20	15

Exhibit 3.19: *Bands considered inappropriate for spectrum trading*

3.8 Need for a co-ordinated approach

The questionnaires asked for the views of respondents whether there is a need for a co-ordinated approach, what aspects of spectrum trading should be co-ordinated, perceived benefits and concerns, and what institution(s) could would be most suited to playing a role in co-ordination. The respondents' views on these issues are summarised below.

Need for a co-ordinated approach

Almost 80% of all respondents believe there is a need for a co-ordinated approach to the implementation of spectrum trading across the European Community.

Exhibit 3.20 below summarises the responses to the following question:

- Do you believe there is a need for a harmonised approach regarding implementing spectrum trading across the European Community?

Need for harmonisation	*SMAs*	*Spectrum users*	*Other stakeholders*
Yes	81%	75%	75%
No	19%	25%	25%
Number of respondents	21	28	20

Exhibit 3.20: *Views on need for co-ordination*

Aspects to be co-ordinated

Over two-thirds of all respondents believe that the following aspects of spectrum trading should be co-ordinated: suitable bands (76%), general framework (73%) and interference conditions (68%). The general view is that aspects such as trading units are better left to the national spectrum markets.

Exhibit 3.21 below summarises the responses to the following question:

- If there is a need for a harmonised approach, what aspects of spectrum trading do you believe could be harmonised?

Aspects for harmonisation	*SMAs*	*Spectrum users*	*Other stakeholders*
Suitable Bands	89%	74%	65%
General framework	79%	57%	82%
Interference conditions	68%	83%	53%
Property rights	37%	61%	65%
Duration	37%	52%	41%
Competition measures	53%	35%	44%
Trading mechanisms	47%	43%	47%
Trading units	21%	26%	35%
Number of respondents	19	23	17

Exhibit 3.21: *Views on aspects of trading that could be co-ordinated*

Benefits and concerns of co-ordination

Through several open questions, all three types of respondent were asked about the perceived benefits of co-ordination, and their concerns relating to (the absence of) such co-ordination. Overall, more benefits then concerns were mentioned, with 'coherent regulatory framework' and 'prevention of cross-border interference' being the most mentioned benefits, and 'differing national conditions' and 'bureaucracy' being the most frequent concerns.

Exhibit 3.22 below summarises the responses to the following questions:

- Do you believe there is a need for a harmonised approach regarding implementing spectrum trading across the European Community? Why? [Open question]
- What are your main concerns with such harmonisation or absence of such harmonisation? [Open question]

Need for harmonisation		*Risks of harmonisation*	
SMAs			
Avoid regulatory fragmentation and competition distortion/ need for a harmonised business environment	8	Need to respond to national circumstances	6
Cross-border interference	5	National legislation encompasses more aspects than the merely technical ones	1
Prevent fragmentation of spectrum bands	1	Bureaucracy	1
International co-ordination	1	Different national assignment mechanisms	1
Economies of scale	2	Implementation complexities	1
Pan-European spectrum trade	1		
Harmonised information databases	1		
Spectrum users			
Ensure coherent regulatory framework: equal terms of trading and competition	7	Nations have differing level of market development and competition	4
Cross-border interference	6	Different national assignment mechanisms	2
International co-ordination	3	Different national spectrum user rights	1
Uncertainty in planning/ need stable market system to support business plan	2	Technical issues and local constraints are best treated at national level.	1
Need to harmonise duration of usage	1	No need for harmonisation in national broadcasting market	1
Economies of scale and low equipment cost	1		
Stakeholders			
Consistency of approach across Europe/ Integration and overseas collaboration	4	Excessive harmonisation will stultify the process/ bureaucracy killing innovation	3
Avoid band fragmentation	2	Sheer complexity of implementation	3
Achieve economies of scale & roaming	1	The creation of more bureaucracy in an already heavily-regulated industry	1
Transparency & lower costs	1	Difficulties in accommodating the differences amongst countries	1
Allow pan-European trades	1		
Attempt to get spectrum near liquid and allow more growth in wireless	1		

Exhibit 3.22: *Perceived benefits and concerns regarding co-ordination*

Institutions that could assist with co-ordination

In an open question, respondents were asked what institutions could play a role in the harmonisation of certain aspects of spectrum trading. The CEPT and the European

Commission were mentioned most often. Respondents believe that CEPT could mostly play a role in technical background work and in identifying bands for trading, whereas the EC should 'provide a political shoulder' and define a legal framework or recommendations regarding spectrum trading. A number of respondents (especially spectrum users) also referred to ETSI (European Telecommunications Standard Institute) working groups as being able to help with standards and compatibility issues. The RSPG (Radio Spectrum Policy Group), the ERG (European Regulators Group) and the ERO (European Radiocommunications Office) were also mentioned.

Exhibit 3.23 below summarises the responses to the following question:

- Which pan-European institutions should play a role in achieving such an approach, and what role would that be?

Institutions	*SMAs*	*Spectrum users*	*Other stakeholders*
CEPT	12	6	7
EC	9	8	9
ETSI	1	5	3
RSPG	3	2	3
ERG/ IRG	2	2	0
ERO	1	0	2

Exhibit 3.23: *Institutions that could play a role in harmonisation*

Annex D: Summary of issues discussed at workshop

On 11 December 2003, 160 spectrum stakeholders from across Europe and beyond attended an open workshop on spectrum trading in Brussels. The event was part of the study being carried out by Analysys, DotEcon and Hogan & Hartson for the European Commission, examining the potential need for co-ordination of spectrum trading frameworks across Europe. This annex describes the issues discussed during that workshop, and summarises the discussions and points raised. All the presentations made by Analysys, DotEcon and Hogan & Hartson are publicly available online at www.analysys.com/spectrumtrading. A number of short presentations made by spectrum stakeholders during the workshop are also available.

1 Issues requested for discussion

Prior to attending the spectrum trading workshop, attendees were given the opportunity to submit the issues they would like the workshop to cover. The table below summarises the issues mentioned in the responses received.

Issues for discussion	number of respondents
Specific bands for trading (broadcasting, 3G, etc)	26
EU harmonisation	23
Change of use and technology	21
Transition issues (conditions, mechanisms, timing)	18
Competition	15
Definition of property rights	14
Spectrum fees (pricing)	11
Regulatory (role of the SMA)	10
Status of spectrum traing elsewhere	7
Interference	5

Exhibit 1: *Issues for discussion requested by attendees*

2 Participants at the workshop

Attendees included the following:

- **spectrum managers (40%)**
  – including regulators, ministries and pan-European bodies
- **spectrum users (30%)**
  – including mobile operators, broadcasters and satellite players

- **other stakeholders (30%)**
  – including manufacturers, consultants, lawyers, consumer groups and scientists.

2 Issues discussed

The workshop covered a number of critical issues in spectrum trading, grouped as follows:

- **What could spectrum trading bring?** – potential benefits and concerns.
- **What are Member States' plans for introducing spectrum trading?** – summary of stakeholder responses to the study team's questionnaire.
- **What options could Member States adopt in trading frameworks?** – defining spectrum rights and obligations, and addressing concerns about interference, international co-ordination and competition.
- **How will trading work in practice?** – case studies of actual and potential spectrum trades.
- **What areas of spectrum trading could be co-ordinated across the Community?** – potential benefits and costs of co-ordinating frameworks for spectrum trading.

The initial findings of the study were presented by the consultants, and participants voiced their views on the need for harmonisation of trading frameworks. A number of the participants were also invited to present their views on particular topics, followed by a series of open discussions with the audience. Copies of the material presented during the workshop can be viewed at www.analysys.com/spectrumtrading.

The following issues were raised during the workshop (note that the opinions expressed below are those of the participants and do not represent the views or official position of the European Commission or of the authors of this study).

Defining spectrum trading

- There are two distinct forms of spectrum trading: transfer of ownership and change of use. Transfer of ownership is often relatively straightforward to introduce. Permitting change of use poses much more significant challenges, but also offers significant potential benefits

Scope for introducing trading

- Participants generally support the introduction of spectrum trading, but many have concerns about its applicability to individual bands, e.g. aviation (safety concerns), satellite (international nature of allocations) and broadcasting (guaranteed spectrum needed to provide broadcasting services).
- There are many forms of trade: it is not a 'one size fits all' or 'all sizes fit all' approach for all frequency bands.
- Some stakeholders believe that not enough has been done to demonstrate how spectrum efficiency will improve as a result of introducing spectrum trading – this is viewed as necessary to justify change.

Relationship with other spectrum management tools

- One spectrum management model does not fit all: command-and-control, harmonised allocations, spectrum trading and unlicensed spectrum all have a role to play.
- Unlicensed bands, with non-exclusive access to free spectrum, have a key role to play in encouraging innovation – some participants favour replacing primary assignments with more unlicensed bands, rather than allowing a wider use of spectrum trading.
- There is a potential conflict between spectrum trading (allowing quick access to spectrum) and harmonisation (creating large markets and economies of scale).
- Some large manufacturers prefer standardisation to drive economies of scale, but smaller manufacturers often prefer flexibility. One stakeholder presenter argued that harmonisation of spectrum may have already gone too far – extrapolating from the success of GSM can be dangerous.
- In the UK, Ofcom plans to use administrative incentivised (spectrum) pricing alongside spectrum trading. However, some mobile operators question whether pricing has any role in this context.

Concerns about the introduction of spectrum trading

- Views vary on the extent to which fragmentation of spectrum may arise through trading, and there is a degree of concern that this may inhibit future international harmonisation.

- Some participants doubt whether market mechanisms can resolve interference issues. In particular, there is concern that cross-border interference issues owing to changes of use could have a negative domino effect across European markets.
- Competition rules are required to prevent monopolisation of scarce spectrum. There is widespread support for the use of existing European competition policy and specific ex-ante regulations modelled on merger regulations.
- Some users fear they might be forced to sell spectrum. However, other participants see trading spectrum as an option, not a mandatory requirement.

The potential need for harmonisation of spectrum trading frameworks in Europe

- Mobile operators are generally supportive of framework harmonisation, especially in relation to the transparency of trading systems and preventing too much national intervention.
- International operators, especially satellite operators, are concerned about lobbying costs if each country takes a different approach to spectrum trading.
- Several participants indicated that treatment of information on trades is an area where harmonisation could be beneficial, particularly in respect of lowering transaction costs.
- Harmonisation measures should not prevent different outcomes (amount of spectrum distributed to different uses or users) in different states.