

Final report for the European Commission

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

Summary of the report

May 2004

Analysys

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About the authors

This report was prepared by Analysys Consulting Ltd, DotEcon Ltd, and Hogan & Hartson LLP for the Radio Spectrum Policy Unit (RSPU) of the Information Society Directorate-General of the European Commission. Analysys, DotEcon and Hogan & Hartson are grateful for the assistance of the RSPU in identifying information sources for this report and providing expert comments on our drafts. We would also like to thank the representatives of other departments of the European Commission, national spectrum management authorities, spectrum users and other stakeholder groups who have participated in our consultation exercises. However, we wish to emphasise that this report is the work of Analysys, DotEcon and Hogan & Hartson, and does not necessarily represent the views of members of the RSPU or any other group.

Unless otherwise indicated, all figures and tables in this report are sourced from Analysys, DotEcon and Hogan & Hartson.

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Hogan & Hartson is the oldest and the largest major law firm based in Washington, D.C. Work on this project was undertaken by a partner in the Brussels office who specialises in developments in European communications law, and advises clients on international communications and radio spectrum matters.

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Overview of our findings

1. This study identifies the options available for implementing spectrum trading and considers whether there are benefits from co-ordination of approaches across the EU. It was undertaken for the Radio Spectrum Policy Unit of the Information Society Directorate-General of the European Commission by Analysys Consulting Ltd, DotEcon Ltd and Hogan & Hartson LLP. The study included an extensive consultation process with spectrum management authorities, spectrum users and other stakeholders.

Trading and liberalisation

2. Throughout, we distinguish two distinct policies related to spectrum trading:
 - *Trading* – the transfer of spectrum usage rights between parties in a secondary market.
 - *Liberalisation* – relaxation of restrictions on the services and technologies associated with spectrum usage rights.

Our key recommendations

3. We recommend that the Commission should seek to move ahead with both spectrum trading and liberalisation through the use of appropriate binding measures on Member States. However, many of the details of how spectrum trading is implemented can be devolved to Member States, providing that national spectrum management frameworks have certain generic features.

The case for co-ordination of broad policy

4. Services derived from radio spectrum are of great economic and social value. There are substantial benefits to European citizens from ensuring that spectrum is used efficiently to deploy services of the greatest benefit to them. Trading and liberalisation can allow more efficient use of spectrum. Liberalisation has the potential to remove entry barriers created by frequency blocks being reserved for particular uses and to promote greater competition in the supply of spectrum-derived services. The combination of trading and liberalisation can also facilitate the introduction of new services and promote innovation. In general, these benefits greatly outweigh the costs associated with trading and liberalisation, although there are certain uses of spectrum where trading and/or liberalisation would not be appropriate.
5. Although many of the benefits of trading and liberalisation accrue locally to the country introducing the policy, there are spill-over benefits for other states. In particular, the co-ordinated introduction of trading and liberalisation across Europe is likely to encourage innovation by giving ready access to radio spectrum for new applications at a pan-European scale. Without such measures, innovative activity may move outside Europe to other trading blocks where spectrum necessary to access large markets can be obtained speedily. This might

cause delays in the introduction of new services and give rise to substantial losses in economic welfare for European citizens. Put differently, if a sufficient number of European countries fail to introduce spectrum trading, this could frustrate the realisation of benefits for all.

The need to co-ordinate detailed policy is more limited

6. There are certain aspects of the framework for spectrum trading that would benefit from a co-ordinated approach across Europe in order to promote efficiency (especially innovation), and minimise costs of both implementation and trading. These include:
 - a common set of parameters for defining usage rights (e.g. frequency, geographical area)
 - a commitment not to impose prior restrictions, without good reason, on the type of trades possible, the reconfiguration of usage rights or the emergence of trading mechanisms
 - clear rules on the association of rights and obligations of spectrum users and how these transfer under a spectrum trade
 - ensuring Member States adopt orderly and transparent approaches towards renewal of usage rights, to avoid uncertainty over the expiry of usage rights inhibiting trading and disincentivising investment
 - retaining a common set of minimal powers to reclaim spectrum, for example if required for pan-European harmonisation
 - an obligation that interference management regimes are consistent with trading and liberalisation
 - defining a minimum set of information that parties to a spectrum trade must disclose
 - common approaches to the protection of competition, based on existing national and EU competition law.
7. Co-ordination of these limited aspects of policy is consistent with much of the detailed implementation of spectrum trading being undertaken by Member States. For example, requiring that Member States' interference management regimes permit trading and liberalisation allows considerable discretion by national spectrum management authorities. Details of the arrangements for the transition to spectrum trading, other than the maximum time allowed for transition, can also be left to Member States.

Mechanisms for implementing these recommendations

8. The current EU framework permits but does not require Member States to implement spectrum trading. Requiring Member States to introduce trading and liberalisation by a certain date is likely to need a binding measure such as a directive. Such a measure would be proportionate, given the scale of the economic benefits at stake. Short of this, it might be

possible to use other, non-binding measures to encourage a critical mass of Member States to permit trading and liberalisation, thereby encouraging innovation across Europe.

9. Our recommendations for limited co-ordination of spectrum trading frameworks in the aspects described above could in the main be achieved through technical implementation measures (potentially through the Radio Spectrum Committee of the European Commission).

Service-by-service phasing

10. We present a high-level analysis and recommendations on the applicability of spectrum trading on a service-by-service basis. Prior to introducing spectrum trading, further assessment of particular uses would be required to see if there would be insurmountable practical problems.

Flexible trading mechanisms can take account of local circumstances

11. Co-ordination of these aspects of trading and liberalisation across Member States would not inhibit the ability of Member States to take account of local circumstances. Even if Member States had similar *frameworks* for spectrum trading, this does not necessarily entail similar *outcomes* in terms of the assignment and use of spectrum, if there are local variations in demand.

Harmonisation of spectrum

12. These proposals do not preclude the harmonisation of a particular frequency band across Europe for a particular use if a compelling case for standardisation were to arise in the future. Indeed, the current EU framework requires Member States to maintain such powers. However, liberalisation and trading should reduce the need for such interventions. Establishing market prices for spectrum would make the opportunity costs of such interventions transparent.

The relationship with unlicensed spectrum

13. Spectrum trading is based on users having largely exclusive usage rights that can be transferred. However, some spectrum bands are shared amongst many *unlicensed* users, with interference managed by restrictions on the range and power of the devices used. For such unlicensed bands, there is no usage right that can be traded. In addition, high transaction costs arising from dealing with large numbers of anonymous users limit the applicability of market mechanisms for unlicensed bands. Nevertheless, spectrum trading allows the opportunity cost of allocating spectrum to unlicensed uses to be observed. This should assist policymakers in determining where it is in the public interest to allocate spectrum to unlicensed uses.

Summary of the report

This study aims to raise awareness of spectrum trading in Europe and make recommendations for co-ordination of Member State frameworks

14. Following implementation of the new EU Framework Directive, all European countries now have the option to introduce secondary trading of spectrum usage rights. Some European countries have already introduced basic frameworks for trading of spectrum, and others are likely to follow shortly. Anticipating these developments, the Radio Spectrum Policy Unit of the Information Society Directorate-General of the European Commission has commissioned this study on ‘*Conditions and options in introducing secondary trading of radio spectrum in the European Community*’ by Analysys Consulting Ltd, DotEcon Ltd and Hogan & Hartson LLP.

15. The core objectives of the study are two-fold:

- to raise awareness of spectrum trading in Europe amongst stakeholders, including spectrum management authorities (SMAs), users, equipment manufacturers and consumer groups
- to identify whether there is a role for co-ordination of Member State spectrum trading frameworks at a Community level, and to formulate appropriate policy recommendations for the Commission.

The report draws on extensive consultation, research and analysis

16. Between September 2003 and April 2004, we held consultations with a wide variety of spectrum stakeholders across Europe, including interviews with SMAs from 23 countries, and bilateral consultations with spectrum users and equipment manufacturers. Some 74 organisations responded to our on-line questionnaire. In December 2003, we held a public workshop in Brussels, attended by 160 spectrum stakeholders.

Access to radio spectrum and the role of spectrum trading

Radio spectrum is a valuable resource ...

17. Radio spectrum plays a key role in generating economic welfare in Europe. It is a key input into many communications services and its use has spawned an extensive electronics equipment manufacturing sector. Services derived from spectrum are inputs into virtually every sector of the European economy, generating jobs, productivity gains and economic growth. Based on available data, we estimate that the economic value generated for consumers of services derived from radio spectrum is around 2%–2.5% of EU aggregate GDP.

... *but usable frequencies are scarce*

18. The amount of spectrum that is usable by particular applications is limited. It is not possible for users to share spectrum indiscriminately because one user may cause *interference* for another user. Different frequencies have different properties, making particular frequencies suitable for different uses. In practice, the suitability of spectrum for a particular application may be further constrained by the availability of equipment, which may be uneconomical to manufacture unless it operates within a certain defined frequency range in order to exploit scale economies. The availability of equipment is often driven by regulatory decisions (by SMAs and international co-ordination bodies) which specify technology requirements for particular frequencies.
19. In many regions of a large number of European countries, demand for access to particular frequencies now exceeds supply. Usable spectrum is *scarce* in that demand would outstrip supply without controls on its use. As all potential demands cannot be met, there is an *opportunity cost* associated with distributing spectrum to particular uses and users. The opportunity cost is the value associated with the best alternative use or user of that spectrum.

Spectrum should be distributed to the uses and users that generate the greatest value ...

20. Ideally, spectrum should be distributed *efficiently*, which means giving access to the combination of uses and users that maximises economic value-added, subject to taking account of social welfare and public policy concerns. The general goal of 'efficient use of spectrum' has been embraced by the European Parliament and Council, and is widely recognised by SMAs.

... *but existing management systems fail to do this*

21. Decisions on spectrum distribution relate to three main questions:
 - what types of uses should be allowed? – *allocation* of spectrum
 - who should be allowed to operate the frequencies? – *assignment* of spectrum
 - to what extent should decisions on allocation and assignment be made by the state (*centralised* decision-making) or devolved to users (*decentralised* decision-making)?
22. Traditionally, European countries have adopted a centralised approach (referred to in this report as *command-and-control*), with governments making all decisions on allocation and assignment. This approach is effective in controlling the use of spectrum to prevent harmful interference, but it places a huge responsibility on spectrum authorities to pick appropriate services, technologies and users. As the variety of spectrum uses and associated technologies increases and spectrum demand expands, so the likelihood increases that governments will make inefficient allocations and assignments.
23. In recent years, SMAs have increasingly experimented with other models of spectrum management. Some spectrum has been allocated for unlicensed use, allowing multiple low-power users to share the same spectrum without having any protection from interference; we call this the *commons* model. Meanwhile, many European countries have turned to auctions as a

way of allowing the *market* to determine primary assignment where spectrum usage rights (licences) are scarce.

24. These reforms offer significant benefits, but only partially resolve the inefficiencies associated with existing spectrum management approaches:

- SMAs rather than the market remain responsible for decisions on allocation. Mistakes are unavoidable; for example, limiting the amount of spectrum allocated to services in high demand can result in artificial scarcity of certain frequencies.
- When designing usage rights, the focus tends to be on avoiding interference between users and uses (as this is clearly observable) and not so much on maximising the economic benefits derived from the spectrum (which may be difficult for SMAs to determine). As a result, valuable spectrum is left unused at any given time.
- SMAs' emphasis on centralising decisions on allocation, and on the timing and design of primary assignment processes (rather than enabling secondary trading) is inherently inflexible. SMAs necessarily respond reactively to changes in technology and markets. Policy changes may take many years and involve complex negotiations and lobbying activity at both the national and international level.

25. In summary, existing spectrum management approaches cannot be relied upon to distribute spectrum efficiently. They generate less economic value than they could, and so deprive EU citizens of potential benefits.

Spectrum trading is a possible solution

26. There are two distinct policies that could be introduced separately or in combination:

- *Trading* – the transfer of spectrum usage rights between parties in a secondary market. The actual trade may take a number of forms, including sale, lease or options.
- *Liberalisation* – the relaxation of restrictions on services and technologies associated with spectrum usage rights, as well as the possibility of reconfiguring usage rights.

27. Introducing trading of rights devolves decisions over *assignment* of usage rights to actual users, allowing the market to determine who has access to spectrum. Liberalisation of spectrum use devolves decisions over *allocation* of spectrum to users, allowing the market to determine how spectrum is used. Without liberalisation, secondary market activity will be limited to transfers of existing usage rights. Without trading, liberalisation will only enable existing users to switch services and technologies; alternative users would not be able to access the spectrum.

Introduction of both trading and liberalisation could lead to more efficient use of spectrum ...

28. The introduction of trading and liberalisation could increase the economic welfare of EU citizens through a number of mechanisms:

- *Direct effects* – Exposing users to the opportunity cost of the spectrum they use will put pressure on them to make best use of it or to sell it to someone else who can.
- *Transparency of opportunity cost* – Increased transparency of the value of spectrum can raise awareness of market entry opportunities and so reduce barriers to entry. It can also help to expose the costs of spectrum used by public services.
- *Competition* – Spectrum trading can lower barriers to expansion and permit new entry. Liberalisation will allow more rapid innovation in the services derived from spectrum.
- *Innovation and shifts in market demand* – Spectrum trading can facilitate change in use and users of spectrum over time in response to shifts in market demand and technological innovations. This, in turn, should increase incentives to both develop and launch innovative services and technologies, potentially enhancing European competitiveness.

... but will not be appropriate in all circumstances

29. The scope for introducing trading and/or liberalisation for some spectrum uses may be limited owing to:

- *Market failure* – If there are knock-on effects from a spectrum trade or change of use not reflected in the willingness to pay for spectrum of the parties involved, it is possible that the trade or change of use could increase rather than decrease overall economic welfare. Examples of such effects include impact on socially valuable services, interference problems and anti-competitive behaviour.
- *Conflict with public policy* – Some trading arrangements may be politically undesirable owing to conflict with other public policy goals.
- *High (and irreducible) transaction costs* – Welfare gains through more efficient use of spectrum may not be realised if transaction costs inhibit trading.

30. Thus, trading and/or liberalisation is not necessarily appropriate in all cases. For the foreseeable future, spectrum trading will co-exist alongside other spectrum management approaches. This means that SMAs must still make decisions about which policy tools are appropriate for which spectrum use (and so for which frequency block, given current allocations), and monitor how this may change over time. Even though spectrum trading is not applicable to all frequencies, it allows the opportunity cost of frequencies allocated by traditional command-and-control or the commons model to be inferred by comparison with those that are traded. This should assist policymakers in determining where it is in the public interest to allocate spectrum to public service bodies and to unlicensed uses.

Spectrum trades are already taking place in a number of countries ...

31. Five countries – Australia, New Zealand, Guatemala, the USA and Canada – have pioneered liberal spectrum management regimes. Trading volumes have been modest but significant (for example, an

8% turnover of usage rights in 2001–02 in Australia). US law has always permitted the trade of spectrum usage rights through re-assignment of usage rights or transfer of control, based on regulatory pre-approval. Most US trades involve simple transfers of ownership and small, relatively low-value usage rights (e.g. usage rights for private mobile radio taxis and for local FM radio). However, some high-value transactions with change of use have also occurred, for example Nextel's aggregation of specialised mobile radio usage rights into a US national mobile network.

... and their experience of trading has generally been positive

32. Concerns about fragmentation of spectrum have not been realised. Trading has generally encouraged competition, but has raised concerns about concentration in some downstream markets. Trading and liberalisation have not created additional interference problems where rights have been clearly defined; for example New Zealand has successfully used secondary trading to open up the 2.0GHz band (partially occupied by fixed-link operators) to commercial mobile.
33. In recent years, many European SMAs have sanctioned de facto transfers of usage rights between companies, even though trading was theoretically prohibited. Some SMAs indicated to us that they regularly receive and grant requests for transfers, and sometimes permit changes in use. Some European countries have already taken advantage of the new EU Framework Directive to explore possibilities of spectrum trading and/or liberalisation – notably Austria, Sweden and the UK. In Austria, two 3G operators recently took advantage of new rules to buy additional spectrum from another usage rights holder.
34. Trading and liberalisation provide enhanced flexibility to all those involved in spectrum use, including incumbents, potential market entrants and equipment manufacturers. That some players value this flexibility is apparent from trading activity both in pioneer countries and in Europe, even within the limited confines of historical spectrum management systems.

Member State frameworks and stakeholder perspectives

Member States have taken divergent approaches towards spectrum trading

35. Under the EU Framework Directive, Member States have the option to introduce spectrum trading in their national legislation. Member States are still in the early stages of developing policy on spectrum trading; nevertheless, it is already apparent that there will be a wide variety of approaches across Europe:
 - Up to one-third of countries studied have either not yet implemented any policy on spectrum trading or have no plans to do so.
 - The countries that plan to implement spectrum trading are at different stages of preparation and/or are following different approaches. Notably, whereas some countries are conducting extensive studies to define detailed regulations prior to allowing trades, others are already allowing trades and some change of use on a case-by-case basis, without defining an exhaustive regulatory framework.

- There is considerable divergence of opinion as to the benefits and concerns associated with spectrum trading. Some countries are opposed to all types of trading; some favour trading but are sceptical about liberalisation; others broadly favour trading and liberalisation.

36. Some of these differences in policy approaches may be temporary. In our consultations, all SMAs indicated an interest in developments in other European countries, and a willingness to adjust their own approaches in response to lessons learned from the experiences of others. Most SMAs expect initial trading in usage rights to be quite thin. Reflecting this, many expect to evolve formal rules only gradually in response to analysis of individual trades, making it difficult to predict the future for national frameworks.

There is widespread support amongst spectrum users and other stakeholders for trading, but judgement is more reserved on liberalisation

37. There was general support amongst stakeholders participating in our consultation for permitting *transfers* of existing usage rights, as these are perceived to create few complications. Attitudes towards *liberalisation* were more mixed, with some stakeholders expressing concern about the impact of unrestricted change of use.

38. More efficient use of spectrum was clearly identified as the main benefit of trading. Respondents also identified a range of concerns, including potential increased interference problems, difficulties in co-ordinating usage in bands across Europe and possible abuse of trading for anti-competitive purposes. Many respondents said that it should be the responsibility of spectrum users to demonstrate that no additional harmful interference will arise from a trade or change of use (or address this through negotiations with adjacent users) before change is sanctioned. A general view is that SMAs should continue to have a role as the final arbiter of any interference disputes.

39. Respondents anticipated that most trades will occur in bands currently used for public mobile, fixed wireless access, private mobile radio and fixed-link services, and that these are the areas most suitable for trading. Services deemed unsuitable for trading include the aeronautical, radionavigation, leisure and maritime bands, primarily owing to safety-of-life issues or practical concerns. The satellite and broadcasting industries also voiced substantial reservations regarding trading and liberalisation in their bands.

Stakeholders favour greater European co-ordination of spectrum trading but with significant national autonomy over detailed implementation

40. A majority of stakeholders believe there is a need for some co-ordination of national frameworks, including general approaches to trading and liberalisation, choice of spectrum bands, interference conditions and collation of information. However, there is also concern that any central regulation should not unduly restrict the ability of SMAs to tailor policies to local conditions.

The case for pan-European co-ordination of spectrum trading

Pan-European co-ordination could be used to prevent undesirable divergence in Member State frameworks for spectrum trading

41. Given the very real possibility that different Member States will adopt different approaches to the introduction of trading, it is important to consider whether the actions of one or more Member States adversely affect the interests of all. This in turn raises the question of whether there might be overall gains in welfare if there was action at the Community level to *co-ordinate* spectrum trading frameworks across Member States.
42. To assess the potential impact of co-ordination, we defined a ‘status quo’ scenario, which assumes that the Commission undertakes no further action to co-ordinate trading or liberalisation. This scenario is based on our discussions with SMAs, which suggested that – at least initially – Member States are likely to take quite divergent approaches towards introducing spectrum trading. We then developed three high-level alternative scenarios for co-ordination:
 - *A: Trading and liberalisation* – All Member States introduce secondary trading and allow liberalisation
 - *B: Trading only* – Member States introduce secondary trading, but remain free to choose whether to allow liberalisation
 - *C: Restrict liberalisation* – Member States have the option to introduce spectrum trading, but liberalisation is restricted.

Implementation of trading and liberalisation across Europe could bring large welfare benefits ...

43. Our quantitative and qualitative assessment of the costs and benefits to Member States indicates that net benefits are greatest if all Member States introduce trading and liberalisation in certain bands. Potential welfare gains are very large, amounting to billions of euros per annum across Europe. Much smaller gains would be realised if trading alone was introduced across Europe, whereas a general restriction on liberalisation would reduce welfare relative to the status quo.
44. These welfare benefits derive from trading and/or liberalisation stimulating increases in efficiency via:
 - increases in the value of services derived from a given unit of spectrum as a result of existing users making better use of spectrum, or transferring it to someone else who can do so
 - increased transparency raising awareness of the true value of spectrum and market entry opportunities, and reducing barriers to entry
 - new entries stimulating competition in downstream markets
 - innovation benefits owing to more rapid adoption of new services and technologies, and greater opportunity for European-based innovations.

45. Competition and innovation benefits, in particular, have a significant pan-European dimension – they will only be realised in full if a critical mass of European countries adopt trading and liberalisation; otherwise there may be insufficient economies of scale to support new entry. Innovation is the most important category of benefits, reflecting the fact that rapid diffusion of new technologies can bring huge cumulative welfare benefits. Openness to innovation will also affect the future competitiveness of Europe vis-à-vis other major markets, such as the USA. If insufficient numbers of countries liberalise their spectrum management regimes, Europe may increasingly become a taker of non-European innovations rather than a maker of innovations for the world.

... whereas the costs of introducing liberalisation are relatively small

46. There are also potential costs associated with introducing liberalisation, but our quantitative and qualitative assessments indicate that for most bands these are small relative to the potential benefits:

- The largest category of costs is the additional burden on regulators and spectrum users of coordinating new and less predictable interference relationships.
- Regulators will face additional costs establishing a spectrum trading framework.
- Spectrum trading could conflict with national policy objectives, but such costs are impossible to quantify, as they are essentially political.
- Other perceived costs include enabling possible anti-competitive practices (which it should be possible to mitigate through existing competition law) and alleged difficulties in implementing future standardisation initiatives (which will remain possible under a suitable spectrum trading framework).

We therefore recommend that the Commission takes steps to mandate the introduction of trading and liberalisation across all Member States.

Recommendation 1: Overall approach to spectrum trading

The Commission should initiate action to obligate Member States to introduce spectrum trading and liberalisation through the use of appropriate binding measures.

Implementation of spectrum trading

There are specific aspects of trading frameworks for which a co-ordinated approach is desirable

47. Our assessment indicates that there are many aspects of a spectrum trading framework where benefits could be enhanced or potential costs mitigated if Member States adopt a similar approach. The Commission has an important role to play in facilitating common approaches to spectrum trading through co-ordination initiatives aimed at specific aspects, such as:

- creation of tradable usage rights, including formulation of approaches to interference management, the expiry and reclamation of rights, and the enforcement of rights
 - developing systems for managing and monitoring trading activity
 - determining an approach to address any competition issues that may arise
 - reconciling the new framework with international co-ordination objectives and obligations, especially with respect to cross-border interference
 - developing policies for the transition to tradable usage rights and the treatment of incumbent users.
48. The degree of co-ordination that is desirable varies for these different aspects of the spectrum trading frameworks. In most cases, it should be sufficient for the Commission to define *generic features* of a trading framework, leaving the detail of implementation to the discretion of Member States. We summarise our specific recommendations below. Our recommendations for co-ordination of detailed aspects of frameworks should not inhibit the ability of Member States to take account of local circumstances. SMAs would still enjoy substantial autonomy with respect to many areas of implementation, such as defining rights and obligations associated with tradable usage rights and organising the transition from the existing management regime.
49. The policy initiatives that we propose for co-ordination of specific aspects of trading frameworks would complement any general initiative by the Commission to mandate trading and liberalisation across Europe. Co-ordination of these aspects would also be beneficial even if the introduction of trading and liberalisation is left to the discretion of Member States. In this case, the benefits from detailed co-ordination would apply primarily to those countries that decided to pursue trading and/or liberalisation.

Recommendation 2: Detailed implementation of spectrum trading frameworks

The details of how spectrum trading is implemented can be devolved to Member States, providing that national spectrum management frameworks have certain generic features. There are benefits to ensuring that these generic features are present in Member State frameworks even if some states do not initially introduce spectrum trading. Therefore, this recommendation is not contingent on implementation of Recommendation 1.

The Commission could use a mixture of binding and non-binding measures to co-ordinate spectrum trading frameworks

50. Policy tools available to the Commission to promote co-ordination include:

- *Binding measures.* These include Council and Parliament directives, and Commission decisions through the Radio Spectrum Decision (which in turn could relate to mandates to the CEPT under that Decision). These ‘hard law’ approaches should ensure Member States’ compliance, but directives generally require considerable time to implement and strong consensus at the highest level of Community policy-making.
- *Non-binding pro-active measures.* These include guidelines or communications for national SMAs (including recommendations through the Communications Committee) with the aim of encouraging a co-ordinated approach, or other Commission statements of best practice. Such approaches are much easier to initiate, but Member States have discretion whether or not to implement them.

51. Although Member States should have a strong self-interest in introducing spectrum trading, we are concerned that relying on voluntary implementation will not deliver sufficient co-ordination of national frameworks over a reasonable timescale. Therefore, we recommend that the Commission intervenes to promote spectrum trading across European countries. Supporting the introduction of trading and liberalisation across the Community would probably require a binding measure. Co-ordinating more detailed aspects of frameworks could be achieved using a mixture of binding and non-binding measures. The use of binding measures is proportionate, given the substantial impact on the welfare of EU citizens that moving to tradable and liberalised spectrum would bring, and the extent to which there are knock-on-effects on other Member States from the introduction of such a policy.

Recommendation 3: EU implementation measures

Individual aspects of spectrum trading frameworks could be co-ordinated using a combination of binding and non-binding measures. Existing bodies, including the Radio Spectrum Policy Group (RSPG) and Radio Spectrum Committee (RSC), could take the lead in co-ordinating many of the detailed aspects of spectrum trading frameworks across Europe.

Spectrum trading requires the development of tradable usage rights

52. Spectrum usage rights are associated with a set of *rights* (which enable the user to use spectrum in certain ways) and *obligations* (which specify conditions that users must fulfil in order to maintain their rights). The need to define rights and obligations for spectrum usage is akin to defining property rights, which are an important pre-requisite for market transactions in general. Without clear property rights, there is significant risk for buyers and sellers, which may inhibit trading and suppress investment.

53. Rights to transmit or receive signals over spectrum can be defined in relation to four basic parameters:
- *geographical area* (e.g. a country, a region or a defined area around a base station)
 - *duration and time of access* (e.g. unlimited or defined length usage rights; access to spectrum throughout the entire day, or at a specific time of day only)
 - *spectrum endowment* – the frequency bandwidth to which access is granted
 - *protection from interference* – the right to receive signals without harmful interference from other spectrum users, and the obligation not to cause such interference.
54. Defining these rights is reasonably simple if trading alone is permitted. Where liberalisation is envisaged alongside trading, the specification of usage rights is more complex, as existing licences in Europe have typically been designed with a particular service and technology in mind (e.g. with respect to emission characteristics and their likely interference impact), both for the frequency block covered by the licence and adjacent frequency blocks. Usage rights may need to be redefined with more technology- and service-neutral characteristics.
55. Governments may also impose additional obligations on usage rights in order to fulfil policy objectives (e.g. coverage obligations, initiation of service schedules). Where liberalisation is introduced, careful consideration needs to be given as to whether it is appropriate to encumber usage rights in this way. Where such conditions are maintained, it is very important that there is legal certainty over how they will be transferred in the event of a trade.

Recommendation 3(a): Creation of tradable rights

Member States should base the definition of usage rights on a minimum set of parameters (e.g. geographical extent, frequencies, etc.) co-ordinated by means of a technical implementation measure (potentially through the RSC).

The market may develop many different forms of trading ...

56. Potential forms of trading include:
- *Sale* – Ownership of the usage right is transferred to another party.
 - *Buy-back* – A usage right is sold to another party with an agreement that the seller will buy back the usage right at a fixed point in the future.
 - *Lease* – The right to exploit the usage right is transferred to another party for a defined period of time but ownership remains with the original rights holder.
 - *Mortgage or other securitisation* – The usage right is used as a collateral for a loan (analogous to taking out a mortgage on a house).

- *Options*. Contingent contracts could be used by spectrum users to increase flexibility in how they use spectrum over time, and manage risk.

The transfer of spectrum rights by sale or lease is already common in countries which have introduced spectrum trading. There are also examples of mortgage-style transactions in Guatemala and New Zealand.

57. Flexibility may be further enhanced if users are permitted to *reconfigure* existing usage rights, for example by separating them in two or amalgamating a number of usage rights. Such reconfiguration could be in terms of frequency, geography, time or code division.
58. There may be circumstances where it is helpful to separate *management rights* from usage rights. By management rights, we mean the right to issue individual spectrum usage rights within a given block of spectrum, as opposed to the right to make transmissions. Management rights for specific uses can potentially be devolved to private managers, who then sell access to users. This approach has been used in New Zealand. Management rights may be similar in practice to the primary holder of a usage right leasing this to users.

... and these different forms of trading should not normally be restricted

59. Variety in the forms of trading may take increases the flexibility with which spectrum can be used, potentially facilitating temporary and experimental uses of spectrum. Therefore, there is a strong case for not imposing any general restrictions on the types of trades that can take place.

Recommendation 3(b): Forms of trading and management rights

Appropriate binding measures should be introduced to ensure that Member States:

- (i) place no prior restrictions on the type of transfer permitted (sale, lease, options, etc.), without good reason
- (ii) place no constraints on reconfiguration of usage rights, without good reason
- (iii) introduce clear rules on the transfer of additional rights and obligations that are associated with a usage right (but Member States retain discretion over the actual rules).

Liberalisation will require more flexible approaches to interference management

60. Trading of existing usage rights should not have any significant impact on interference. However, liberalisation of usage rights could complicate the interference landscape, potentially introducing new combinations of services. Where possible, new, technology-neutral parameters for interference management will be required for adjacent frequencies and geographical areas. There are two main alternative approaches that SMAs could adopt in addressing this challenge:
- *Option 1: Case-by-case approval by SMAs*. The SMA approves liberalisation proposals on a case-by-case basis, establishing technology-neutral interference conditions and resolving

any interference disputes. This approach would function well if volumes of trade involving liberalisation are modest and predictable. However, if applications for change of use are more frequent than expected, the SMA could be overwhelmed, resulting in undesirable delays.

- *Option 2: Self-management by spectrum users.* Neighbouring users negotiate directly with each other. Provided initial rights and obligations are clearly defined, there should be a strong incentive for users to accommodate each other. Where necessary, financial payments may be made between users as compensation for tolerating additional levels of interference. Disputes would only be referred to the SMA as a last resort if negotiations break down. In principle, this approach should be more flexible and produce more efficient outcomes than Option 1, although it may not function effectively if there are a large number of users involved in an interference negotiation. The SMA may need to step in to resolve situations where efficient outcomes are hampered by high transactions costs where there are many parties.

Recommendation 3(c): Interference management

- (i) Member States should be required, through appropriate binding measures, to introduce an interference management regime suitable for trading and liberalisation, but Member States should retain discretion over the details of the regime.
- (ii) The Commission should initiate technical implementation measures on methods for specifying interference thresholds and establishment of initial threshold levels (for example through the CEPT, with a mandate from the RSC).

Buyers and sellers require clarity over the expiry of usage rights

61. If the duration of a usage right is uncertain (e.g. if there is a possibility that it could be terminated prematurely) or approaching its end date, then this will depress the value of the usage right in a secondary market. Investments in providing services derived from the spectrum will be discouraged owing to uncertainty about whether a usage right could be renewed. Therefore, the likelihood of efficient spectrum use will normally be maximised if usage rights are granted in perpetuity. For SMAs, usage right expiry and reclamation powers may provide useful flexibility as a public policy tool. When creating tradable rights, SMAs need to balance these conflicting interests but primary regard needs to be given to the question of ensuring that there are good incentives to use spectrum efficiently.

... and certainty that their rights will be enforced

62. In order to facilitate efficient trades, spectrum users will need to be confident that other users will meet their obligations, especially in regard to interference, and that their own rights will be upheld. Thus, there will remain an important role for SMAs in monitoring and enforcing usage rights and obligations. A range of penalties to tackle transgressors should be available to the SMA. These could include fines and the suspension or revoking of usage rights, but would need to be proportionate to the offence and consistent with the EU Authorisation Directive.

Recommendation 3(d): Expiry and reclamation of usage rights

- (i) Member States should be required, through binding measures, to adopt orderly and transparent approaches towards renewal of usage rights.
- (ii) While it is not necessary for Member States to adopt identical procedures for renewal of usage rights, best practice is likely to involve the award of usage rights that have an expectation of continuation (e.g. perpetual rights, expectation of automatic renewal on expiry or rolling notice periods).
- (iii) Member States should retain powers to reclaim usage rights when necessary (e.g. in response to an EU decision to harmonise a band, or in extremes to address undesirable fragmentation). The Commission should use technical implementation measures to set parameters for such powers and the circumstances under which they can be used.

A public register of spectrum usage rights and trades would facilitate trading

- 63. In order for a secondary market to function, potential buyers require information about the usage rights that could be traded. This would be facilitated through the creation of public registers of spectrum usage rights and trades (similar to land ownership registers). It is in any case necessary to maintain a register of spectrum holdings, to enforce interference management and pursue transgressors. In our consultation, over 80% of respondents backed the development of on-line registries. Most likely this task would be assumed by SMAs, as they already possess or will collect this information.
- 64. Information to be collected on trades could include details of: the usage rights actually traded; the type of transaction; the date of the transaction; the identity of the participants; and the price paid. Mandatory public disclosure of a trade would assist in revealing information in what might be a relatively thin market. Ideally, this should include accurate price information in order to improve price disclosure. Governments may need to take a pragmatic approach to mandatory price disclosure as it may be difficult to observe true prices without extensive auditing (for example, a spectrum trade might be bundled with the transfer of other assets).

Recommendation 3(e): Availability of information

- (i) The Commission should actively enforce the existing requirement of Member States to maintain a public register of spectrum assignments (i.e. owners of usage rights). These should follow a consistent format.
- (ii) All Member States should develop public registers of trades. These should follow a consistent format. The Commission should define a minimum set of information to be collected by Member States on each spectrum trade and establish a maximum time period for disclosure of information. This requirement should be established by binding measure, with detailed co-ordination of contents and format determined through the RSC and/or CEPT.

(iii) Registers of trades should include information on prices, given that price discovery might be limited in thin markets, although a pragmatic approach may need to be taken to collation of such data as auditing may be difficult.

The market should be allowed to develop a variety of trading mechanisms

65. Buyers and sellers may be brought together through a variety of trading mechanisms:

- *Bilateral negotiation* – a buyer or seller approaches the other party and a trade is agreed.
- *Auctions* – a buyer advertises their need for spectrum (or a seller announces that spectrum is available) and invites offers in a competitive process.
- *Brokerage* – buyers and sellers use a broker to identify each other. This is analogous to using an estate agent to buy or sell a property.
- *Exchanges* – multiple buyers and sellers come together in a single market. Spectrum could potentially be traded much as in a stock market or commodity exchange, with periodic clearing of accumulated buy and sell orders.

Some or all of these approaches could exist in parallel. Ideally, the market should be left to determine trading mechanisms as appropriate to the needs of the market participants. There is no rationale for restricting the form of trade possible, or indeed encouraging a particular form of trade (e.g. through an SMA acting as a broker or market-maker).

Recommendation 3(f): Trading mechanisms

Member States should be required by appropriate binding measures not to restrict, without good reason, any types of trading mechanism (bilateral trades, auctions, brokers, spectrum exchanges, etc.) from developing in the market.

There is concern that trading and liberalisation could facilitate anti-competitive behaviour

66. To date, competition in the spectrum market has been protected mainly through the design of primary assignment processes, with spectrum divided into a specified number of defined packages to provide competing services. This is an inflexible approach, as the number of competitors is effectively determined by the design of usage rights. Moves toward either trading or liberalisation would mean that the number of competing suppliers of a service could respond to changing circumstances.

67. In our consultations, SMAs and spectrum users voiced concerns that the new freedoms provided by spectrum trading might be abused by parties engaging in anti-competitive behaviour. The theoretical possibility exists that, without appropriate controls, spectrum could be acquired in order to block rivals from offering competing services and to build or maintain market power in

the supply of services to end-users. This would imply that unrestricted trading could produce inefficient outcomes that reduce, rather than increase, consumer welfare. In particular, hoarding of unused spectrum has been raised by some SMAs and spectrum users as a particular concern.

These concerns appear unwarranted, provided trading is implemented with liberalisation

68. In the case that spectrum is traded *and its use liberalised*, concerns about possible anti-competitive trading substantially decrease. If change of use is possible, acquiring spectrum in order to block entry or expansion by rivals is unlikely to be successful. Liberalisation of spectrum use creates new opportunities for entry by acquiring spectrum outside traditional patterns of frequency use. Not only does this mean that blocking entry by acquiring spectrum becomes impractical, but there is greater opportunity for dislocating innovation, which can generate substantial benefits for customers in the long run.
69. In the case that spectrum can be traded, but *liberalisation is constrained*, concerns about competition need more careful consideration. The quantity of spectrum available for a particular nominated use may be limited. Where spectrum scarcity is sufficiently acute, it may be possible to acquire spectrum in order to exclude entrants or block expansion by rivals. Whether such behaviour is likely in practice depends on the specifics of the case considered, especially on the extent of spectrum scarcity.

Existing competition law and merger regulations should generally be sufficient to prevent competitive abuses

70. Even where competition concerns might potentially arise because of trading without liberalisation, competition law, including merger regulations, already provides powerful measures to constrain anti-competitive behaviour. Transactions involving trade in spectrum with a significant impact on competition may be captured by merger controls. Trade of a sufficient amount of spectrum to eliminate or constrain a competitor will often make little sense without sale of corresponding assets such as network infrastructure or customer base.
71. We have examined whether there is any need for ex ante sector-specific rules on spectrum trading in order to filter out anti-competitive transactions. Broadly, we find that sufficiently rapid moves towards liberalisation should eliminate the need for ex ante rules specifically for radio spectrum. There is, though, a question about how best to manage a transitional situation in which spectrum is traded without the ability to change use, especially if this situation is expected to endure for a considerable time. Competition law and merger control are powerful tools, but nevertheless there might be some argument for prior screening of transactions on competition grounds in cases where spectrum scarcity is particularly acute. From a competition perspective, this is an inferior substitute for liberalisation and should only be considered if significant delay is anticipated in moving from trading without change of use to a liberalised regime, or if no liberalisation is envisaged.

72. If ex ante sector-specific rules to protect competition prove necessary, they need to be flexible and case-specific; mechanical rules related to quantities of spectrum held by parties to a transaction would be entirely unable to distinguish whether a transaction significantly affected competition in the supply of services to end-users.

Recommendation 3(g): Competition

Member States should adopt a common approach, based on general EU competition law. Member states should not be able to introduce ex ante sector-specific rules unilaterally.

International obligations will constrain the introduction of trading and liberalisation in some bands...

73. There are a number of bands where international obligations will prevent or limit scope for trading and (especially) liberalisation:
- (a) Frequency bands harmonised by EU directives and decisions. Change of use is prohibited in Community law – so only trading with change of ownership is possible.
 - (b) Certain ITU decisions on allocations of bands for uses effectively proscribe Member State autonomy on allocation issues, e.g. international co-ordination of public safety services.
 - (c) Certain ITU allocations are protected by footnotes saying that no other use is permissible. This typically applies to certain ‘passive’ uses e.g. for radio astronomy, that depend on measuring unique characteristics of specific spectral lines.
 - (d) Certain frequency bands are set aside by EU Member States for multi-national defence co-ordination. Bands set aside for NATO use have treaty obligations barring any chance of use.

... but in other bands, European SMAs have wide discretion

74. In relation to other bands, the limited legal enforceability of most decisions by international and European co-ordination bodies means that national SMAs have much greater discretion to alter spectrum allocations than is commonly supposed. International agreements may inhibit the scope, feasibility or desirability of allowing spectrum trading with liberalised use. The ITU rules permit non-conforming operations, but there is limited experience of managing cross-border interference arising from uses which do not conform to ITU Radio Regulations. However, none of the ITU rules establish an absolute barrier to Community action, as Member States have always conditioned their acceptance of ITU treaties on compliance with EU law.

Transition policies for introducing spectrum trading need to be tailored to local conditions ...

75. The transition to spectrum trading requires Member States to develop specific policies towards existing usage rights and their current users. There are four main alternative policies, which envisage either incumbents vacating existing bands or modification of existing usage rights:

- *Band clearance.* Existing users are given notice to vacate their frequency bands, so that new tradable rights can be assigned. This approach has traditionally been used by SMAs when reallocating a frequency band for a new use, and has been used in Australia to introduce spectrum trading. However, it may be unpopular with incumbent users and difficult to implement if there is not sufficient alternative spectrum for displaced incumbents to migrate to.
- *Creation of overlay rights.* New usage rights are assigned in a frequency band but, for a limited period, incumbents are able to continue using the band. This is a form of band clearance, but with the dislocating impact on incumbents tempered by a transition period. This approach has been proposed in the USA for the 700MHz band.
- *Conversion of existing usage rights.* Existing usage rights are converted into new, tradable usage rights, which may also permit liberalisation. This approach leaves incumbents in place, and is most obviously appropriate in bands where existing uses are not expected to change. A number of European countries, such as Sweden and the UK have de facto or explicitly adopted this approach for many bands when introducing spectrum trading. One potential political problem is that incumbents could receive windfall gains (or losses), where the spectrum was originally assigned below market value (or the price was inflated owing to artificial scarcity) or if relaxation of usage restrictions increases the value of spectrum.
- *Creation of management rights.* Commercial organisations are assigned rights to manage blocks of spectrum and create new, tradable usage rights. These management rights may initially be encumbered by existing users, whose licences are converted into tradable usage rights. This approach has been pioneered in New Zealand.

All these approaches have merit, depending on the nature of existing uses and users in different frequency bands. As the current situation in a given band may be different across European countries, SMAs should have significant discretion to tailor transition policies to local conditions.

... *but users require certainty over the nature and timing of transition*

76. Member States could launch trading and liberalisation simultaneously in all suitable bands or take a progressive approach to introducing spectrum trading. Simultaneous launch would give users the immediate ability to migrate across bands in response to market signals. However, this may be unduly disruptive to incumbent users and their stakeholders. Almost 90% of respondents to our questionnaire preferred a progressive, use-by-use approach to introducing spectrum trading.
77. At least initially, trading volumes may be modest and change of use infrequent (based on international experience and our consultation with users). Therefore, a modest delay in introducing spectrum trading in *some* frequency bands is not likely to cause significant efficiency losses, if this is for the purpose of phasing. Trading could be introduced first where benefits clearly outweigh costs and practical implementation issues are not too severe. This would permit lessons to be learned before moving to wide adoption of spectrum trading.

Recommendation 3(h): Transition issues

- (i) Member States should have a high degree of autonomy in organising their transition, so as to reflect local market conditions, subject to obligations to introduce trading and liberalisation for particular bands by specific dates.
- (ii) National governments should retain discretion over treatment of incumbent users, use of spectrum pricing and the treatment of windfall gains and losses.

The suitability of frequency bands for introducing trading and/or liberalisation depends on their current use

78. We have made a preliminary assessment of the net economic benefits, political and social considerations, and practicalities associated with introducing trading and liberalisation in relation to specific existing spectrum uses. Our recommendations are as follows:

Introduce <i>trading and liberalisation</i> throughout Europe in frequency bands currently allocated to the following services:	Introduce <i>trading (liberalisation optional)</i> throughout Europe in frequency bands currently allocated to the following services:
<ul style="list-style-type: none"> • <i>Broadcasting - satellite</i> – for space-to-Earth links if and where a recognised spectrum access environment is deemed appropriate • <i>Fixed links</i> (where usage rights are assigned exclusively to individual users) • <i>Fixed wireless access</i> • <i>Land mobile – private mobile radio</i> (where usage rights are assigned exclusively to individual users) • <i>Land mobile – public mobile networks</i> • <i>Satellite (fixed and mobile)</i> – for space-to-Earth fixed links if and where a recognised spectrum access environment is deemed appropriate; for mobile, subject to assessment of current co-ordination practices • <i>Special user groups</i> (military, public safety, public transport), subject to ensuring that essential services are not disrupted 	<ul style="list-style-type: none"> • <i>Broadcasting – terrestrial</i> (with a review of the case for liberalisation following the 2005 ITU Regional Radiocommunications Conference) • <i>Land mobile – private mobile radio</i> (where usage rights are shared between users and the SMA undertakes co-ordination of individual users) • <i>Fixed links</i> (where spectrum rights are shared between users and the SMA undertakes co-ordination of individual users)

79. In order to realise the full pan-European benefits of trading and liberalisation, it is necessary that countries adopt similar approaches for most bands. This implies that the timetable for introducing spectrum trading by band should be co-ordinated, but it need not be identical. Our

assessment has been undertaken only in terms of the principal categories of service using the radio spectrum. A more detailed examination of the applicability of trading and liberalisation will need to be made for each specific frequency band prior to implementation.

Recommendation 4: Suitability of spectrum bands for trading and liberalisation

The introduction of trading and liberalisation across different bands should be co-ordinated. Further examination of the applicability of trading and liberalisation will need to be made for each specific frequency band prior to implementation.

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