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Study on information on the allocation, availability and use of radio spectrum in the Community

Final report

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Table of contents

A. Executive summary

Information relating to radio spectrum is a key requirement for many players in the electronic communications market, including network operators, equipment manufacturers, broadcasters and regulators. Such information has historically been provided by the national regulatory authorities (NRAs) responsible for managing radio spectrum. However increasing harmonisation of spectrum use in Europe and the growth in multi-national provision of electronic communication services has created interest in a European spectrum information portal, to enable quick and easy access to data from each EU country. The first implementation of such a portal, known as EFIS (European Frequency Information System) was launched by the ECC (European Communications Committee) in 2002.

The purpose of this Study was to identify the information currently provided on management and use of the radio spectrum by EU NRAs and through EU-wide facilities such as EFIS, and to assess the extent to which this information meets the needs of spectrum users and other interested parties. The Study sought examples of good practice in spectrum information provision and developed recommendations for improvements to such provision in Europe. During the course of the Study, questionnaires were circulated to all EU and Accession Country NRAs, and there was extensive consultation with European industry players. A workshop was held to discuss the findings of the study on December 1st 2004, which was attended by a broad cross-section of regulators and industry.

The main conclusions and recommendations that have emerged from the study are summarised below:

1. Industry requires radio spectrum information relating to three broad areas, namely:

a) How to gain access to radio spectrum, including:

- Spectrum Allocations (the allocation of blocks of spectrum to specific categories of service such as fixed, mobile or broadcasting, as defined by the ITU;
- Channel Plans (how spectrum is packaged for individual services such as fixed links or PMR);
- Frequency Assignment Procedures (the technical and administrative procedures involved in assigning frequencies to individual users);
- Interface Requirements, (equipment standards that must be complied with in each Member State);
- How to apply for rights of use for radio frequencies;
- Frequency application forms for rights of use
- Cross-border co-ordination (procedures or technical constraints that might impact on the use of frequencies in border areas or lengthen the processing time for applications;
- Existing cross-border co-ordination agreements for spectrum use (to enable these to be taken into account when preparing applications for rights of use)
- Spectrum Fees

b) Current usage (occupancy) of radio spectrum, including:

- how, where and under what conditions specific frequencies are currently used in each Member State;
- Outcome of monitoring exercises (e.g. to determine whether frequencies are in use at particular locations or to verify network coverage)
- Outcome of enforcement activities (e.g. actions taken in response to illegal spectrum use).

c) Policy and Strategy for Spectrum Management, including:

- The National and International Regulatory Framework (policy framework under which access to radio spectrum and the authorisation of electronic communication networks and services is managed);
- How to notify equipment under Directive 99/05 (how manufacturers or vendors must provide notification to NRAs of the compliance of new equipment with the Directive, prior to launching in the NRA's home market);
- Authorisation Policies (the NRA's approach to granting rights of use for radio frequencies);
- Spectrum Strategy (the NRA's future plans for radio spectrum management;
- Spectrum Refarming Policy (how the NRA would deal with the transfer of spectrum from an existing user to a new user);
- Spectrum Trading Policy and information necessary to support trading, such as a register of rights of use.

2. It was considered that **the best way of providing access to the above information** was through a European spectrum information portal. The study team has examined the legal implications of requiring NRAs to make information available via such a portal and has concluded that this would be compatible with the new EU Regulatory Framework for Electronic Communication Networks and Services, as now implemented in full in nearly all Members States. The new Framework makes it a legislative priority for the collection, publication and dissemination of radio spectrum information. It would therefore not be necessary to modify the current Regulatory Framework to require NRAs to provide relevant information to be made available on the portal.

3. Based on the considerable support from the Industry for the provision of spectrum information in a centralised way and the generally favourable view of the existing EFIS facility, the Study Team has proposed that **EFIS should be enhanced** along the following lines:

- EFIS should be updated on a regular basis by a permanent maintenance team. A key role of the team would be to monitor new developments in the Member States and ensure their integration into EFIS as well as support Member States with the identification of out to date information. Although this would require some additional human resources to be allocated to EFIS (around one person full-time), this would be largely offset by synergy with other ECC activities (improved awareness of national developments should lead to efficiency improvements in areas such as the ECC working groups and the drafting of reports, recommendations and decisions)
- Information should be sourced from NRAs at regular intervals with specified deadlines for NRAs.
- High level information e.g. National Frequency Allocation Tables (NFATs) and equipment Interface Standards should be provided in a common format and be directly accessible through the portal
- More detailed information, e.g. relating to individual frequency assignments or national authorisation procedures, could be provided by links to NRA web sites[1].
- Descriptive information, e.g. describing legislation or authorisation procedures, should be provided in plain English, with links to relevant legal texts.

It was noted in the Study that the use of common formats and the English language could increase the costs for NRAs to provide information via the portal. However, an assessment

[1] It was noted the importance of ensuring links to NRA web-sites are regularly updated.

of the potential benefits in terms of resource savings for spectrum users and a more dynamic, innovative and competitive wireless market indicates that these would substantially outweigh these costs.

4. There was strong support from both NRAs and industry to **build on the EFIS database on a "step by step" basis**. The Study Team proposed that priority should be given to the following enhancements to EFIS, which are expected to yield substantial benefits for users (based on industry feedback) for a modest investment in additional resources by ECC and NRAs:

- Ensure that all EU NFATs area available through EFIS and include detailed information on the applications allowed and deployed in each frequency band.
- Provide information on how to notify equipment not covered by existing radio interface requirements, under the R&TTE Directive[2].
- Include in the NFATs additional information on any specific policies that might apply for each individual application. This might, for example, cover limitations in geographic availability of spectrum or limitations to transmitter powers.
- Provide information on how to apply for frequencies, with links to the relevant application forms and details of the spectrum fees that are payable for each service.

5. A cost benefit analysis indicated that the projected annual cost to ERO to develop an enhanced spectrum information portal addressing the above areas and based on EFIS would be in the range € 50,000 – 100,000. The corresponding cost savings for the industry were evaluated between € 492,000 and € 6.18 million. In addition, substantial benefits are anticipated in terms of increased innovation and competition in the wireless sector, since improved information provision would make it easier for new market players to gain access to radio frequencies.

6. The Study also made a number of other recommendations in relation to specific aspects of information provision by NRAs, namely:

i) Spectrum strategy

- Information on future strategy for radio spectrum management (e.g. plans to change frequency allocations or introduce new types of authorisation) is necessary for industry to develop effective business plans
- NRAs should therefore publish a document describing their strategy for radio spectrum management at regular intervals (at least every 5 years).
- Ideally the strategy document should be in a common format defined by the EU Radio Spectrum Policy Group (RSPG).
- In the longer term the NRA strategy documents should be accessible in English via the European spectrum information portal.

ii) Application forms

- Many different application formats are used currently by NRAs, leading to potential confusion and increased administrative overheads for applicants seeking rights of use in several countries.
- NRAs should be encouraged to adopt harmonised formats for application forms for spectrum rights of use, such as the harmonised PMR form developed by the ECC[3].

[2] It is understood that the second version of EFIS will include the radio equipment interfaces for each country.

iii) Interface Requirements

- There is considerable variation in the availability and quality of interface standards provided by EU NRAs, e.g. with regard to channel plans or other frequency related aspects
- NRAs should be encouraged to review their existing interface requirements and ensure that full information is provided on relevant spectrum related matters.

iv) Links to other organisations and information sources

- In some Member States more than one organisation is responsible for spectrum management and this can entail substantial additional effort for users seeking information on spectrum availability.
- In many cases, market players based in one country may require comparative information on spectrum availability in other countries.
- NRAs should therefore provide easily accessible hyperlinks to other national spectrum management organisations (where applicable) and also to the EFIS and TRIS[4] databases.

v) Currency of information

- It is important that users have confidence that information provided is current and up-to-date
- NRAs should therefore clearly indicate the date when information was last updated and provide contact details to confirm the status of the information.
- NRAs should ensure that any changes affecting spectrum management are reflected in the public information as soon as possible.

vi) Contact details

- It is likely that new market entrants and smaller companies in particular will need to have direct dialogue with the NRA in order to gain full understanding of spectrum issues.
- Specific names, contact details and areas of competence should therefore be provided on the NRA's web-site, to minimise the risk of delay or confusion.

vii) Frequency register

- There is clear interest from many in industry in information on existing frequency assignments, such as frequency, bandwidth, location and duration of rights of use.
- Such information would be particularly important in an environment where spectrum trading was permitted, to enable potential buyers to determine what is available in the spectrum market. However, information such as the duration of existing rights would be useful even in the absence of trading, for example to enable potential market entrants to be aware of when existing spectrum users may vacate the spectrum.
- Each NRA should therefore take steps to develop a frequency register that can be accessed on-line via the NRA web site. A tentative list of the minimum set of parameters, could be frequency, bandwidth, geographic location, duration of the right of use and, where a spectrum trading environment exists, contact details for the right holder.

[3] See ERC Recommendation ERC/REC 00-02 on Harmonisation of licence application form and licence documentation for PMR (Professional Mobile Radio)

[4] TRIS (technical regulations information system is a technical standards database operated by the EU (DG Enterprise)

B. Presentation of the study

1 Introduction

1.1 Scope of the Study

Information relating to radio spectrum is a key requirement for many players in the electronic communications market, including network operators, equipment manufacturers, broadcasters and regulators. Such information has historically been provided by the national regulatory authorities (NRAs) responsible for managing radio spectrum. However increasing harmonisation of spectrum use in Europe and the growth in multi-national provision of electronic communication services has created interest in a European spectrum information portal, to enable quick and easy access to data from each EU country. The first implementation of such a portal, known as EFIS (European Frequency Information System) was launched by the ECC (European Communications Committee) in 2002.

The purpose of this Study was to identify:

i) Information provided on management and use of the radio spectrum by National Regulatory Authorities (NRAs) in EU Member States and Accession Countries

ii) The needs of the customers of the NRAs, e.g. Service Providers, Network Operators, equipment manufacturers, vendors, test houses and other NRAs

iii) Best practice in the supply of relevant information on the use of the radio spectrum by NRAs

iv) Where improvements in information provision might make existing processes more effective, for example in supporting the growth of pan-European markets in radiocommunication equipment and services, or facilitating cross-border co-ordination of radio systems.

v) Additional information that NRAs might need to provide to support the adoption of new approaches to spectrum management, such as spectrum trading.

During the course of the Study, questionnaires were circulated to all EU and Accession Country NRAs, and there was extensive consultation with European industry players. A workshop was held to discuss the findings of the study on December 1st 2004, which was attended by a broad cross-section of regulators and industry.

1.2 Benefits of improving the quality and accessibility of information on radio spectrum in the Community

Improvements to the quality and availability of information on radio spectrum would facilitate the entry of new players into the electronic communications market and reduce the costs incurred by existing players on obtaining such information. This would in turn lead to further competition and innovation in the provision of wireless communication services, supporting the strategic goal agreed at the Lisbon summit of making the EU the most competitive economy in the world by 2010.

1.2.1 NRA Benefits

By highlighting best practice and clarifying the information needed by spectrum users, the Study's recommendations should help NRAs to align their information provision more effectively with users' requirements. This will enable NRAs to:

- concentrate their resources on providing the information most needed by their customers;
- prioritise the updating and provision of specific radio spectrum information;
- adopt a consistent approach to the presentation of information, based on established best practice and feedback from users;

- improve their efficiency by reducing the need to deal with individual queries from potential market entrants.

1.2.2 User Benefits

Spectrum users should enjoy benefits from improved availability and quality of spectrum information, including:

- reduced timescales and costs associated with market entry;
- reduced risk and uncertainty;
- greater awareness of opportunities to access unused spectrum, encouraging new, innovative wireless applications

More competition should emerge in the delivery of services and products due to greater transparency and easier entry into other Member States' markets. By improving the awareness of requirements that have to be met in each Member State there is a greater likelihood of pan-European networks and services emerging, strengthening the European market for electronic communications.

1.3 Types of Spectrum Information

Feedback from industry identified eighteen specific information requirements relating to the management and use of radio spectrum, which have been grouped into three broad areas, as follows:

1.3.1 Information required to access radio spectrum

i) **Spectrum Allocations**, i.e. information on the allocation of blocks of spectrum to specific categories of service such as fixed, mobile or broadcasting, as defined by the ITU;

ii) **Channel Plans**, i.e. how spectrum is packaged for individual services such as fixed links or PMR;

iii) **Frequency Assignment procedures**, i.e. the technical and administrative procedures involved in assigning frequencies to individual users;

iv) **Interface Requirements**, i.e. details of equipment standards that must be complied with in each Member State;

v) **Information on how to apply for frequencies**, i.e. guidance on how to submit applications for rights of use such as how to complete the forms;

vi) **Frequency application forms**, i.e. any standard forms that must be completed and submitted in order to apply for a right of use;

vii) **Information on cross-border co-ordination**, i.e. details of any procedures or technical constraints involved that might impact on the ability to use frequencies in border areas or lengthen the processing time for applications[5];

viii) **Information on existing cross-border agreements** (to enable these to be taken into account when preparing applications for rights of use)

ix) **Information on spectrum fees**

1.3.2 Information on current usage (occupancy) of radio spectrum

x) **Information on the use of radio spectrum**, i.e. details of how, where and under what conditions specific frequencies are currently used in each Member State;

[5] Article 5.3 of the Authorisation Directive specifies a six week limit for NRAs to issue rights of use for radio frequencies but notes that this is without prejudice to any applicable international agreements.

xi) **Information on the outcome of monitoring**, i.e. whether the results of monitoring exercises (e.g. to determine whether frequencies are in use or to verify network coverage) are published;

xii) **Information on the outcome of enforcement activities**, e.g. details of action taken in response to illegal spectrum use.

1.3.3 Policy and Strategy for Spectrum Management

xiii) **Regulatory Framework**, i.e. the policy framework under which access to radio spectrum and the authorisation of electronic communication networks and services is managed;

xiv) **Information on how to notify equipment under Directive 99/05**, i.e. the process by which manufacturers or vendors must provide notification of the compliance of new equipment with the Directive, prior to launching in the market;

xv) **Authorisation Policies**, i.e. the NRA's approach to granting rights of use for radio frequencies;

xvi) **Spectrum Strategy**, i.e. information on the NRA's future plans for radio spectrum management;

xvii) **Spectrum Refarming policy**, i.e. information on how the NRA would deal with the transfer of spectrum from an existing user to a new user;

xviii) **Spectrum Trading policy and information requirements**, i.e. whether the NRA allows or plans to allow the trading of spectrum between users and the NRA's views on what information might be required to support such trading.

C. Industry and NRA responses

2 Overview of industry responses and comments

2.1 Introduction

In order to gain a thorough understanding of the information needs of spectrum users, questionnaires was prepared and sent to representatives of various industry sectors. Interviews were also held with several organisations to gain further insight into their needs. In total, 33 completed questionnaires were received, of which 23 were from operators or service providers and 10 from equipment manufacturers, vendors or developers. In addition a shorter questionnaire was circulated to smaller organisations involved in the PMR and SRD sectors. This led to a further 5 responses.

The most comprehensive responses were provided by those involved in fixed services (point to point links and fixed wireless access) and public cellular networks. We attribute this to:

i) the relative size of the organisations involved in these markets. The vendors of cellular and fixed equipment tend to address a large, substantially global market and the operators that use such technology tend to be major organisations with pan-European interests.

ii) the need by these organisations for detailed information beyond that currently provided through the international organisations. For example, information on existing transmission sites may be needed in order to identify sharing opportunities and expedite network rollout. In other sectors, such as SRDs, the information provided at the CEPT and ETSI level is often sufficient, although some SMEs rely solely on contact with their home NRA for their information requirements. For the maritime and aeronautical sectors where the use of the spectrum is defined at the ITU level on a global basis, sector-specific organisations such as the International maritime Organisation and Eurocontrol largely dictate how spectrum is used and provide the main source of information for those active in these sectors.

iii) the current state of development of the market for such services in Europe. In the case of fixed services is little harmonisation of frequency bands but there is considerable demand for fixed link equipment from the cellular operators in each country. Therefore detailed information on national frequency regimes for fixed services is required. Conversely, in the case PMR sector (where interest in the provision of information at a European level was markedly lower), the market is mature and the users are generally small, local companies operating in a single country. Consequently there is little interest in the situation in other countries and the majority of existing and potential users only require information from their home NRA.

iv) the existence of specific trade organisations that represent smaller users' interests and keep them informed of developments. For example, organisations have been established in countries such as the UK and France to represent PMR users' interests.

v) the differences in equipment design and the ability to cater for wider bandwidths. For example, many PMR or telemetry systems designed to operate in the 400 MHz frequency range have sufficiently wide bandwidth and tuning flexibility to accommodate a wide variety of non-harmonised frequency allocations, whereas high performance fixed link equipment often has to be custom-built to cater for specific national channel plans.

The following graphs indicate the degree of importance attached to each of the categories of information identified in the Study by the two main groups of respondents (operators and vendors). Each respondent to the initial questionnaire was asked to grade the importance of the information category on a scale of one to five. The graphs show the average level of importance attached to each category by the group of respondents concerned.

2.2 Operators / Service Providers

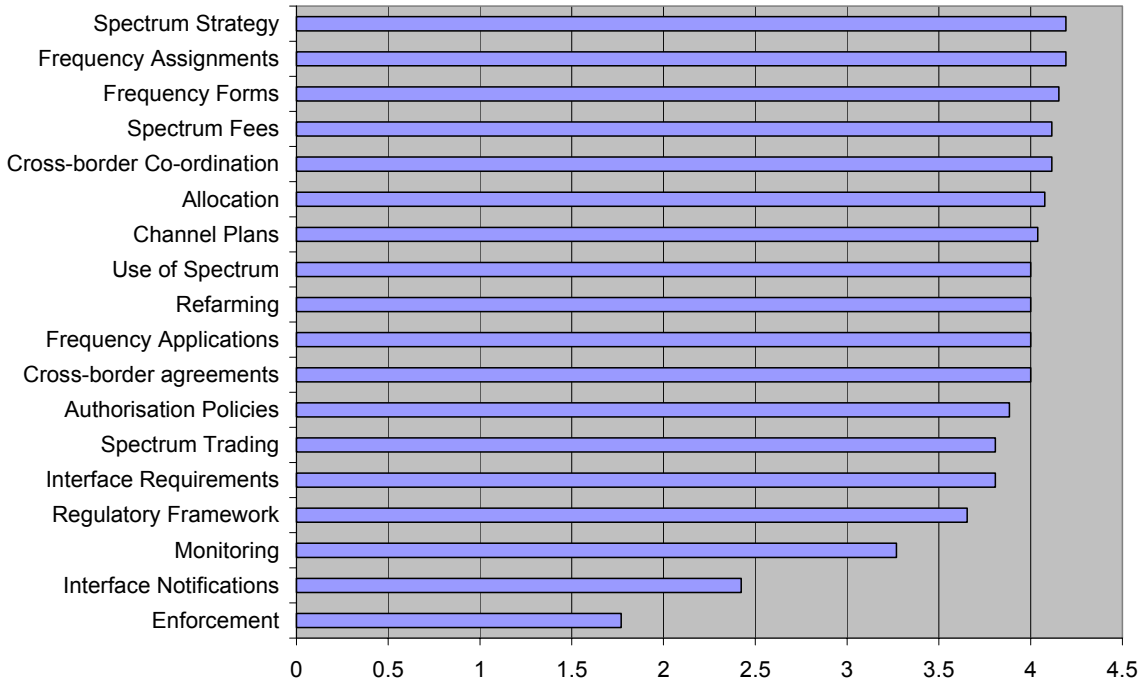


Figure 1 Relative importance of information categories for Operators

It can be seen that a high degree of importance is attached to most aspects of spectrum information, with the exception of interface notifications, enforcement and, to a lesser extent, monitoring. Particular importance is attached to information on spectrum fees and to information directly related to the process of applying for frequencies, such as application forms, cross-border co-ordination and information on frequency assignments. Strategic issues such as refarming and potential new initiatives such as trading are also seen as important.

Annex A of this report provides a summary of the operators' views concerning their requirements for specific radio spectrum information from NRAs. The following is a summary of the main reasons given by the operators for requiring radio spectrum information:

i) Network related requirements:

- Infrastructure planning, e.g. location of existing transmission sites and potential sharing opportunities;
- Choice of appropriate equipment;
- Network engineering, e.g. in the case of fixed links the detailed design of the network such as the identification of appropriate frequency bands and sites based on spectrum access and management policies and required data capacity;
- Monitoring, such as information on potential interference issues that could impact on the operation of the network;
- Management, e.g. options for how the network capacity can be extended or quality of service requirements achieved;
- Spectrum strategy such as information on what additional spectrum (if any) may become available to allow the further development of the network.

ii) Research and development

- Business planning;
- Investment decisions;

- Cost optimisation.

It was noted that the reasons for requiring access to information varied between the different service categories (mobile, fixed etc). For example, in the case of fixed services the reasons for requiring access to spectrum information were generally for planning and engineering whereas for the public cellular networks research and development and spectrum strategy were quoted by most respondents. This probably reflects the different nature of these services, in that fixed point to point links are typically planned and co-ordinated individually by the NRA as part of the frequency assignment process whereas cellular access networks are planned by the network operator. This difference arises from the shared nature of fixed link spectrum, as opposed to the exclusive spectrum assignments for cellular access networks.

In the majority of cases information was required by respondents in all the information categories identified in the questionnaire and most types of information were scored highly in terms of level of importance. The only two exceptions were "information on the outcome of enforcement activities" and "information on how to notify equipment under the R&TTE Directive"[6]. However even in these categories the level of importance was identified as of average importance or above by most respondents. It was mainly the cellular operators that required access to the outcome of enforcement activities.

None of the respondents identified any additional requirements for information beyond those mentioned in the Questionnaire.

It was interesting to note that in some cases the operators mentioned that they are active within the international committees of ITU, CEPT and ETSI. Consequently they are often aware in advance of potential changes to spectrum usage that might affect their business activities. However although they might be aware of studies and proposed changes to spectrum use they still need information on how, if and when the individual NRAs propose to implement any consequential changes.

2.3 Equipment Manufacturers / Vendors

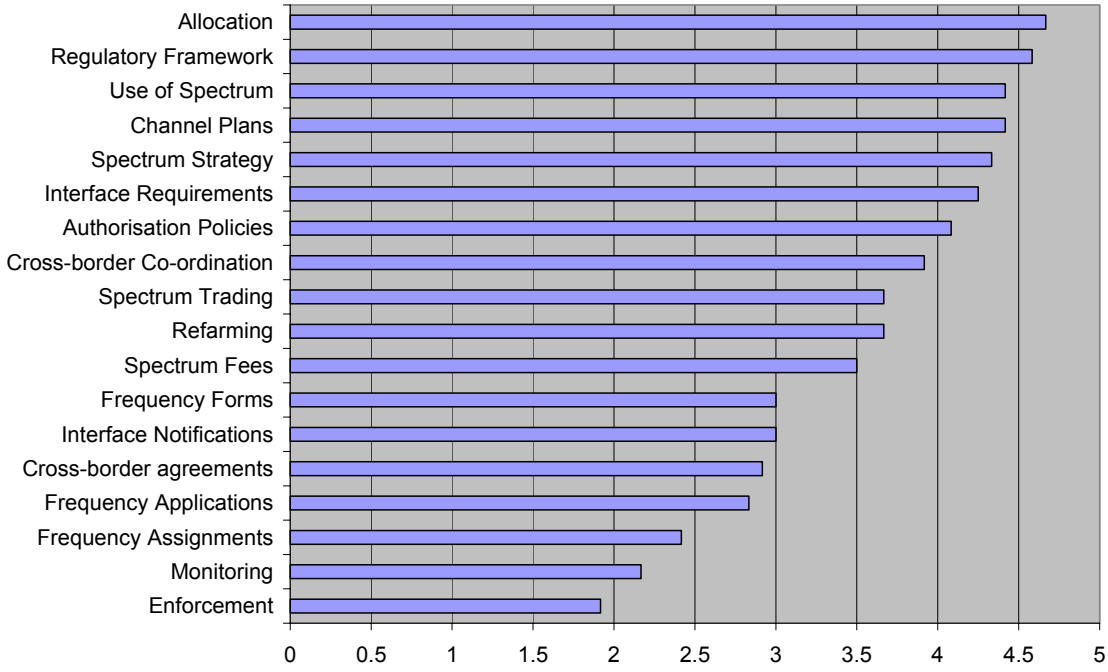


Figure 2 Relative importance of information categories for Manufacturers / Vendors

[6] The reason why there might have been a low response to information on how to notify equipment under the R&TTE Directive might have been because the operators considered this was specifically relevant to the manufacturers of the equipment.

In this case it is apparent that much less importance is attached to information related to frequency assignments, whilst greater importance is attached to interface requirements. Overall, manufacturers appear to attach less importance to spectrum information than operators, however many of the individual categories of information were still considered to be important or very important..

Annex B provides a summary of the operators' responses to the part of the industry questionnaire that addresses their requirement for specific radio spectrum information from NRAs. The following summarises the main reasons cited by manufacturers for requiring radio spectrum information:

i) Business Planning

- Identification of business opportunities (e.g. by being aware of spectrum that is widely available across the EU)
- Planning and provision of current and future products (ensuring they are compatible with current frequency availability)
- Strategic planning (e.g. developing new product lines to take account of planned changes to spectrum allocations.

ii) Product Development

- Availability of spectrum for future products
- Product design (e.g. need to cover multiple bands if these are not harmonised)
- Equipment approval (how to obtain approval in order to enter a national market)

iii) Sales and support

- Providing customers with necessary information to commission and operate their systems (e.g. how to acquire authorisations or frequency assignments)
- Facilitating entry to developing markets outside the EU (by enabling established EU standards or band plans to be put forward in the absence of any existing national provision)
- Providing frequency application forms to customers.
- Outcome of monitoring (provides awareness of where particular frequencies are available for use).

2.4 Comparing the needs of operators and manufacturers/vendors

The different emphases placed on the various information categories by manufacturers and operators can be seen more clearly in the following graph, which compares the level of importance of each category for each of the two groups:

It can be seen that certain categories are rated very important by both groups, namely spectrum strategy, channel plans, use of spectrum and frequency allocations. Operators also place a high importance on information relating to frequency assignments, frequency applications and forms, cross-border agreements and spectrum fees, whereas manufacturers place a greater importance on the information relating to the regulatory framework, interface requirements and authorisation policies. Only one category of information appeared to be of lower interest to both groups, namely enforcement activities.

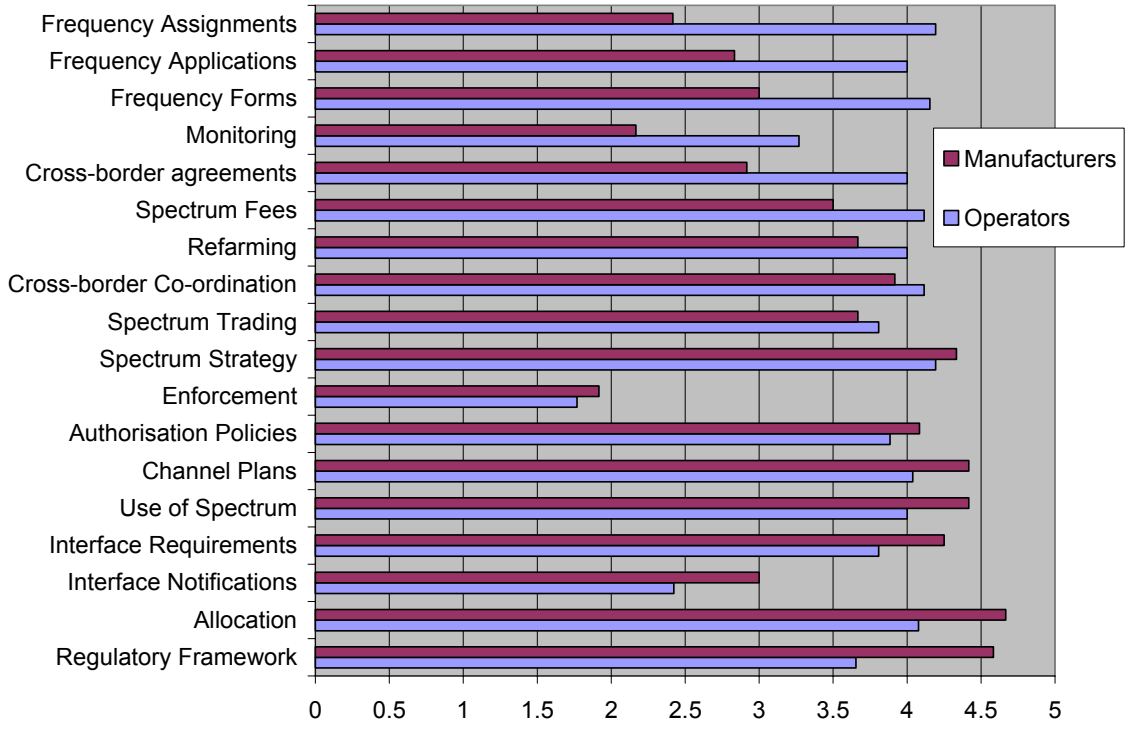


Figure 3: Relative importance of information categories for Operators and Manufacturers / Vendors

2.5 Current resources involved in radio spectrum issues

In general, costs and resources associated with spectrum management were very dependent on the number of frequency applications, studies undertaken, consultations responded to and the number of relevant international and national meetings that required the respondent's involvement

Responses from two major national telecommunications operators, each with around 200,000 – 250,000 employees in total, indicated that several hundred employees were engaged in spectrum related activities, including network planning, frequency applications and a number of other activities. Of these around five full time staff in each company dealt specifically with frequency management. One equipment vendor with 50,000 employees had around 30 people involved in spectrum management issues around the world at a cost of approximately €2M. Even smaller vendors with as few as 60 employees can commit between one to three people to radio spectrum issues at a cost of €10,000 to €20,000 per year.

3 Key points raised in industry responses

3.1 Information required from International Organisations

The type of information required from International Organisations such as the ITU-R, EC or CEPT and the reasons for requiring the information included:

- Information and documents from international meetings (e.g. ITU-R Study Groups or CEPT Project Teams) to enable the respondent to follow and participate in those meetings, or to make representations to the meeting where the issues involved affect the respondent's business
- Information on spectrum usage to identify possible business opportunities, e.g. demand trends for fixed links in different frequency bands
- Supplementary information required in addition to that already provided by NRAs, for research and development, investment planning and spectrum strategy
- Planning and engineering fixed links
- Standards for equipment design and conformity
- Information on the background regulatory regime, e.g. the ITU Radio Regulations or EU Directives.

3.2 The Need for an enhanced European Spectrum Information Portal

3.2.1 Introduction

It was clear from the industry responses that there was considerable support for the existence of a web-based portal providing access to radio spectrum information within the EU. There was also widespread awareness of, and positive regard for, the existing ECC EFIS facility. This section reviews the current status of EFIS and considers the need for an enhanced information portal, based on industry feedback.

3.2.2 Current Status of EFIS

EFIS (the ERO Frequency Information System) was launched in January 2002. EFIS is freely available to the public on the Internet either via the ERO website or directly under www.efis.dk. With EFIS the ERO aims to provide a valuable service to all parties with an interest in radio spectrum. EFIS also contributes to the CEPT policy objectives of spectrum harmonisation and transparency as well the EU policy objectives laid down in the EU Radio Spectrum Decision[7].

Participation in EFIS

EFIS is widely supported by CEPT Member Countries, 22 of whom already provide information through the EFIS portal. The following table indicates which of the current EEA and EU Accession countries currently participate in EFIS.

Country	Participation EFIS	Country	Participation EFIS
Austria	Yes	Lithuania	Yes
Belgium	Yes	Luxemburg	Yes
Bulgaria	No	Malta	No
Cyprus	No	Norway	Yes
Czech Republic	Yes	Poland	Yes
Denmark	Yes	Portugal	Yes
Estonia	Yes	Romania	No
Finland	Yes	Slovak Republic	No
France	Yes	Slovenia	Yes
Germany	Yes	Spain	Yes
Greece	No	Sweden	Yes
Hungary	Yes	Switzerland	Yes
Iceland	Yes	The Netherlands	Yes
Ireland	Yes	Turkey	No
Italy	Yes	UK	No
Latvia	No		

Table 1 : List of countries providing information to EFIS

Main functionalities of EFIS:

EFIS allows searches and comparisons of spectrum utilisation across Europe as well as related information such as CEPT documents, radio interface specifications according to the R&TTE Directive and other national or international regulations.

The second version of EFIS currently under development provides the possibility to perform searches and comparisons for radio interfaces.

EFIS Maintenance procedure:

Currently, maintaining and updating the information in EFIS is the responsibility of the individual NRAs that participate in the scheme. NRAs upload data in XML format directly into the EFIS portal.

[7] Decision No 676/2002/ec of the European Parliament and of the Council of 7th March 2002 on a regulatory framework for radio spectrum policy in the European Community (OJ L, 24.02.02, pp 1 - 6)

This procedure minimises the involvement of ERO but means that the scope and quality of information provided through EFIS may vary depending on how often and thoroughly it is checked by each NRA.

3.2.3 Industry views on a European Portal

Most of the respondents were aware of EFIS, though few used it on a frequent basis. There was much less awareness of the TRIS database. There was virtually unanimous support from the industry respondents to the development of a European portal providing a central point of access to radio spectrum information, beyond that currently available through EFIS. The chart below illustrates the level of awareness and usage of the existing databases and the level of support for a more comprehensive spectrum information portal:

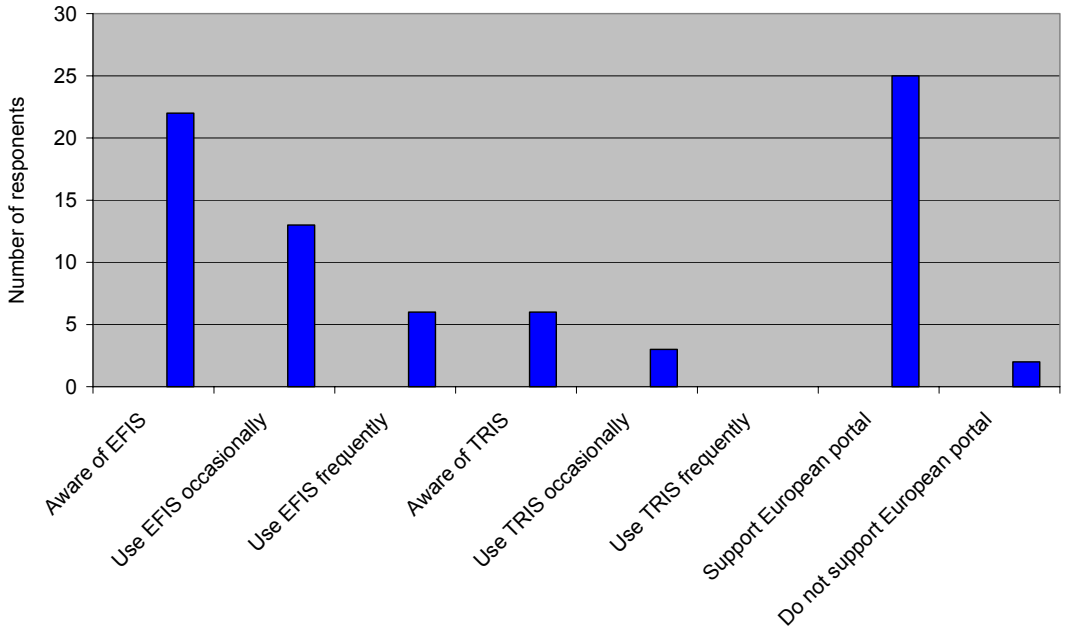


Figure 4 : Level of awareness and usage of European databases

The response from the European Telecommunications Network Operators' Association (ETNO) reflected the views of many respondents and is summarised below:

- The portal should provide precise information on the present use of a frequency band, including the designated service (based on the ITU classification), specific authorised applications within this service (e.g. cellular, PMR, etc), applicable regulations restricting the band to particular technologies, channel plans, technical constraints to protect existing services (e.g. interface requirements and possible constraints on transmitters or receivers) and environmental aspects. A clear reference to any international harmonisation measures affecting specific frequencies or bands should be included.
- Information on the expected future use of frequency bands and on time schedules for projected changes of use. Related to this are any refarming procedures that may apply in specific countries.
- Information on the authorisation process, e.g. the procedure for granting rights of use (first come first served, comparative selection or auctions), duration of rights of use, spectrum fees and any proposals regarding spectrum trading. Where trading is envisaged, access to information on existing rights of use (in the form of a spectrum rights registry) should be available.

Respondents emphasised the importance of a harmonised approach to the way spectrum information is provided and the need for NRAs where possible to make information accessible via the portal. Information needs to be regularly updated to ensure that it is accurate and to ensure consistency between the portal and any corresponding national NRA data (such as the NFAT).

This raises the issue of whether there should only be one central portal for this information. The record of NRAs updating the ERO with the status of adoption of ERC/ECC Recommendations and Decisions is not entirely positive and indicates that there needs to be a process put in place that requires the NRAs to update their information on a pre-determined regular basis, with a suitable audit mechanism in place.

3.2.4 Awareness of Existing European Information Portals (EFIS and TRIS)

It was clear from the responses that some organisations were unaware of the existence of portals such as EFIS and TRIS (this was particularly the case for TRIS). For example, the European interest group representing GSM operators (GSM Europe) claimed to be unaware of EFIS or TRIS and proposed that, to improve awareness, details of the portals should be circulated to spectrum management groups and hyperlinks provided from the web-sites of the EC and NRAs. Most respondents to the short questionnaire sent to SMEs said that their sources of information were their local NRA or trade organisation and therefore they had no requirement for a European portal.

3.2.5 Specific comments on EFIS

The trade body EICTA[8] felt that EFIS could be very useful if it were complete and reliable. Comparative information on frequency bands, allocations, applications and references to international regulations are needed. A harmonised presentation, i.e. a consistent structure and format of tables for each country, is highly desirable. A standardised set of information should be requested from all NRAs – for example, currently only some countries provide information about licence holders. Information about fees should also be provided. As spectrum trading is considered in some European countries, links to related information sources should be incorporated, in particular concerning information about licence holders. It would also be useful for operators to have information about the strategic planning of frequency bands, such as currently provided by the Swiss NRA BAKOM.

Another trade association described EFIS as a good basis for the development of a more comprehensive European spectrum information system. Its structure allowing access to national frequency tables as well as comparisons between countries or with the European Common Allocation table (ECAT) was considered very useful.

Several respondents commented that the information on EFIS should be updated more frequently and interested parties informed by of any changes by e-mail.

A network operator commented that EFIS could be improved by providing links to NRAs for the purpose of obtaining more detailed information on national frequency allocations. A vendor thought that EFIS should allow for a full database search and should be made more homogeneous in its structure for the data from different countries. More detailed information was also needed, e.g. on the current and future usage of frequencies. The accountability and relevance of any national list, included in EFIS, should be secured through a comprehensive commitment of administrations to supporting EFIS. Manufacturer1 felt that EFIS could be improved by providing more statistical information & summaries.

A mobile operator commented that it would be useful to have information on all CEPT countries included in EFIS (a number are missing currently, including some EU Member States such as Greece and the UK). This respondent also felt that information about the usage of spectrum should be provided within EFIS.

3.2.6 Specific comments on TRIS

EICTA felt that TRIS was only partly useful and that there was low awareness about the facility among EICTA members. This was confirmed by the members' individual responses, the overwhelming majority of which were unaware of the facility. EICTA suggested that the structure of TRIS should be improved, with more up-to-date information backed up with tables, facts, figures

[8] European Information and Communication Technology Association

and explanatory notes. In order to achieve full transparency, Member States' notification of draft technical regulations should take place before they are adopted in national law. One of the equipment vendors considered TRIS to be of little value, but one of the mobile operators was more positive, describing TRIS as a well presented and comprehensive website. The latter also made the following suggestions on how to make the EFIS and TRIS portals more useful:

- Provide a brief introductory description
- Include a "site map" and interactive links for navigation
- Allow the user to select criteria for order of responses
- Improve the search engine for advanced searches
- Include the date on documents
- Provide outputs in pdf format
- Include a "back" navigation button on TRIS
- Provide more external links
- Increase the speed of response
- Provide an option for statistical information in Excel format.

3.2.7 Industry views on an enhanced European Spectrum Information Portal

Many respondents were in favour of a more harmonised approach to presentation and content than is currently the case with EFIS. The same structure and format of tables should be used for all countries, services and frequency bands and a standardised set of information provided. A network operator thought that this should include information about entities holding spectrum rights of use (i.e. a frequency register). Another mobile operator considered ease of benchmarking to be the main advantage of a European spectrum information portal, but this depended on the definitions of the information collected being consistent amongst the different countries. Another network operator and a manufacturer both mentioned the need for a harmonised set of information.

One of the mobile operators considered that any new initiative should build on the existing EFIS portal and the organisation and processes already in place within CEPT. Having one access point at the European level with hyperlinks towards national tables was favoured. These views were echoed in a separate response by the same operator's parent company. The mobile operator also considered EFIS to be a good basis for the development of a European spectrum information portal, considering the EFIS structure which allows access to nation tables as well as comparisons between countries or with the ECA table as very useful. The operator felt strongly that there should be a single European source of spectrum information to avoid duplication and potential inconsistency between multiple sources. This source should be maintained by CEPT. Another operator suggested that updates should be regularly and immediately notified to interested parties by e-mail.

One of the manufacturers claimed to need much more information than EFIS currently provides. This was echoed by another manufacturer, who considered EFIS to be a good starting point, but insufficiently detailed for designing equipment and therefore of limited use to a manufacturer. Another manufacturer noted that the development of ERC/ECC Recommendations and Decisions has been excellent for manufacturers as it provided the opportunity for more harmonised use of spectrum. However the information available on the ERO web-site in respect of implementation of Recommendations and Decisions is of little use because the ERO does not always appear to follow up with the NRAs to check the current status. If a European spectrum information portal were established it would be important to address this deficiency, e.g. by tasking people to chase NRAs regularly for updated information.

3.3 Views on Information currently provided by NRAs

There was a widespread view that the current state of information provision by European NRAs was inadequate. For example, the trade body EICTA complained that NFATs are often incomplete, inaccurate and out of date

An equipment manufacturer complained that the information found at NRAs' websites was in many countries not provided in a satisfactory way. For example, there was a big difference in the information provided on non-harmonised frequency bands, in which the NRA can individually choose specific requirements (e.g. treatment of the various equipment classes defined in ETSI standards). It was important for these requirements to be made clear and explicit but in many cases they are not. Many countries fail to bring all the relevant data or hyperlinks together in one place, so making searches more difficult (Austria was cited as an example of this). Some countries have made an effort to make more information public but it is often incomplete (e.g. the Slovak Republic NRA shows Point to Multipoint link data but not Point to Point).

A similar point was made by another manufacturer, who felt that there was no consistency in the information provided by different NRAs. Information was generally not sufficiently detailed, for example national frequency tables only provided a top level view such as whether a band is allocated to a specific service. When it is necessary to design systems for a potential client much more detailed information is required including channel plans, bandwidths, any restrictions on use and the detail of the frequency assignment process. In the latter case some NRAs were much better than others, for example the Finnish NRA FICORA was regarded as having a particularly useful national frequency table.

Another manufacturer felt that development of on-line frequency assignment and licensing should be a key requirement for every NRA as part of their e-commerce initiatives. This would reduce bureaucracy, speed up licensing time and enable greater use of wireless.

Another manufacturer felt that the state of spectrum information provision in Europe was a mess and that this must be fixed if the internal market is to function properly in this area. The Swiss NRA Bakom was cited by this respondent as an example of best practice, with Finland, Denmark and the UK also scoring highly. However, even these were typically of mixed quality. For example, a number of positive and negative aspects were raised in the case of the Danish NRA:

Positive:

- It is relatively simple to get most required information in English on the NRA web site
- The national frequency plan is easy to find
- There is a comprehensive help function for frequency-finder
- Radio interface specifications are available and linked to the national frequency plan
- It is possible to submit equipment notifications on-line.

Negative:

- The radio interface specifications are mainly just ETSI-standards, which provide insufficient information for a full radio interface specification
- All documents and on-line notification require Microsoft software, which was not considered to be a technologically neutral approach
- The notification demands a reference to the Danish radio interface specification but this appears to contradict the need for notifying equipment.

A manufacturer from the PMR sector was particularly concerned about disparities in NRAs' provision of information on PMR. One of the most important information requirements for the PMR industry is the data on the actual use of the PMR frequency bands, which is needed for developing new equipment. Spectrum information currently available in France is not detailed enough especially as far as planning of future systems is concerned. PMR information was considered to be better in Germany and in the UK.

3.4 Scope of Information Required by Users

One of the network operators considered that precise information for each country on the present use of all frequency bands is needed, including:

- the designated services based on the ITU definitions,
- authorised applications within these services,
- channel plans
- interfaces requirements and possible constraints on transmitters and receivers
- specific regulations applicable to the use of the band (e.g. constraints on some services in order to share the band with other services),
- reference to the applicable European Decisions and Recommendations,
- licence duration
- spectrum fees
- information on the holders of spectrum rights of use and on the usage made by these holders
- information on the expected future use of frequency bands, and of the time schedule for possible change of use.
- environmental aspects.
- a clear reference to any spectrum harmonisation at the European level.

The operator observed that a lot of information about frequency bands used by public mobile operators is already publicly available (e.g. number of subscribers, services usage, number of base stations etc) either through the NRAs or other sources. However, information about the actual use of frequency bands by other entities is usually not generally available. Therefore, any effort to improve the availability of information on spectrum use should first target these other entities.

3.5 Preferred Language

In general, English was the preferred language. One manufacturer felt that whilst English was desirable it may be worth considering using the three languages used in the ITU for formal documentation (French, English and Spanish), although this respondent acknowledged that this could lead to maintenance problems. Currently it is found that consultations are often made available in the NRA's native language and only translated into English much later such that there is very little time to respond or the date for response has passed.

Another manufacturer felt that for international companies, information must always be made available in English regardless of the national language. One of the mobile operators felt there was an inherent need to publish information in English and not exclusively in the country language.

3.6 Encouraging Market Entry and Promoting Competition

One of the manufacturers felt that NRAs could do more to promote the use of wireless services to smaller users who do not have the same experience as some of the major European / International users. Vendors currently have to take the lead in educating such users but it would be useful to have independent Organisations providing clear (transparent) information on their web-sites. Another manufacturer felt that the use of licence-exempt bands needs closer attention and a plan should be put in place either through CEPT or individually by each NRA to identify possible applications. This would support moves towards lighter-touch regulation.

3.7 Making Contact with NRAs

Most respondents considered the use of e-mails a reasonable method for obtaining information from NRAs. However, for both e-mail and telephone contacts, the effectiveness depends very much on the contact person and also whether there is a specific person that can be identified within the NRA to deal with the specific issue raised. The use of generic e-mail addresses such as info@nra.org was not favoured; one manufacturer had found it difficult to obtain any reply from such contact points and adopted instead the approach of contacting named NRA contacts listed on the ERO web-site. Even though these people might not be the correct contacts to deal with the specific question they will generally forward the e-mails to the correct person and provide an update on progress to the sender so that they know who is dealing with the query. It is however important that these contacts are maintained however; in at least one case the authors have found that the ERO contact's mailbox has been full and the mail has been rejected.

Another manufacturer commented that the CEPT SE 19 Project Team mailing list is normally their first potential source of information. If this is not suitable then the lead contact information for each NRA, found on the ERO web-site, is normally used. It is generally found that the contact person will know who in the organisation to contact and will normally copy the person requesting the information in any exchange of e-mails.

3.8 Information Requirements for Spectrum Trading

One of the manufacturers noted that the move towards spectrum trading means that spectrum information has much greater utility and such data must be provided transparently for the market to operate competitively. It would typically be a two step process by looking for the application type in a country via EFIS then searching for more detailed information (e.g. equipment classes and system definitions) contained in the relevant National Interface Notifications via TRIS. One of the operators felt that trading would require the ability to access information about licence holders.

A UK trade body recommended that comprehensive information is provided, especially at a national level, on processes for dispute resolution in a trading environment. These should provide for but not be limited to interference related disputes. Similar information would also be required on resolution mechanisms for trans-national disputes.

3.9 Preferred format for information

The figure below provides an overview of the relative importance that respondents attach to availability of information in electronic or hard copy format. There is a strong preference for electronic information provision, with many respondents finding it difficult to obtain information where this is only available in paper format. The main advantage of web-based information that was cited by respondents was immediate access, with the information typically available in minutes. Telephone contact was noted by [one respondent] as a on other way of obtaining information quickly, but clearly this depends on the availability of an informed individual at the time of calling

One respondent suggested that information should be updated on a monthly basis and another commented that NRA web sites should have a searchable database system for information retrieval. Others proposed that e-mails could be used to inform registered users of new additions to a web-site. We note that some NRAs (e.g. Ireland and Denmark) already operate such a system.

All the respondents thought information should be available in English, with only a few proposing both the national language and English. If English is accepted by the majority this could yield savings in terms of holding duplicated information on web-sites, although arguably this could be perceived as discriminatory to smaller national companies that may not have in-house English speakers. In the case of legal documents it is likely that the national language would have precedence in the case of a legal dispute and it might therefore be necessary to provide such information in both languages.

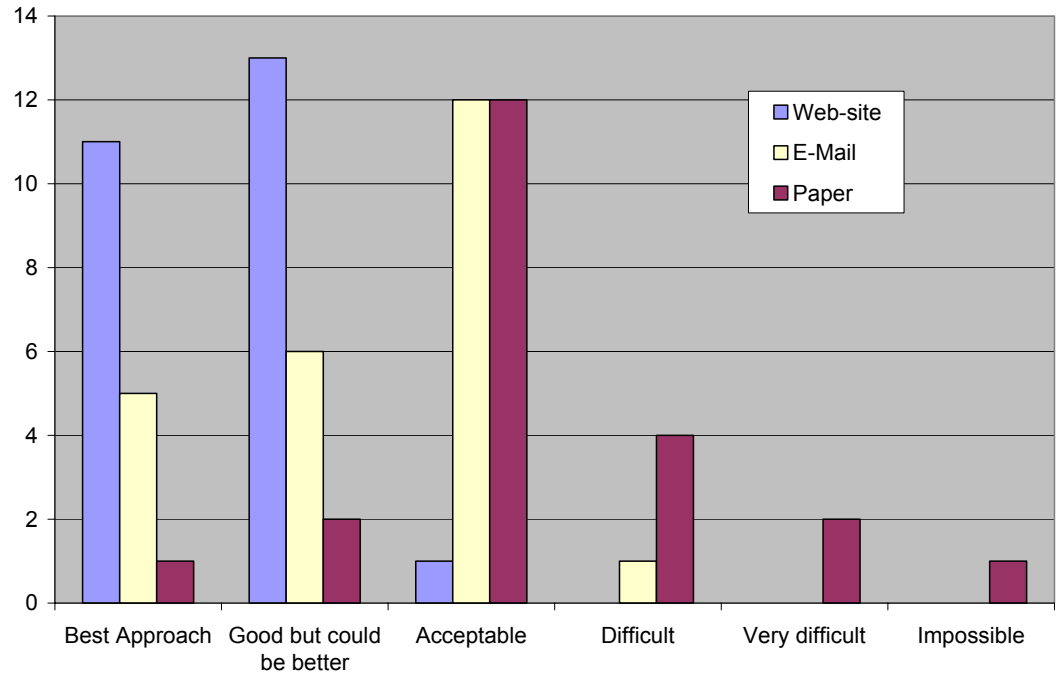


Figure 5 Summary of responses on preferred format of radio spectrum information

3.10 Sector-Specific Information initiatives

Certain major users of radio spectrum have established their own industry-supported facilities to collate information on spectrum use. A good example is the **SAFIRE** (Spectrum and Frequency Information Resource) developed by the European air traffic control agency, Eurocontrol.

Eurocontrol needs specific information about national policies relating to the aeronautical use of spectrum. They have to understand the particularities of the national legislation (e.g. how problems of interference can be dealt with). Specific data like information on Air Defence radar also used by Air Traffic Control, may be requested to be kept confidential by States. Eurocontrol and IATA are developing SAFIRE as an information system for European aeronautical services to be fed by national Air traffic Services Providers and Aviation authorities. The information will be made available to interested parties such as Radio Regulators and the EC.

The SAFIRE database provides the following information and functionalities:

- access levels
- spectrum data: allocation information
- spectrum links: web links to spectrum information
- user information exchange: message board facility
- assignment management: population of data tables
- frequency management: proposals, co-ordination messages and distribution lists
- query management: database querying activity
- monitoring: regular data sampling
- reporting: report generation
- database management: database functions – export, comparison, backup and archive

It can provide the following spectrum allocation detail:

- Footnotes
- Protection criteria
- Legal information

An interference monitoring database provides the following:

- Entry form on agreed template
- Logging into defined database table

Statistics are also derived from frequency tables:

- Number of stations in service
- Monitoring sample periods
- Growth analysis of radio services
- Number of assignments made
- Number of proposals failed
- Figures supplied by region / airspace

4 Overview of NRAs' responses and comments

4.1 Introduction

A questionnaire was sent to the NRAs or organisations responsible for spectrum management in the 31 countries covered by the study. Interviews were also held with several organisations to discuss specific issues in more detail. The answers to the questionnaire are discussed in more detail in the annexes.

The following information provided by the NRAs is analysed in this chapter:

i) The number of organisations responsible for spectrum management and spectrum information in each country;

ii) Availability of information on the role of each responsible organisation;

iii) Mode of information availability (e.g. web site or paper documents);

iv) Information on the regulatory framework for electronic communication services in each country;

v) Information on future spectrum strategy;

vi) NFAT management;

vii) Availability of the NFAT through EFIS and NRA web sites;

viii) Responsibility for publishing and maintaining the NFAT;

ix) Any other national tables or databases;

x) Cost and human resources associated with providing and maintaining general information relating to radio spectrum

xi) Information on spectrum refarming

xii) Information on spectrum trading

4.2 Number of organisations responsible for spectrum management and spectrum information

Where there is no NRA responsible for spectrum matters, the responsible organisation is a Government Department.. This is the case in countries such as Bulgaria, Cyprus, Malta, or Romania. A single independent organisation, generally the NRA, manages all the issues related to spectrum management in the United Kingdom, Switzerland, Finland, Iceland, Sweden and Poland. In the United Kingdom, Ofcom was formed in 2003 by merging of the Radiocommunications Agency (RA), the Independent Television Commission (ITC), the Radio Authority, the Office of Telecommunications (Oftel) and the Broadcasting Standards Commission (BSC). Prior to the merger the RA, which was a Government Agency, was responsible for spectrum management.

In many countries, such as Austria, Denmark, Ireland or Luxembourg, two organisations are involved in spectrum management and information, generally the NRA where one exists, and the Government Department in charge of spectrum management (typically the Ministry of communications or telecommunications).

Other organisations involved in some countries are:

- Communities' representative organisations such as the Ministries of Communities (Flemish, French and German) in Belgium or The Scottish, Welsh and Northern Ireland Executives in the United Kingdom

Information on the organisations involved in spectrum management can generally be found on the web sites of the NRAs. The following table summarises the main bodies responsible for spectrum management in Europe and where information on these bodies is available

Country	Organisation(s)	Is this information available and where?
Austria	1. Federal Ministry for Transport, Innovation and technology, Postal and telecom Branch. 2. Communications Authority Austria (KommAustria)	Yes: www.rtr.at
Belgium	BIPT, Ministries of the communities (Flemish, French, German)	Yes: www.bipt.be
Bulgaria	Ministry of Transport and Communications (MTC)	Yes: www.crc.bg
Cyprus	Ministry of Communications and Works (DEC-MCW)	Yes www.mcw.gov.cy)
Czech Rep	1) Czech Telecommunication Office (CTO) 2) Ministry of Informatics (MICR)	Yes: Telecommunications Act
Denmark	National IT and Telecom Agency (NRA), Ministry of Science, Technology & innovation	Yes: www.itst.dk
Estonia	1. Ministry of Economic affairs and Communications, 2. Estonian National Communications Board, 3. Ministry of Defence, 4.Contact person from Estonian Air Navigation Services	Yes: www.sa.ee (Estonian only) + State gazette
Finland	FICORA (Finnish Communications Regulatory Authority)	yes, www.ficora.fi and distribution lists for interest groups
France	1) The Prime Minister 2) DIGITIP 3) ANFr (Agence Nationale des Fréquences - Spectrum Agency), 4) other administrations (see comment)	Yes, web sites

Country	Organisation(s)	Is this information available and where?
Germany	1. BMWA, 2. RegTP (Regulierungsbehörde für Telekommunikation und Post), 3. BMVg, 4. IT Amt der Bundeswehr	yes, Part 5 des TKG (Telecommunication Act)
Greece	1) Ministry of Transport and Communications (YME). 2) Ministry of Defence. 3) EETT (National Telecommunications and Post Committee). 4) National Broadcasting Council	Yes, Copy of NFAT is on EETT and Ministry of Transport & Communications web sites in Greek
Hungary	Ministry of Informatics and Communication (IHM), Ministry of Defence (HM), National Communications Authority, Hungary (NHH), Governmental Frequency Management Agency (KFGH)	Yes, published on NHH WEB site www.nhh.hu
Iceland	Post- and Telecom Administration (NRA)	No or partially available
Ireland	ComReg (NRA) ; Dept of Communications Marine and Natural Resources (DCMNR): Government Department	Yes: 1. Department Communications, Marine and Natural Resources website. (www.dcmnr.ie); 2. ComReg web site (www.comreg.ie)
Italy	1) Ministero delle Comunicazioni 2) Autorita per la garanzie nelle communazioni (NRA)	Yes, official journal and www.comunicazioni.it and www.agcom.it
Latvia	Latnet	Yes: www.esd.lv
Lithuania	Communications Regulatory Authority	Yes: www.rrt.lt
Luxembourg	1) SMC. (Service des Médias et des Communications) / Ministry of State. 2) ILR (Institut Luxembourgeois des Régulations - NRA)	Yes: www.etat.lu/ILR/content.html
Malta	Wireless Telegraphy Department (WTD), in the future: Malta Communication Authority	Yes: www.wtd.gov.mt
Netherlands	Ministry of Economy Directorate General Telecommunications and Post (dgTP); Radiocommunications Agency (AT); National Authority of regulation of telecommunications (OPTA)	Yes, web sites (www.minez.nl, www.agentschap-telecom.nl, www.opta.nlà)
Norway	1. Norwegian Post- and telecommunications Authority (NPT), Independent Regulator. 2. The Ministry of Transport and Communication (MOT). 3. Ministry of Cultural and Church Affairs	Yes: www.npt.no
Poland	Office of Telecommunications and Post Regulation (URTIP)	Yes: www.urtip.gov.pl
Portugal	ICP-ANACOM	Yes – www.anacom.pt
Romania	MCTI (Ministry of Communications and Information Technology)	Yes: www.igcti.ro
Slovak Rep	1) Telecommunications Office of The Slovak Republic (NRA). 2) Ministry of Transport and telecommunications	Yes: www.telecom.gov.sk
Slovenia	1) ATRP (Telecommunications, Broadcasting and Post Agency - NRA). 2) Ministry of Information Society (MID)	Yes: www.apek.si/
Spain	Ministerio de Industria, Turismo y Comercio (Ministry of Industrie, Turism and Commerce)	Yes - www.setsi.mcyt.es (Spanish only)
Sweden	PTS: Post- och telestyrelsen (National Post and Telecom Agency)	Yes – www.pts.se
Switzerland	OFCOM/BAKOM	Yes – www.bakom.ch
Turkey	1) Telecommunications Authority (TA): NRA 2) Ministry of transportation	Yes, www.tk.gov.tr
United Kingdom	1) OFCOM; 2) Government; 3) Ministry of Defence (MoD), 4) Scottish Executive	Yes, www.ofcom.org.uk

Table 2: organisations responsible for spectrum management

4.3 Information provided by NRAs on the regulatory framework

4.3.1 Introduction

Information on the regulatory framework is publicly available in all the countries listed above except Hungary and Malta. The level of detail provided ranges from an overview of the regulatory framework (Luxembourg) to a very detailed level of information in the UK which provides the licensing regime, national legislation, information on spectrum changes, frequency authorisation policy guidelines and authorisation procedures.

4.3.2 Languages used for information on the regulatory framework

Information on the regulatory framework is available:

- Only in the national language in Cyprus, Denmark, Luxembourg and Slovenia, Ireland and the UK (in the latter two cases English is a national language and information is not provided in any other language)
- In the national language and partly in English in Estonia, Poland, the Netherlands, Turkey and Greece. In Turkey and Greece most information is published in Turkish or Greek only, but English is used for high profile information or where there is likely to be particular interest from foreign companies or individuals (e.g. amateur radio or GSM / 3G licensing). In the Netherlands only certain information documents, applications forms, links to other organisations and the frequency register are available in English.
- In the national language and fully in English in Iceland and Belgium

4.3.3 Organisations responsible for international activities

NRAs and Government Departments in charge of communications are the main responsible organisations regarding international coordination. NRAs tend to be mostly responsible for agreeing and notifying implementation to ECC Recommendations, Decisions and Reports. The responsibility for responding to ETSI standards public enquiries is sometimes shared between NRAs, Ministries and national standardisation organisations. In the Netherlands, a Dutch ETSI Members Deliberative Body is responsible for responding to ETSI standards public enquiries.

Government Departments tend to be mostly responsible for signing up to ITU Radio Regulations and agreeing to opinions in the EU Radio Spectrum Committee (RSC) and in the Radio Spectrum Policy Group. This reflects the enhanced legal status of ITU and EU instruments (international treaty status and binding Directives) compared with the voluntary nature of ECC instruments.

Responsibility	NRA	Ministry	Radio Agency	National standardi-sation organisation	Other
Agreeing to ECC Recommendations, Decisions and Reports	B, Cz, Dk, E, Fi, Ic, Ir, Lu, M, No, Sk, Sl, Swe, Swi, T, UK	A, Cy, G, Gr, H, Ir, It, M, Ne, Pl	Ne (consultation)		
Notifying implementation of ECC Recommendations, Decisions and Reports	B, Cz, Dk, E, Fi, Ic, Ir, Lu, No, Sk, Sl, Swe, Swi, T, UK	A, Cy, G, Gr, H, It, M, Pl	Ne		
Responding to ETSI standards public enquiries	Dk, E, Fi, Ir, No, Pl, Swi, T, UK	A, G, Gr, It, Lu, M, Pl		B, Cz, H, Ic, Sk, Sl, UK	Cy, Ne
Notifying Interface Requirements	Cz, Dk, E, Fi, Ic, Ir, Lu, No, Pl, Sk, Swi, T, UK	A, B, G, Gr, H, It, Lu, M, UK	Ne		Cy
Signing up to ITU Radio Regulations	B, Dk, E, Fi, Ic, Lu, No, Swi, T, UK	A, Cy, Cz, Dk, G, Gr, H, Ic, Ir, It, Lu, M, Ne, Pl, Sk, Sl			
Agreeing on opinions in the EU Radio Spectrum Committee	Dk, E, Fi, Ic, Lu, M, No, Pl, T, UK	A, B, Cy, Cz, Dk, Fi, G, Gr, H, Ic, Ir, It, Ne, No, Sk, Sl, Swe			
Agreeing on opinions in the EU Radio Spectrum Policy Group	Dk, Fi, Ic, Lu, No, Pl, T, UK	A, B, Cy, Cz, Dk, E, Fi, G, Gr, H, Ic, Ir, It, Lu, M, Ne, No, Sk, Sl, Swe			
Other (please specify)	Fi (Cocom)	Gr, Fi (Cocom)			

Table 3: organisations / international coordination

Legend: *A: Austria, B: Belgium, Bu: Bulgaria, Cy: Cyprus, Cz: Czech Republic, Dk: Denmark, E: Estonia, Fi: Finland, Fr: France, G: Germany, Gr: Greece, H: Hungary, Ic: Iceland, Ir: Ireland: It: Italy, La: Latvia, Li: Lithuania, Lu: Luxembourg, M: Malta, Ne: Netherlands, No: Norway, Pl: Poland, Pt: Portugal, R: Romania, Sk: Slovak Republic, Sl: Slovenia, Sp: Spain, Swe: Sweden, Swi: Switzerland, T: Turkey, UK: United Kingdom*

4.3.4 Keeping spectrum users informed

The way spectrum users are informed by NRAs about changes to the regulation of the radio spectrum or the regulatory framework varies from publication on web-sites to distribution of individual information by post or e-mail. In most countries information is made available via NRA or Government web sites. Some countries rely on the ERO web site to inform their users about agreement to or notification of ECC Recommendations, Decisions and Reports.

More interactive ways of informing the users are:

- The NRA holding information meetings (Finland, Netherlands and the UK)
- Management of a mailing list (Finland)
- Individual information (Austria for ITU regulations and EU Radio Spectrum Committee and Radio Spectrum Policy Group opinions)

The Communications Committee (COCOM), a specialised working and advisory body of the European Commission, is also mentioned by the Finnish NRA as part of its communications policy.

The following table indicates how individual countries notify national spectrum management developments or the regulatory framework:

Category	Publica-tion on paper	Publica-tion on ERO web site	National Web site (NRA or Ministry)	Consul-tation	Mailing list	Indivi-dual informa-tion	Mee-tings	Discus-sion in national standard body	TRIS
Agreeing to ECC Recommendations, Decisions and Reports	A, Cy, Cz, I, Pl	B, Ic, Ne, Swe	Cz, E, Gr, Ic, Ir, Lu, Sk, UK	Dk, Fi, I	Fi		Fi, Ne, UK		
Notifying implementation of ECC Recommendations, Decisions and Reports	A, Cy, Dk, H, I, Pl	B, Cy, Cz, E, Ic, Ir, Swe, UK	Gr, Cy, H, Ic, Lu, M, Ne, Sk, UK	Fi, I	Fi		UK		
Responding to ETSI standards public enquiries	I, Pl, Sk		Gr, H, Ic, Lu, Sk	Dk, Fi, I	Fi		Ne, UK	A	
Notifying Interface Requirements	A, B, Dk, Gr, I, Pl		Ic (planned), Ir, Lu, M, Ne, UK	Fi, I	Fi				Gr
Signing up to ITU Radio Regulations	E (press), H, I	Swe	Dk, H, Ic (planned), Ne, Pl	Fi, I	Fi	A	Fi, UK		
Agreeing on opinions in the EU Radio Spectrum Committee	I		B (RSC), Dk, Ic (planned), Pl (planned)	I	Fi	A	Fi, Ne		
Agreeing on opinions in the EU Radio Spectrum Policy Group	I		B (RSPG), Dk, Ic (planned), Pl (Planned)	I	Fi	A	Fi, Ne		

Table 4: information of the spectrum users

Legend: A: Austria, B: Belgium, Bu: Bulgaria, Cy: Cyprus, Cz: Czech Republic, Dk: Denmark, E: Estonia, Fi: Finland, Fr: France, G: Germany, Gr: Greece, H: Hungary, Ic: Iceland, Ir: Ireland: It: Italy, La: Latvia, Li: Lithuania, Lu: Luxembourg, M: Malta, Ne: Netherlands, No: Norway, Pl: Poland, Pt: Portugal, R: Romania, Sk: Slovak Republic, Sl: Slovenia, Sp: Spain, Swe: Sweden, Swi: Switzerland, T: Turkey, UK: United Kingdom

4.4 Information on future spectrum strategy

4.4.1 Publication and language

4.4.1.1 Publication

Most of the countries (18 out of 26) which answered the questionnaire, claimed that they publish details of their future spectrum strategy. Belgium said that it does not publish a document addressing specifically the future spectrum strategy but instead publishes the results of consultations.

4.4.1.2 Language for future spectrum strategy documents

Eleven countries stated that they only publish future spectrum strategy documents in the national language (Austria, Denmark, France, Italy, Netherlands, Norway, Slovenia Spain, and Sweden[9]). Four published their documents in both English and the national language (Cyprus, Germany, Hungary and the Czech Republic). The following table indicates for each NRA whether the national spectrum strategy is published and if so in what language(s).

Country	Publication of the future spectrum strategy	Language available
Austria	Yes	National language
Belgium	Yes, results are generally public. Consultations are published	
Cyprus	Yes	National language and English
Czech Rep	No	
Denmark	Yes	National language
Estonia	No	
Finland	No	
France	Yes, www.anfr.fr	National language
Germany	Yes	National language, English
Greece	No	n/a
Hungary	Yes	National language, English
Iceland	No	
Ireland	Yes	National Language (English)
Italy	Yes	National language
Luxembourg	n/a	n/a
Malta	No	
Netherlands	Yes	National language
Norway	Yes	National language
Poland	Yes	n/a
Slovak Rep	Yes	National language, English
Slovenia	Yes – official gazette	National language

[9] : 11 countries if we consider that Ireland and the UK publish it in English

Country	Publication of the future spectrum strategy	Language available
Spain	Yes	National language
Sweden	Yes, when adopted	National language
Switzerland	No	
Turkey	No	
United Kingdom	Yes	National Language (English)

Table 5: spectrum strategy – publication & language

4.4.2 Review of the spectrum strategy

The approach to updating the national spectrum strategy differs between countries.

- Some review their spectrum strategy at defined intervals: every 3 years for Cyprus and Hungary, every 2/3 years in the Netherlands, every two years in Ireland, the United Kingdom and Poland, every 18 months in Norway, once a year in Denmark and Slovak Republic.
- It is an ongoing activity in France
- Review takes place after WRCs in Austria.
- Review takes place in response to EU or CEPT Decisions and Directives in Iceland, Finland and Malta.

The following table summarises the approach to updating the national spectrum strategy in each country:

Country	Periodic review of the spectrum strategy
Austria	After WRC
Belgium	No defined review period
Cyprus	every 3 years
Czech Rep	On continuous basis
Denmark	once a year
Estonia	NFAT reviewed 1 or 2 times a year
Finland	All the time, depending on the development in CEPT ECC work
France	It is an ongoing activity
Germany	A first version exists and is currently updated.
Greece	Ongoing basis
Hungary	at least every 3 years
Iceland	In the past, the PTA has implemented all harmonised measures (ECC Decisions, EU Directives...)
Ireland	Every two years
Italy	Mainly depending on the policy objectives and industry/operators/market demand
Luxembourg	n/a

Country	Periodic review of the spectrum strategy
Malta	As necessary. This depends on the developments in technology and on the issuance of new ECC deliverables
Netherlands	once every 2/3 years
Norway	Every 18 months
Poland	It is under preparation. The spectrum strategy will be reviewed, according to needs, at least ones per two years
Slovak Rep	Every year
Slovenia	After any WRC Frequency allocation table and Frequency usage are reviewed
Spain	Every 2 to 3 years
Sweden	When necessary. Not decided
Switzerland	When necessary
Turkey	Annually
United Kingdom	Approximately every 2 years

Table 6: spectrum strategy – periodic review

4.4.3 Development of the future spectrum strategy

Various approaches are taken by NRAs to developing their future spectrum strategies, as summarised in the following table:

Country	Consultation with Industry	Consultation with other organisations	Adopting the approach decided on by other NRAs	Unilaterally	Other
Austria	yes, if required	yes, if required	Yes, within the CEPT framework	Yes, if no other parties are interested	
Belgium	yes	yes	Yes	in some cases	Broadcasting: determined by the 3 communities
Bulgaria					
Cyprus	yes	yes	no	yes	n/a
Czech Rep					Close in allocations as in ERC/REP 25
Denmark	yes	yes	n/a	no	
Estonia	No	yes	Yes	Yes	Special commission for UMTS
Finland	yes	yes	yes	yes	yes
France	Yes	Yes	No	No	
Germany	yes	yes	no	no	Cf. Document "Strategic Aspects of the Spectrum Regulation of the RegTP"
Greece	On specific issues (e.g. fixed link channel plans)	Ministry			
Hungary	yes	yes	yes	yes	
Iceland	No	No	No	No	ECC / ERO / EU
Ireland	Yes	Yes	No	No	Yes: European harmonisation
Italy	Yes	Yes	Yes		forum and/or consultation opened to the general public can also be applied
Latvia					
Lithuania					
Luxembourg	yes	yes	partly	no	yes: operators
Malta	no	no	yes	yes	public consultation
Netherlands	yes	yes	no	no	
Norway	yes	yes	yes		
Poland	yes	yes	no	no	
Portugal					
Romania					
Slovak Rep	yes	yes	yes		international harmonisation (ITU/EU)

Country	Consultation with Industry	Consultation with other organisations	Adopting the approach decided on by other NRAs	Unilaterally	Other
Slovenia					Yes: all regulation (including Frequency usage plan) has 30 days consultation period
Spain	Yes	Yes	Yes	No	
Sweden	Yes	Yes	No	No	No
Switzerland	yes	yes	yes	No	
Turkey	Yes	Yes	Yes	Yes	Yes (military)
United Kingdom	yes	yes	no	yes	

Table 7: development of the future spectrum strategy

Some NRAs also develop parts of their future spectrum strategy unilaterally:

- Cyprus, Estonia, Finland, Hungary, Malta and the United Kingdom;
- Austria, if no other parties are interested;
- Belgium in some cases.

Other methods used for the development of the future spectrum strategy include:

- the involvement of the three communities in Belgium for broadcasting aspects;
- the creation of a special commission for UMTS in Estonia;
- taking into account the European Decisions and Directives. This was explicitly mentioned by Iceland, Ireland and Slovak Republic.

4.4.4 Information covered by published Spectrum Strategy documents

Six countries (Denmark, Germany, Ireland, Norway, Slovak Republic and UK) publish their spectrum strategy in the form of a specific document covering substantially the following aspects:

- Description of the present strategy;
- Directions the NRA wants to take in terms of future spectrum strategy;
- Details for specific frequency bands or services (aeronautical, maritime, military…).

In **Germany**, the regulatory body, RegTP, publishes a detailed document called "strategic aspects of the spectrum regulation of the regulatory authority for telecommunications and posts". Among other things, it details the position of the regulatory body on issues such as:

- Regulatory status of the satellite services
- Digitisation of the broadcasting service
- Identification and protection of the extension bands for UMTS/IMT 2000
- Frequency utilisation parameters for GALILEO
- Implementation of Short Range Devices and Ultra Wideband applications
- Global harmonisation of frequency ranges for WLAN radio applications
- Strategic aspects of trunked and private mobile radio

- Development of the fixed service (radio relay)
- Radio applications for internal and external security

The document also presents selected refarming cases:

- Redeployment of the former cellular C-network frequencies
- Redeployment of the former TFTS frequencies

In **Ireland**, the spectrum strategy document covers:

- Regulatory framework for spectrum management
- Economic and Social impact of spectrum use
- Key drivers affecting future spectrum demand
- Strategy for managing radio spectrum
- Planning for the future

Ofcom in the **UK** details the following in its strategy document:

- Management of the Radio Spectrum;
- Developments in Radiocommunications;
- Military Spectrum Strategy;
- Aeronautical Spectrum Strategy;
- Maritime Spectrum Strategy;
- Spectrum Management Mechanisms;
- The Authorisation of Spectrum Use;
- Research

The following table summarises the type of information relating to spectrum strategy that is published by each country:

Country	Information covered
Austria	On a case-by-case basis
Belgium	no specific strategy document
Cyprus	NFAT
Czech Rep	ERC/ECC Reports, World Radio Conferences
Denmark	www.vtu.dk/fsk/ITC/524938.pdf
Finland	In FICORA Regulation 4 and annexes. Information on future usage of frequency bands is provided. Whenever major changes in spectrum utilisation are required, a consultation phase is organised
France	n/a
Germany	see above
Greece	Strategy not publicly available
Hungary	The Annexes of the Government Decree on the establishment of National Table of Frequency Allocations (FNFT) contain footnotes relating to the closing or opening of frequency bands, and the provisions relating to the transition period.
Iceland	No formal spectrum strategy document available
Ireland	see above
Italy	n/a
Luxembourg	n/a

Country	Information covered
Malta	n/a
Netherlands	Frequency allocation, frequency assignment and licensing issues
Norway	The strategy is general in nature and gives indications on the directions NPT want to take spectrum management. http://www.npt.no/portal/page?_pageid=80,42638&_dad=portal&_schema=PORTAL (Norwegian only)
Poland	n/a
Slovak Rep	Items regarding spectrum strategy: economic use of frequency spectrum, satellite communications, access to Internet for all, broadband access, digital TV and radio broadcasting, research and technical department, international cooperation
Slovenia	Use of frequency spectrum
Spain	NFAT
Sweden	Consultation document published on www.pts.se.
Turkey	Service, frequency bands, ERC/ECC Decisions or Recommendations, ITU and EU Footnotes, etc.
United Kingdom	see above

Table 8: spectrum strategy – information covered

4.5 NFAT management

The approach to maintaining the NFAT also varies from country to country. The following sections show which countries currently make their NFATs available through the EFIS portal and the organisation(s) responsible in each country for maintaining and publishing the NFAT.

4.5.1.1 Availability of the NFAT through EFIS

The availability of the National Frequency Allocation Table (NFAT) on EFIS or on the NRA's web site is presented in the table below:

Country	Available on EFIS	Available on NRA's web-site
Austria	Yes	Yes
Belgium	Yes	Yes
Bulgaria	No	Yes
Cyprus	No	Yes
Czech Republic	Yes	Yes
Denmark	Yes	Yes
Estonia	Yes	Yes
Finland	Yes	Yes
France	Yes	Partially
Germany	Yes	Yes
Greece	No	Yes
Hungary	Yes	Yes
Iceland	Yes	Yes
Ireland	Yes	Yes
Italy	Yes	Yes
Latvia	No	No
Lithuania	Yes	Yes
Luxemburg	Yes	Yes
Malta	No	Yes
Norway	Yes	Yes
Poland	Yes	Yes
Portugal	Yes	Yes
Romania	No	No
Slovak Republic	No	Yes
Slovenia	No	Yes
Spain	Yes	Yes
Sweden	Yes	Yes
Switzerland	Yes	Yes
The Netherlands	Yes	Yes
Turkey	No	Yes
UK	No	Yes

Table 9: availability of the NFAT

4.5.1.2 Maintaining and publishing responsibilities of the NFAT

In most cases, the national NRA is responsible for maintaining and publishing the national frequency allocation table. In other cases, the NRA and the Ministry share those responsibilities.

Country	Maintaining	Publishing
Austria	Federal Ministry for Transport, Innovation and technology,	Federal Ministry for Transport, Innovation and technology,
Belgium	Belgian Institute of Posts and Telecommunications	Belgian Institute of Posts and Telecommunications
Cyprus	n/a	n/a
Czech Rep	Czech Telecommunications Office	Czech Telecommunications Office
Denmark	National IT and Telecom Agency	National IT and Telecom Agency
Estonia	Estonian National Communications Board,	Estonian National Communications Board,
Finland	Finnish Communications Regulatory Authority	Finnish Communications Regulatory Authority
France	National Frequency Regulation Agency (ANFR)	ANFR after Prime Minister approval
Germany	Federal Ministry of Economics and Labour/ Regulatory Authority for Telecommunications and Posts	Federal Ministry of Economics and Labour
Greece	Ministry of Transport and Communications	Ministry of Transport and Communications
Hungary	National Communications Authority	IHM
Iceland	PTA	PTA
Ireland	Commission for Communications Regulation	Commission for Communications Regulation
Italy	Ministry of Communications	Ministry of Communications
Luxembourg	Luxembourg Institute of Regulation	Luxembourg Institute of Regulation
Malta	Ministry for Competitiveness and Communications	Ministry for Competitiveness and Communications
Netherlands	Radiocommunications Agency	Directorate General Telecommunications and Post
Norway	Norwegian Post and Telecommunications Authority	Norwegian Post and Telecommunications Authority
Poland	Ministry of Infrastructure in cooperation with Office of Telecommunication and Post Regulation	Council of Ministry
Slovak Rep	Ministry	Ministry
Slovenia	Post and Electronic Communications Agency	MID (allocation - like ITU RR5); ATRP (spectrum use - like CEPT/ERC/REP 25)
Spain	Ministry of Industry Tourism and Commerce	Ministry of Industry Tourism and Commerce
Sweden	National Post and Telecom Agency	National Post and Telecom Agency
Switzerland	Office of Communications (Ofcom/Bakom)	Office of Communications (Ofcom/Bakom)
Turkey	Telecommunications Authority	Telecommunications Authority
United Kingdom	Office of Communications (Ofcom)	Office of Communications (Ofcom)

Table 10: NFAT – maintaining and publishing responsibilities

4.6 Other national tables or databases

In addition to the NFAT, some countries make other tables available to the public. These include for example national frequency registers and transmission site databases.

4.6.1 National Frequency Registers

Some NRAs provide on-line frequency registers. However the level of detail provided varies considerably:

- The register provided in the Netherlands provides details of applications, interface standards, etc in each frequency band but not information on rights holders
- The Danish frequency register includes extensive details of individual holders of spectrum rights. There is a requirement in the Radiocommunications Act 1997 to provide the frequency register. Before the Act was passed by Parliament consultation took place, in particular with the Ministry of Justice. The conclusion was at that time, that there would be no legal difficulty in publishing information on actual licensed frequencies. The frequency register is a copy of the assignment database so it is not feasible for the information to be accidentally or intentionally amended. It is updated each day. Also some of the fields that are on the assignment database are not included in the frequency register e.g. status of payment for spectrum access.
- The UK is planning has recently introduced a frequency register over the coming year to facilitate the introduction of spectrum trading. This contains the following information
    - name of licensee
    - reference number of licence
    - contact details of licensee
    - geographic indication (generic- e.g. national or indication of city or county)
    - frequency assigned (specific frequency or band depending on licence class)

  The Danish and UK databases provide useful templates for a “spectrum rights register that could be used to support spectrum trading where this is introduced. It is interesting to

4.6.2 Transmission Site Databases

On-line transmission site databases exist in France, Ireland and the UK. The UK and Ireland facilities provide the following information:

- Site Name / ID
- Site co-located or shared
- Antenna Height Above Ground,
- Service Type
- Network Operator

The “Cartoradio” database in France is a database of national mobile phone base stations and of broadcasting stations (radio and television).

4.6.3 Technical interface database:

The UK has on-line information on Air Interface Requirements and Technical Frequency Assignment Criteria (TFAC) in the United Kingdom

4.6.4 Summary

The following table summarises the information databases and tables (other than the NFAT) that are available from NRAs:

Country	Other tables - Responsible Organisation	Table / Database and information provided
Cyprus		radio & TV frequency assignment plans, authorization registry, radio amateur call sign database
Czech Rep	CTO	Frequency Spectrum Usage Plan
Denmark	National IT and Telecom Agency	licensing register
Estonia	Estonian National Communications Board,	State Register of the licences: information about licence holder, date of issuing and period of validity
France	ART, CSA, ANFr	Cartoradio (location in France of radio stations), Radio amateurs directory, allocated frequency bands for telecommunication usages, TV and radio database
Germany	RegTP	FreqNP
Hungary	NHH and IHM	Frequency bands and radio applications available for civil purposes, rules relating to the use of frequency bands, international and national documents, special conditions, individual requirements
Ireland	`Site viewer` – a database of national mobile phone base stations. (online, searchable with map facility). The database is managed by the Commission for Communications Regulation (ComReg), the data itself is the property of the Operators. AIP – Aeronautical Radiocommunications and Radionavigation information. The publication is managed by the Aeronautical Information Services of the Irish Aviation Authority. Database of independent broadcasters in Ireland– A list available from the Broadcasting Commission of Ireland www.bci.ie. Database of public service broadcasters in Ireland – A list available from the RTE www.rte.ie	Site Name, Site ID, County, site co-located or shared, Antenna Height Above Ground, Service Type and Network Operator. The database is managed by the Commission for Communications Regulation (ComReg), the data itself is the property of the Operators
Netherlands	The Radiocommunications Agency also maintains a National Frequency Register (www.agentschap-telecom.nl/english). In the National Frequency Register you will find the radio interface per frequency band on which the allocation of the band is based	The radio interface contains a number of non-mandatory technical parameters and standards. However, if applied, they give the user of the radio spectrum a reasonable level of confidence that they will cause no interference to other radiocommunications or in radio apparatus
Spain	Ministry of Industry, Tourism and Commerce	Allocations; Radio Regulation footnotes; National footnotes; Channel plans
Sweden	PTS	No other tables but a database containing all licences (the national frequency register)
Switzerland	OFCOM/BAKOM	The frequency register but not publicly available
United Kingdom	UK plan of frequency authorisation (PFA); WT register; Site finder; Air Interface Requirements and also Technical Frequency Assignment Criteria (TFAC)	a) More information on actual current use and plans in short to medium term (5 years) that FAT. b) Licensing or authorisation regime for allocations listed in UK FAT) Database of individual licensed) Information on all mobile phone base stations

Table 11: other national databases & tables

4.7 Cost and human resources associated with providing and maintaining general information relating to radio spectrum

4.7.1 Estimated annual cost

Estimation of the annual cost and human resources associated with providing and maintaining information relating to radio spectrum proved to be complicated for NRAs. Various estimates were given by the NRAs ranging from €30,000 per annum for the Netherlands up to €1,250,000 for Hungary and €2 million for the Slovak Republic.

In the UK, Ofcom and its predecessor the Radiocommunications Agency does not differentiate between policy development and provision of information in costings. In some cases it has however been possible to make rough estimates of the resources involved in specific activities, for example:

- UK Spectrum Strategy: approx. €280k per update (every two years) for main team, i.e. €140k per annum.
- NFAT: approx. €120k p.a.
- General upkeep of policy/procedure manuals and other key pieces of information about authorisation arrangements: approx. €600k p.a.
- Development of the frequency register to support spectrum trading is expected to cost several hundred thousand euro.

In response to a request for further information on the Norwegian frequency allocation table the NRA responded that their long term strategy is to:

- publish all available frequencies/spectrum in Norway on their web-site
- publish all spectrum/transmitter licenses/rights on their web-site.

As a first effort, they made their frequency plan interactive, linked all national/regional spectrum rights to the plan, and presented some of the available frequency bands between 2 and 40 GHz. This required about 550 hours of work from an external consultancy firm and about 300 hours of internal effort. The cost for the external consultants was estimated to be around €100 000.

In Denmark the estimated cost for providing the interactive frequency plan on the internet was around 500,000 kroner (€67,000). Information from Denmark estimated the cost of implementing the spectrum register to have been around 1 million kroner (€134,000).

4.7.2 Estimated number of staff

The following table provides NRAs' estimates of the resources involved in providing and maintaining general information relating to radio spectrum. The estimates vary from 0.2 full-time equivalents in Austria to 5 in France and 7 in the Netherlands. Note that the figures given by the Slovak Republic, Cyprus and Hungary are believed to represent the total staff involved in spectrum management issues.

Country	Estimated cost per annum	Estimated number of staff
Austria	Not available	Approx 0.2 man-years per annum
Belgium	no details available	no details available
Cyprus	no estimation	17 persons (DEC-MCW)
Czech Rep	n/a	n/a

Country	Estimated cost per annum	Estimated number of staff
Denmark	500,000 kroner (67000 EUR) for provision of the interactive frequency plan on the Internet	n/a
Estonia	n/a	n/a
Finland	n/a: part of several employees' normal work	n/a: estimated 10 to 15 persons involved
France	n/a	5 people
Germany	n/a	n/a
Greece	n/a	Around 1 person-month per annum for content management. IT Dept is responsible for website
Hungary	1,250,000 euro	140
Iceland	100 000 EUR	1
Ireland	EUR 60000	1.5
Italy	n/a	n/a
Luxembourg	not available	not available
Malta	n/a	2
Netherlands	30000 Euros	7 persons (dgTP and AT)
Norway	150000 euros	1
Poland	n/a	n/a
Slovak Rep	Approximately 2 Mil. EUR	107 persons - state inspection and market supervision. 21 persons frequency management. 12 regulations issues
Slovenia	50000 EUR	2
Spain	n/a	n/a
Sweden	n/a	n/a
Switzerland	n/a	n/a
Turkey	1) Frequency database developed in-house by IT Department – approx 20 people involved over a period of 1 year. 2) Spectrum Management system (developed jointly by TA and local University) cost around $1M – covers all frequency management, assignment and monitoring 3) Cost of translation where documents translated to English: 8.2 Million TL per page (180 words)	21 people in spectrum management department including 13 technical people
United Kingdom	1) Approx €280k per issue of UK Spectrum Strategy for main team, so €140k per annum. Two, full-time equivalent staff 2) Approx €120k for PFA. One, full-time equivalent staff 3) Approx €600k for general upkeep of policy/procedure manuals and other key pieces of information about authorisation arrangements. Five, full-time equivalent staff.	

Table 12: cost and human resources

4.8 Spectrum refarming

4.8.1 Implementation of spectrum refarming

Ten countries (out of the 26 responses) indicated that they have implemented a policy for spectrum refarming: Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Spain, Turkey and the United Kingdom.

Country	Have you implemented a policy for spectrum refarming ? (yes/no)	If yes, is it publicly available ? In what language
Austria	No, not as separate document	No, not as separate document
Belgium	No specific policy: on a case-by-case basis	n/a
Cyprus	No	
Czech Rep	No	
Denmark	yes	Yes, National language
Estonia	yes	n/a
Finland	yes	yes: National language, Swedish and English
France	Yes	Yes, National language
Germany	yes	yes: National language, English
Greece	No	
Hungary	Yes	No
Iceland	No	
Ireland	No	
Italy	Yes	National language
Luxembourg	No	
Malta	No	
Netherlands	No	
Norway	No	
Poland	No	
Slovak Rep	No	
Slovenia	No	
Spain	Yes	Yes: National language
Sweden	No general policy on spectrum refarming adopted. See ECC Report 16 for information about the refarming in some CEPT countries. The procedure for refarming is flowing from the general principles of administrative (public) law.	
Switzerland	no	
Turkey	Yes	In specific cases - National language
United Kingdom	Yes	Yes, English

Table 13: implementation of spectrum refarming

4.8.2 Availability of the policy for spectrum refarming

Among the ten countries where a policy for spectrum refarming has been implemented, six (Denmark, Finland, France, Germany, Spain and the United Kingdom) publicly provide the related documents.

In Turkey, when refarming issues arise, the Telecommunications Authority (TA) consults and discusses with affected parties. In the case of the UMTS bands, a document was published outlining TA's proposed strategy to re-farm fixed links over 10 years old. A document was also published on proposed refarming of NMT450 spectrum to TETRA

4.8.3 Nature of the information

When available, the information published typically includes the following:

- Executive order - The radio spectrum policy mandate (Denmark)
- National Table of Frequency Allocations (Finland)
- Band-specific information only. No overall information (United Kingdom)
- Consultation (Turkey)

Such information is generally provided on the NRA's web site.

4.8.4 NRAs' views on what information should be made available for spectrum refarming

NRAs were asked for their views on what information should be made available to support spectrum refarming activities. The responses are summarised in the following table:

Country	Views on what information should be made available
Austria	If refarming is needed, existing users are consulted
Belgium	n/a
Denmark	n/a
Estonia	licence expiry, number of end-users, equipment re-tuning, advantages of new technologies
Finland	Future plans usually available several years beforehand
France	All the information can be obtained through the refarming process when needed
Germany	The examples mentioned are a helpful support concerning the analysis of the refarming questions, although this information can be referred partially at each time over the national FreqNP. Decisions for a forthcoming refarming of a certain frequency range on the basis of frequency need inquiries can also be from international interest and should be therefore also published.
Hungary	Any information for planning the spectrum refarming is available in the database of the Authority. Information on the spectrum use, expenses of equipment and amortisation conditions have to be obtained for economical analyses relating to the spectrum refarming
Ireland	n/a
Italy	n/a
Norway	NPT believes that spectrum refarming mainly should be used when current licenses expire or when current licence holder wants to introduce new technologies in existing licenses (we believe in a marked based approach). Furthermore, spectrum trading combined with technology neutral licenses may reduce (or basically even remove) the need for the authorities to get heavily involved in spectrum refarming issues.
Spain	n/a
Sweden	Not decided

Country	Views on what information should be made available
United Kingdom	Information on current users at assignment level is currently treated as commercial in confidence. However this is almost certain to change to enable spectrum trading. It is unlikely that additional specific information above that necessary for efficient trading would be required in addition to band-specific information and plans described earlier. In general the following outline: -Where possible, provide notice in UK Spectrum Strategy - Consultation with users, industry and public - Publish statement of plan - Publish criteria for new use as appropriate - Implementation

Table 14: spectrum refarming - information

4.9 Spectrum trading

4.9.1 Implementation of spectrum trading

Out of the 26 countries which answered this question, 12 have already decided to introduce spectrum trading, 5 decided not to introduce it and 9 have not yet decided. Austria and Norway have both already implemented trading and Norway has experience in the field of spectrum trading in the following sectors: Private Mobile Radio, Satellite uplink and downlink, broadcasting, fixed wireless. Cyprus is following the work undertaken by the RSPG before coming to a decision about spectrum trading. Belgium, which has already decided to implement spectrum trading will also take into account the RSPG's work in order to define its detailed position on trading.

The following table indicates the current position of each country with regard to the introduction of spectrum trading

Country	Introduction of spectrum trading planned
Austria	Yes (already implemented)
Belgium	Yes
Cyprus	No decision currently (but follows RSPG)
Czech Rep	n/a
Denmark	No decision currently
Estonia	No
Finland	No
France	Yes
Germany	Yes
Greece	Yes
Hungary	Yes
Iceland	No
Ireland	No decision currently
Italy	Yes
Luxembourg	No decision currently
Malta	No decision currently
Netherlands	Yes
Norway	Yes
Poland	No decision currently
Slovak Rep	No
Slovenia	No
Spain	Yes
Sweden	Yes. Introduced by July 25 2003
Switzerland	No decision currently
Turkey	No decision currently
United Kingdom	Yes

Table 15: introduction of spectrum trading

4.9.2 Information provided on spectrum trading

Only a limited number of countries are already planning to provide information on spectrum trading: Norway and the United Kingdom are the most advanced in this field. They already provide or plan to provide the following information:

- Method and characteristics of the trading mechanism
- Register of Right or Property register (Norway)
- Register for each tradable class indicating owner, frequency and geography of each licence (United Kingdom)
- Types of use which may be traded (United Kingdom)
- Links to contextual information, e.g. fees, application procedures, Information sheets for each product (United Kingdom)

The following table summarises the information that NRAs are currently planning to provide in relation to spectrum trading (where applicable):

Country	Information likely to be made available to support spectrum trading
Austria	refer to telecommunications law §56
Belgium	Co-operating with RSPG in order to define detailed position on trading
France	Decision will be taken after the end of the RSPG work on spectrum trading. Frequency bands where spectrum trading will be allowed will be defined by decree.
Germany	The German Telecommunication Act in the version from 22 June 2004 addresses spectrum trading in § 62. But it is not certain for the moment if the individual process steps with the frequency trade, for example the publication of database etc. will be made publicly available
Greece	EETT is unlikely to be able to make individual licence information available due to confidentiality rules
Hungary	Method of frequency distribution: tendering or auction. Place and date of the procedure, participation fee and conditions. Size of the spectrum blocks, purpose and exact conditions of its use, responsibilities. Conditions of the payment, legal background of the spectrum use and transfer of the right for use. Test auction is organized for the participants
Ireland	The changes necessary to primary legislation to allow spectrum trading are currently under consideration
Italy	Related regulation allowing spectrum trading for broadcasting and electronic communication services is published on the Official Journal of Repubblica Italiana and made available on the web site www.comunicazioni.it.
Netherlands	To be decided
Norway	The NPT is currently working towards fast introduction of more systematic and open / published procedures, transparency and a register of rights (Property register).
Poland	The national frequency table is published and available on our web site. We do recognize several possibilities for improvement on both substance and presentation of the information, and allow for improvements in the following year

Country	What information on trades and ownership of spectrum rights do you intend to make publicly available ?
Spain	Under study
Sweden	In the case that an application for a major license if submitted to the PTS the draft decision will be subject to a public consultation.
United Kingdom	For trading, the UK Frequency Authorisation plan will be enhanced on the website to indicate which types of use may be traded. It will also provide links to contextual information (e.g. fees, application procedures, Information sheets for each product). A register of WT act licences to be provided on the website for each tradable class indicating owner, frequency and geography of each licence

Table 16: information provided on spectrum trading

4.9.3 Provision of information on spectrum trading

Information on spectrum trading is provided via Web sites in Denmark, The Netherlands and in the United Kingdom. Consultations are also organised in The Netherlands and in Sweden.

Country	How is information made public ?
Austria	refer to telecommunications law §56
Belgium	No decision yet
Denmark	on the website of the ministry and NITA
France	Decision will be taken after the end of the RSPG work on spectrum trading
Germany	paper/Internet. For specific information, people should contact the RegTP directly
Hungary	Minister decree on the rules relating to the use of frequency bands defines the method of the frequency distribution in all frequency bands. NHH prepares the tender or auction and publishes in newspapers. For fee, the participants can obtain from the NHH a guide on the detailed rules on the procedure, the technical requirements and the legal conditions.
Netherlands	Internet and consultations
Norway	Via a register on the NRA web site
Spain	Under study
Sweden	Subject to public consultation
United Kingdom	A register of trades will be provided to list applications to trade at the point of consent and to indicate whether the trade was approved or rejected. It will provide links to the relevant data on the rights of use register

Table 17: spectrum trading – availability of information

4.9.4 Spectrum rights of use databases

It is likely that the effective operation of a spectrum trading environment would require a database of spectrum rights of use, so that potential buyers can be made aware of potential trades. The issue of a national spectrum rights of use database has only been addressed in a few countries. In **Denmark**, the National Frequency Register was a requirement in the

Radiocommunications Act of 1997. Before the Act was passed by Parliament consultation took place, in particular with the Ministry of Justice. The conclusion was that there would be no legal difficulty in publishing information on licensed frequencies. The register is now available, in Danish only, and provides the following information, as applicable to each licence type:

- Name
- Address
- Customer number
- Licence number
- Transmitter location
- Type of frequency use
- Type of equipment
- Call sign, ship's name and identification no. (maritime use)
- Category (amateur use)
- Plant description (industrial use)
- Antenna height, power, height above sea level

In the **UK** a frequency register has recently been introduced to support spectrum trading. The register contains the following data about all tradable licences:

- Name of licensee
- Reference number of licence
- Contact details of Licensee
- Geographic indication (not exact but generic- e.g. national, Oxford area)
- Frequency assigned (in some classes this will be exact and in some generic)

The second bullet is to allow cross reference into the trading register. Under the fifth bullet the frequency will clearly indicate the band but not necessarily the exact spot frequency. The intention is to give someone interested in trading for a certain type of use opportunity to make contacts to find out more detail. Particular concern has been expressed about precise information being disclosed on spot locations or frequency for things like fixed links because it could compromise network security. There was less concern about names in the responses to our trading consultation. The inclusion of any requirement in the WT Register regulations overrides any confidentiality issue because it is set in primary legislation (the Communications Act section 170) to be able to make such regulations.

The classes to be included will be significantly increased next year and Ofcom will consider carefully whether to extend the range of data. This will require further regulations to be made and more consultation.

In parallel with the WT register and the Trading register, Ofcom is also proposing to enhance the "UK plan for frequency authorisation". This plan is currently published on the RA legacy website and shows each licence product, frequency range and whether it is open for applications (as per Article 5 Authorisation Directive). It will shortly be rebuilt in a different style which allows daily updates but also to give a front end to the registers and provide wider context. The wider context will include links to such aspects as information sheets, application procedures, fees, international clearance and be steadily developed to give as much context as possible.

Initially the data would not be sufficient to calculate interference potential etc. The degree to how much Ofcom can enhance the register will probably depend on feedback and also data validity, and maybe something for a privately provided database in due course. Regarding the Australian and Danish models which Ofcom studied in detail, Ofcom doesn't think the Danish one gives any more in scope than Ofcom is proposing although the Australian one is

perhaps more open about individual stations but the Australians work in a very different legal structure.

Norway, the Netherlands and the UK have all considered the status of frequency registers. There is no legal status for the initial publicly available register in Norway, but this is planned in the future. The legal status of the UK's recently launched register is enshrined in a specific statutory instrument, the Wireless Telegraphy (Register) Regulations 2004.

Country	Status of the spectrum rights database
Austria	refer to telecommunications law §56
Belgium	No decision yet
Denmark	n/a
France	Decision will be taken after the end of the RSPG work on spectrum trading
Germany	It is based on an ordinance.
Greece	Not yet known (legislation is pending)
Hungary	n/a
Ireland	To be considered in primary legislation as per 2.6.2.
Italy	n/a
Netherlands	Legally binding
Norway	The initial publicly available "register" will have no legal status. Our ambition is to move in direction of a register which gives legal status. The agreement concluded by the seller and buyer (and governed by private law) combined with the written approval issued by the NPT (following from an request for trading issued by the seller and approved by the buyer) will constitute the legal status of a spectrum rights which have been traded.
Spain	n/a
Sweden	Not decided
United Kingdom	Statutory Regulation defines the information to be contained in the Licence and trading registers

Table 18: spectrum trading – status of the rights of use database

Australia's "Radiocommunications Record of Licensing" (RRL) database

Perhaps the best example of an established, comprehensive, publicly accessible database of spectrum use is the RRL facility provided by the Australian Communications Authority (ACA). This is accessible free of charge via a search facility on the ACA web site, enabling up to 5,000 records to be accessed per search. Alternatively, the entire database can be obtained on CD-ROM for a one-off payment of A$130, with daily updates available for an annual subscription of A$1,818. The data included in the database includes the following elements:

Client Information

Licensee name, address and company number (where applicable)

Industry Code

Licence Information

Licence Number

Status of licence, i.e. Not-Issued, Pending Issue, Issued, Renewal Notice, Expired, Surrendered or Cancelled

Call sign allocated by the ACA.

Date of commencement and expiry

Licence Type and any Special Conditions
Assignment Information
Assigned Frequency and Bandwidth
Operating Mode, i.e. transmit, receive or both
Emission Designator as per the ITU standard format
Transmitter Power and EIRP
Antenna Height, Azimuth, Polarity and Tilt
Level of Protection from interference
Station Class based on International Frequency Registration Board codes
Spectrum Access Special Conditions
Date Approved
Licensed Area, Site identification and location (latitude and longitude)
Effective Radius of a mobile site
Antenna type, size, frequency band, gain, beamwidth and front-to-back ratio

4.9.5 Required information

According to the NRAs which answered to the questionnaire, the required information for spectrum trading should include:

- information on the companies involved in the trading
- date of the trade
- spectrum involved
- licence number

The **UK** NRA (Ofcom) considers it is up to the market to provide data on potential opportunities for trading and that factual, contextual information should be provide by the NRA **Greece** raised the issue of confidential information linked to frequency bands used by the military forces and shared with civil applications. Trading is unlikely to be possible in such frequency bands.

Country	What spectrum information will be required ?
Austria	refer to telecommunications law §56
Belgium	No decision yet
Denmark	n/a
France	Decision will be taken after the end of the RSPG work on spectrum trading
Germany	There is a question of data protection. Some data may be confidential. To bring more flexibility, they will probably think about giving a new structure to it. RegTP would be satisfied to discuss about it inside the CEPT and RSPG.

Country	What spectrum information will be required ?
Greece	Buyers would need info on how spectrum is currently used. But there is a problem with military use, which is often shared with civil bands. Where spectrum is shared by the military it will be difficult to make any changes of use through trading. It is also not possible to give information on how military uses spectrum. Change of use as a result of trading is not anticipated in next 10 years. Trading is expected to be limited to block allocations like cellular
Hungary	Spectrum information: Spectrum block assignment, discreet frequencies, guard bands. Territorial extension of the radio application. Rules of the channel spacing. Limits of the performance and protection values on the national borderline and the borderlines of the service areas. International and national frequency coordination requirements. These information are given the participants by the NHH after the participation fee has been paid
Ireland	n/a
Italy	n/a
Netherlands	Depends on the original license and its conditions. (cross) ownership
Norway	The register will contain information on the companies involved in the trading, the date of the trading, the spectrum involved and the licence number. The licence itself will be made available through the national frequency table.
Spain	n/a
Sweden	Not decided
Switzerland	OFCOM/BAKOM is not authorised to make public all data relative to spectrum information. It is a matter of data protection. Do not want to communicate information which could be used by market competitors.
United Kingdom	Details of Ofcom's proposals can be found in the Consultation document on spectrum trading[10]. The registers mentioned above intend to cover factual information. Contextual information will also be required. Ofcom consider it is up to the market to provide data on potential opportunities for trading.

Table 19: spectrum trading - information

4.10 Feedback from Industry / users

Some NRAs actively seek feedback from spectrum users as part of the process of developing and disseminating information. For example, in **Turkey**, the NRA's Quality of Service department sends questionnaires to a sample (around 20%) of licensees every 6 – 12 months, asking for feedback on the TA's services. Comments received are used to help improve the quality of service where required. There are also quality targets (e.g. on licence turnaround) that the TA has to meet. The **Netherlands** NRA asks for comments on its web site about information to be provided on their frequency allocation table.

[10] "Notice of Ofcom's proposals to make regulations: Spectrum Trading and the Wireless Telegraphy Register", September 2004, downloadable from www.ofcom.org.uk

5 Conclusions on Industry and NRA positions on radio spectrum information

Based on the responses to the questionnaire and our interviews with industry and NRA representatives, the following conclusions have been drawn:

i) Industry is generally aware of **EFIS** but has found it of limited use because it often does not provide sufficient detail or does not provide information in a consistent format. The search facilities are considered good at facilitating access to required information, where it is available. Respondents felt that EFIS should include all the EU countries and preferably other CEPT countries as well. The information should be updated more frequently and e-mail alerts provided to those users who want to be informed when the data changes. It was also felt that EFIS should be expanded to include the radio interface requirements[11].

ii) Industry is not widely aware of **TRIS** and more needs to be done to raise the visibility of this database. Among those who were familiar with TRIS there were concerns that the search facility was not easy to use, for example when trying to find all the relevant interface requirements for a specific frequency band or product.

iii) If the full benefit is to be derived from initiatives such as EFIS and TRIS it is important that potential users are made aware of their existence. One approach would be to publicise the databases on the NRA web-sites as well as those of the ERO and the European Commission, along with hyperlinks.

iv) The information provided on **radio equipment interface requirements** by NRAs varies considerably in the level of detailed information provided and it is not always sufficient to determine whether a product can be used in the country concerned. This is especially the case where there are different classes of equipment contained in ETSI Standards and it is not clearly indicated in the interface requirements which options are allowed.

v) Based on the number of respondents who indicated the need for specific information and also the level of importance identified, the key information requirements from NRAs are:

a. Allocation of frequency bands to different services as defined by the ITU
b. The regulatory framework (i.e. the adoption and actual implementation of relevant EU Directives)
c. Channel plans for specific services and applications
d. Authorisation policies (any specific requirements placed on the use of the spectrum such as transmitter output power restrictions, simplex or duplex operation of PMR, fixed links link length policies)
e. Interface requirements (i.e. clear definition of what equipment can be placed on the market)
f. How to notify equipment under the R&TTE Directive
g. Assignment procedures
h. How the radio spectrum is used (e.g. information on actual usage of the radio spectrum such as the specific service, location of transmitters, or details of the authorised users of frequencies)

[11] This work is currently ongoing.

i. Outcome of monitoring exercises to determine for example traffic levels and congestion in specific frequency bands

j. How to apply for frequencies (e.g. guidelines to advise potential spectrum users on whether they need to apply for an authorisation and if so how)

k. Frequency application forms to request frequencies

l. Spectrum fees

m. How cross-border co-ordination is carried out

n. Existing cross-border agreements that already exist for specific services with neighbouring countries

o. Spectrum strategy (i.e. proposed future use of radio spectrum including timescales for implementing any changes)

p. Spectrum "refarming" policies describing, for example, the national approach to how spectrum can be released for new uses and how it is funded.

q. Spectrum trading policies and supporting spectrum rights registry.

vi) The information provided by NRAs also has to be accurate and ideally provided in plain language rather than legal texts because it is typically used by engineers and business strategists rather than legal experts.

vii) Web-sites were considered to be by far the preferred method of providing information as they can provide immediate access. Paper documents were considered to be a very inefficient method and long timescales to obtain these were sometimes quoted. A number of respondents indicated that information should be available within one week of decisions being made at the latest.

viii) English was universally cited as a preferred language. In some cases the national language was also proposed.

ix) Contact points in NRAs need to be provided on web-sites and should be for specific people rather than general contact information points (e.g. enquiry@nra.org), as the latter often failed to respond.

x) There was strong support for the provision of an enhanced EU / CEPT spectrum information portal, particularly from larger industry players. This was considered as one way of ensuring that NRAs make the necessary resources available to update their information. Section 11 of this report considers the options and issues raised by such a development in more detail.

D. Assessment of spectrum information requirements and availability

6 Scenarios where spectrum information is required

A number of scenarios were developed during the study, based on the feedback from industry reported in previous chapters. These scenarios demonstrate the need for access to a wide range of information that should ideally be publicly available in an easily accessible format and illustrate how such information might be obtained.

6.1 Equipment manufacturer engaged in product development

Manufacturers' spectrum information requirements for product development can be summarised as:

- Information on frequency allocations and usage, to define the frequency band(s) in which the product can operate. The source of information would be EFIS, the NFATs or national frequency registers. The latter, where they exist, are likely to provide the most detailed information about how particular frequency bands may be used.
- Information on permitted bandwidths, required modulation schemes etc to specify the detailed product design. The source of the information would be the equipment interface requirements. If these are not available manufacturers may have to rely on other sources such as ITU-R or CEPT Recommendations or ETSI standards, however as these typically provide multiple options direct dialogue with the NRA will be necessary to clarify the precise technical criteria that apply.
- Information on how to notify the equipment standard so that the manufacturer can place the product on the market.
- Information on how and where the product can be deployed, e.g. for network planning purposes. This information would typically include any geographic constraints on deployment of equipment (e.g. to protect other services such as aeronautical communications) as well as detailed information on any policies that might apply to the deployment of equipment (e.g. link length policies for fixed links, limits on transmitter output power or special antenna requirements to minimise interference to other services or countries).

6.2 Potential pan-European operator

In this scenario we consider the needs of a potential pan-European network operator who wants to launch a new service or technology that has not yet been deployed within Europe. This new service or technology might be new or might already be in use elsewhere in the World. In some cases, the service or technology may fit readily into one of the existing ITU-R allocation categories (mobile, fixed, etc.), however increasing convergence between services means some new services may not precisely map with these definitions. For example, digital broadcast technology may be used in the future to deliver content to mobile phones and 3G mobile technology may be used to deliver fixed wireless access. In practice, the ITU-R definitions are relatively broad. For example, the ITU-R definition of broadcasting would permit the delivery of content to mobile phones; however national regulations relating to the use of broadcast spectrum may prevent this. In addition, many different applications may be covered by a single ITU-R service category. For example, public cellular networks, private mobile networks and cordless phones are all "mobile" services but different spectrum is allocated to each and very different authorisation rules apply. Hence the ITU service category alone is unlikely to be sufficient for the operator to ascertain whether the proposed service or technology can operate in a particular frequency band. Clear definitions of the types of

application that are covered by the various ITU-R service categories in each country would be helpful in this regard.

We expect that the operator would have a view on the preferred frequency band for the new service or technology and on the minimum amount of contiguous spectrum needed to provide services. As the service or technology is new to Europe, it is unlikely to be included at this stage within any National Frequency Allocation Tables.

The first requirement for the potential operator will be to identify a suitable block of spectrum, ideally available in all the countries where they aspire to provide service. The first stage will be to identify the frequency bands where their service fits i.e. where the service as defined by the Radio Regulations and any national definitions relating to specific services can be deployed. This information should be found through the National Frequency Allocation Tables and using a central portal like EFIS would make it easier to access all the information from a single web-site. It is important that the information provided includes any national restrictions on the use of particular spectrum for particular applications, e.g. whether the spectrum must be used for public or private systems or whether national definitions of service categories that are less flexible than the ITU-R definitions apply.

Information will also be required on the current use of that frequency band to see if there is a block of frequencies that are not being currently in use or could be "refarmed", i.e. transferred from an existing use to the new service or technology. If the spectrum is not currently assigned information would be required on the authorisation process. If the spectrum would need to be refarmed information would be required on whether the country supports secondary trading and if not on whether there are refarming policies, such as time restrictions or entitlement to compensation. For incumbent users

To assess the potential for spectrum trading or possibly refarming the potential operator requires information on the actual use of frequencies to be available. The type of information required initially will be:

- What the spectrum is currently used for and whether it is solely for that service or whether there are other services, such as SAP/SAB usage, also authorised on certain individual frequencies?
- Who the licensee is. Is it a single organisation that needs to be contacted if there is the potential to trade spectrum or a large number?

This will allow an assessment to be made on:

- Whether there is sufficient contiguous spectrum available,
- The likelihood that the existing users will be willing to be bought out or the spectrum management organisation may be willing to refarm the spectrum
- How easy it would be to negotiate a trade. The more licensees the more difficult it might be especially if they are not all willing to trade their frequencies.

If as a result of this assessment it appears possible to obtain access to a suitable block of spectrum then further information will be needed to develop a sound business plan if the spectrum is to be traded. This information would include:

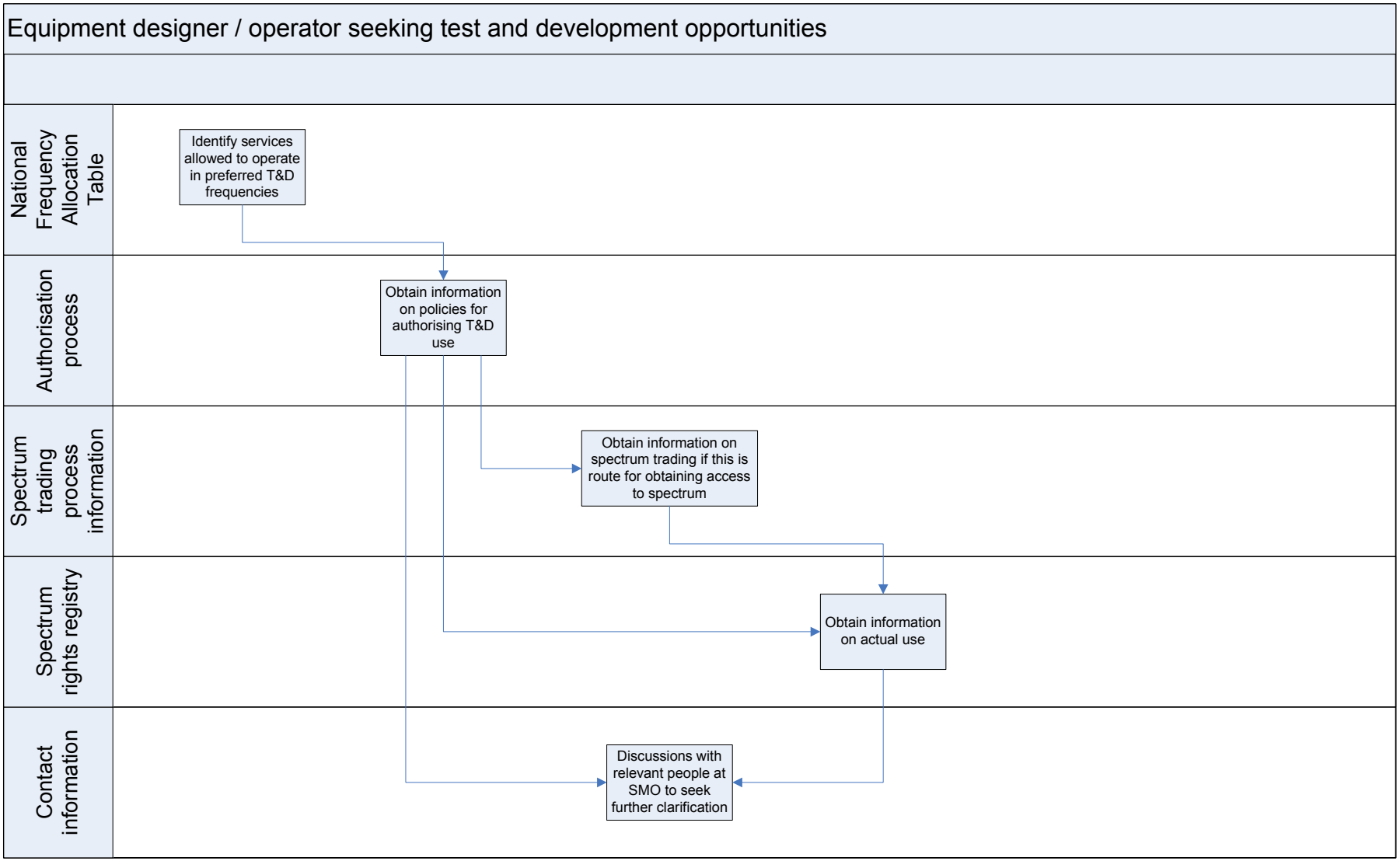
- Site information so it is possible to assess where the spectrum is used and the extent of the roll-out
- The actual technical parameters of the equipment deployed so an assessment can be made of the interference environment in which it may be necessary to operate.

It would be expected that all this information would be made available through a detailed spectrum right registry.

In the absence of spectrum trading any decision on refarming would be at the NRA's discretion. The approach to authorisation of a new service is likely to depend on the level of demand for spectrum for the new service. If the level of demand exceeds

the amount of spectrum that can be made available, the number of rights of use that can be issued will be limited and the NRA will be obliged by Article 7 of the Authorisation Directive[12] to grant the rights on the basis of selection criteria that are objective, transparent, non-discriminatory and proportionate. In practice this means that an auction or comparative selection procedure will be necessary. In order to ascertain the demand for the new service or technology, the NRA will need to hold a public consultation.

[12] OJ L 108, 24.4.2002, p.27


Equipment designer / operator seeking test and development opportunities
National Frequency Allocation Table
Identify services allowed to operate in preferred T&D frequencies
Authorisation process
Obtain information on policies for authorising T&D use
Spectrum trading process information
Obtain information on spectrum trading if this is route for obtaining access to spectrum
Spectrum rights registry
Obtain information on actual use
Contact information
Discussions with relevant people at SMO to seek further clarification

6.3 Equipment vendor providing full customer support to operators seeking an authorisation to deploy the equipment

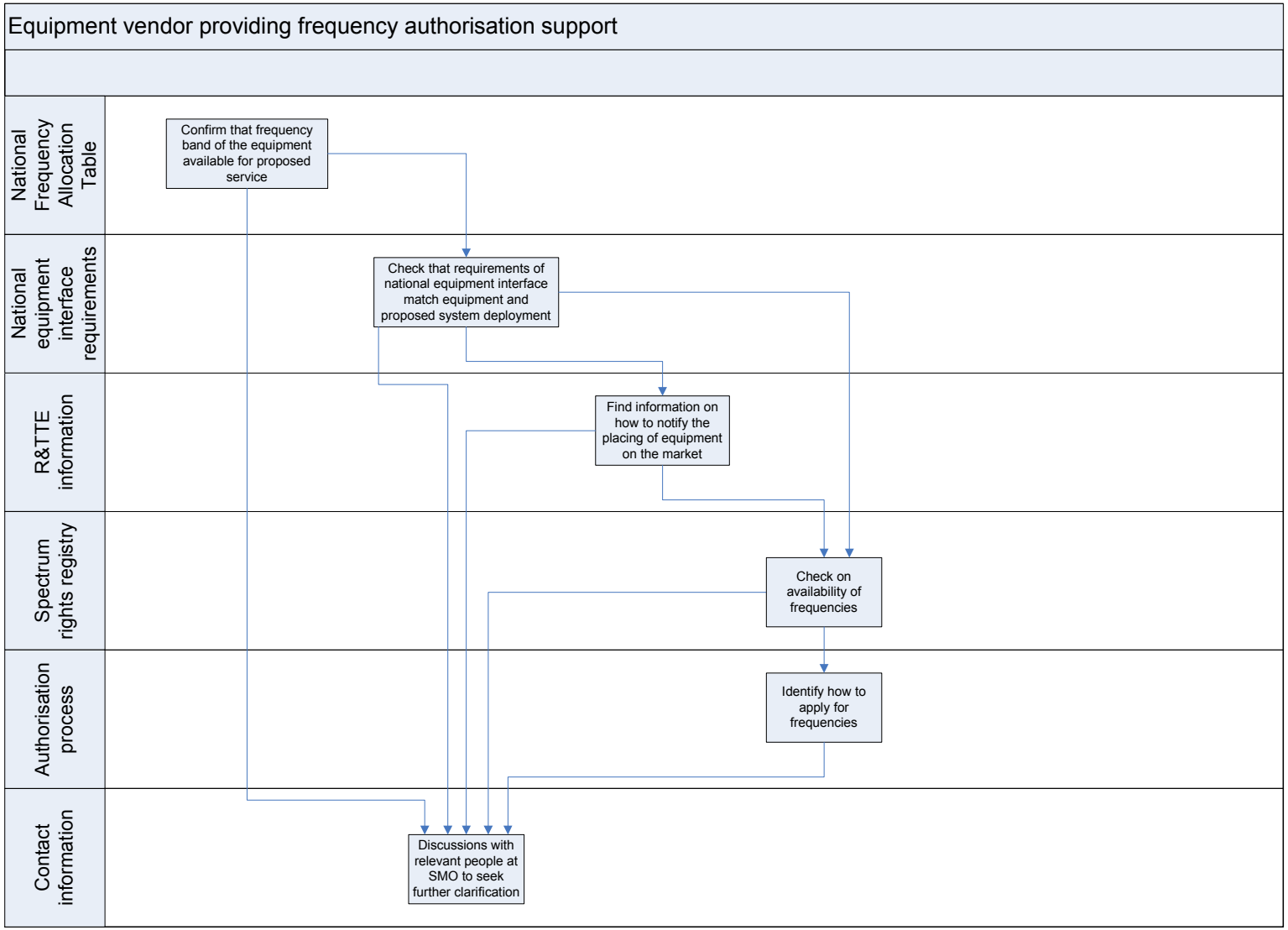
In this scenario we consider the needs of an equipment vendor whose equipment does not operate in frequencies for which the use is harmonised and is therefore not covered by Class 1 as defined under the R&TTE Directive. The first stage would be to confirm that the vendor's equipment can be deployed in the country concerned in the frequency band for which it has been designed and that any restrictions on the technical parameters would not prevent the customers' needs being met. The sources of information would be:

- The National Frequency Allocation Table to identify the services that can use the frequency bands in which the equipment operates
- The national frequency register / database (if one exists) to determine whether there is spectrum in the requisite band(s) that would be available for the vendor's customer
- The national interface requirements to identify whether the equipment can be placed on the market in the country of the potential customer and the technical parameters that have to be met
- How to notify under article 6.4 of the R&TTE Directive if there is no available information on whether the equipment can be used in that country

If the NFAT allocations are not compatible with use of the equipment in the requisite band(s), the vendor will need to initiate direct dialogue with the NRA to see if there is any scope for operation under Article 4.4 of the Radio Regulations[13]. If the NFAT allocations are compatible but no frequency register / database exists, it will also be necessary for the vendor to contact the NRA directly to ascertain whether frequencies would be available. If the information obtained indicates that the equipment can be installed and operated in the country within the existing NFAT allocations and it is apparent that frequencies are available, the next stage for the vendor would be to assist their customer in obtaining an authorisation for the necessary frequencies. The vendor would need information on the authorisation regime in the country and any associated policies, e.g. whether auctions or comparative selection procedures apply where the number of rights of use is limited. In the case of equipment that is authorised on a first come first served basis it will be necessary to complete the necessary frequency authorisation application, referring to any associated guidance notes that are available. In the case of frequencies that are authorised through a competitive procedure (auction or comparative selection) it will be necessary to understand whether such spectrum may become available in the foreseeable future, possibly through information provided in the country's spectrum strategy document and / or by contact with relevant people at the Spectrum Management Organisation.

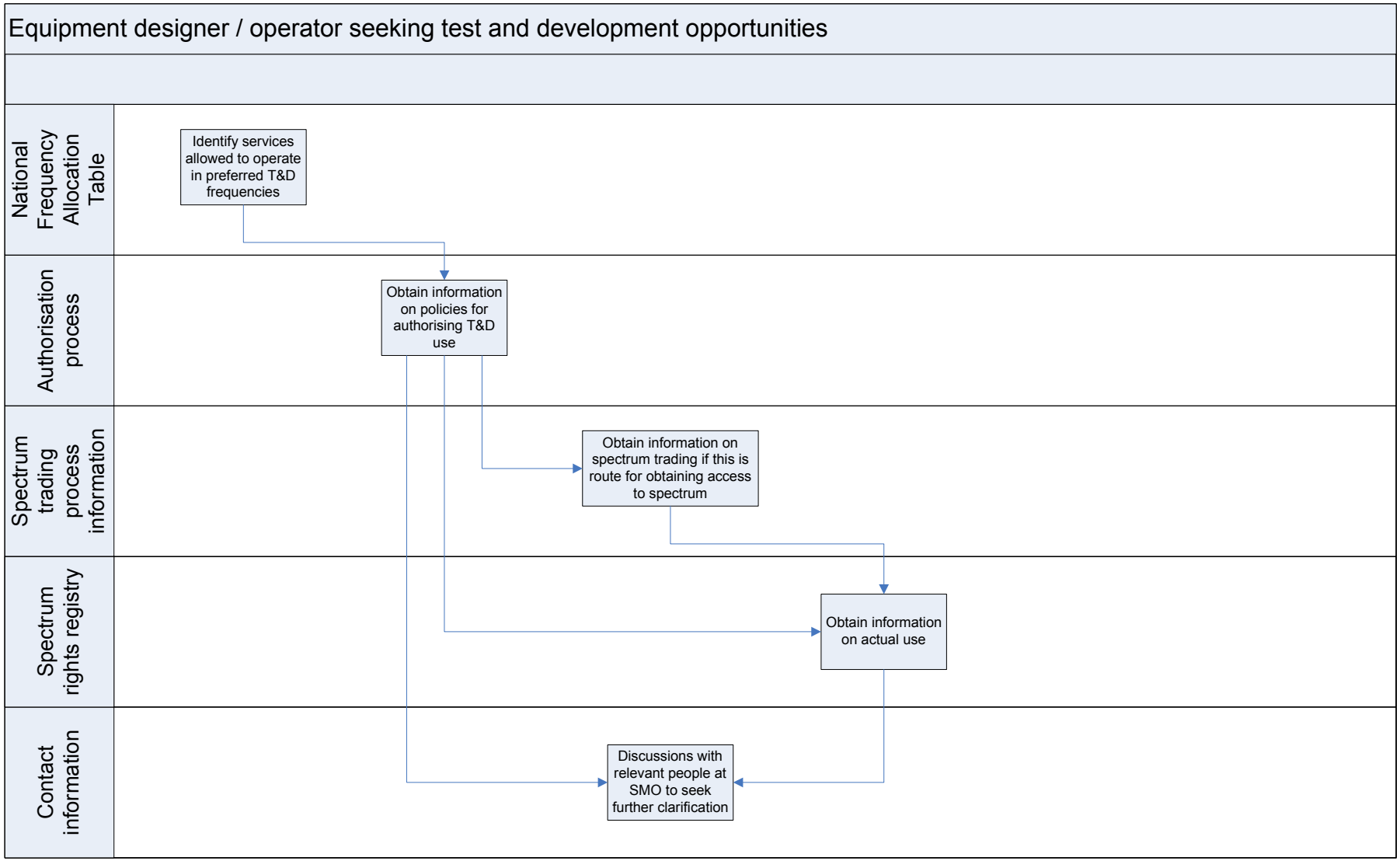
Contact information may be required at all stages in this process if it is necessary to seek clarification on the information provided by the Spectrum Management Organisation or to obtain feedback on progress of the frequency authorisation.

[13] Article 4.4 allows NRAs to authorise the use of radio equipment at variance with the allocations in the frequency allocation table so long as there is no risk of harmful interference arising to services that are operating in accordance with the table.


Equipment vendor providing frequency authorisation support
National Frequency Allocation Table
National equipment interface requirements
R&TTE information
Spectrum rights registry
Authorisation process
Contact information
Confirm that frequency band of the equipment available for proposed service
Check that requirements of national equipment interface match equipment and proposed system deployment
Find information on how to notify the placing of equipment on the market
Check on availability of frequencies
Identify how to apply for frequencies
Discussions with relevant people at SMO to seek further clarification

6.4 Equipment designer / operator seeking test and development opportunities

In this scenario we consider the needs of an equipment designer or operator who wants to test or trial a new product or service. The first step will be to ascertain whether there are suitable frequencies available through information provided in the National Frequency Allocation Table on the specific services allowed to operate in that part of the band. It will also be important to have information on the policies adopted by the Spectrum Management Organisation on the use of spectrum for test and development purposes as well as the necessary application forms and any guidance notes. It may be the case that the required test and development frequencies are in a band already in use and in this case it may be necessary to speak to the appropriate people at the NRA to see how test and development access can be facilitated. If a secondary trading regime exists it may be necessary for the equipment designer / operator to contact the spectrum users directly and in this case information will be needed, in the form of a spectrum rights registry, to detailed information on the use of the frequencies. Information required would be the organisation(s) authorised to use the spectrum, the service they are providing, the geographical location of the services and the technical parameters if it may be necessary to operate in the same geographical area. Assistance may be further required from the NRA if it is not possible to obtain access to spectrum through trading.


Equipment designer / operator seeking test and development opportunities
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Identify services allowed to operate in preferred T&D frequencies
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Spectrum trading process information
Obtain information on spectrum trading if this is route for obtaining access to spectrum
Spectrum rights registry
Obtain information on actual use
Contact information
Discussions with relevant people at SMO to seek further clarification

6.5 New Private Mobile Radio (PMR) dealer

In this case the needs of a small organisation are specifically considered. The potential new PMR dealer will first need to obtain information on the frequency bands available for PMR and any restrictions on their use in the country where it intends to establish its business. The type of information required will be:

- The frequency bands that can be used to provide PMR services. This could be obtained from EFIS or the National Frequency Allocation Table (NFAT) provided that it included the necessary detail on the actual applications that can be deployed (i.e. should specifically refer to PMR bands rather than just "mobile").
- Any specific limitations that might be applied by the NRA in those frequency bands e.g. simplex or duplex operation, channel bandwidths, restrictions on transmitter power or the type of systems that can be deployed. This information is most likely to be provided in the equipment interface requirements but may also be included in the NFAT.
- Any information on the approach adopted by the NRA when assigning frequencies e.g. the criteria used for deciding whether PMR channels should be exclusive or shared between multiple users. This would typically be provided by the NRA in the form of guidance notes on the PMR authorisation process.
- Which organisation should be approached to obtain a PMR licence. In most countries this is the NRA but in some cases it may be a local authority.

As well as providing important information needed to support customers this information will allow the dealer to identify suitable equipment suppliers. In addition the dealer may require information on how to notify equipment under article 6.4 of the R&TTE Directive, before placing it on the market.

The dealer will probably want to provide support by obtaining frequencies for the customer and will therefore need to have information on the authorisation process and access to the necessary application forms and guidance notes. Information on the spectrum fees payable will also be important so the dealer can inform the customer on the total cost of a PMR system. It may also be necessary to have the contact details of the relevant person at the NRA in case any specific questions should arise.

The dealer will also need to be aware in advance of any proposed changes by the NRA to spectrum management of PMR. This might for example relate to plans to introduce digital PMR or changes to allowed technologies or bandwidths to ensure efficient use of the available spectrum. This information might be provided directly via the NRA's web site or through industry consultation, but for smaller organisations a more effective approach may be to use a Trade Organisation that represents the PMR industry.

6.6 Equipment Vendor engaged in business strategy development

To assist a vendor in the development or review of their strategic plans information on actual frequency usage would also be useful to identify demand trends in each country. Such information would also assist in identifying lightly used bands that provide opportunities to introduce new products and applications, allowing industry to be more pro-active in the development of new products. This information could be made available through a frequency register and also by publishing information obtained through monitoring. Note however that any information on spectrum usage must be accurate to be of value to vendors: making the frequency register publicly available would require those NRAs with incomplete or inaccurate spectrum usage information to rectify these deficiencies.

Information on a NRA's spectrum strategy, where publicly available, will also help to inform equipment vendors' product development strategies by clarifying future expectations for specific frequency bands. One vendor responding to our questionnaire commented that it is important that vendors have the opportunity to identify new opportunities and suitable spectrum as if it is left to the NRAs alone it will take considerably longer for new ideas to enter the market.

6.7 System design and network planning

Where spectrum is shared between a number of users, such as in the case of fixed links or private mobile radio (PMR), it is essential for either the equipment vendor or the user to obtain information on how frequency assignments are undertaken in a country. For example information on whether there are block allocations (i.e. exclusive assignments of contiguous spectrum that can be self-planned by the user), or whether some frequencies are limited to private or public use only is important during the development of the equipment and is used to determine suitable tuning ranges. Information on any technical constraints that might apply such as the requirement to use Automatic Transmit Power Control or the use of a minimum link length policy[14] will also provide details on what equipment can be deployed.

Further information is then required on the detailed frequency assignment approach so that the vendor or user can plan their network and so have the detailed information necessary to submit the necessary frequency application forms.

One fixed link vendor commented that the information on frequency assignment provided on the UK Radiocommunications Agency legacy web-site is extremely useful and provides the type of information necessary to design systems and plan networks.

6.8 Information needed for spectrum trading intermediaries

Where a spectrum trading regime exists it is possible that organisations will emerge to act as "brokers" between parties wishing to trade spectrum. Such brokers may undertake to deal with any technical or regulatory issues relating to the trade, to ensure that the trade does not result in interference arising either to the trading parties or to any other spectrum user. In order to perform this function the intermediary will need to be aware of the technical criteria that apply to all of the spectrum users that might be affected by the trade. In addition to the trading parties themselves, these might include users operating on the same frequency at a different geographic location or users operating on nearby frequencies at the same location. A comprehensive database of all the assignments in the frequency band concerned will be necessary, containing information such as:

- Transmitter power level
- Receiver interference limits
- Antenna gain, directivity and pointing direction
- Terrain height (above sea level) and antenna height (above ground level)
- Operating frequency and bandwidth
- Name and contact details of authorised user

[14] Some NRAs apply a minimum link length for fixed links in specific frequency bands, where the minimum length is greater in lower frequency bands in order to encourage where possible the use of higher frequency bands with less congestion

6.9 Existing spectrum user monitoring continuing availability of their spectrum

Existing network operators or other spectrum users may need to monitor spectrum developments to ensure continued interference free use of spectrum. For example, the NRA's future spectrum strategy ma be of interest so that users can identify at an early date any proposals for change of use affecting their spectrum. Users may also need to monitor whether the equipment interface requirements are modified, for example to require more efficient use of the spectrum using improved modulation techniques, narrower bandwidths or more directive antennas. Also any changes to cross-border co-ordination, or restrictions on the use of equipment (e.g. transmitter output levels or geographic deployment) will be of interest. However it would generally be expected that the NRA would consult directly with the existing operator or user, where they are known.

6.10 Existing user wishing to modify a spectrum rights of use

In this scenario an existing spectrum user may want to amend the terms of a spectrum right of use (e.g. to accommodated different channelling or technology) and identify, in advance of contacting the NRA, whether this might be feasible. Any guidance information on how such requests are dealt with by the NRA would be useful especially if this includes the necessary considerations and criteria that will be used to make a decision. The user may also be interested in how the spectrum is used by other users if it is shared (e.g. in the case of fixed links or PMR) and this information could be provided in a spectrum rights registry. Information on the use and users of the spectrum in adjacent bands might also be required if the proposed changes could alter the interference environment. This would be obtained from the National Frequency Allocation Table and a spectrum rights registry if more detailed information is required on the users. This information, in conjunction with the equipment technical parameters provided in the interface requirements, could then be used to undertake sharing studies to investigate the potential impact of the proposed changes. Contact information may be required at all stages in this process to seek clarification on the information provided by the Spectrum Management Organisation.

7 Assessment of information provision by spectrum managers and examples of good practice

The following section contains the study team's views on the spectrum information currently provided by the NRAs and the Ministries in the 31 countries considered in the study. Examples of good practice as identified by the study team or in the feedback from industry are highlighted in section 7.2.

7.1 Comments on the available spectrum information

Based on desk research by the study team, the analysis of the questionnaires received from the NRAs and the interviews with NRAs, the general conclusion is that the availability and quality of spectrum information is not sufficiently consistent across Europe. There are a number of areas where this causes difficulties for uses, as discussed in the following sections:

7.1.1 Sources of information

In many countries, spectrum information is not available from a single source. The users have to search through many sources before they can find the requested information. This is a particular problem when changes are made to the regulatory framework and there is more than one organisation involved: users are frequently obliged to check both the NRA and the relevant Government department's web sites in order to get the latest updates.

7.1.2 Responsible organisations

In every analysed country, it has been possible to find some information (a "first level" of information) on a responsible spectrum management organisation. In most cases, it is possible to go directly to a section of the web site relating to frequency management by clicking an appropriate link from the home page.

The split of responsibilities between the various entities involved in spectrum management are very clear in some cases, especially those with a single entity in charge of all aspects of spectrum management (e.g. Switzerland) but much less clear in others. France is probably the most complicated example with a spectrum agency (ANFr) a telecommunications regulatory body, ART which manages the telecommunications spectrum, a media regulatory body CSA in charge of the radio and television spectrum and the Ministry of Industry which is in charge of strategic issues such as spectrum trading and pricing. It is interesting to note that some countries have recently consolidated several sector-based organisations into one organisation, for example in the UK there is now a single regulator (Ofcom) doing the work of five former bodies which previously dealt individually with radio spectrum. TV broadcast licensing, sound broadcast, broadcast content and telecommunications.

Organisational structures or a diagrammatic description generally appear on the web sites. Some provide the names, telephone numbers, and/or e-mail addresses of the responsible persons. Information on other relevant organisation is not often provided. Norway is a good example where it would be easy to identify the relevant contacts within the Norwegian P&T. In Finland, FICORA provides on its web site several contact points for each sector.

7.1.3 Format and Language of documents

The provision of spectrum information through legal documents is not generally regarded as an effective way to provide information to the public. Moreover, such legal documents are mostly available in the national language only and not often translated in English. TO ensure optimum accessibility, information should be made available in plain language and in English as well as the national language. English is used by many NRAs together with the national language but in many cases not all the information has been translated. This is a difficulty especially in new entrant countries.

The Web sites are certainly the easiest access mode to spectrum information and much preferred by industry, whereas obtaining paper can involve long timescales and additional costs.

7.1.4 National Frequency Allocation Table (NFAT)

Most countries make the NFAT available on-line and in English. However, the full version of the NFAT is only available in paper form in France and Germany. In Greece, the NFAT is managed by the Ministry of Transport and Communications but is published on both the Ministry and NRA (EETT) web sites. This creates the possibility of inconsistency between the two when changes are made, however we note that the table on the EETT web site currently downloads from the Ministry web site. This would appear to be a sensible approach, ensuring that only a single version of the table is available at any one time.

The level of detail of the information contained in the NFAT varies from one country to another. There were a number of extremely good examples of NFATs. For example in the case of the Danish NFAT, available in English, there were hyperlinks provided so that referenced information could be easily found. The level of detail exceeded that available through EFIS. In a number of cases there were no details on when the tables were last updated and this makes it very difficult to know how up to date and relevant the information is. It is interesting to note that FICORA in Finland have used the NFAT to define the necessary radio interface requirements under the R&TTE Directive; this provides a very useful single source of all information for industry.

7.1.5 Spectrum rights registry

In most countries it is not possible to get information on individual spectrum rights, which constitutes an increasingly important source of information for users. A national frequency register is available on the NRA web-sites in Denmark, the Netherlands and Switzerland, but only the Danish register includes information on spectrum rights holders. A spectrum rights registry is likely to be particularly important in countries that adopt spectrum trading, but may also be of use in other countries, for example to identify opportunities for site sharing.

7.1.6 Frequency authorisation information for specific services

The information available on national frequency authorisation regimes is very variable and often depends on the ability of the person accessing the web-site to speak the local language. It was noted that there was more information available in English on applying for services, such as amateur use or temporary use for SAP/SAB, where there is a much greater expectation that there will be applications from users coming from other countries. There was also generally more information available on spectrum that is or has been awarded as frequency blocks (e.g. cellular spectrum blocks awarded to single operators) through competitive processes such as “beauty” contests and auctions.

7.1.7 Equipment Interface Specifications

A first level of information is available as the R&TTE Directive is generally explained on the web sites of the NRAs or spectrum agencies. The interface requirements are normally provided as stand-alone documents but there is no standard format of information.

7.1.8 Costs and human resources

The estimation of the costs and human resources linked with spectrum management proved to be very difficult for NRAs and spectrum agencies. It is very difficult to precisely identify the exact number of people involved in spectrum management tasks as this work is often undertaken as part of their other responsibilities and activities.

7.2 Example of Good Practice

Based on desk research and the opinions expressed in the questionnaires and during the interviews with the Industry, the study team identified a number of examples of good practice in the provision of information on radio spectrum by NRAs. These are highlighted below.

- **Finland:** FICORA, the Finnish NRA, is regarded by the Industry as having a particularly useful **NFAT**. The NFAT available on the web site provides the following information:
    - Governmental decrees
    - Licensing of terminals
    - Standards and specifications
    - Specific channel plans
    - Priorities, if any
    - ERC Recommendations and Decisions, ECC Decisions
    - Maximum radiated power, antenna radiation pattern.
- **Luxembourg** and **Sweden** also provide particularly detailed NFATs.
- **Switzerland** is a good example in terms of the **scope and level of detail** of information. The Swiss Spectrum Management Authority also provides a good level of information about the strategic planning of frequency bands;
- **Denmark** and the **Netherlands** provide very good interactive **frequency registers**
- The **UK** provides a good example of information provision on **interface standards** and **frequency assignments**.
- **Ireland** provides extensive guidance on **authorisation procedures** for the various radiocommunications services and consults widely with industry in developing its **strategy** and authorisation policies. Information briefs are also published on radio technology developments and international developments such as World Radio Conferences. There is also a very detailed spectrum strategy document.
- The **UK**, **France** and **Ireland** provide comprehensive **on-line databases** of all mobile phone base stations, with location and power details. Information on implementation of the **new EU Framework** is described particularly well on the ComReg (**Ireland**) web site.

Overall, based on industry feedback and the study teams own research, the FICORA web site appears to provide a particularly useful source of spectrum information and serves as a good example of “best practice” in this area. Information provided in English on the web site includes:

- the national frequency plan, including
    - Amendment to regulation
    - Definitions and references
    - List of abbreviations
    - NFAT
    - Maritime channelling tables
    - Frequency allocations for GSM and UMTS network operators
    - PMR standards
- Use, licences and conformity assessment of radio equipment
- Interference problems

- Market surveillance
- International and national cooperation, including:
    - WRC 2003 working group
    - ITU-R recommendations
    - CEPT/ERC Recommendations
    - CEPT/ERC Decisions
- Advice for Foreign users of radio equipment
- Legal regulations relating to radio spectrum
- List of documents available
- Contact information: a detailed list of contacts for information about specific radio spectrum issues, including:
    - contents of the Frequency Plan
    - conformity assessment and placing of radio equipment on the market
    - PMR
    - equipment exempted from licensing
    - radio links
    - satellites
    - mobile networks
    - matters concerning frequencies below 27 MHz
    - broadcasting
    - structure and availability of the Frequency Plan

8 Comparing users' information needs with current national provision

The main issues identified by industry in relation to NRAs' provision of radio spectrum information were:

- Difficulty finding information as sometimes the organisation responsible for the day to day management of the radio spectrum may not legally have the responsibility to publish and maintain spectrum information such as the NFAT. This problem is compounded where responsibilities are divided between several organisations and it is not always clear which is the appropriate web site from which the information can be obtained.
- Lack of a common presentation format for information. For example information may be made available in one country in the form of legal texts and in another as a plain language summary. Also the location of information on NRA web sites differs from one country to another. This makes it more difficult to access information or increases the time to find it.
- Lack of information in another commonly accepted international language in addition to the local language (English is generally the preferred choice). This means that although information is available, its proper interpretation requires either the assistance of local representatives or the ability to understand the language concerned. Generally in such circumstances it would be necessary to contact the NRA directly by phone.

The responses from NRAs to the study questionnaire showed a wide variation in the information available in specific areas – in some cases little or no information was provided. The following table has been drawn up based on the responses received and additional desk research undertaken by the Study Team.

User information requirement	Current NRA provision
Allocation of frequency bands to different services as defined by the ITU	This is generally available in the NFATs provided by all but one of the 31 countries studied (the exception was Romania)
The regulatory framework (i.e. the adoption and actual implementation of relevant EU Directives)	The regulatory framework is generally available but the information is often provided as complex legal texts. The Industry requires information in plain language and legal texts are of limited utility.
Channel plans	Generally provided through references to ERC/ECC Recommendations and Decisions, ITU Recommendations and ETSI standards. May be provided in the NFAT or in the radio interface requirements.
Authorisation policies (any specific requirements placed on the use of the spectrum such as transmitter output power restrictions, simplex or duplex operation of PMR or fixed link hop length policies)	This information is generally available if there are any specific policies implemented. However there is no common approach to providing the information and it can often be difficult to find.
Interface requirements (i.e. clear definition of what equipment can be placed on the market)	Not all relevant interface requirements are currently available and different formats are used by different NRAs. Also in some cases where there are options included in the ETSI standards the interface requirements do not make clear which options are allowed in the country concerned.

User information requirement	Current NRA provision
How to notify equipment under the R&TTE Directive	Generally provided but the notification forms differ in format.
Assignment procedures	The detailed approach adopted by the NRAs on assigning frequencies is generally not provided. However high level information is generally provided on those services that require an individual assignment and authorisation and those that are exempt. Often those services that are exempt are identified through legal texts which may not be fully clear to lay persons.
How the radio spectrum is used, e.g. information on actual usage of the radio spectrum such as the specific application, location of transmitters, or a spectrum rights registry providing details of the authorised users of frequencies	A number of NRAs provide a frequency register but only one (Denmark) currently includes details of spectrum rights holders. France, Ireland and the UK provide comprehensive details of the locations and technical characteristics of cellular base stations, whilst the Swiss NRA has a similar facility for broadcast transmitters.
Outcome of monitoring exercises to determine for example traffic levels and congestion in specific frequency bands	This type of information is not provided by the majority of the NRAs. Norway and the UK have provided information in relation to specific projects such as utilisation of PMR or fixed wireless access bands.
Outcome of enforcement activities	This type of information is not generally provided by NRAs.
How to apply for frequencies (e.g. guidelines or information memoranda that are provided to assist potential spectrum users in knowing whether they need to apply for an authorisation and if so how access to the spectrum is authorised and how to complete any relevant applications)	This information is generally provided but NRAs but often only in national languages, with the exception of a few services where there could be visiting organisations or individuals that require access to spectrum (e.g. services in support of outside broadcasting or radio amateurs).
Frequency application forms to request frequencies	Different formats for frequency application forms are used across Europe (although CEPT developed a standardised form for PMR several years ago, few NRAs have adopted them)
Spectrum fees	This information is provided by the majority of the NRAs. In some cases it can only be obtained through the legal texts (fee regulation) which can be a lengthy document as it details the fees for all services.
How cross-border co-ordination is carried out	Limited information is available from some NRAs about cross border coordination. This coordination process is very often a very long one, especially for crowded frequency bands such as PMR but this is generally not made clear in the information.
Existing cross-border agreements that already exist for specific services with neighbouring countries	Can be found in some cases.
Spectrum strategy (i.e. proposed future use of radio spectrum including timescales for implementing any changes)	Spectrum strategy information is provided by most of the countries but the approach to providing the information and the actual content varies. Few countries publish a specific document on spectrum strategy.
Spectrum “refarming” policies describing, for example, the national approach to how spectrum can be released for new uses and how it is funded.	Limited availability as often refarming is addressed on a case by case basis directly with the affected parties. The level of detail provided varies significantly

User information requirement	Current NRA provision
Spectrum trading policies and supporting spectrum rights registry.	Trading has only been implemented by a very limited number of countries and although a number are planning to implement trading in the future they still need to put in place the necessary policies and supporting information databases such as a spectrum rights registry. Only the UK has a dedicated trading register in place.

E. Need for additional measures, conclusions and recommendations

9 The need for additional legal measures

The purpose of the section is to assess to what extent existing community legislation serves the objectives of gathering and making available radio spectrum information (allocation, availability and use of spectrum) and where additional measures, if any, would be relevant to improve the situation.

9.1 Overview of the current EU Regulatory Framework:

Making information available has been a constant goal of European spectrum policy for many years. Since the drafting of the Green Paper on radio spectrum and the result of the public consultation (Com (1999)538) on the Green Paper, Community legislation has strived to serve the objective of making available radio spectrum information The legislative objective has been to ensure that all information required is indeed identified and made available, by legislating the manner and methods by which the collection, publication and dissemination to the public of such information is effected.

As will be seen in the following sections, the current legislative framework has provided all the legal tools necessary to permit the making available of radio spectrum across the European Union in a harmonized and complete fashion. The elements found in each of the pertinent legislative initiatives should form the basis for the seamless provision of such information across Europe.

By way of background, it should first be noted that in the results of the public consultation on the Green Paper, the availability of information on spectrum was seen as a critical factor in the context of establishing Community agreement as to where harmonization of spectrum use was required, for assessing the level of spectrum management to which harmonization is technically feasible and for ensuring the proper implementation of the R&TTE Directive. From the inception, It was therefore suggested that any decisions would require:

(i) Member States to make publicly available essential information relating to the use of the radio spectrum reserved for uses other than mobile and personal communications and

(ii) that information to be provided should include the NFAT, possibly supplemented by radio spectrum assignment information for all radio frequencies and licensing information for services other than telecommunications.

In response to the conclusions of the special European Council of Lisbon of 23 - 24 March 2000, and building on the Communication on the results of the public consultation on the 1999 Review of the Electronic Communications Sector and the principles and orientations for the new Regulatory Framework (COM(2000)239), the Commission proposed in July 2000 a package of measures for a new regulatory framework for electronic communications networks and services. The package consisted mainly of five proposed EP and Council directives under Article 95, and one proposed Commission Decision on a regulatory framework for radio spectrum. All such initiatives were adopted on 7 March 2002, and are described below in so far as they relate to the making available of radio spectrum information.

9.1.1 The Framework Directive

The Framework Directive[15] seeks to establish a harmonised framework for regulation of electronic communication throughout the community. It covers a wide range of issues and a number of articles have an impact on availability on information. In particular, it defines, *inter*

[15] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (OJ L 108, 24.4.2002, pp 33 – 50)

alia, the extent of the powers of the NRAs' and the harmonised use of radio frequencies on a transparent, non-discriminatory and proportionate basis. It also addresses the question of spectrum trading.

The following articles of the Framework Directive are of particular relevance for this Study.

- First, the following provisions clearly provide for the identification of the authorities in charge of spectrum information, and mandate the respective tasks of each of the authorities involved, as well as the procedures they follow, the requirements to be published and made available to the public.

National regulatory authorities (Article 3)

1. Member States shall ensure that each of the tasks assigned to national regulatory authorities in this Directive and the Specific Directives is undertaken by a competent body.

4. Member States shall publish the tasks to be undertaken by national regulatory authorities in an easily accessible form, in particular where those tasks are assigned to more than one body. Member States shall ensure, where appropriate, consultation and cooperation between those authorities, and between those authorities and national authorities entrusted with the implementation of competition law and national authorities entrusted with the implementation of consumer law, on matters of common interest. Where more than one authority has competence to address such matters, Member States shall ensure that the respective tasks of each authority are published in an easily accessible form.

5. National regulatory authorities and national competition authorities shall provide each other with the information necessary for the application of the provisions of this Directive and the Specific Directives.

6. Member States shall notify to the Commission all national regulatory authorities assigned tasks under this Directive and the Specific Directives, and their respective responsibilities.

Such article should be read in conjunction with certain sections of the preamble of the directive and in particular the points below:

(11) In accordance with the principle of the separation of regulatory and operational functions, Member States should guarantee the independence of the national regulatory authority or authorities with a view to ensuring the impartiality of their decisions.[…] . National regulatory authorities should be in possession of all the necessary resources, in terms of staffing, expertise, and financial means, for the performance of their tasks.

(13) National regulatory authorities need to gather information from market players in order to carry out their tasks effectively. Such information may also need to be gathered on behalf of the Commission, to allow it to fulfil its obligations under Community law. Requests for information should be proportionate and not impose an undue burden on undertakings. Information gathered by national regulatory authorities should be publicly available, except in so far as it is confidential in accordance with national rules on public access to information and subject to Community and national law on business confidentiality.

- Second, specifically as concerns radio spectrum, Article 9 of the Directive provides the framework for the allocation and management of radio frequencies on an objective transparent, non-discriminatory and proportionate manner. This provision also is the basis for permitting spectrum trading so as to increase efficient use of spectrum in the Community.

Management of radio frequencies for electronic communications services (Article 9)

1. Member States shall ensure the effective management of radio frequencies for electronic communication services in their territory in accordance with Article 8. They shall ensure that the allocation and assignment of such radio frequencies by national regulatory authorities are based on objective, transparent, non-discriminatory and proportionate criteria.

2. Member States shall promote the harmonisation of use of radio frequencies across the Community, consistent with the need to ensure effective and efficient use thereof and in accordance with the Decision No 676/2002/EC (Radio Spectrum Decision).

3. Member States may make provision for undertakings to transfer rights to use radio frequencies with other undertakings.

4. Member States shall ensure that an undertaking's intention to transfer rights to use radio frequencies is notified to the national regulatory authority responsible for spectrum assignment and that any transfer takes place in accordance with procedures laid down by the national regulatory authority and is made public.[..].

Such article should be read in conjunction with section 19 of the preamble of the directive:

(19) Radio frequencies are an essential input for radio-based electronic communications services and, in so far as they relate to such services, should therefore be allocated and assigned by national regulatory authorities according to a set of harmonised objectives and principles governing their action as well as to objective, transparent and non-discriminatory criteria, taking into account the democratic, social, linguistic and cultural interests related to the use of frequency. It is important that the allocation and assignment of radio frequencies is managed as efficiently as possible. Transfer of radio frequencies can be an effective means of increasing efficient use of spectrum, as long as there are sufficient safeguards in place to protect the public interest, in particular the need to ensure transparency and regulatory supervision of such transfers. Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision)(13) establishes a framework for harmonisation of radio frequencies, and action taken under this Directive should seek to facilitate the work under that Decision.

- Finally, the Framework Directive underscores the importance of publication and dissemination of information, including radio spectrum information, is a readily accessible fashion

Publication of information (Article 24)

1. Member States shall ensure that up-to-date information pertaining to the application of this Directive and the Specific Directives is made publicly available in a manner that guarantees all interested parties easy access to that information. They shall publish a notice in their national official gazette describing how and where the information is published. The first such notice shall be published before the date of application referred to in Article 28(1), second subparagraph, and thereafter a notice shall be published whenever there is any change in the information contained therein.

2. Member States shall send to the Commission a copy of all such notices at the time of publication. The Commission shall distribute the information to the Communications Committee as appropriate.

9.1.2 The Authorisation Directive

The Authorisation Directive[16] abolishes the concept of individual licences and introduces the general authorisation, subject only to specific obligations which can apply to rights to use radio frequencies which by their nature are individually and exclusively granted where there is a risk of harmful interference in frequency use. As concerns access to information on radio spectrums, this Directive underscores the necessity of transparency, and in particular, assuring easy access to information concerning the rights, conditions, procedures, charges, decisions and related information on the rights of use of radio frequencies. This Directive is a clear mandate to national authorities to assure a level playing field of access to this information for all players.

In view of the objective of this Authorisation Directive to legislate the assignment and management of radio frequencies in an objective, transparent, non-discriminatory and proportionate manner, both the Preamble to the Authorisation Directive and the provisions of the Directive itself are quoted below in extenso:

General statements regarding information requirement and publication of information (Preamble):

(12) [-------] the procedure for assignment of radio frequencies should in any event be objective, transparent, non-discriminatory and proportionate.

(13) As part of the application procedure for granting rights to use a radio frequency, Member States may verify whether the applicant will be able to comply with the conditions attached to such rights. For this purpose the applicant

[16] Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (OJ L 108, 24.4.2002, pp 21 – 32)

may be requested to submit the necessary information to prove his ability to comply with these conditions. Where such information is not provided, the application for the right to use a radio frequency may be rejected

(15) The conditions, which may be attached to the general authorisation and to the specific rights of use, should be limited to what is strictly necessary to ensure compliance with requirements and obligations under Community law and national law in accordance with Community law.

(18) The general authorisation should only contain conditions which are specific to the electronic communications sector. It should not be made subject to conditions which are already applicable by virtue of other existing national law which is not specific to the electronic communications sector. Nevertheless, the national regulatory authorities may inform network operators and service providers about other legislation concerning their business, for instance through references on their websites.

(19) The requirement to publish decisions on the granting of rights to use frequencies or numbers may be fulfilled by making these decisions publicly accessible via a website

(22) Where the demand for radio frequencies in a specific range exceeds their availability, appropriate and transparent procedures should be followed for the assignment of such frequencies in order to avoid any discrimination and optimise use of those scarce resources.

(24) Where the harmonised assignment of radio frequencies to particular undertakings has been agreed at European level, Member States should strictly implement such agreements in the granting of rights of use of radio frequencies from the national frequency usage plan.

(34) The objective of transparency requires that service providers, consumers and other interested parties have easy access to any information regarding rights, conditions, procedures, charges, fees and decisions concerning the provision of electronic communications services, rights of use of radio frequencies and numbers, rights to install facilities, national frequency usage plans and national numbering plans. The national regulatory authorities have an important task in providing such information and keeping it up to date. Where such rights are administered by other levels of government the national regulatory authorities should endeavour to create a user-friendly instrument for access to information regarding such rights.

Objective and scope (Article 1)

1. The aim of this Directive is to implement an internal market in electronic communications networks and services through the harmonisation and simplification of authorisation rules and conditions in order to facilitate their provision throughout the Community.

Rights of use for radio frequencies (Article 5)

2. Where it is necessary to grant individual rights of use for radio frequencies and numbers, Member States shall grant such rights, upon request, to any undertaking providing or using networks or services under the general authorisation, subject to the provisions of Articles 6, 7 and 11(1)(c) of this Directive and any other rules ensuring the efficient use of those resources in accordance with Directive 2002/21/EC (Framework Directive).Without prejudice to specific criteria and procedures adopted by Member States to grant rights of use of radio frequencies to providers of radio or television broadcast content services with a view to pursuing general interest objectives in conformity with Community law, such rights of use shall be granted through open, transparent and non-discriminatory procedures.

When granting rights of use, Member States shall specify whether those rights can be transferred at the initiative of the right holder, and under which conditions, in the case of radio frequencies, in accordance with Article 9 of Directive 2002/21/EC (Framework Directive). Where Member States grant rights of use for a limited period of time, the duration shall be appropriate for the service concerned.

3. Decisions on rights of use shall be taken, communicated and made public as soon as possible after receipt of the complete application by the national regulatory authority, within three weeks in the case of numbers that have been allocated for specific purposes within the national numbering plan and within six weeks in the case of radio frequencies that have been allocated for specific purposes within the national frequency plan. The latter time limit shall be without prejudice to any applicable international agreements relating to the use of radio frequencies or of orbital positions.

Harmonised assignment of radio frequencies (Article 8)

Where the usage of radio frequencies has been harmonised, access conditions and procedures have been agreed, and undertakings to which the radio frequencies shall be assigned have been selected in accordance with international agreements and Community rules, Member States shall grant the right of use for such radio frequencies in accordance therewith. Provided that all national conditions attached to the right to use the radio frequencies concerned have been satisfied in the case of a common selection procedure, Member States shall not impose any further conditions, additional criteria or procedures which would restrict, alter or delay the correct implementation of the common assignment of such radio frequencies.

Information required under the general authorisation, for rights of use and for the specific Obligation of transparency (Article 9)

1. National regulatory authorities may, in accordance with the provisions of Article 8, impose obligations for transparency in relation to interconnection and/or access, requiring operators to make public specified information, such as accounting information, technical specifications, network characteristics, terms and conditions for supply and use, and prices.

2. In particular where an operator has obligations of non-discrimination, national regulatory authorities may require that operator to publish a reference offer, which shall be sufficiently unbundled to ensure that undertakings are not required to pay for facilities which are not necessary for the service requested, giving a description of the relevant offerings broken down into components according to market needs, and the associated terms and conditions including prices. The national regulatory authority shall, inter alia, be able to impose changes to reference offers to give effect to obligations imposed under this Directive.

3. National regulatory authorities may specify the precise information to be made available, the level of detail required and the manner of publication.

4. Notwithstanding paragraph 3, where an operator has obligations under Article 12 concerning unbundled access to the twisted metallic pair local loop, national regulatory authorities shall ensure the publication of a reference offer containing at least the elements set out in Annex II.

5. In the light of market and technological developments, Annex II may be amended in accordance with the procedure referred to in Article 14(3).

Compliance with the conditions of the general authorization or of rights of use and with specific obligations (Article 10)

1. *National regulatory authorities may require undertakings providing electronic communications networks or services covered by the general authorization or enjoying rights of use for radio frequencies or numbers to provide information necessary to verify compliance with the conditions of the general authorization or of rights of use or with the specific obligations referred to in Article 6(2), in accordance with Article 11.*

Obligations (Article 11)

1. Without prejudice to information and reporting obligations under national legislation other than the general authorisation, national regulatory authorities may only require undertakings to provide information under the general authorisation, for rights of use or the specific obligations referred to in Article 6(2) that is proportionate and objectively justified

Publication of, and access to, information (Article 15)

1. Member States shall ensure that the specific obligations imposed on undertakings under this Directive are published and that the specific product/service and geographical markets are identified. They shall ensure that up-to-date information, provided that the information is not confidential and, in particular, does not comprise

business secrets, is made publicly available in a manner that guarantees all interested parties easy access to that information.

2. Member States shall send to the Commission a copy of all such information published. The Commission shall make this information available in a readily accessible form, and shall distribute the information to the Communications Committee as appropriate.

9.1.3 R&TTE Directive

The provisions of the Radio and Telecommunications Terminal Directive[17] are crucial to the availability of information on radio spectrum, in that it imposes both on the network operator and the national authorities the obligation to publish information on radio equipment, thereby permitting the various players in the market to access data critical to radio spectrum management.

- **Obligation for network operators to publish their interfaces**

The Directive requires operators of public telecommunications services to publish the characteristics of their interfaces, thereby allowing any manufacturer to construct terminal equipment to be attached to that network

- **Obligation for Member States to publish the rules to access the radio frequency spectrum**

Member States therefore are committed to publish such details allowing manufacturers to build products capable of operating in as large a market as possible.

The following provisions are particularly relevant for the purpose of the Study.

General statements (Preamble):

22. Whereas effective use of the radio spectrum should be ensured so as to avoid harmful interference; whereas the most efficient possible use, according to the state of the art, of limited resources such as the radio frequency spectrum should be encouraged;

23. Whereas harmonised interfaces between terminal equipment and telecommunications networks contribute to promoting competitive markets both for terminal equipment and network services;

24. Whereas, however, operators of public telecommunications networks should be able to define the technical characteristics of their interfaces, subject to the competition rules of the Treaty; whereas, accordingly, they should publish accurate and adequate technical specifications of such interfaces so as to enable manufacturers to design telecommunications terminal equipment which satisfies the requirements of this Directive;

29. Whereas, in order to enable the Commission to monitor market control effectively, the Member States should provide the relevant information concerning types of interfaces, inadequate or incorrectly applied harmonised standards, notified bodies and surveillance authorities

31. Whereas manufacturers should notify Member States of their intention to place radio equipment on the market using frequency bands whose use is not harmonised throughout the Community; whereas Member States therefore need to put in place procedures for such notification; whereas such procedures should be proportionate and should not constitute a conformity assessment procedure additional to those provided for in Annexes IV or V; whereas it is desirable that those notification procedures should be harmonised and preferably implemented by electronic means and one-stop-shopping;

Notification and publication of interface specifications (*Article 4*)

1. Member States shall notify the interfaces which they have regulated to the Commission insofar as the said interfaces have not been notified under the provisions of Directive 98/34/EC. After consulting the committee in accordance with the procedure set out in Article 15, the Commission shall establish the equivalence between notified interfaces and assign an equipment class identifier, details of which shall be published in the Official Journal of the European Communities.

2. Each Member State shall notify to the Commission the types of interface offered in that State by operators of public telecommunications networks. Member States shall ensure that such operators publish accurate and adequate technical specifications of such interfaces before services provided through those interfaces are made publicly available, and regularly publish any updated specifications. The specifications shall be in sufficient detail to permit the design of telecommunications terminal equipment capable of utilising all services provided through the corresponding

[17] Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (OJ L 91 , 07.04.1999, pp 10 - 28

interface. The specifications shall include, inter alia, all the information necessary to allow manufacturers to carry out, at their choice, the relevant tests for the essential requirements applicable to the telecommunications terminal equipment. Member States shall ensure that those specifications are made readily available by the operators.

Placing on the market (Article 6)

4. In the case of radio equipment using frequency bands whose use is not harmonised throughout the Community, the manufacturer or his authorised representative established within the Community or the person responsible for placing the equipment on the market shall notify the national authority responsible in the relevant Member State for spectrum management of the intention to place such equipment on its national market. This notification shall be given no less than four weeks in advance of the start of placing on the market and shall provide information about the radio characteristics of the equipment (in particular frequency bands, channel spacing, type of modulation and RF-power) and the identification number of the notified body referred to in Annex IV or V.

9.1.4 The Access Directive

The Access Directive[18] introduces greater transparency through NRA rights to require, inter alia, publication of detailed, technical specifications, network characteristics, terms and conditions for network supply and use, and prices. It does not, as such, provide any relevant provisions regarding information on spectrum allocation, availability and use.

9.1.5 Radio Spectrum Decision

The Radio Spectrum Decision[19] has laid the foundation for a general Community radio spectrum policy. The objective of this policy is to ensure co-ordination of radio spectrum policy approaches, harmonised conditions for the availability and efficient use of radio spectrum in particular to support specific Community policies, the provision of relevant information on spectrum usage and the co-ordination of Community interest in international negotiations in relation to existing EU policies such as in electronic communications, transport, R&D or broadcasting.

The radio spectrum policy involvement at the Community level contributes in particular to improving information about use of spectrum, plans for spectrum usage and availability of spectrum. The following provisions are of particular interest within the context of the Study.

General statements of the Radio Spectrum Decision (Preamble)

(2) A policy and legal framework therefore needs to be created in the Community in order to ensure coordination of policy *approaches and, where appropriate, harmonised conditions with regard to the availability and efficient use of radio spectrum[….]. At the same time, appropriate technical support can be provided at national level.*

(4) This Decision is based on the principle that, where the European Parliament and the Council have agreed on a Community policy which depends on radio spectrum, committee procedures should be used for the adoption of accompanying technical implementing measures. Technical implementing measures should specifically address harmonised conditions with regard to the availability and efficient use of radio spectrum, as well as the availability of information related to the use of radio spectrum.

(7) Where it is necessary to adopt harmonisation measures for the implementation of Community policies which go beyond technical implementing measures, the Commission may submit to the European Parliament and to the Council a proposal on the basis of the Treaty.

(14) The coordinated and timely provision to the public of appropriate information concerning the allocation, availability and use of radio spectrum in the Community is an essential element for investments and policy making. So are technological developments which will give rise to new radio spectrum allocation and management techniques and radio frequency assignment methods. Development of long-term strategic aspects require proper understanding of the implications of how technology evolves. Such information should therefore be made accessible in the Community, without prejudice to confidential business and personal information protection under Directive 97/66/EC of the European Parliament and of the Council of 15 December 1997 concerning the processing of personal data and

[18] Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (OJ L 108, 24.4.2002, pp 7 – 20

[19] Decision 676/2002/ EC of the European Parliament and of the Council on regulatory framework for policy in the European Community on a regulatory framework for radio spectrum policy in the European Community (OJ L 108, 24.4.2002, pp 1 - 6

the protection of privacy in the telecommunications sector(10). The implementation of a cross-sectoral radio spectrum policy makes the availability of information on the whole radio spectrum necessary. In view of the general purpose of harmonising radio spectrum use in the Community and elsewhere in Europe, the availability of such information needs to be harmonised at European level in a user-friendly manner.

(15) It is therefore necessary to complement existing Community and international requirements for publication of information on use of radio spectrum. At international level, the reference paper on regulatory principles negotiated in the context of the World Trade Organisation by the Group on Basic Telecommunications also requires that the existing state of allocated radio frequency bands be made publicly available. Commission Directive 96/2/EC of 16 January 1996 amending Directive 90/388/EEC with regard to mobile and personal communications(11) required Member States to publish every year or make available on request the allocation scheme of radio frequencies, including plans for future extension of such frequencies, but covered only mobile and personal communications services. Moreover, Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity(12), as well as Directive 98/34/EC of the European Parliament and of the Council of 22 June 1998 laying down a procedure for the provision of information in the field of technical standards and regulations and of rules on information society services(13), require Member States to notify the Commission of the interfaces which they have regulated so as to assess their compatibility with Community law.

(16) Directive 96/2/EC was at the origin of the adoption of a first set of measures by CEPT such as European Radiocommunications Committee Decision (ERC/DEC/(97)01) on the publication of national tables of radio spectrum allocations. It is necessary to ensure that CEPT solutions reflect the needs of Community policy and are given the appropriate legal basis so as to be implemented in the Community. For that purpose, specific measures have to be adopted in the Community both on procedure and substance.

(23) Member States should implement this common framework for radio spectrum policy in particular through their national authorities and provide the Commission with the relevant information required to assess its proper implementation throughout the Community, taking into account international trade obligations of the Community and its Member States.

Aim and scope (Article 1)

1. The aim of this Decision is to establish a policy and legal framework in the Community in order to ensure the coordination of *policy approaches and, where appropriate, harmonised conditions with regard to the availability and efficient use of the radio spectrum;*

(b) ensure the effective implementation of radio spectrum policy in the Community, and in particular establish a general methodology to ensure harmonised conditions for the availability and efficient use of radio spectrum;

(c) ensure the coordinated and timely provision of information concerning the allocation, availability and use of radio spectrum in the Community;

Availability of information (Article 5)

Member States shall ensure that their national radio frequency allocation table and information on rights, conditions, procedures, charges and fees concerning the use of radio spectrum, shall be published if relevant in order to meet the aim set out in Article 1.

They shall keep this information up to date and shall take measures to develop appropriate databases in order to make such information available to the public, where applicable in accordance with the relevant harmonisation measures taken under Article 4.

Notification (Article 7)

Member States shall give the Commission all information necessary for the purpose of verifying the implementation of this Decision. In particular, Member States shall immediately inform the Commission of the implementation of the results of the mandates pursuant to Article 4(3).

9.2 Conclusions on the need to modify the regulatory framework

The study team's conclusion is that considering

(i) the Regulatory Policy is implemented or will shortly be implemented in full in nearly all Members States [20] and

(ii) that it contains a solid basis for the proposition that the collection, publication and dissemination of radio spectrum information is a legislative priority for the European Union,

the current regulatory policy does not need to be modified as it serves the objectives which were set.

We therefore do not believe that it is necessary to adopt measures which go beyond technical implementation measures, and which would require the Commission to submit to the European Parliament and to the Council a proposal on the basis of the Treaty. Any additional measure should therefore remain limited to measures which can be adopted on the basis on the Radio Spectrum Decision and limited to technical reinforcement or improvement of existing legal requirements.

9.3 Additional measures to harmonise provision of spectrum information.

As noted above, the current legislation provides for a satisfactory legal framework to ensure that information can be made available and gives the legal ground and rationale for providing information and making it public. However, the existing legislation does not make sufficient provision regarding the format of such information as well as the details of its content so that spectrum users can have access to, and that NRAs can provide, a comprehensive set of information sufficient for appropriate decision making.

Section 4 of this Report has assessed the current level of information in the different areas regarding regulatory framework, spectrum strategy, NFAT management, and spectrum management, and has provided views on which additional information should be made available. Section 3 of this Study also has identified the scope of information required by the users whereas section 11 provides information regarding prioritisation of information for the purpose of setting up a spectrum information portal.

The conclusion is that the type of measures to be adopted to improve the provision, availability and quality of spectrum information depend on information usage expectations. Based on our findings, our recommendation is that additional measures should be adopted primarily for improving the current level of information for existing use rather than on the basis of future need for information for forthcoming events such as spectrum trading and refarming. Any action in that respect (such as frequency registers) may appear premature and non productive at this stage, until the Commission makes further progress on the conditions to introduce trading of radio spectrum.

Our conclusion is that through the work of the NRAs and other responsible organisations, information exists but, due to the lack of harmonisation in format and level of details, such information does not fully meet the need of spectrum users. To remedy this situation various options are available and are described below.

[20] State of implementation of the R&TTE Directive ; http://europa.eu.int/comm/enterprise/rtte/implem.htm#Austria.

State of implementation of the 2002 Communication Regulatory Framework :
http://europa.eu.int/information_society/topics/telecoms/implementation/annual_report/index_en.htm

9.3.1 Option 1 : CEPT Mandates

Article 4 of the Radio Spectrum Decision enables the Commission to issue mandates to CEPT for the development of technical measures with a view to ensuring harmonised conditions for the availability of information. The Commission could therefore issue a mandate CEPT to carry out activities to support the improvements in information provision identified in this Report.

The choice of a mandate to CEPT is particularly relevant in this context since the Electronic Communication Committee (ECC) of CEPT has already been working on similar issues and article 3 of the Spectrum Decision provides that "activities pursued under this Decision shall take due account of the work of international organisations related to radio spectrum management, e.g. the ITU and CEPT".

ECC has already recently adopted a Decision regarding the publication of National Frequency Allocation Tables (NFATs)[21].The rationale behind this Decision is that many CEPT countries have developed NFATs using different formats and presentations rendering impossible the achievement of a unified system presenting the most relevant data. The ECC Decision aims to define the contents, presentation of data and the respective methods to harmonise NFATs. So far only 10 countries have officially notified that the Decision had been implemented.

The ECC has also issued a Decision on EFIS[22], under which all CEPT countries were required to enter and maintain defined mandatory data mainly focusing on Spectrum Allocation and Spectrum Application. Most Member States have implemented this Decision. Experience on EFIS is therefore very valuable considering that such a facility is highly rated by its users, despite suggested improvements.

The EU Spectrum Decision provides for similar goal, namely the need to ensure that:

(i) national radio frequency allocation tables and information on rights, conditions, procedures, charges and fees concerning the use of radio spectrum, shall be published,

(ii) that such information shall remain up to date and

(iii) that Member States shall take measures to develop appropriate databases in order to make such information available to the public.

Therefore, considering CEPT experience with the adoption of ECC Decisions on NFATs and EFIS, the Commission could efficiently mandate CEPT with the aim to address harmonization of presentation of information regarding information on regulatory framework, allocation, availability and use of radio spectrum. The mandate should also address the issues of the level of detail required (and identified in this Report) so that the same level of information is provided for all countries. The goal should be that the published information contains all data that is necessary for the effective use of this information.

Assuming a satisfactory outcome of the mandate, the Commission should be able to make the results of the mandate compulsory for Member States, including their contribution to EFIS as a means to satisfy their obligation to make the information available to the public. In effect the Commission can decide whether the results of the mandate shall apply in the Community and on the deadline for their implementation by the Member States.

Using a CEPT Mandate and recourse to EFIS should also satisfy the objectives which are laid down in article 15 of the preamble of the EU Radio Spectrum Decision which states that "*In view of the general purpose of harmonising radio spectrum use in the Community and elsewhere in Europe,* the availability of such information needs to be harmonised at European level in a *user-friendly manner*.

In view of the above considerations, this is our preferred option and the implications of this approach are discussed further in chapter 10 as part of our recommendations.

[21] ECC/DEC/(03)05, ECC Decision of 17 October 2003 on the publication of national tables of frequency allocations and utilisations

[22] ECC/DEC/(01)03 ECC Decision of 15 November 2001 on ERO Frequency Information System (EFIS)

9.3.2 Option 2 : Direct EU Action

The EU Spectrum Decision provides that where it is necessary to adopt harmonized measures for the implementation of Community policies which do not fall within the remit of CEPT, the Commission could adopt direct implementation measures with the assistance of the Radio Spectrum Committee (Article 4.1). The Spectrum Decision also provides that where the results of mandates to CEPT are not available or deemed not acceptable, the Commission should take appropriate alternative action to achieve the objectives of the mandate (article 4.3).

To ensure the coordinated and timely provision of information concerning the allocation, availability and use of radio spectrum in the Community the Commission may also adopt technical implementing measures which not do not fall within the remit of CEPT. Such technical measures could take the form of a list of detailed information to be published with a certain time frame and according to a specific format with respect to the following elements:

- Publication and format of national radio frequency allocation table
- information on rights, conditions, procedures in relation to spectrum
- Spectrum charges and fees concerning the use of radio spectrum.

Such a list could be inserted as an Annex to the Radio Spectrum Decision. For a detailed list of items to be included, we refer to section 8 of this Report.

9.4 Need for additional measures: addressing confidentiality issues

The issue of confidentiality of information needs to be addressed in particular with respect to:

- Member States being required to make available information on rights, conditions, procedures, charges and fees concerning the use of radio spectrum (article 5 of the Radio Spectrum Decision) ;
- Additional information being required to be published in contemplation of introduction of spectrum trading and the potential need to keep and maintain frequency register (see section 11 of this report).

There is a conflicting interest between the need for detailed and/or additional information and the protection of spectrum users' interests. Therefore any publication of information needs to comply with the requirement of Article 8 of the Radio Spectrum Decision. This Article provides that Member States shall not disclose information covered by the obligation of business confidentiality, in particular information about undertakings, their business relations or their cost components, unless:

(i) it is essential for the purposes of fulfilling their duties, in which case such disclosure shall be proportionate and shall have regard to the legitimate interests of undertakings in the protection of their business secrets and,

(ii) it is relation to information on conditions linked to the granting of rights to use radio spectrum which does not include information of a confidential nature.

In order to ensure that the same level of information is obtained, it is recommended that each NRA indicate what they consider to be covered by business confidentiality. Further, a list of all the information which are required to be published, but that are not regarded as confidential in any of the Member states, should discussed before being implemented.

As matter of principle such list could include all elements of information which undertaking have to provide to the NRA or that NRA provide or may request on the ground of the Authorization Directive:

- The Authorisation Directive authorises NRAs to ask for information required in order to keep a register or list of providers of electronic communications networks and services provided that information must be limited to what is necessary for the identification of the provider (such as company registration numbers, and the provider's contact persons, the provider's address).
- Under the Authorisation Directive, NRAs may also require undertakings to provide information under the general authorisation or under the decision regarding the rights of use of radio frequencies that is proportionate and objectively justified for procedures for, and assessment of, requests for granting rights of use. However, where NRAs require undertakings to provide information they are also required to inform them of the specific purpose for which this information is to be used. In order to allow availability of such information, NRAs should therefore be sure to inform all undertakings that they will consider such information as non-confidential and will make them be made public.

Using the rights of NRAs under the Authorisation Directive, within the limits set forth by the Radio Spectrum Decision, could therefore be used as mean to overcome the confidentiality issues raised by the need to make further information available.

10 Recommendations

The Study has concluded that a substantial amount of spectrum information already exists in Europe but due to the lack of harmonisation in format and level of details, such information does not fully satisfy the needs of spectrum users. The study team recommend that the most expedient and effective way to address this deficiency would be for the development of an enhanced European spectrum information portal based on the existing CEPT EFIS facility. This proposal is discussed in detail in recommendation 1 below. A number of other specific recommendations have been made in relation to the information provided by NRAs on a national basis and these are presented hereafter (recommendations 2 to 7).

Recommendation 1: Enhancement of EFIS

A mandate should be given to CEPT to enhance the EFIS system so that all of the principal information needed by the users of spectrum can be accessed via this facility. Specific details of the information that should be accessible via EFIS are presented in chapter 11, however the following general principles should apply:

i) EFIS should be updated on a regular basis by a permanent maintenance team, using information sourced from NRAs.

ii) Information that is suitable for presentation in a common format, e.g. national frequency allocation tables or equipment interface standards should be incorporated directly into the EFIS database in a form that enables ready comparison between countries (this is already possible to some extent but is hindered by the use of inconsistent formats for the information from different countries).

iii) NRAs should be required to provide this information to EFIS in a timely manner on a pre-defined periodic basis according to the required common format of information defined by EFIS.

iv) Descriptive Information, e.g. relating to the regulatory framework or authorisation policies, should be summarised in plain English language rather than complex legal text, with hyperlinks as necessary to national legislation or other relevant documents on NRA web sites.

This approach will provide an effective solution to the needs identified and presents many advantages. For example:

- EFIS is already in place, presents information in a harmonised way, works well and is perceived as a useful tool by the industry.
- The envisaged software enhancements have been discussed with ERO and seem to be feasible at a reasonable cost.
- Most of the European NRAs have already put in place the procedures for uploading information to EFIS and adopting the specified format of information. They have also put in place the procedures for translating the information into English.

The study team have considered the likely costs and benefits associated with enhancing EFIS in the manner proposed. These and other pertinent issues are discussed in chapter 11.

Recommendation 2: Spectrum Strategy

There is strong support from industry for NRAs to publish in an accessible format their future strategy for spectrum management. We recommend that NRAs be encouraged to publish such strategies at regular intervals (at least every five years) and that the RSPG should consider an appropriate common format to adopt for such a document, taking account of those that are currently available. In the longer term this would facilitate development of a

European spectrum strategy portal linking to the on-line version of each national strategy document, providing a single source of information for organisations seeking to operate in more than one EU country.

Recommendation 3: Application Forms

NRAs should be encouraged to adopt harmonised formats for application forms for spectrum rights of use. For some services, such as PMR, CEPT has already proposed harmonised formats and we recommend that CEPT should be tasked with developing similar harmonised formats for other relevant services such as fixed links. Once agreed, NRAs should be required to adopt these forms within a reasonable period.

Recommendation 4: Interface Requirements

NRAs should be encouraged to re-examine their existing interface requirements and ensure that full information is provided on relevant spectrum policies that might apply, such as link length policies, or specific options of equipment that are required to ensure, for example, efficient use of the radio spectrum.

Recommendation 5: Links to other organisations and information sources

Each NRA should provide easily accessible links to other national spectrum management organisations and to the EFIS and TRIS databases. In the case of the EFIS and TRIS databases it is recommended that standard informative text should also be provided by the ERO and the European Commission, respectively, that explains the information that is made available and the search facilities. This should increase the awareness of industry to such useful sources of information.

Recommendation 6: Dated Information

A simple but very useful step to improve the integrity and usefulness of information already provided by NRAs would be to clearly indicate the date when the information was published and also the intended date for updating.

Recommendation 7: Information on recent developments

A number of NRAs provide information on the most recently published information. This provides industry the opportunity to easily check on latest developments and quickly identify issues that might be of relevance to them. It is recommended that this approach should be adopted by all NRAs. Further benefit would be obtained by using e-mail to notify interested parties when new information is made available.

Recommendation 8: Frequency register

There is clear interest from many in industry in information on existing frequency assignments, such as frequency, bandwidth, location and duration of the right of use. Such information would be particularly important in an environment where spectrum trading was permitted, to enable potential buyers to determine what is available in the spectrum market. However, information such as the duration of existing rights would be useful even in the absence of trading, for example to enable potential market entrants to be aware of when existing spectrum users may vacate the spectrum.

We therefore recommend that each NRA take steps to develop a frequency register that can be accessed on-line via the NRA web site. A tentative list of the minimum set of parameters, could be frequency, bandwidth, geographic location, duration of the right of use and, where a spectrum trading environment exists, contact details for the right holder. The inclusion of additional information beyond the common list could be left to the discretion of individual NRAs . The registry should also be accessible by means of a hyperlink from the EFIS database.

11 Issues arising from the proposed enhancement of EFIS

There are a number of issues that need to be considered with regards to the enhanced spectrum information portal put forward in Recommendation 1 above, namely:

- What information should the enhanced portal provide, how should it be formatted and how should the information be accessed?
- Who should be responsible for the content and management?
- How often should it be updated?
- How can it be funded and resourced?
- What are the legal, security and other issues that need to be considered?
- What should be the role of the individual NRA web-sites?

11.1 Information

The information accessible via the portal should ideally cover all those aspects identified in section 8 of this report. For convenience, this is recapped below:

11.1.1 Information required to access radio spectrum

i) **Spectrum Allocations**, i.e. information on the allocation of blocks of spectrum to specific categories of service such as fixed, mobile or broadcasting, as defined by the ITU;

ii) **Channel Plans**, i.e. how spectrum is packaged for individual services such as fixed links or PMR;

iii) **Frequency Assignment procedures**, i.e. the technical and administrative procedures involved in assigning frequencies to individual users;

iv) **Interface Requirements**, i.e. details of equipment standards that must be complied with in each Member State;

v) **Information on how to apply for frequencies**, i.e. guidance on how to submit applications for rights of use such as how to complete the forms;

vi) **Frequency application forms**, i.e. any standard forms that must be completed and submitted in order to apply for a right of use;

vii) **Information on cross-border co-ordination**, i.e. details of any procedures or technical constraints involved that might impact on the ability to use frequencies in border areas or lengthen the processing time for applications[23];

viii) **Information on existing cross-border agreements** (to enable these to be taken into account when preparing applications for rights of use)

ix) **Information on spectrum fees**

[23] Article 5.3 of the Authorisation Directive specifies a six week limit for NRAs to issue rights of use for radio frequencies but notes that this is without prejudice to any applicable international agreements.

11.1.2 Information on current usage (occupancy) of radio spectrum

x) **Information on the use of radio spectrum**, i.e. details of how, where and under what conditions specific frequencies are currently used in each Member State;

xi) **Information on the outcome of monitoring**, i.e. whether the results of monitoring exercises (e.g. to determine whether frequencies are in use or to verify network coverage) are published;

xii) **Information on the outcome of enforcement activities**, e.g. details of action taken in response to illegal spectrum use.

11.1.3 Policy and Strategy for Spectrum Management

xiii) **Regulatory Framework**, i.e. the policy framework under which access to radio spectrum and the authorisation of electronic communication networks and services is managed;

xiv) **Information on how to notify equipment under Directive 99/05**, i.e. the process by which manufacturers or vendors must provide notification of the compliance of new equipment with the Directive, prior to launching in the market;

xv) **Authorisation Policies**, i.e. the NRA's approach to granting rights of use for radio frequencies;

xvi) **Spectrum Strategy**, i.e. information on the NRA's future plans for radio spectrum management;

xvii) **Spectrum Refarming policy**, i.e. information on how the NRA would deal with the transfer of spectrum from an existing user to a new user;

xviii) **Spectrum Trading policy and information requirements**, i.e. whether the NRA allows or plans to allow the trading of spectrum between users and the NRA's views on what information might be required to support such trading.

Whether all the information should be made available via the portal or whether in some cases it could provide links to the relevant part of the NRA web-site would need to be considered carefully. The former might be the ultimate aim but the use of links to NRA web-sites may be necessary in the interim. However it is important at an early stage to define a common format in which the information should be presented to make it easier for those accessing a number of NRA web-sites.

11.2 Content and management

The individual NRAs are the only organisations that can provide the necessary information and it is recommended that a formal mechanism should be established to ensure that it is provided on time and in the necessary format. It is suggested that such a role could be undertaken by the ERO provided that appropriate resources are provided. A similar mechanism to that used by the EC to gather information for the annual implementation reports on the telecommunications regulatory package, with requirements for NRAs to provide updated information by a pre-determined deadline each year, could be applied. The portal should be made available on the ERO web-site and there should be links provided from the European Commission web-site as well as all the individual NRA web-sites. The link should be easily found on the NRA web-sites ideally either on the front page or the index page that leads to specific radio spectrum information.

11.3 Updating the information accessible via the portal

There are two options for updating the information. The first is to require NRAs to send the necessary information to the ERO who will check the information to ensure that it is in the correct format before adding to the portal. The other option is to maintain the information in a de-centralised manner with the individual NRAs being able to access their own information and update it as required. The content could then be checked retrospectively to ensure it is in the correct format etc. The advantages and disadvantages of the two approaches are considered in the table below:

Options for updating	Advantages	Disadvantages
Central organisation responsible	• Can ensure information in required format before providing access via portal • Can easily keep a check on when information is up-dated. • Can ensure resources are available for implementing updates.	• May increase the timescales before revised information is included. • Updates may only be made to a strict calendar and not when actually required. Less flexibility. • More costly as require more resources in the responsible central organisation.
NRA responsible	• Flexibility to update when required. • Data more likely to be kept up to date with new information added as it becomes available • Could lead to NRAs using the same format of the information on their own web-sites to avoid duplication of information • Less expensive in terms of central resources	• Format of information not centrally checked before included on web-site. • Possibility that up-dates not carried out unless required by a regulation to undertake this responsibility

Table 20: options for updating the information provided via the portal

In terms of implementation the second option is preferred on the basis that information is more likely to be updated regularly and costs will be lower, but it would need to be supported by a regulation requiring NRAs to update the information regularly. It will be essential to agree the required format of the information in advance and in the initial stages at least it will be necessary for a central team to check that the required format has been followed.

11.4 Funding and Resourcing issues

11.4.1 Introduction

It is proposed that the central organisation responsible for the implementation and monitoring should be the ERO under an appropriate maintenance contract. Once the portal has been implemented the effort required to ensure it is regularly up-dated and the formats followed should be significantly reduced as much of the information proposed would not need changing unless there are changes in the underlying legislation or new services /

technologies proposed. As proposed earlier most of the resources would be provided by the NRAs but there would need to be effort provided by the ERO to maintain the quality and accuracy of the information. This would require additional human resources and thus funding for the ERO, although synergies with existing ERO activities could offset some of these costs.

11.4.2 Information on the cost of providing spectrum information

11.4.2.1 Estimations

NRAs were asked during the study to provide estimates of the cost of providing and maintaining information relating to radio spectrum. Various estimations were given by the NRAs ranging from €30,000 for The Netherlands to €1,250,000 for Hungary and €2 million for the Slovak Republic. It is very difficult to know exactly what these figures cover and if they only relate to the provision of spectrum information.

11.4.2.2 United Kingdom

In the UK, Ofcom (and its predecessor the Radiocommunications Agency) does not distinguish between policy development and provision of information in its costs. Some estimates were however provided relating to specific activities, namely.

- UK Spectrum Strategy: Approx. €280k to produce biannual update of spectrum strategy , i.e. €140k per annum
- Maintaining NFAT costs approx. €120k p.a.
- General upkeep of policy/procedure manuals and other key pieces of information about authorisation arrangements: approx. €600k p.a.

11.4.2.3 Norway

In response to a request for further information on the Norwegian frequency allocation table the NRA responded that their long term strategy is to:

- publish all available frequencies/spectrum in Norway on their web-site
- publish all spectrum/transmitter licenses/rights on their web-site.

As a first effort, they made their frequency plan interactive, linked all national/regional spectrum rights to the plan, and presented some of the available frequency bands between 2 and 40 GHz. This required about 550 hours of work from an external consultancy firm and about 300 internal hours. The cost for the external consultants is estimated to be round €100,000.

11.4.2.4 Denmark

In Denmark the approximate cost for providing the interactive frequency plan on the internet was around 500,000 kroner (€ 67,000). The cost of providing the frequency register was estimated to be around 1 million kroner (€134,000).

11.4.2.5 Translation costs

- Norway has now made available an English version of their website where they present available frequency bands; the translation from Norwegian to English was completed for a total cost of 20.000 euro.
- Turkey gave an estimation of 8.2 Million TL (€ 4.30) per page (180 words)

11.5 Implications of EFIS enhancement for ERO

In this section, we analyse the feasibility of extending the EFIS database and the implications of the different options for ERO.

11.5.1 Cost of the second version of EFIS

ERO provided the following information on the cost incurred in the development of the second version of EFIS (EFIS 2). This second version provides the possibility to perform searches and comparisons for radio interfaces. The need for external resources in the development of the EFIS 2 project had been budgeted for DKK 279,200 (excl VAT – €37,542) which corresponded to 349 hours. The project is almost finished (October 2004) and is still within the budget limit.

In 2003, ERO expert resources for EFIS 2 related work was estimated at DKK 342,000 (€46,000), equivalent to 60 man-days (the EFIS 2 workload has not been recorded as a separate item). 2004 figures will be lower, since most of the ERO effort was in the preparation of the project which took place in 2003.

It should be noted that the EFIS maintenance, although Administrations do provide all the information, requires ERO expertise. A number of countries need assistance when uploading information for the first time. Also, the list of standardized terms in EFIS has to be updated from time to time (ERO chairs the EFIS Maintenance Group which deals with this).

11.5.2 Possible extensions of EFIS

ERO confirmed to the study team that it would be possible to include access to documents on national spectrum strategy, refarming policies, trading policies, frequency assignment databases or frequency registers in future updates to the EFIS system.

The two main principles for making information available in EFIS are:

i) The EFIS system is frequency oriented, so information can be easily linked to a frequency band as for instance ECC Decisions have been linked to frequency bands in the present version of EFIS. New documents can be uploaded by administrations and will appear as items in the appropriate box (frequency band and appropriate column) in the web page that shows the result of a search.

ii) EFIS also provides for a search and comparison mode for applications, allocations, and in EFIS 2, radio interfaces. If information is to be compared between countries, then the existing system could be expanded with extra tables and an adapted graphical user interface.

The cost of incorporating new information in EFIS will be comparable with the development of EFIS 2 if the new information contains elements that should be subjected to a search. In this case, NRAs would have to standardise these elements and this could require considerable effort, depending on the format in which the information is available on a national level.

If it only requires documents to be put on the server (as is possible today), then in the first instance this would not require any ERO resources. However, if too many documents are uploaded, then the user will need a more structured presentation and that will require some development. The resources for this development are not likely to exceed the development cost for EFIS 2. Of course for NRAs the cost will be low, since information is just copied from the national level. Translation of documents into English, although preferred, is not currently required in EFIS.

11.5.3 Permanent EFIS maintenance team

In addition to software development there will be a need for ongoing human resources to ensure a sustainable high accuracy of the content. Synergies might be achieved with other activities at ERO which could offset some of these costs (e.g. efficiencies may result in the

operation of CEPT working groups as a result of improved access to NRA data). These additional resources would take the form of desk officers to monitor new developments in the Member States and ensure their integration into EFIS as well as to support Member States with the identification of out to date information. Furthermore, periodic reports could be made on the implementation of recommendations made in this study and ultimately the provision of information as foreseen through EU legislation or technical implementation measures. The tasks performed by the ERO would have the objectives of quality control and high sustainable accuracy of EFIS.

There are two principal cost elements associated with implementing the enhanced spectrum information portal in accordance with recommendation 1, namely:

i) the initial development cost of updating EFIS;

ii) the ongoing maintenance costs of the information portal: costs linked to the continuous maintenance of the portal including the monitoring of information available at national level (e.g. changes of information, need for updating etc.).

The cost of updating EFIS has already been detailed elsewhere in this report. We estimate that the maintenance activity could necessitate the involvement of one person full-time. This would correspond to an annual cost of €60 to €100K according to the qualification of the person responsible for the maintenance.

11.6 Cost-benefit analysis

Qualitative assessment

Some qualitative improvements linked to the provision of better spectrum information should be noted here :

- Benefits for SMEs: small and medium enterprises which do not have the necessary resources to search for spectrum information today will benefit from an improved and easier spectrum information availability;
- Improvements in spectrum information availability will facilitate technological innovation in Europe by enabling manufacturers to better identify the opportunities in terms of future frequency bands availability;
- A more efficient usage of spectrum and consequently added value if considering the value of spectrum;
- Facilitation of spectrum trading across Europe.

Quantitative assessment

In order to evaluate the costs and benefits associated with an improvement of spectrum information availability in Europe, we have estimated the benefits in terms of saved man days for industry, taking into account the following:

- an evaluation of the number of players involved;
- an estimation of the annual effort for each player: this is based on the answers to the Industry questionnaire;
- an estimation of the benefits for the identified players: our assumption is based on an easier availability of spectrum information which will decrease the time spent by the Industry on searching for spectrum information.

The costs are based on the cost of the development of the second version of EFIS where the interface requirements have been included with search facilities. The evaluation of the new costs is also based on discussions with the ERO EFIS team.

List of the players considered

We identified in each category, a certain number of European industry players which allocate resources to spectrum activities:

Type of player	Number of players	Name of players
Large operators	6	T-Mobile, FT/Orange, TIM, Telefonica, Vodafone, mm02
Small operators	15	KPN, Telia Sonera, Mobistar, Proximus, Auna, Bouygues Telecom, SFR, Hutchison, Portugal Telecom, Radiolinja, Swisscom Mobile, TDC, Tele 2, Telenor, Xfera
Large manufacturers	4	Alcatel, Siemens, Ericsson, Nokia
Small manufacturers	15	Ascom, Astrium, EADS, Italtel, Finmecanica, Marconi, Nera Asa, Philips Electronics, Sagem, Thomson, Cambridge Broadband, Ogier Electronics, Ceragon, InterWave, Thales, DMT, Rohde & Schwarz, Stratex
Other (associations, users…)	4	ETNO, Alliance TICS, EICTA, GSM Association, UIC, Eurocontrol, EDF, SNCF, BBC

This estimate is based on those players that are active within ETSI or took part in the questionnaire and in practice there are likely to be considerably more existing and potential operators and manufacturers that require access to radio spectrum information. Using this methodology allows an initial, conservative estimation of the total effort for industry and this is translated in the following table into annual effort expressed in man-years:

Western European players	Number of players	Annual effort relating to spectrum info (man-years)	Total lower estimation	Total upper estimation
Large operators	6	5-100	30	600
Small operators	15	1	15	15
Large manufacturers	4	5-100	20	400
Small manufacturers	15	1	15	15
Other (associations, users…)	4	0,5	2	2
Total			82	1032

Benefits

The total effort expended annually by industry in radio spectrum activities is estimated in the range 82 to 1,032 man-years. Assuming that the availability of an enhanced spectrum information portal decreases the industry effort in this area by 10 %, this equates to a saving of 8.2 to 103 man-years per annum. Assuming an annual saving the equivalent cost savings could be between € 492,000 to € 6.18 million.

Costs

The effort required to enhance the information provision from EFIS could be in the range € 50,000 – 100,000 (the cost of the second version of EFIS was € 40,000). An annual cost of €60 to €100K related to the maintenance of the portal should also be added as discussed above.

Conclusion

Based on the estimates above it demonstrates that even a modest 10% reduction on the effort expended by industry on finding spectrum information as a result of the enhanced portal would result in annual savings of at least five times the cost associated with the enhancement.

11.7 Requirement for a legal disclaimer regarding accuracy of information

Based on the responses to the Questionnaire and interviews it is proposed that the data base should be provided in English only as this was the one language proposed by everyone. It is also proposed that the data base should include a summary of the legal texts and not the detailed clauses. This has implications as generally the basic information is the legal text in the local language. It will therefore be important that all users of the data base are made aware, through a suitable disclaimer similar to that provided on EFIS, that the [Portal] is an information tool and not a legally binding instrument. Links could be provided to detailed legal texts for those wishing to access such information.

The requirement to make this information publicly available will encourage NRAs to check on the accuracy of assignment data or obtain such data from the incumbent operators.[this is an argument for the section regarding the benefit arising from information accessibility]

11.8 Role of NRA web-sites

The European spectrum information portal will not replace the need for individual NRA web-sites. However it is hoped that the NRAs would adopt the same common format where information is duplicated in both places. To provide the required level of detail it will also probably be necessary to cross-refer to the NRA web-site and it is expected that legal texts in the local language will only be made available on the NRA web-site.

11.9 Prioritisation of information

It is recognised that the cost and resource implications of providing all the identified information for the full range of different radio services could be significant and would be difficult to achieve in the short term for a number of the NRAs. It has also been proposed that EFIS should be extended to provide the identified information and that this should be done on a step by step basis[24]. It is therefore necessary to identify what information needs to be made available for the different services and whether it is feasible to prioritise between the services themselves.

[24] This proposal was supported by a number of the attendees at the Public Workshop on 1st December 2005.

11.9.1 Information requirements

11.9.1.1 Output from Industry Questionnaire

The responses to the industry questionnaire have indicated that all the information is of average to very high importance. The reasons given for requiring information varied considerably from research, development of equipment, planning and engineering of networks to strategic planning. In the case of the operator replies the only two subjects that scored less than an average of 3[25] were the outcome of enforcement activities and how to notify equipment under the R&TTE Directive. For the manufacturers those subjects that scored less than an average of 3 were the outcome of enforcement activities, outcome of monitoring, assignment procedures, how to apply for frequencies and existing cross-border agreements.

For each of the categories of information we have identified, we have attempted to specify their importance in relation to specific radio services, in terms of whether they are essential, desirable, or not needed.

11.9.1.2 Not needed (X)

Of all the categories of information considered, only one was consistently rated of lower importance than the others by industry respondents, namely the **outcome of enforcement activities.** We therefore consider that it is not necessary for NRAs to provide such information, although we acknowledge that such information might provide a useful deterrent in countries where there is a particular problem with illegal use.

11.9.1.3 Desirable (√)

Another consideration in determining the priorities is the resources needed to make information available and the necessary timescales. In the case of **spectrum refarming** it would clearly be useful if there was a stated general policy. But, provided there are open and transparent consultations when specific spectrum requires refarming as well as information provided in advance on future strategies for the spectrum this should generally be sufficient.

A similar argument can be made for the **outcome of monitoring exercises** as generally the information is only required when the NRA is considering making additional spectrum available or enable sharing of the spectrum between users. Other monitoring exercises could be in response to a specific request from an operator or to identify the source of an interference complaint. The outcome of such exercises would generally be of interest only to a limited number of people and organisations and could be provided based on specific requests. It would however be useful for the NRA to provide a list of monitoring activities that have been completed, are ongoing and are planned so that there is an awareness of what information is and might become available. This would only need to be a brief description such as “Completed monitoring of xx MHz to yy MHz in the regions of A and B”.

Information on **existing cross-border formal agreements** and **information on how cross-border co-ordination is undertaken** between different countries would be useful to operators so they could try and plan their networks to avoid the need for cross-border co-ordination. Options available to the prospective operators could then be to use alternative frequency bands where there are free frequencies which do not have to be co-ordinated or to reduce output powers or use alternative sites. This would have the benefit of avoiding delays to frequency assignments beyond the maximum timescales of six weeks stated in the Authorisation Directive[26]. This would have cost benefits as network roll-out would not be delayed and would also save the costs and resources of the involved NRAs. It may be useful to provide this information on an individual NRA’s web-site where there are cross-border co-ordination delays for specific services that lead to considerable delays in frequency authorisation.

[25] Level 3 in the Questionnaire meant that the information was of average importance.

[26] Article 5.3

Specifically in the case of fixed links it is desirable to have information on the detailed approach used to **assign frequencies.** This will allow potential users, such as the cellular operators who extensively use fixed links to connect their base stations, to undertake their own planning in advance of submitting frequency applications. This would save the need for a number of iterations before the network design and frequencies can be finalised. For example information on which fixed link sites are designated as transmitting in the high band or low band and their location could save the high costs incurred by users and the NRA in agreeing frequencies.

It is also extremely useful for those manufacturers and vendors to have access to the NRAs **spectrum strategy** so that they can plan their business based on the individual NRA's plans for future use of the spectrum and the proposed or planned timescales. Information would also be required on any changes to the regulatory framework such as a review of spectrum fees or the introduction of trading. To reduce timescales and costs the proposed changes to spectrum use could be added to the National Frequency Allocation Table, which is the approach adopted in Finland.

It would also be useful to provide an overview in plain text of the **regulatory framework** so that vendors and operators are aware of the approaches to spectrum management and the implementation of the EU Directives in the different countries.

11.9.1.4 Essential (√√)

Information that is essential includes:

- The National Frequency Allocation Table including information on the allocation of frequency bands to different services and also specific applications of those services (e.g. identify a band is used for mobile and the specific application is for the provision of national data networks)
- The equipment interface requirements including the relevant channel plans and frequency bands, and the allowed equipment options if any are included in the ETSI standards and any specific relevant policies.
- Information on how to notify equipment under article 6.4 of the R&TTE Directive.
- Information on how frequencies and / or bands are authorised and any specific policies that might apply in addition to those identified in the equipment interface requirements. For example in the case of fixed links any policies with regards to minimum link lengths allowed in certain frequency bands.
- Information on how to apply for frequencies and the relevant application forms.
- Information on the spectrum fees that will be payable on application and on an annual basis.

It is noted that EFIS already provides information on different services that can use the different frequency bands through the National Frequency Allocation Tables but in the case of some countries the level of detail does not include the specific applications. A first step could be to ensure that all the National Frequency Allocation Tables made available through EFIS include this more detailed information. The second version of EFIS provides the possibility to perform searches and comparisons for radio interfaces and this could potentially be extended to also include on a per country basis information on how to notify equipment, not currently covered, under the R&TTE Directive. The additional information on any specific policies that might apply for each specific application may be relatively easy to add as, for example, an additional "comment" column in the NFAT. Once these first four items are in place the next step could be to address the other two items identified by industry as essential.

Currently the implementation of **spectrum trading** is limited and there is only a requirement for a full **spectrum rights registry** in a few countries. Although the information in a spectrum rights registry could be used to identify whether there is the potential to use certain frequency bands for new services and technologies this is only considered as "desirable". Also it is recognised that in some countries there would need to be a major exercise undertaken prior to publishing information on frequency use to verify the existing databases and also in some cases to obtain the necessary information from the previous incumbent operators who had self managed their spectrum. This should therefore be a longer term objective with the exception of those countries where it is intended to allow trading and in those cases it might be easier to provide the information through links to the relevant page of the NRA web-sites. Although there would be benefit in adopting a standardised format for spectrum registries we recognise that in practice that this may be constrained by differing legal constraints, e.g. in relation to confidentiality, and different approaches to trading adopted by different NRAs. We therefore recommend that a minimum set of parameters be defined for inclusion in spectrum registers, namely frequency, bandwidth, geographic location and contact details for the right holder. The inclusion of additional information could be left to the discretion of individual NRAs along with the format of the registry, which should be accessible by means of a hyperlink from the EFIS database.

In addition it is essential to know which Spectrum Management Organisations are responsible for the different services if the responsibility is shared. Also there should a list of people, with information on their area of expertise, to contact in the individual NRAs in the case of any questions.

11.9.1.5 Specific requirements for different services

It is possible to refine the above information on the basis of the different services. For example in the case of the Aeronautical services the frequencies available to aircraft are allocated and agreed internationally. Also the equipment is not covered by the R&TTE Directive. In this case information would be required on the allocations in the Radio Regulations, the authorisation procedures and relevant forms, spectrum fees, and also information on how to obtain type approval, installation approval and the Flight Radiotelephony Operator's Certificate.

The table below considers the requirements of the different services.

	Fixed Links	Fixed Wireless Access	Public Mobile Networks	Private Mobile Radio	Maritime	Aeronautical	Satellite services	T&D	Broadcasting (terrestrial)	SAB	Amateur/CB	Licence Exempt	Scientific Services
Information required to access radio spectrum													
Spectrum Allocations	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√
Channel plans[27]	It is expected that any channel plans would be included in the equipment interface requirements					As req'd for type approval	Eqmt I/F req'ments		It is expected that any channel plans would be included in the equipment interface requirements				
Interface Requirements	√√	√√	√√	√√	√√	X[28]	√√	X	√√	√√	√√[29]	√√	X
Assignment procedures	√	X	X	√	X	X	√	√	X	√	X	X	X
How to apply for frequencies	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√
Frequency application forms[30]	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√
Cross-border co-ordination	√	√	√	√	X	X	√	X	√	X	√	X	X
Existing cross-	√	√	√	√	X	X	√	X	√	X	√	X	X

[27] Respondents to the Questionnaire noted that there was no consistency in the information provided in the equipment interface requirements so there could be examples where the accepted channel plans are not currently included.

[28] Aeronautical not covered by R&TTE Directive

[29] Most equipment used by the radio amateurs is self built and not covered by the R&TTE Directive

[30] Frequency application forms would differ between services. In some cases where the spectrum is to be auctioned the form would be the formal request that has to be completed by potential bidders. Also in some cases it may just be a notification procedure.

	Fixed Links	Fixed Wireless Access	Public Mobile Networks	Private Mobile Radio	Maritime	Aeronautical	Satellite services	T&D	Broadcasting (terrestrial)	SAB	Amateur/CB	Licence Exempt	Scientific Services
border agreements													
Spectrum fees[31]	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√	√√
How to notify equipment under R&TTE Directive	√√	√√	√√	√√	√√	X	√√	X	√√	√√	√√	√√	X
Information on current usage (occupancy) of spectrum													
Information on use of the radio spectrum[32]	√	√	√	√	X	X	√	X	√	X	√	X	X
Information on outcome of monitoring[33]	√	√	√	√	√	√	√	√	√	√	√	√	√
Information on outcome of enforcement activities[34]	X	X	X	X	X	X	X	X	X	X	X	X	X
Policy and Strategy for Spectrum Management													

[31] Spectrum fees may not apply to all the services but it will be important that this is made clear.

[32] A spectrum rights registry would be expected to be an essential requirement in those countries where spectrum trading has been introduced. The services to be included will depend on those that can be traded. Other wise such information is nice to have so that vendors and operators can obtain more detailed information on the actual use of the spectrum.

[33] It would be expected that the majority of spectrum monitoring exercises would concentrate on the frequency bands below 3 GHz and would cover services such as FWA, PMR, licence exempt and terrestrial broadcasting.

[34] In some specific instances information on the outcome of enforcement activities might be useful if there are specific concerns within industry on whether specific spectrum is prone to illegal interference problems.

	Fixed Links	Fixed Wireless Access	Public Mobile Networks	Private Mobile Radio	Maritime	Aeronautical	Satellite services	T&D	Broadcasting (terrestrial)	SAB	Amateur/CB	Licence Exempt	Scientific Services
Regulatory Framework	√	√	√	√	√	√	√	√	√	√	√	√	√
Authorisation policies[36]	√√	√√	√√	√√	√√ (operator's certificate)	√√ (operator's certificate)	√√	√√	√√	√√	√√	X	√√
Spectrum Strategy	√	√	√	√	√	√	√	√	√	√	√	√	√
Spectrum refarming policies[37]	√	√	√	√	X	X	√	X	√	X	√	X	X
Spectrum trading policies[38]	√√	√√	√√	√√	X	X	√√	√√[39]	√√	√√[40]	√√	X	X

[35] Would expect the majority of any specific policies to be included in the equipment interface requirements for that specific country

[36] Would expect the majority of any specific policies to be included in the equipment interface requirements for that specific country

[37] It is assumed that spectrum refarming policies refers to an agreed approach or approaches that would cover all the relevant services.

[38] (only relevant to those countries and services where trading is allowed

[39] Information would be required on how spectrum trading would allow access to spectrum for Test and Development activities

[40] Information would be required to see how could gain access to spectrum to provide such services if there are no dedicated frequency bands, which is normally the case because access is only required on a short term basis.

11.9.2 Services

As noted from the previous table it is possible to identify which information is not required for some services. A degree of prioritisation could be made in terms of the services for which information in addition to the National Frequency Table (including the allocation of frequency bands to different services and specific applications thereof) and the equipment interface requirements is required. This could be done on the basis of the potential number of applicants for new frequencies or spectrum, the maturity of the market, the need for European wide information or only information from one country, the degree of harmonisation of use across Europe, the availability of frequencies, the sophistication of the potential operators, the support that is generally provided by the vendors to the operators, the support provided by Trade and other organisations, the potential for illegal use and harmful interference and the mobility of equipment and terminals within Europe. This would lead to the following conclusions:

- Priority 1 (Top priority):
  - Services Ancillary to Broadcasting
  - Amateur / CB
  - Licence exempt
- Priority 2:
  - Fixed links
  - Test and Development
  - Fixed Wireless Access
  - Public Mobile Networks
  - Private Mobile Radio
- Priority 3:
  - Maritime
  - Aeronautical
  - Satellite Services
  - Broadcasting (terrestrial)
  - Scientific Services

12 Glossary

Term	Definition
2G	2nd Generation (mobile services)
3G	3rd Generation (mobile services)
ACA	Australian Communications Authority
ANFR	National Agency for Frequency Regulation (France)
ART	Telecommunications Regulatory Authority (France)
AT	Radiocommunications Agency (Netherlands)
ATRP	Telecommunications Broadcasting and Post Agency (Slovenia)
BAKOM	Office of Communications (Switzerland
BBC	British Broadcasting Corporation
BIPT	Belgian Institute of Posts and Telecommunications
BMVg	Federal Ministry of Defence (Germany)
BMWA	Federal Ministry of Economics and Labour (Germany)
CEPT	Conference of European Post and Telecommunications Administrations
CEPT SE	CEPT Spectrum Engineering Working Group
COCOM	EU Communications Committee
ComReg	Commission for Communications Regulation (Ireland)
CSA	Superior Council for Audiovisual services (France)
CTO	Czech Telecommunication Office
DCMNR	Department of Communications, Marine and Natural Resources (Ireland)
DEC-MCW	Ministry of Communications and Works
dg TP	Ministry of Economics, Directorate General for Post and Telecommunications
DIGITIP	Director General of Industry, Information Technology and Posts (France)
DT	Deutsche Telecom
EADS	French Telecommunications Provider
ECA	European Common (Frequency) Allocations
ECC	European Communications Committee (CEPT committee)
EDF	
EEA	European Economic Area
EETT	National Telecommunications and Post Committee (Greek NRA)
EFIS	ERO Frequency Information System (ECC on-line database)
EICTA	European Information, Communications and Consumer Electronics Industry Technology Association
EIRP	Equivalent Isotropically Radiated Power
ERO	European Radiocommunications Office (administrative department of CEPT)
ETNO	European Telecommunications Network Operators (trade association)
ETSI	European Telecommunications Standards Institute
FICORA	Finnish Communications Regulatory Authority
FL	Fixed Links
FT	France Telecom

FWA	Fixed Wireless Access
Galileo	Proposed European satellite navigation system
GPRP	Groupement Professionnel Radio Privé
GSME	GSM Europe (trade association)
IATA	International Air Transport Authority
ICP	National Communications Authority (Portugal)
IHM	Ministry of Informatics and Communication (Hungary)
ILR	Luxembourg Institute for Regulation
IMT-2000	ITU family of standards for 3G mobile services
ITU	International Telecommunications Union
ITU-R	ITU Radiocommunications Sector
KFGH	Government Frequency Management Agency (Hungary)
Latnet	Latvian NRA
MCTI	Ministry of Communications and Information Technology (Romania)
MID	Ministry of Information Society (Slovenia)
NFAT	National Frequency Allocation Table
NHH	National Communications Authority (Hungary)
NITA	National Information Technology and Telecom Agency (Denmark)
NPT	Norwegian Post and Telecommunications Authority
NRA	National Regulatory Authority
Ofcom	Office of Communications (UK, Switzerland)
OPTA	National Authority for Telecommunications Regulation (Netherlands)
PMR	Private Mobile Radio
PTA	Post and Telecommunications Administration (Iceland)
PTS	National Post and Telecommunications Agency (Sweden)
R&D	Research and Development
R&TTE	Radio and Telecommunications Terminal Equipment
RegTP	Regulatory Authority for Telecommunications and Posts (Germany)
RR	Radio Regulation (ITU)
RSC	Radio Spectrum Committee
RSPG	Radio Spectrum Policy Group
SAB	Services ancillary to broadcasting
SAFIRE	Spectrum and Frequency Information Resource (Eurocontrol)
SAP	Services ancillary to programme making
SME	Small or Medium Enterprise
SNCF	National Rail Operator (France)
SRD	Short Range Devices
T&D	Test and Development
TA	Telecommunications Authority (Turkey)
TFTS	Terrestrial Flight Telephone Service
TICS	Union des syndicats de l'industrie des technologies de l'information
TKG	German Telecommunications Act
TRIS	Technical Regulations Information Database (EU on-line database)
UIC	International Union of Railway Operators

UMTS	Universal Mobile Telecommunications System (European 3G standard)
URTIP	Office of Telecommunications and Post Regulation (Poland)
WiFi	Wireless Fidelity (propriety WLAN standard)
WLAN	Wireless Local Area Network
WLL	Wireless Local Loop
WRC	World Radio Conference
WT	Wireless Telegraphy
YME	Ministry of Transport and Communications (Greece)

13 Annexes (provided separately)

ANNEX A – SUMMARY OF OPERATOR RESPONSES ON INFORMATION REQUIRED FROM NRAS

ANNEX B – SUMMARY OF VENDOR RESPONSES ON INFORMATION REQUIRED FROM NRAS

ANNEX C - SUMMARY OF INDUSTRY RESPONSES ON INFORMATION REQUIRED FROM INTERNATIONAL ORGANISATIONS

ANNEX D – SUMMARY OF INDUSTRY RESPONSES ON AN ENHANCED EUROPEAN SPECTRUM INFORMATION PORTAL

ANNEX E – OVERVIEW OF EASE OF ACCESS TO INFORMATION

ANNEX F - Responses from NRAs

ANNEX G – Responses from industry

ANNEX H – Report on public workshop