CEPT Report 011

**Report from CEPT to the European Commission
in response to the Mandate on:**

**EFIS
(ERO Frequency Information System)**

Final Report on 27 September 2006 by the:

Electronic Communications Committee (ECC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)

Table of contents

List of annexes

1 Executive summary

The ERO Frequency Information system EFIS is a portal for spectrum information which currently allows search and comparison of frequency allocations, frequency applications and radio interfaces. At present, 25 countries have provided frequency allocations and applications information for EFIS, and 4 administrations have uploaded detailed and comparable radio interface information.

Further facilities such as search and comparison of radio interfaces, and right of use information in a standard format for those frequency bands of high economic interest where market mechanisms would apply, are planned to be included in the system next year. Also the facility of uploading into EFIS national spectrum policy and strategy in the form of documents will be included.

This report on EFIS is written in response to the EC Mandate to CEPT on the use of EFIS for publication and access to spectrum information within the Community.

It explains the current set up and facilities and contents of EFIS (sections 3-5) and gives detailed information on the suitability of EFIS as the common European portal for frequency information, and the plans for incorporating the necessary new features in EFIS to meet future requirements in relation to the tentative objectives for a common European portal contained in Annex 1 of the EC Mandate.

Concerning the tasks of the EC Mandate CEPT has studied:

- *The efforts, timeframe and cost issues* related to the use of EFIS as a common portal, taking into account the need for upgrading the present EFIS and for the continuous maintenance of its content are addressed in the sections on Maintenance (5.1.1, detailing both basic/current and additional EFIS maintenance agreements), Timeframe (7, giving an overview over the timescales for the necessary software enhancement of the current EFIS), and EFIS related costs, i.e. ERO costs (6, indicating figures for both manpower and expenditure involved)
- The question to which extent the *costs of upgrading and continuous maintenance* of EFIS would need to be financed outside of the ERO budget is answered in the Conclusions.
- *Clarification of operational details*, in particular, the necessary links and updating mechanisms between ERO and national administrations with a view towards minimising additional costs and manpower for national administrations can be found in the section on Maintenance (5), ERO costs (6) and in Cost allocation (8), in which the amount of data provided by administrations to EFIS and its format have been analysed and an overview of cost associated with modules of data entry is given. Best practices (9) shows the result of cost allocation research based on the experience of the four most advanced countries in terms of uploading information to EFIS is given. Also The way ahead (10) and Tools and utilities (11) give information on contain information on links and updating mechanisms and ways of minimising costs and manpower for national administrations.

- *Quantification of major cost elements for administrations* resulting from the tentative objectives given in Annex 1 of the Mandate can be found under Conclusions and recommendations. For details of 'general' costs involved in uploading information to EFIS and updating information therein see above.

With regard to the **tentative objectives in Annex 1** of the Mandate, the report explains in the sections on EFIS software (4) and Tables (5) that EFIS already provides for the spectrum information on Allocations, Applications and Radio Interface Specifications.

The implementation of the feature of having (for a sub-set of frequency bands, viz those of high economic interest) Right of Use information, for which a standard format has been defined by the EFIS Maintenance Group, would mean additional software development.

For the inclusion in EFIS of EC Decisions and documents on National spectrum policy and strategy only a minor change (addition of an extra column) would be necessary.

With regard to the **further requirements** listed in Annex 1, ERO decided in February 2006 to allocate substantial additional resources (176 man-days per annum), to the maintenance of the content of EFIS.

A list of national contact persons within the administrations to whom queries can be addressed for response or forwarding to an appropriate person will be included in EFIS.

Feedback mechanisms will be established for user-related aspects (incorporated in the web user interface) as well as for aspects of data integrity.

Section 12 contains the conclusions drawn from and recommendations based on the main body of this report.

2   Introduction

Many parties that have an interest in the radio spectrum need information about the regulations applicable to the use of radio equipment. Such information can usually be retrieved from the national authority responsible for spectrum management.

In Europe the individual authorities present this information in different formats and often in different languages, which makes it difficult for the user to extract the desired details.

This fact was recognized by CEPT, and ERO was tasked with the development of an information database that feeds an Internet search and compare web interface. This database, the ERO Frequency Information System (EFIS), has been operational since 2001. It provides information on frequency allocations, frequency applications and radio interface specifications from many countries on a search and compare basis. Until now, 25 countries have submitted data to the database. The level of detail varies from country to country, as EFIS participation allows for a step by step approach to the information being supplied.

EU member states have an obligation to publish frequency related information. The EC, in an effort to investigate the current situation regarding this obligation, commissioned a study that resulted in a report on information on the allocation, availability and use of radio spectrum in the Community, developed by IDATE. It was concluded from this report that EFIS could be a candidate for a European portal for spectrum information. Subsequently the EC, advised by the Radio Spectrum Committee, decided to give a mandate to CEPT with the aim to assess the feasibility and effort required to use the EFIS for implementing a common information portal in the EU.

This report describes the current status of EFIS, then elaborates on how further need for information could be taken on board and what consequences this would have for ERO (in the first instance) and later (in the final report) for ERO as well as administrations.

3   The EFIS hardware

3.1   Present setup

The EFIS hardware consists of a database and a web server. Interactions between these, in order to respond to user requests, are made possible by the EFIS software.

The system has been founded on open standards. It can therefore, in theory, be deployed on all technical platforms that conform to these standards. The open standards chosen are the leading standards within each individual area and are therefore supported by most platforms. Consequently the system can be deployed, and later redeployed with minimum expenditure, on almost all server platforms on the market. The configuration is as follows:

- Microsoft Windows NT Server
- Microsoft Internet Information Server + JRun Proxy Connector
- JRun J2EE Application Server
- Microsoft SQL Server

ERO

NT Server I

IIS +
JRun

NT Server II

SQL Server 7.0

Client/browser

Request/
Response

JDBC-
ODBC-
bridge
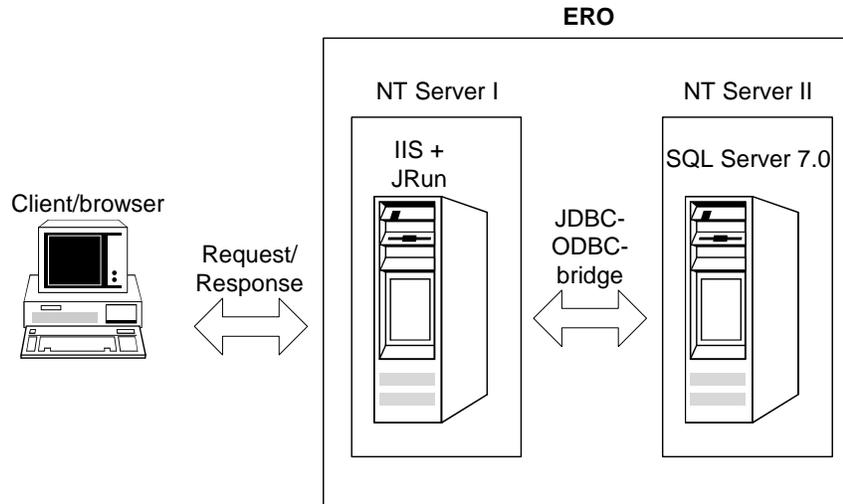
The SQL server holds a database that consists of a number of tables containing the user data as well as tables containing system related data (such as the definition of application terms in a 3-layer structure). These tables contain keywords that can be used to retrieve data in a structured way. The web-originated user queries are programmed in Java, which enables fast execution and flexibility with regard to future developments.

3.2 Extension requirements

The present hardware arrangement can handle all software extensions mentioned in this report.

4 The EFIS software

As mentioned above, the software enables interaction between the database and the web server. It also features direct maintenance of the content of the database by national administrations.

4.1 Existing search features

The information presently available in EFIS has been standardized along the following principles:

4.1.1 Frequency allocations
The list of services which have an allocation in Article S5 of the ITU Radio Regulations is the basis for EFIS allocations. The list is subdivided into three layers of detail in accordance with the definitions given in the RR (see Annex 1). When searching for and comparing information EFIS makes use of these layers.

4.1.2 Applications
The list of applications (see Annex 2) is complementary to the list of allocations, and it is meant to describe the actual use allowed within the frequency bands.
It is divided into three layers of detail. This allows each administration to choose the level of detail it wants to provide within a certain frequency band. When searching for and comparing information EFIS makes use of these layers.
Only standard terms are used which give clear guidance for data entry and retrieval. The list is maintained by the EFIS Maintenance Group, working under the auspices of the Frequency Management Working Group in CEPT. The layered structure of the list also enables administrations to introduce applications that have been defined on a national level only. In such a case, the next (higher) level in EFIS will usually accommodate this application.

4.1.3 Radio interfaces
In the EFIS context, the technical parameters for regulation of radio transmitters have been introduced as radio interfaces. These radio interfaces are identical with the regulated interfaces, according to the R&TTE Directive. They are subject to notification with the EC. The TCAM[1] is examining the possibility of streamlining the list of items to be included in the radio interfaces but it has yet to decide on a new radio interface template. Many countries now publish details of regulated interfaces on the Internet. This information, however, is not comparable and can only be searched on a country-by-country basis. The EFIS now makes the data more standardized and accessible.

For any application a user may request a detailed overview of the radio interfaces for each country that has supplied such data in the system. EFIS produces an output that allows direct comparison of the interface elements between countries. Additional information on specific radio interface elements can be made available as notes.

4.2 Additional search features

The mandate lists new information to be provided by EFIS:

4.2.1 Right of use

The right of use information is only required for frequency bands, in which spectrum trading is allowed. The EFIS maintenance group decided to define this standard as follows:

- ➢ Lower frequency (numeric, EFIS format)
- ➢ Upper frequency (numeric, EFIS format)
- ➢ License holder name and contact details (free text format)
- ➢ Duration of the license
- ➢ Information on location
  - ○ National (tick box) or
  - ○ Regional or local (free text field, link to national details) or

---

[1] Telecommunication Conformity Assessment and Market Surveillance Committee, composed of representatives of the Member States and chaired by a representative of the European Commission

- o   One transmitter (free text field, link to national details)
- Spectrum trading Yes/No (tick box).

It was also suggested that the sites to which the link to national details points should be written in the English language.

For those involved in spectrum trading or other market mechanisms (e.g. auctions), it is crucial to obtain information on:
- ☐ Contact details of the right holder
- ☐ Time duration
- ☐ Geographic area/location

In some cases this information will have cross-border dimensions and should then preferably be available as a multi-country presentation. EFIS could provide this if the relevant information would be available in a standardized format, at least for the three content elements mentioned above.

The required software will present the rights of use information for one country in the search menu. Comparison between countries will be possible after a search for applications has been chosen.

It is noted that some administrations (e.g. Denmark) already provide the information on the rights of use in a spectrum registry. This registry should be linked to the EFIS database in such a way that an EFIS search result would point to the right frequency band in that registry.
Implementing this feature in EFIS would require extra software. The development of such software would require programming efforts comparable to those for introducing radio interfaces information in the system.

4.2.2   Spectrum policy and strategy
For many spectrum users, information on spectrum policy and strategy is essential in the planning process. Documents on this issue have already been published by several administrations, and to make them available in the EFIS system would only require an extra document column to be added in the user interface relevant to the search for applications.

4.2.3   National contact person
In each administration, a person should be responsible for providing information that cannot be retrieved from EFIS.

5   Content

5.1   Tables

The information in the system (content of the database) is country-specific and falls within the responsibility of national administrations. Updates are introduced directly into the system by the responsible contact persons in the administrations. Most contact persons use XML file uploading to update the information. Such a file contains allocations, applications and radio interfaces.
EFIS also provides a feature for downloading information from other countries.

Future development of additional software providing new features will not change the uploading principle. All information for every table in the system can be uploaded in one XML file, now and in the future.

Some information on frequency allocations and use has been introduced in the system by ERO:

- ☐   The ITU Radio Regulations frequency table for Region I.
- ☐   The latest version of the CEPT European Common Allocation Table (ECA)

These two sets of data contain information that has been agreed upon in relevant forums. The ITU set is the result of an agreement between countries in Region I, while the ECA set presents a more detailed overview of allocations and applications to be harmonised in CEPT / Europe. This information is updated periodically by the ERO and approved by the FM Working Group of CEPT/ECC, according to information collected from several sources.

Country-specific information has been supplied by national administrations. Such data is maintained by administrations over the Internet using a standard web browser.

5.2   The user interface

In the EFIS system, country-specific information is queried on request by a user via the web interface (http://www.efis.dk). The search keys available are *frequency band*, *allocation, application and radio interface*.
Additional information is organised within the system and shows up under headings such as *Short comments, National Table of Frequency Allocations, Activities, Documents, R&TTE* and *Other*.

In order to compare data across national borders, the information has been standardised. Frequency bands, allocations and applications have already successfully been standardised within CEPT. The list of standard items in EFIS is maintained by the CEPT/ECC FM Working Group and can be updated as necessary. The standard terminology used is, in most cases, also used on a national basis. Radio interface specifications have been standardised in conformity with the template developed by TCAM.

Other information, such as availability of a harmonised standard, and also class of equipment, has been included. The National Tables of Frequency Allocations can be retrieved from the system as a document. In the column 'Other' a number of documents such as ECC Decisions can be found for downloading.

The additional information required by the mandate will be accessible via the main menu. The information on the right of use will be comparable across countries for a certain frequency band.

5.3   Maintenance mechanism

5.3.1   Basic ERO maintenance arrangement
ERO hosts the EFIS Internet site at their premises. Hardware maintenance is organized along the same principles as the ERO web site and includes regular back-up, virus protection and error reporting features.

Software maintenance is performed as and when necessary, and always after changes in the EFIS lists of allocations, applications and the radio interface elements have been agreed upon by the FM Working Group

For content maintenance, all countries supplying information to EFIS have appointed contact persons in charge of maintenance of the data supplied. A contact person is provided with a username and a password that will allow access to the EFIS edit menu. The content can be changed in two ways:
1. by changing items one by one per frequency band. This is a rather time-consuming exercise, but useful if small changes have to be made.
2. by uploading an XML file containing all information into the database. As the size of a typical XML file is about 600 kB, this is done in a matter of seconds.

One feature which may be used for maintenance is the possibility of downloading all information from other countries, including the European common allocation data, as an XML file. Especially for new entrants this can be useful, since in most cases adjusting such a file to a country's specific needs, and subsequently uploading it, can be done in less time than introducing all data in the edit mode. All country-specific information on allocations, applications and radio interfaces is contained in one XML file, which can be edited using a simple editor.

ERO also chairs the EFIS Maintenance Group, a subgroup under the FM Working Group, which is responsible for the list of allocations, the list of applications and the radio interface elements. Any changes in these lists until now have been discussed in the EFIS MG and subsequently agreed by the FM Working Group. As some changes require amendments to national databases or software, it is important to carefully balance the pros and cons thereof. The EFIS Maintenance Group is also the platform for the exchange of views on how the EFIS software could be improved.

5.3.2   Additional ERO maintenance arrangement

In February 2006, ERO has decided to allocate additional resources (176 man-days per annum) to the maintenance of the content of EFIS. The following activities are foreseen:

5.3.2.1   Non-participating countries
Presently (February 2006), 25 countries participate in EFIS, so a number of potential
new participants within CEPT could be identified. ERO will approach those with the
aim to assist the administration with a first upload of information in a step by step
approach. If necessary, ERO will assist with transferring the format into the EFIS data
format. After this initial step regular maintenance is less intensive, since the necessary
changes are often minimal and can even be done manually. ERO may, if required,
visit those administrations that need more intensive help.

5.3.2.2   Information format
For most countries, the table of national frequency *allocations* (the terms relate to ITU
services) is available. A list of *applications* will usually be developed as a separate
table, and perhaps in another format. *Radio interfaces* could also be formatted
differently from other information. They would be notified to the EC as regulated
interfaces under the R&TTE Directive. The information on *rights to use* the radio
spectrum relates to national frequency assignments, which are usually recorded in a
separate database.

For each of these types of information, ERO will advise on and assist with
transferring national data into EFIS standard format.

5.3.2.3   Content update control
The following ERO activities have been identified:
☐   In order for the user of EFIS to know what version the information on each
     country is, the software will be amended so as to show a revision date.
☐   A user feedback mechanism will be put on the EFIS web site that enables users to
     comment on the information. These comments will be collected by ERO and acted
     upon if possible. If not, they will be made available to the EFIS Maintenance
     Group for further consideration.
☐   ERO will check regularly with administrations for updates of their data.
☐   ERO will carry out surveys into the developments of spectrum use on the national
     level on a yearly basis in order to support administrations to keep the EFIS
     database up to date.
☐   ERO will monitor the development of harmonised standards under the R&TTE
     Directive and the development of ECC Decisions in order to make references to
     those in EFIS.

6   EFIS related costs

6.1   *ERO costs*

6.1.1   Personnel

The annual budget for EFIS up to February 2006 has been 75 man-days. This covers
chairing the EFIS Maintenance Group, supervising software developments, assisting
administrations and updating the European Common Allocation data.

As of early February 2006 ERO has assigned more resources to make an active approach to the maintenance of the EFIS content. Another 176 man-days have been added to the annual budget (approximately 80% of a full position in ERO). Thus, a total of 242 man-days are allocated annually.

6.1.2 Hardware

No changes in hardware are foreseen apart from regular maintenance.

6.1.3 Software

For the regular software maintenance of EFIS, the annual budget is 6,600 euros. This covers debugging if necessary, and correcting small errors etc by external parties.

The extensions of EFIS require software development which will be performed by an external party. The cost of such software development as foreseen in section 4.1.4 and 4.1.5 can be estimated on the basis of previous experience with recent software modifications. It is assumed that these extensions require only a one-off investment. Adding EFIS facilities to put information on the rights of use in the system is estimated at 50,000 euros. Adding a feature that can handle spectrum policy and strategy information documents and links will cost an extra ca 10,000 euros.

6.1.4 Summary

The table below summarizes the approximate cost for ERO with relation to EFIS.

EFIS element	ERO cost (€)	ERO personnel (man-days)
Regular maintenance	6,600 / year	75
Content maintenance (5.1.2)		176
Introducing new features		
Right of use (4.1.4)	50,000	-
Spectrum policy and strategy (4.1.5)	10,000	-
National contact person (4.1.6)	-	-

7   Time frame

It is necessary to thoroughly define the required additional features of EFIS at an early stage. Therefore, in the autumn (Sep 2006) meeting of the EFIS Maintenance Group, the format for these new features should be decided. At the same time, the required 2007 budget for the software development has to be allocated by the ERO/ETO Councils.

In the first months of 2007 the software extensions will be implemented. Testing and debugging will be done before the summer, and the software is expected to become operational at the end of 2007 for administrations to start uploading information. Final adjustments should be completed in mid 2008.
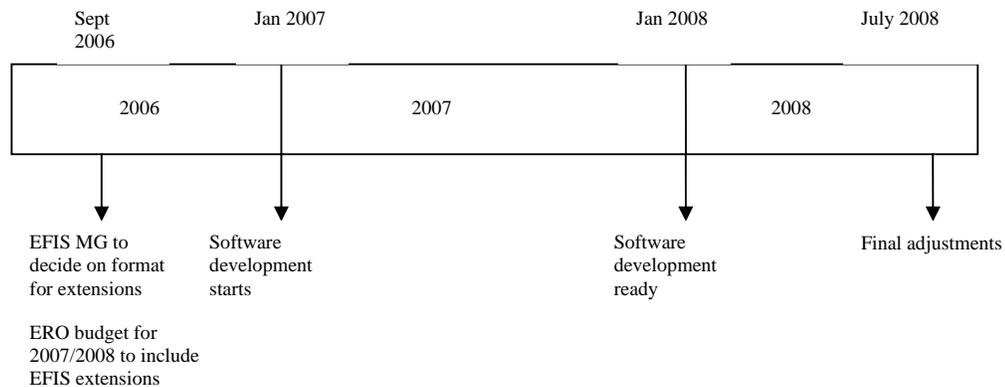
8   Cost allocation

Administrations may, for historical reasons, have stored information on frequency allocations, applications, radio interfaces and right of use in different places. The format of that information may also vary. A number of different "flavours" have been identified in this study, notably (electronic) text documents, spreadsheets and databases. Different mechanisms are required to shape up this information for introduction in EFIS.

For each of the above information components, different formats may currently be present on a national level:

☐   In many cases, the ***allocation*** table is part of primary telecom regulation and does not necessarily need to be in a format that is easy to transfer into the EFIS database.

☐   The ***applications*** table is likely to resemble ERC Report 25 (the European table of frequency allocations and utilisations covering the frequency range 9 kHz to 275 GHz). The format may be text, spreadsheet or database.

☐   In case of EU members, ***radio interfaces*** have to be notified to the EC (R&TTE Directive art 4.1). This notification, following the procedure under Directive 98/34/EC, is based on submission of paperwork and requires text documents to be developed. Of course, some other format could be used as a primary source of information.

☐   The information on the ***right of use*** (this is usually licence information) is more likely to reside in a database or spreadsheet, since for some categories tens of thousands of entries may be registered. Furthermore, (data for) each category may also be present in another place, and organised differently there.

For some countries, the quantity of information currently available in EFIS has been examined. Below is a graphical representation of the findings::
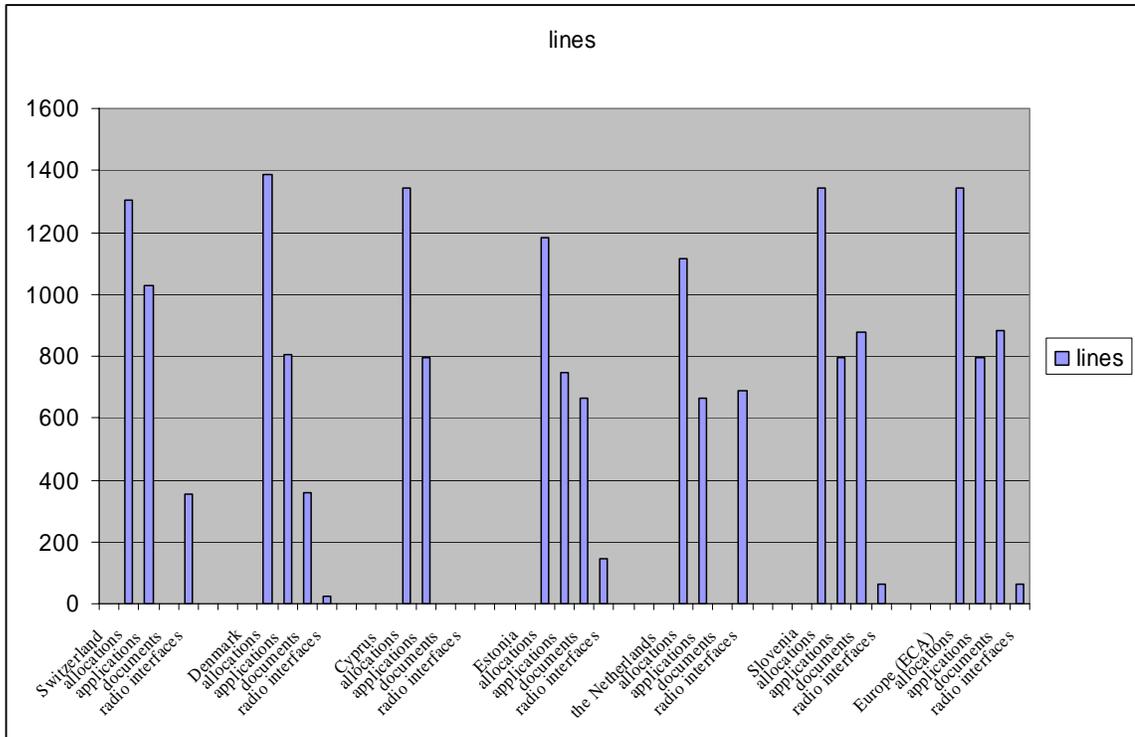
This table shows that the number of allocation lines contributed by one country varies from 1100 – 1400, the number of application lines from 650 – 1030 and the number of radio interfaces varies a lot, obviously depending on the percentage of the frequency bands for which administration have published radio interfaces.

Because the information on spectrum related issues may be fragmented within the administrations, or at least not be available in one single location, the cost of transforming this information into EFIS format should be broken down into the smallest modules that administrations could possibly identify and process. For the identification of these modules a survey has been carried out. The responses (annexes 1,2, 3 and 4) indicate a general structure as depicted below:

applications

Rights of use

radio interfaces

allocations

spreadsheet

text

database
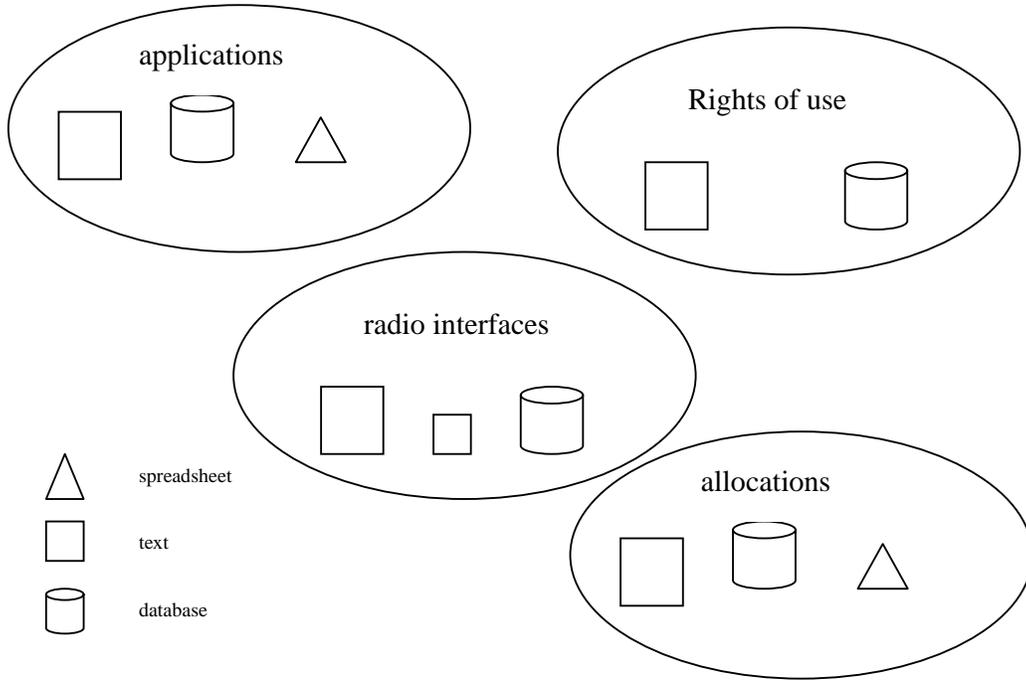
The response to the survey has also been analysed in terms of how many countries use a certain format at the moment, and if they plan any change for the near future. This overview (see below) shows that over 50 % of all respondents use a text-based format for spectrum related information. This indicates that a lot of improvement is necessary, since EFIS needs to be fed with database formatted information.

Current status of allocations format:		
format	Format allocations:	Future format allocations
Database	8	12
Pdf, Word, HTML	9	3
Spreadsheet	1	
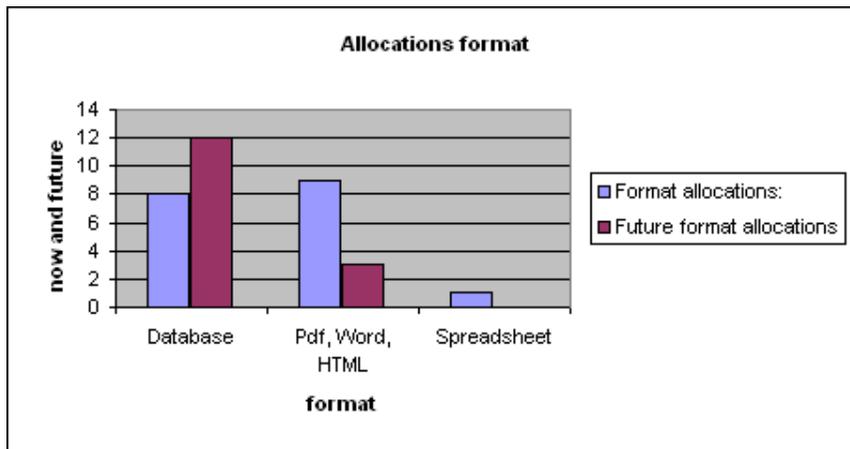
Current status of applications format:		
format	Format applications:	Future format applications
Database	8	12
Pdf, Word, HTML	9	3
Spreadsheet	2	
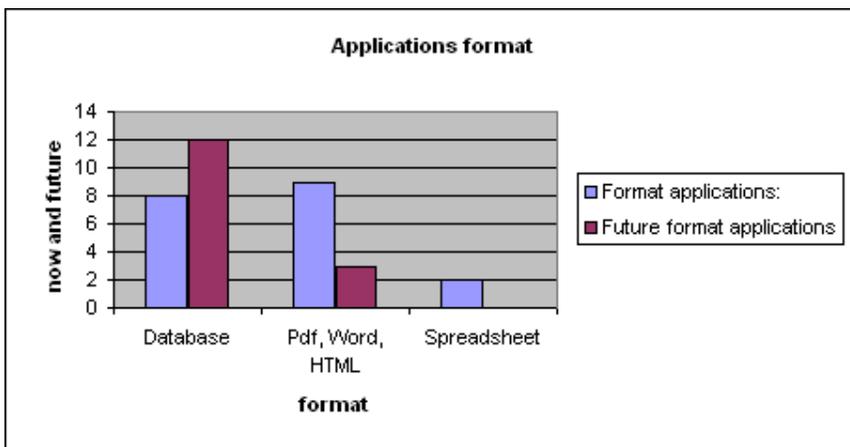
Current status of radio interface format:		
format	**Format radio interface:**	**Future format radio interface**
Database	6	10
Pdf, Word, HTML	12	4
Spreadsheet	2	
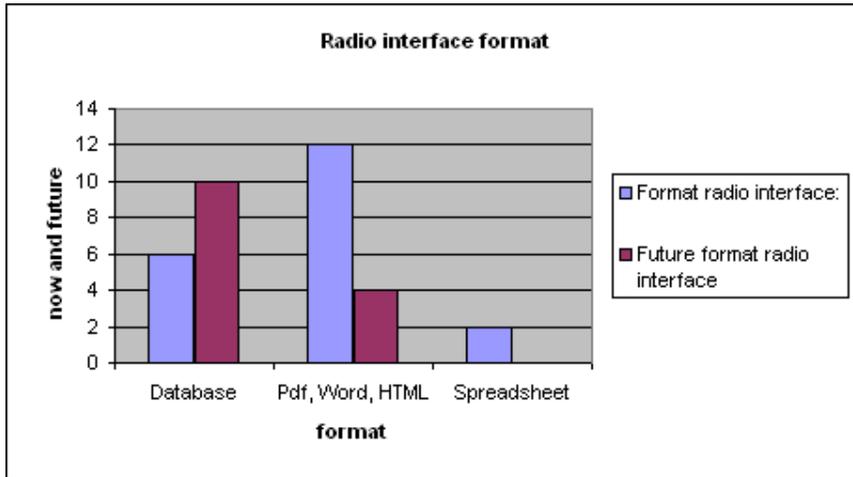
Current status of rights of use format:		
format	**Format rights of use:**	**Future format rights of use**
Database	7	4
Pdf, Word, HTML	7	3
Spreadsheet		
Mixed format	2	1
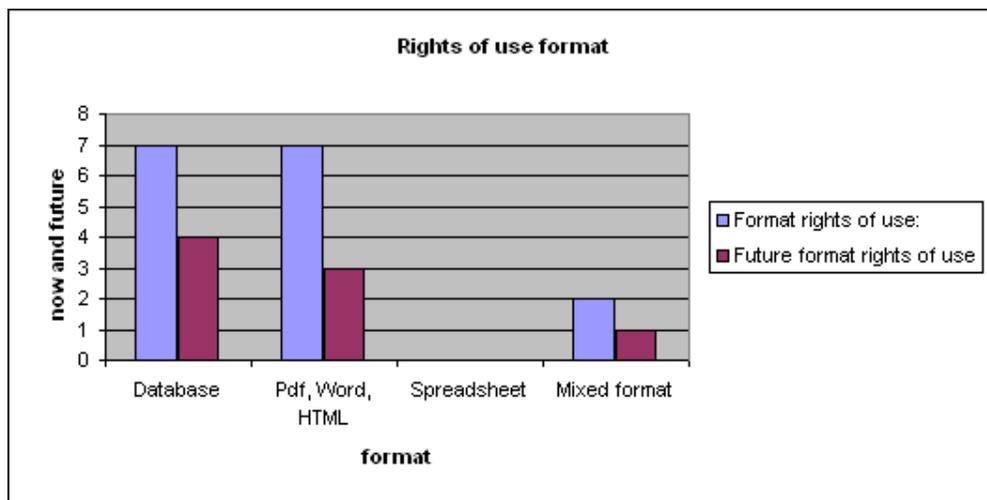
The cost for administrations of transforming information into EFIS format depends on which modules they have in place. For some countries which currently carry out this process, the associated costs have been investigated.

Interviews have been held with the administrations of the Netherlands, Switzerland and Estonia. These countries are the most advanced in uploading EFIS information, including radio interfaces. Based on this information cost allocations for most of the modules above have been estimated. An overview is given below:

	Module	Formatting (man-days and €)
allocations	database	
	spreadsheet	
	text	52 hrs data entry
applications	database	
	spreadsheet	
	text	40 hrs data entry
radio interfaces	database	From €15000 hrs to €21000 [*software development incl allocations and applications*]
	spreadsheet	
	text	68 hrs per 100 interfaces data entry
rights of use	License database 1 License database 2	From 60 hrs (*software development*)
	License spreadsheet	
	text	30 hrs per 100 license holders data

9 Best practices

Because the spectrum information can be introduced in EFIS step by step, the level of detail varies from country to country. All countries presently contributing to EFIS (25) have uploaded information on frequency allocations and applications.
A limited number of countries have introduced information on radio interfaces in non-standard format (i.e. as documents); but so far, only four countries (Estonia, the Netherlands, Switzerland and Liechtenstein) have uploaded radio interface information in a standard format, so that radio interfaces can be compared between those countries.

Realistic cost estimates for the work on transforming national information into EFIS format should be based on actual figures from players in the field. Since the four most advanced countries in terms of uploading information have a more extensive experience than others, cost allocation research has been focused on those countries. A detailed position has been obtained on the development of (eventually) EFIS-XML formatted information for each of the four countries. Their initial information structure was different, which is reflected in the modules that were developed for the information transformation. In all cases, databases would also cover spreadsheets, since a spreadsheet can easily be introduced in a database.

The Netherlands and Switzerland have produced software tools that provide information transformation mechanisms from a national source to EFIS-XML. The modules covered are indicated in the paragraphs below.

9.1 Estonia

The national website offers a good overview of spectrum related information (frequency allocations and applications) in English. Estonia was the first country to provide radio interfaces for EFIS in a standard format. Even before the standardised information became available, a vast number of radio interfaces had been uploaded as documents. The transformation of information from the national resources (text documents) into the EFIS-XML had been accomplished manually, using the EFIS edit mode.

The cost of developing the Estonian EFIS-XML information is given in the following table:

	Module	Formatting (man-days and €)
allocations	database	
	text	Manual insertion of data in EFIS: 500 man-hours Error checking of inserted data: 40 man-hours **Note that these figures cover allocations and applications**
applications	database	
	text	See above, under Allocations
radio interfaces	database	
	spreadsheet	
	text	Manual insertion of data in EFIS: 100 man-hours
rights of use	License database 1 License database 2	A new licence register system is currently being developed/tested. Development of an interface in this system to allow the extraction/output of relevant info for EFIS is estimated at ca EUR 3,000

9.2 The Netherlands

In the Netherlands, the frequency allocation table is maintained separately from the other information, since it has a different legal status.
The maintenance mechanism for frequency application information as well as radio interfaces is more flexible, and decisions do not have to be approved by the Council of Ministers as is the case for the frequency allocation table.
The information on the right of use is contained in licences. It may be necessary to shape these data to transform them into the EFIS-XML format.

All data were stored in a database before the need for transfer to EFIS arose. For the transformation of information to the EFIS-XML format, a software utility was developed. The Netherlands Administration has made this utility available to other administrations on request. It can be used to extract information from three different types of database. If relevant information is stored in a spreadsheet, it is recommended to convert this into a database, after which the utility can be used. In future, however, ERO, as coordinator, will take over the distribution of the utility to those administrations who request it.[2].

The cost allocation for EFIS related costs are specified as follows:

	Module	Formatting (man-days and €)
allocations	database	ICT expert:
	text	
		Utility: 80 man-hours
applications	database	Other*: 130 man-hours
	text	
		* adapting data model to EFIS; connecting national allocations and applications to EFIS allocations and applications; converting data; implementing checks (e.g. overlapping of frequencies)
radio interfaces	database	
	text	
rights of use	License database 1 License database 2	Modification of the utility to allow the extraction of relevant info for EFIS is estimated at approx 60 man-hours

---

[2] see chapter tools and utilities

9.3   Switzerland

The Swiss Administration has developed a database maintenance tool with fully integrated EFIS-XML support. It offers a graphical user interface for easy incorporation of changes and includes over 300 radio interfaces. All information was entered manually in the database.
The Swiss national website provides this information in a comprehensive user-friendly way. A search facility is included that narrows down the information requested, and yet the search result offers further information through links to related information.

The cost of developing the Swiss facility can be summarized as follows:

	Module	Data entry into database (man-days and €)	Extension to EFIS (man-days and €)
allocations	database		Ca CHF 15,000 for development of tool 4 man-months for data input **Note that these figures cover allocations and applications**
	text	Production of NTFA: CHF 100,000 for development of tool 12 man-months for data input **Note that these figures cover allocations and applications**	
applications	database		Ca CHF 15,000 for development of tool 4 man-months for data input **Note that these figures cover allocations and applications**
	text	Production of NTFA: CHF 100,000 for development of tool 12 man-months for data input **Note that these figures cover allocations and applications**	
radio interfaces	database		Ca CHF 35,000
	text	3 man-months for data input	
rights of use	License database 1 License database 2		

Not only did the Swiss administration develop a way to automatically upload EFIS information in XML format, but also integrated a complete maintenance system for spectrum allocation, spectrum application and radio interface information. Using this software, changes in the information can be easily accommodated on a national level with automatic maintenance of the relevant EFIS data. The resulting data are presented on the national website[3] in a user friendly way, including search facilities.

10   The way ahead

The EFIS system allows for easy upload of information in several ways:
1. The administrator (in ERO) may upload tables from a spreadsheet.
2. EFIS contact persons in administrations may manually edit information using the Internet edit interface with ERO assigned username and password.
3. EFIS contact persons may upload their spectrum information using the XML upload facility.

The EFIS editing interface also features downloading any national table in XML format in the edit mode.

Different scenarios may be envisaged for administrations wishing to publish frequency information on line. Four typical cases could be described as below:

Scenario I - starting from scratch

For administrations wishing to start publication of frequency information in EFIS as well as on the national website, the most cost-effective approach is to consider the ECA information first.
The EFIS export feature can be used to download an XML file containing all ECA information to a computer within the administration.
The file must then be reviewed and modified where necessary, according to national needs. After that, submitting the file to EFIS will complete the initial work.
Maintenance requires the same procedure, but on a smaller scale, since the modifications will only reflect changing national positions.

In this case the EFIS database is used as the main repository of national data. It would therefore be good practice to arrange a secure backup of the relevant XML file on a national level.

The information can also be provided on a national website, maybe after translation into the national language of the information contained in EFIS (which is in English). For website presentation, ERO may be consulted for the software to be used.

---

[3] http://www.bakom.ch/themen/frequenzen/00652/00654/index.html?lang=en

The following diagram illustrates the setup:
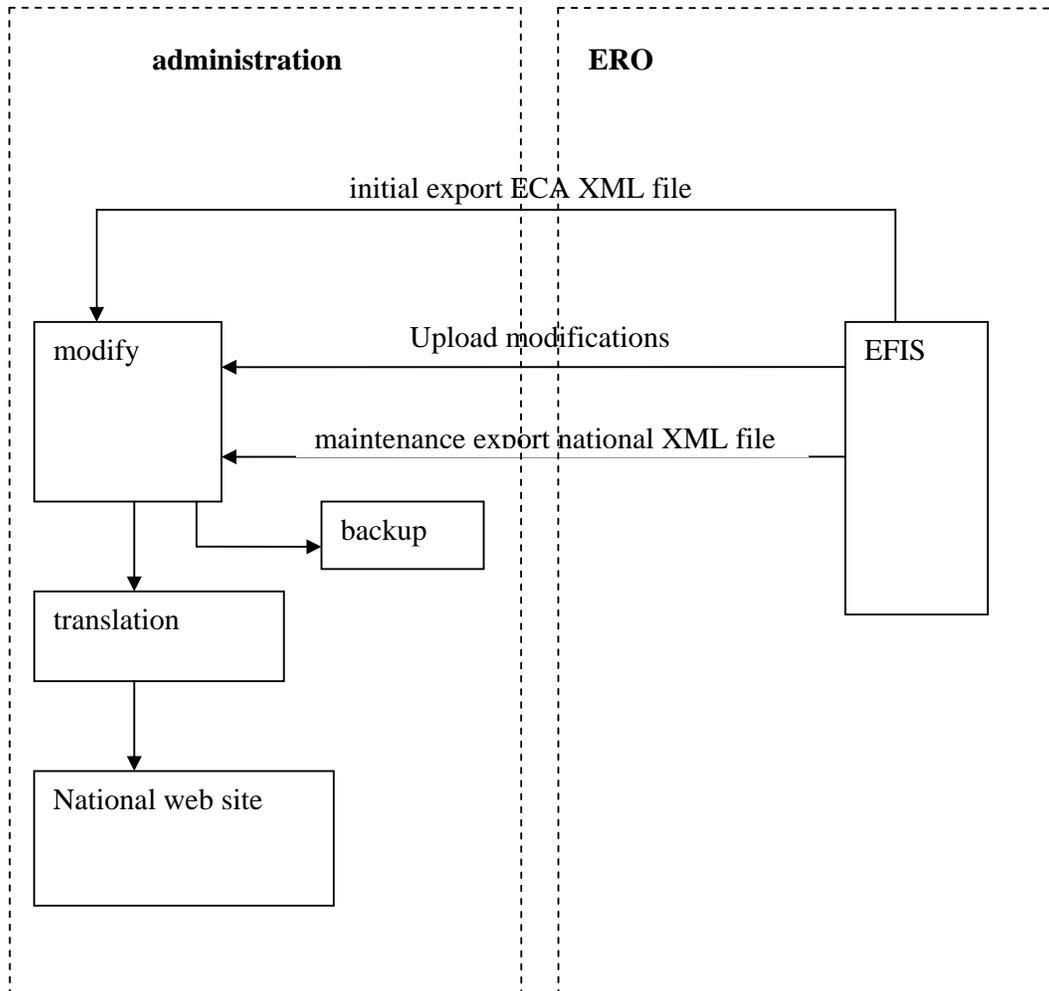
The efforts associated with this setup will be approximately 30 hours for 100 modifications, due to national positions, in the ECA information,.
The cost associated with the introduction of right of use information would be approximately 30 hours per 100 license holders if the information had to be introduced manually. If a tool for extraction of the right of use information had to be developed, then the cost would be between €3000 and €6000.

Scenario II – export of existing national database to EFIS

If a national database already exists, this database will be the source of national frequency information. To export the relevant parts to EFIS, the database first needs to be translated in English. Then the results will have to be formatted in an EFIS XML file.

The diagram below illustrates scenario II:
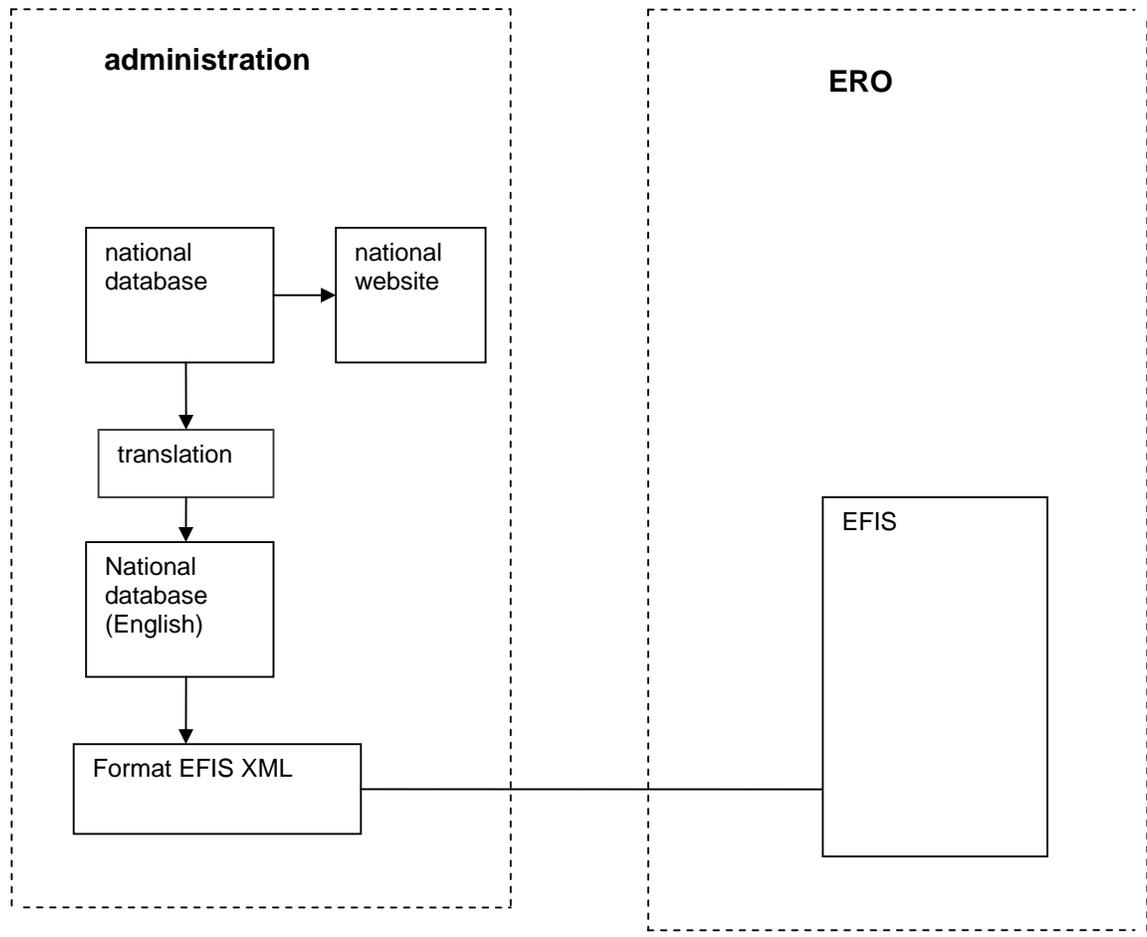
The utility that formats the relevant information from the national database into an EFIS XML file is available from ERO free of charge. The cost associated with the introduction of right of use information would be approximately 30 hours per 100 license holders if the information had to be introduced manually. If a tool for extraction of the right of use information had to be developed, then the cost would be between €3000 and €6000.

Scenario III – National database

The national administration may use a database and accompanying software for maintenance of its data. All frequency related information is also translated into English. The results are fed both into the national website and EFIS.
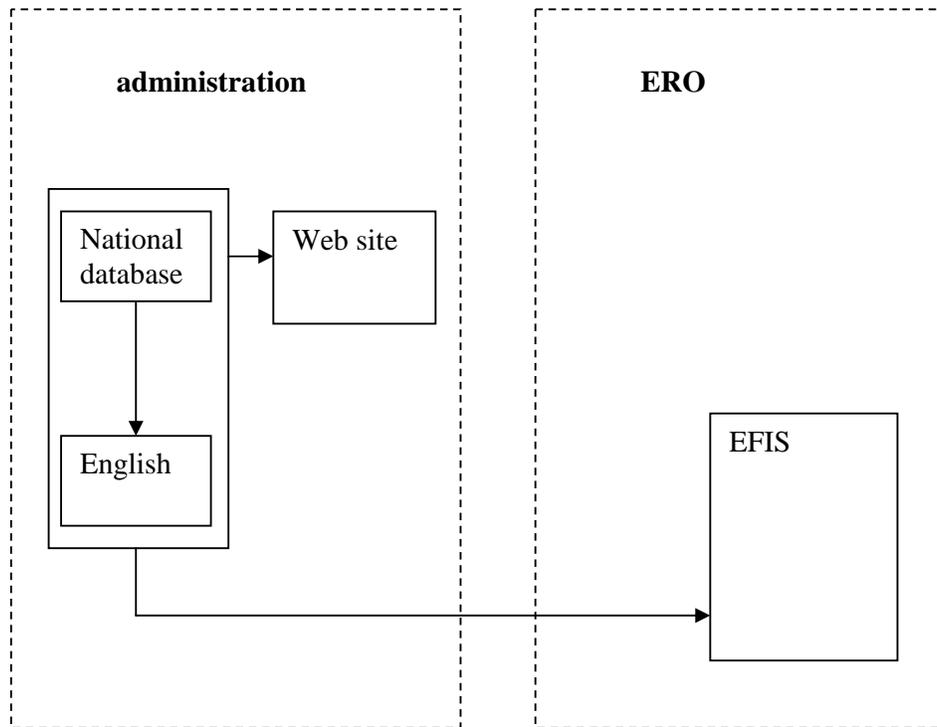
The cost of a standard package of 2000 lines of allocations/applications and 350 lines of radio interfaces to be provided in the system would be equivalent to 810 hours + translation into English. Software for this system would be made available by ERO and is free of charge. The cost associated with the introduction of right of use information would be approximately 30 hours per 100 license holders if the information had to be introduced manually. If a tool for extraction of the right of use information had to be developed, then the cost would be between €3000 and €6000.

Scenario IV – Introduction/modification of national data in EFIS

EFIS offers a user interface to introduce or modify national data in the system. This is basically sufficient to feed EFIS with information without the need to use any sophisticated tools.
The process is, however, time-consuming, and if there is no connection to a national database maintenance of the information (now in two places) becomes a problem.

A block diagram is given below:
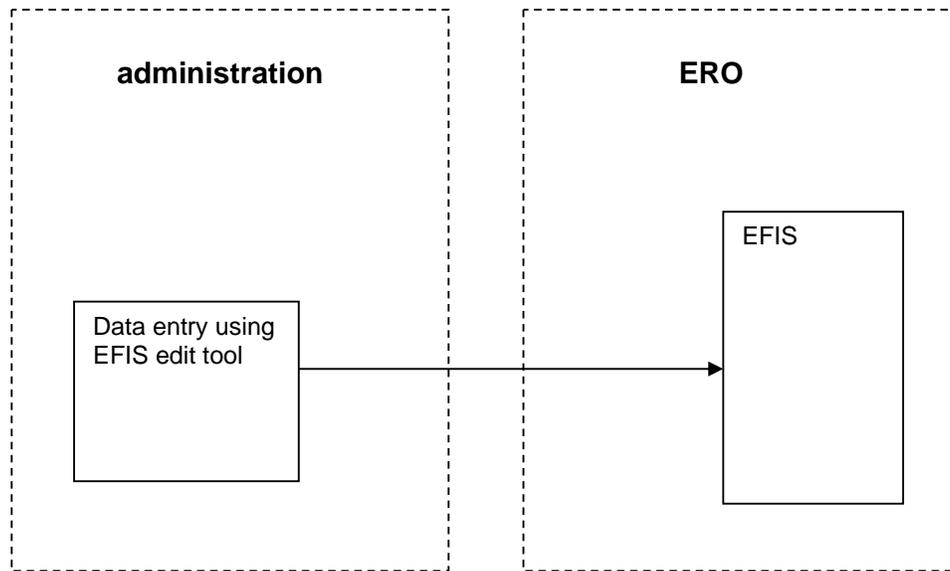
The efforts associated with making a standard package of 2000 lines of allocations/applications and 350 lines of radio interfaces available would be 810 hours + translation into English. For the introduction of right of use information, 100 licenses holders would require approximately 30 hours effort.

11 Tools and utilities

Some countries have developed software to transform information from a database into EFIS-XML format, or even to maintain the national data while automatically updating the EFIS information. In the EFIS Maintenance Group there has been a willingness to not only share the experience with those tools, but also make them available free of charge or for a symbolic fee. As further assistance may be needed when introducing tools and utilities, ERO may coordinate this process.

So far, the following tools and utilities have been identified:

The Netherlands utility: Transforms data from a database (or spreadsheet, see above, under 'Best practices') into EFIS XML.
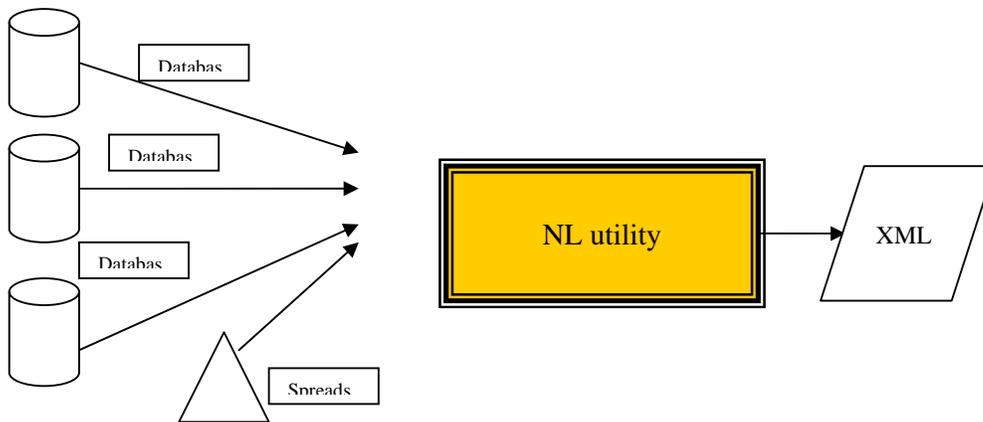
The Swiss integrated tool: Offers maintenance of database information, publication on the national website and transformation into EFIS-XML format
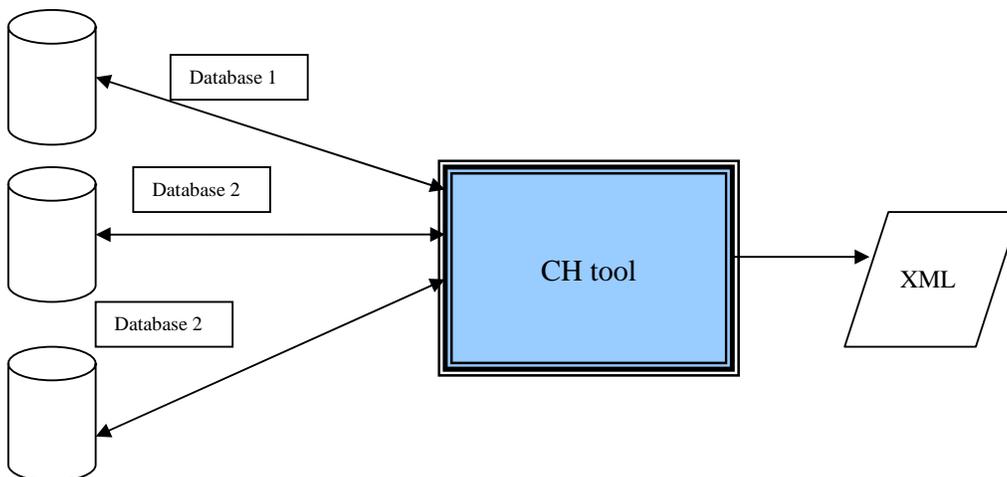
12 Conclusions and recommendations

12.1 CEPT responses to Mandate

1 Assessment of the efforts, timeframe and costs related to the use of EFIS as the European Community portal for spectrum information, considering the need for upgrading the present EFIS system and for the continuous maintenance of the content thereof so as to fulfill the requirements from EC legislation related to public information on the use of radio spectrum.

EFIS can fulfil the requirements from EC legislation related to public information on the use of the radio spectrum. Most of the spectrum information given in Annex 1 of the Mandate can already be collected in EFIS. Adding the required additional features, right of use information (limited to bands of high economic interest) and links to policy and strategy information (ref sections 4.1.4 and 4.1.5), making EFIS the European portal for spectrum information, will cost an estimated €60,000 and can be completed in mid 2008 (see section 7). Inclusion of documents such as EC Decisions is already possible in the present set-up.

2 Determine to which extent the costs of upgrading and continuous maintenance of EFIS would need to be financed outside of the ERO budget.

The cost of upgrading EFIS and continuously maintaining the system will be borne by ERO.

3 Clarification of operational details, in particular, the necessary links and updating mechanisms between ERO and national Administrations with a view towards minimising additional costs and manpower for national Administrations and being effective as well as clear on liability issues.

Updating of information in EFIS is the responsibility of Administrations. Uploading all information of a specific country is only a matter of seconds, as it requires only one file to be uploaded via the Internet (section 5.1.1). Manual update is also available.
In support of the work of Administrations, ERO has already allocated extra resources (176 man-days per annum) for regular update control and further assistance to Administrations (chapter 5.1.2).
ERO will assist an Administration with a first upload of information in a step-by-step approach. If necessary, ERO will assist with transferring the format into the EFIS data format. ERO may, if required, visit those Administrations that need more intensive help.

4   Quantification of major additional cost elements resulting from the tentative objectives given in Annex 1, which would be incurred by individual Member States.

With regard to the task of quantifying major additional costs elements resulting from the tentative objectives given in the Mandate, a cost allocation model for the introduction of spectrum information in EFIS has been developed. For a number of administrations an overview is given of the format of the available national information, i.e. the starting point for these administrations. For a limited number of administrations more details on cost aspects have been collected. Based on this information, modules of data entry have been identified, and the cost associated with providing national information to EFIS can be estimated in specific cases.

Below is a table which shows estimated costs for Administrations that start 'from scratch', i.e. with manual entry of data into EFIS.

Estimation of the cost for Administrations (chapter 10), if all information manually for a typical 2000 lines of allocation/application and 350 lines of radio interface information.	
Information	**Cost (in terms of resources)**
Allocations	
Applications	810 hours plus translation into English
Radio interfaces	
Right of use information	30 hours * per 100 license holders (note that this information is only required for frequency bands where spectrum trading is allowed). *The effort is equivalent to attendance at one ECC meeting.*

However, under 'Recommendations' below, various possibilities for a **quicker and much less costly** way for an Administration to enter data into EFIS are described. Additionally, information on various **tools and utilities**, available free of charge, is given.

With its existing facilities of search and comparison of frequency allocations, frequency applications and radio interfaces, EFIS already includes three of the mandatory <u>types of spectrum information</u> listed under **Information to be made available and common formats** under Tentative Objectives in Annex 1 of the Mandate.

As mentioned in the report, the fourth type of mandatory information, *viz* right of use, for which a standard format has been set by the EFIS Maintenance Group, will be added to EFIS in 2007. The additional costs for the extra facility will be covered via ERO's budget.
In order to reduce the costs at national level, the "right of use" information should not, however, be made available for all frequency bands; the first priority would be for administrations to provide information for those frequency bands of high economic interest where market mechanisms would apply. This would for most administrations limit the amount of data to be provided.

The fifth type of information, national spectrum policy and strategy, in the format of documents, will also be added to EFIS in 2007, and also this cost will be borne by ERO.

With regard to the **Further Requirements** in Annex 1, ERO has already allocated more effort to EFIS (an additional 176 man-days per annum) in order to have the necessary resources to ensure quality and reliability of the data content in EFIS and to encourage more administrations to upload information. A number of potential new participants within CEPT will be approached with the aim to assist the administration with a first upload of information in a step-by step-approach. ERO may, if required, visit those administrations that need more intensive help. ERO will also check regularly with administrations for updates of their data. In addition, ERO will monitor the development of harmonised standards under the R&TTE Directive and the development of ECC Decisions in order to make references to those in EFIS. Furthermore, to aid identification of out-of-date information, a revision date for updates of data will be included in the software.

A list of national contact persons in Administrations responsible for updates and uploading national information to EFIS already exists. ERO will check that the national contact persons listed are also those to whom queries concerning usage rights and general guidance on finding national spectrum information (which cannot be found in EFIS) should be directed, and, if not, that they are able to redirect the query to the relevant person within the Administration.

In order to monitor the quality of the information presented, feedback mechanisms will be established for user-related aspects (incorporated in the web user interface) as well as for aspects of data integrity.

12.2 Recommendations

Administrations are advised to make use of the resources available in ERO for assistance with regard to publication of spectrum information in the portal. Now that ERO can offer tools, utilities and support to assist administrations in their effort to provide spectrum information in EFIS, development of similar software on a national level can be avoided, which in most cases will mean a substantial reduction in cost for Administrations.

- For most countries, the table of national frequency *allocations* (the terms relate to ITU services) is available. A list of *applications* will usually be developed as a separate table, and perhaps in another format. *Radio interfaces* could also be formatted differently from other information. They would be notified to the EC as regulated interfaces under the R&TTE Directive. The information on *rights to use* the radio spectrum relates to national frequency assignments, which are usually recorded in a separate database.
  For each of these types of information, ERO will advise on and assist with transferring national data into EFIS standard format. After this initial step regular maintenance is less intensive, since the necessary changes are often

minimal and can even be done manually. ERO may, if required, visit those administrations that need more intensive help.

- Instead of entering data manually, Administrations are advised to avail themselves of the facility of automatic download from EFIS in the form of an XML file either of the European Common Allocation Table (ECA) or of the national data of another administration. This data can then be customized to reflect country-specific information and then uploaded. This method is in most cases far less time-consuming than manual entry. The XML upload facility will be provided free of charge by ERO.

- Tools and utilities for maintenance and upload of frequency information to EFIS (ref section 11) have been made available to ERO which will coordinate and distribute these to administrations on request and free of charge, providing support with the development of a national solution (establishing the relevant databases and data transfer software) including automatic data upload to EFIS.

- Recently ERO established an EFIS competence centre with the aim to assist national administrations in setting up a frequency information database with EFIS extension. As this offers an all-in-one solution, it is recommended for administrations that have to acquire a new system or upgrade a major part of an existing system. A tool for extracting information from an existing database and submitting this to EFIS in right XML format is also available.

- Maintenance of EFIS data is critical. To guarantee a good synchronization of the relevant data, a close connection should be established between any national source of information and EFIS. All information should preferably be maintained in one location, with automatic synchronization of the data in all other places.

- Translation into English is a must. As the terminology used in both national data and in EFIS standard data should match, this is a specialist job.

LIST OF RADIO SERVICES IN THE ITU RADIO REGULATIONS (RR)

This is the list of services, which have an allocation in Article S5 of the RR.

For the purpose of this decision the List of Radio Services in the ITU RR is divided into three layers of detail in accordance with the definitions given in the RR. When searching for and comparing information EFIS makes use of these layers. For example, a search for a specific term in layer 2 will automatically start a search for all terms in layer 3 under that specific term. If nothing is found in either layer 2 or 3, EFIS also checks layer 1 and informs the user if there is a hit.

Layer 1	Layer 2	Layer 3
Amateur		
Amateur-Satellite		
Broadcasting		
Broadcasting-Satellite		
Earth Exploration-Satellite	Earth Exploration-Satellite (active)	
	Earth Exploration-Satellite (passive) **Meteorological-Satellite**	
Fixed		
Fixed-Satellite		
Inter-Satellite		
Mobile	Aeronautical Mobile	Aeronautical Mobile (R) Aeronautical Mobile (OR)
	Land Mobile	
	Maritime Mobile	Maritime Mobile (distress and safety)
		Maritime Mobile (distress and calling)
		Maritime Mobile (distress, safety and calling)
	Mobile (distress and safety)	
	Mobile (distress and calling)	
	Mobile (distress, safety and calling)	
	Mobile except aeronautical mobile	
	Mobile except aeronautical mobile (R)	
Mobile-Satellite	**Aeronautical Mobile-Satellite**	**Aeronautical Mobile-Satellite (R)** **Aeronautical Mobile-Satellite (OR)**
	Land Mobile-Satellite	
	Maritime Mobile-Satellite	
	Mobile-satellite except aeronautical mobile-satellite	
	Mobile-satellite except aeronautical mobile-satellite (R)	
Meteorological Aids		

Layer 1	Layer 2	Layer 3
Radio Astronomy		
Radiodetermination	Radionavigation Radiolocation	Aeronautical Radionavigation Maritime Radionavigation
Radiodetermination-Satellite	**Radionavigation-Satellite** **Radiolocation-Satellite**	**Aeronautical Radionavigation-Satellite** **Maritime Radionavigation-Satellite**
Space Operation		
Space Research	Space Research (active) **Space Research (deep space)** Space Research (passive)	
Standard Frequency and Time Signal		
Standard Frequency and Time Signal-Satellite		

N.B.:

For all **bolded** services it is possible to give them none, one or more of the following 3 attributes:
 (space-to-Earth)
 (Earth-to-space)
 (space-to-space)

For example:
Fixed-Satellite (space-to-Earth) (Earth-to-space)
Space Operation (Earth-to-space) (space-to-space)

LIST OF SEARCHABLE APPLICATIONS

Explanatory Note

The list of Searchable Applications has been developed in order to allow an efficient and meaningful search for frequency information within Europe. It is based on the following principles:

1. The list should facilitate an efficient and meaningful search and not a legally binding description of the Application terms used.

2. The list should only use unambiguous terms, which give clear guidance for data entry and retrieval.

3. The List of Searchable Applications is complementary to the List of Radio Services in the ITU RR and it is meant to describe the actual utilisation of the frequency bands. In other words, the List of Radio Services in the ITU RR gives the regulatory framework and the List of Searchable Applications gives the actual use.

4. The List of Searchable Applications should allow administrations to associate the terms used on a national level with the terms used in the list.

The List of Searchable Applications is divided into three layers of detail. This allows each administration to choose the level of detail it would like to indicate within a certain frequency band. When searching for and comparing information EFIS makes use of these layers. For example, a search for a specific term in layer 2 will automatically start a search for all terms in layer 3 under that specific term. If nothing is found in either layer 2 or 3, EFIS also checks layer 1 and informs the user if there is a hit. This functionality allows for an efficient and meaningful comparison, even though each administration has the flexibility to choose the level of detail it would like to indicate in a specific band.

Wherever possible administrations should use the highest detail possible (layer 3) when entering data into EFIS. In general, layer 3 only represents a few more specific expressions that do not necessarily cover all possible applications of the relevant term in layer 2. Those applications that are not covered by these more specific expressions are to be associated with the more general term in layer 2 or even in Layer 1, if necessary.

Due to the fact that some detailed applications can belong to 2 or even more general applications, e.g. the detailed application GPS can be regarded as an aeronautical, maritime or military application, they may show up several times in the list when presented in hierarchical mode. In alphabetical presentation mode each term in the list is only mentioned once.

The abbreviations used in the list are described at the end of this annex.

Layer 1	Layer 2	Layer 3
Aeronautical	Aeronautical communications	AGA communications (civil) Aeronautical satcoms SAR (communications) TFTS
	Aeronautical navigation	Beacons (aeronautical) Airborne weather radar Airborne doppler navigation aids Altimeters ASDE DME ILS Loran C MLS SAR (navigation) VOR
	Aeronautical surveillance	ADS ASDE Primary radar SSR
	Aeronautical telemetry	
	Satellite navigation systems	Galileo GPS Glonass
Broadcasting	Broadcasting (terrestrial)	AM sound analogue DRM FM sound analogue MWS TV analogue (terrestrial) T-DAB DVB-T
	Broadcasting-satellite receivers	Satellite radio Satellite TV SIT/SUT
	SAP/SAB and ENG/OB	In-ear monitors Professional cordless cameras Professional radio microphones SAP/SAB airborne video links SAP/SAB engineering links SAP/SAB remote control SAP/SAB P to P audio links SAP/SAB P to P video links SAP/SAB vehicular audio links SAP/SAB vehicular video links Talkback

Layer 1	Layer 2	Layer 3
Fixed links	Point-to-Multipoint	MWS Scanning telemetry Subscriber access excluding MWS Unplanned, uncoordinated fixed links
	Point-to-Point	Private fixed networks Public fixed networks SAP/SAB P to P audio links SAP/SAB P to P video links Unplanned, uncoordinated fixed links
	Multipoint-to-Multipoint (Mesh)	
Defence systems	Aeronautical military systems	AGA communications (military) Beacons (tactical) IFF JTIDS/MIDS RSBN TACAN-DME
	Land military systems	Fixed radio relay (military) Tactical radio relay Tactical mobile
	Maritime military systems	Sonobuoy
	Meteorological aids (military)	
	Radiolocation (military)	Tactical radar Air-defence radar
	Satellite systems (military)	Earth exploration-satellite (military) GPS Glonass Satellite communications (military)
	Telemetry (military)	
Land mobile	Digital cellular	GSM GSM-R IMT-2000/UMTS
	Analogue cellular	NMT TACS
	Cordless telephones	DECT CT0 CT1 CT1+ CT2
	Emergency services	PLB
	Inland waterway communications	

Layer 1	Layer 2	Layer 3
	Paging	ERMES On-site paging Wide area paging Talkback pocket unit
	PMR/PAMR	PMR PAMR DMO PMR 446 TETRA TETRAPOL
	SAP/SAB and ENG/OB	In-ear monitors Professional cordless cameras Professional radio microphones SAP/SAB airborne video links SAP/SAB engineering links SAP/SAB remote control SAP/SAB P to P audio links SAP/SAB P to P video links SAP/SAB vehicular audio links SAP/SAB vehicular video links Talkback
	Telemetry (civil)	Scanning telemetry
Maritime	GMDSS	DSC EPIRBs MSI NAVTEX SAR (communications) SAR (navigation)
	Satellite navigation systems	Galileo GPS Glonass
	Maritime communications	AIS Inland waterway communications INMARSAT Port operations On-board communications Ship movement
	Maritime navigation	Beacons (maritime) Inland waterway radar Loran C Maritime radar SAR (navigation)
Meteorology	Oceanographic buoys Sondes Weather radar Weather satellites Wind profilers	

Layer 1	Layer 2	Layer 3
Satellite systems (civil)	Aeronautical satcoms	INMARSAT
	Amateur-satellite	
	Broadcasting-satellite receivers	Satellite radio Satellite TV SIT/SUT
	Earth exploration-satellite	Active sensors (satellite) Passive sensors (satellite) Synthetic aperture radar Weather satellites
	Feeder links	
	FSS Earth stations	VSAT SIT/SUT SNG ESV
	Inter-satellite links	
	MSS Earth stations	INMARSAT IMT-2000 satellite component S-PCS
	Satellite navigation systems	Galileo GPS Glonass
	Standard frequency and time signal-satellite	
	Space operations	
	Space research	Active sensors (satellite) Deep space (satellite) Passive sensors (satellite)
Radio astronomy	Continuum measurements Spectral line observations VLBI observations	
Short range devices	Alarms	Social alarms
	Railway applications	AVI Eurobalise Euroloop
	Detection of avalanche victims	
	Detection of movement and alert	
	Inductive applications	
	Medical implants	ULP-AMI
	Model control	Flying Model control
	Non-specific SRDs	

Layer 1	Layer 2	Layer 3
	Radio microphones	Professional radio microphones Consumer radio microphones Aids for handicapped
	Wideband Data Transmission Systems	HIPERLANs Radio LANs DECT
	RFID	
	RTTT	RSU OBU Vehicle and infrastructure radar SRR
	Wireless audio applications	
Other	Amateur	
	CB radio	AM CB PR 27
	D-GPS	
	HAPS	
	ISM	Microwave ovens
	Meteor scatter communications	
	Land radionavigation	
	Radiolocation (civil)	
	Standard frequency and time signal	
	Tracking systems	

ABBREVIATIONS

ADS	Automatic Dependant Surveillance (Aeronautical)
AGA	Air-Ground-Air
AIS	Universal Shipborne Automatic Identification System
AM	Amplitude Modulation
ASDE	Airport Surface Detection Equipment
AVI	Automatic Vehicle Identification
CB	Citizen's Band
CT	Cordless Telephone
DECT	Digital Enhanced Cordless Telecommunications
D-GPS	Differential Global Positioning System
DME	Distance Measuring Equipment
DMO	Direct Mode Operation (PMR)
DRM	Digital Radio Mondiale
DSC	Digital Selective Calling
DVB-T	Digital Video Broadcasting - Terrestrial
EAS	Electronic Article Surveillance
ENG/OB	Electronic News Gathering / Outside Broadcasting
EPIRBs	Emergency Position Indicating Radio Beacons
ERMES	Enhanced Radio Messaging System
ESV	Earth Stations on-board Vessels
FM	Frequency Modulation
FSS	Fixed-Satellite Service
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GSM-R	Global System for Mobile Communications on Railways
HAPS	High Altitude Platform Station
HIPERLANs	High Performance Radio Local Area Networks
IFF	Identification Friend or Foe
ILS	Instrument Landing System
IMT-2000	International Mobile Telecommunications-2000
ISM	Industrial, Scientific and Medical Applications
JTIDS	Joint Tactical Information and Distribution System
LANs	Local Area Networks
MIDS	Multifunctional Information Distribution System

MLS	Microwave Landing System
MSI	Maritime Safety Information
MSS	Mobile-Satellite Service
MWS	Multimedia Wireless System
NAVTEX	Narrow-band direct-printing telegraphy system for transmission of navigational and meteorological warnings and urgent information to ships
NMT	Nordic Mobile Telephone
OBU	On-Board Units
PAMR	Public Access Mobile Radio
PLB	Personal Locator Beacon
PMR	Private (Professional) Mobile Radio
RFID	Radio Frequency Identification
RSBN	Radiolocation System for Short Range Navigation (Abbreviation stands for the Russian term)
RSU	Road Side Units
RTTT	Road Transport and Traffic Telematics
SAB	Service Ancillary to Broadcasting
SAP	Service Ancillary to Programme making
SAR	Search and Rescue
SIT/SUT	Satellite Interactive Terminal / Satellite User Terminal
SNG	Satellite News Gathering
S-PCS	Satellite - Personal Communications System
SRDs	Short Range Devices
SRR	Automotive Short Range Radars
SSR	Secondary Surveillance Radar
TACAN	Tactical Air Navigation
TACS	Total Access Communications System
T-DAB	Terrestrial Digital Audio Broadcasting
TETRA	Terrestrial Trunked Radio
TETRAPOL	Digital PMR technology
TFTS	Terrestrial Flight Telecommunication System
TV	Television
ULP-AID	Ultra Low Power Animal Implant Devices
ULP-AMI	Ultra Low Power Active Medical Implants
UMTS	Universal Mobile Telecommunications System
VLBI	Very Long Baseline Interferometry
VOR	VHF Omnidirectional Radio Range
VSAT	Very Small Aperture Terminal