

# THE ORGANIZATION OF FREQUENCY SPECTRUM MANAGEMENT IN FRANCE A SCHEME OF FLEXIBLE ORGANIZATION APPROPRIATED FOR INTRODUCTION OF INNOVATIVE RADIO SYSTEMS IN THE RADIO FREQUENCY SPECTRUM

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## ABSTRACT

The organization of this management must be designed in such a way that it allows in a dynamic environment the introduction of new and innovative radio systems in suited frequency bands. The institutional environment must be stable to reduce uncertainties and insure the developments and the operations of radio network while being enough flexible to be able to introduce innovations or innovative systems. Such a method needs to implement a complex system which, to be run, has to combine various interdisciplinary aspects recovering as well the physics of the radio electric waves, the techniques of different radio systems, the laws about public goods as economics and market demand. This contribution describes the French organization.

## INTRODUCTION

There are debates in many countries around the World for introducing new systems or new technologies. Indeed, leaning on the history of “commons”, ones are supporting that the private property is the most effective in the exploitation of the scarce resources, taking into account examples that may be not relevant in the case of frequency resource. Others, leaning on the development of technologies demonstrate that in the opposite way that the “commons” model is the advantageous path for all. In parallel we notice that a number of administrations distinguishes the spectrum intended for an exclusive use by the administrations, the defence and commissioned agencies (governmental spectrum), from spectrum used by industry, the others do not make this strong distinction and are considering radiofrequency spectrum as a whole entity.

The organization of the radio frequency spectrum at the level of a state gives a structure of the future, especially in the debate about the **spectrum property** and the **trading of rights to use frequencies**. Foundations of the organization are important to provide the market with the certainty required to ensure the growth and innovation and they allow or not an easy implementation of the trading of property rights of use of frequencies recently introduced the Directives and the “Spectrum” Decision of the European Parliament and the European Council.

The **design of the frequency management organization** has a great importance and gives a frequency management more or less flexible. **Flexibility** has the meaning of the capacity to move easily from a stable condition to an other one which is also stable as the previous one. For the spectrum management, flexibility means possible modifications of the allocations of frequency bands or level of the protection of the quality of spectrum. It may need an action from State to compensate the market failures. This point will be solved by the use of a **relocation funds** directly or indirectly managed by the spectrum organization which is explained hereafter. This basic principle reminds that of land management theory by D. Ricardo and L. Walras for who the value refers not only the scarcity but to the use.

## THE IMPORTANCE OF THE DESIGN OF FREQUENCY MANAGEMENT ORGANISATION

We thus notice that several types of organizations exist through the World. Due to historical reasons, importance is given to regulation of networks and competition aspects; less to radiofrequency spectrum that was left to the competence of state administration. We can note that the choice of an organisation has to live together with very strong organisations: Defence, broadcasting, civil aviation and civil telecommunications, each organisation requiring important uses of spectrum. The scheme of organisation makes the modifications of allocations between these users more or less flexible. One of the best schemes is to associate their regulators in the spectrum process. In this case, frequency demand can be discussed and frequencies transferred between users.

In fact, it is necessary to make a separation between the aspect of property of the radio electric frequency spectrum and the management of this property. This point opens the discussion about the proprietary of the spectrum and the proprietary rights to use the spectrum. In many spectrum organisations, there is confusion between the radio frequency spectrum itself and the monopoly of its management made by the state or within a state organisation. Due to unclear rules of property, questions could raise when trying to create a policy in favour of an efficient trade of rights to use frequencies.

## PROPERTY OF RADIO FREQUENCY SPECTRUM

The French state entrusted the management of the whole spectrum to a state agency (the “Agence Nationale des Fréquences – ANFR” <http://www.anfr.fr>). Besides the technical management, this one represents the state in the International and European Conferences on specific topics of radio frequency spectrum. The Agency has the duty to prepare and to present the national frequency table to Prime Minister who authorizes by an order the allocations of frequency bands to the ministerial departments and to the independent authorities after approval of the board of the Agency. Its members represent the stakeholders: *affectataires*, budget, industry representatives and independent experts. These members representing the radiocommunications industry give independent and balanced opinions on the use of spectrum with a view in a long term.

Radio spectrum is clearly defined as State public property (*domaine public*). Due to the law, a personal authorisation (*intitu personae*) is mandatory. As said before, at a first level, the government allocates frequency bands to various Radiocommunication services in different frequency bands managed by 8 government departments and 2 independent authorities (CSA for broadcasting and ARCEP for civil radiocommunications) called *affectataires*. In conformity with No. 18.2 of the Radio Regulations, at a second level, authorizations are granted for the use of spectrum (either directly or through independent authorities for private entities).

By the French law, State public property cannot be sold or alienated. In accordance with the laws, **the State has the duty to look after its property and to use it efficiently**. Especially, this obligation justifies the investments made for implementing and operating a radio-monitoring network. Also, it justifies the studies on spectrum engineering made to use efficiently the frequencies. There are other obligations ruled by the law (fees, access, economics of public goods that must be used in view of maximising the community surplus and national welfare, compromise between sovereign services and private purposes, fair partition of the resource between users). That means spectrum management has to take into account simultaneously government uses, private enterprise interests and consumers benefits, i.e. all the spectrum stakeholders interests.

To carry out these tasks, ANFR relies on its technical departments and **consultative committees** associating technical directorates of *affectataires*, industry (manufacturers and operators) and independent experts within which consensus is sought and found. The latest example is the work on the digital dividend obtained after the switch-off of analogue TV in bands III, IV and V. This organization makes possible dialogues between all spectrum stakeholders, facilitates interaction with the market, allows the estimate of spectrum demand and makes easier spectrum refarming in order to meet increasing the civil spectrum demands.

## THE AUTHORISATIONS AND THE SECONDARY MARKETS

The **property rights** of the use of spectrum (including obligations) derive from the status of State public property. As said before, by an order of the Primer Minister, the whole spectrum is allocated at a first level to 10 ministerial departments and independent authorities; there is no piece of spectrum unallocated. The governmental departments receive the capacity to assign frequencies for their own different users (as army, police, first responder services ...). The independent authorities receive also the capacity to manage and assign frequencies for their own uses. Especially, the telecommunication authority assigns frequencies or gives authorisation for allotments in specific bands with technical conditions for the authorised uses. The operators report to the authority.

At the first level, sharing of frequency bands between *affectataires* (band managers) is of principle. There is an exclusive application only when sharing is demonstrated as impossible. Thus, practise of a form of **secondary market** exists between *affectataires*. At this first level, often exchanges and introduction of new applications are made on bilateral technical discussions and achieve quickly the treatment of the demands. In case of difficulties, the two or more parties put the discussions within a committee involving all *affectataires* which has to conclude formally on the demand. If necessary, it could require the technical departments of the Agency to produce spectrum compatibility studies; there the Agency is playing its role of a **trustworthy third party**. It could be recommended to the relocation funds to be sued.

At the second level, for private authorized users, within a specific band, an order to organize the secondary market of authorised rights of uses of frequencies is planned for the end of this year. Nevertheless, this is not completely new, within the law on the *domaine public*; an incumbent gets the possibility to introduce a buyer to administration. When there is no controversial access to the concerned frequencies, the transfer is automatically authorised.

On dense areas, in order to implement new networks or to expend existing networks, licensee holders use to negotiate modifications of frequency assignments. For example, an operator can offer to modify the antenna pattern of an existing network in order to add a new assignment in his network; modification is based on technical analyses. Due to the fact

that the rights of use of frequencies are clearly defined, the new assignments are easily registered, creating new property rights. However, the number of modifications is low and until now, it does not justify to set up of a spectrum market place. Ten years ago, considering that PMR was working in an apparent self organisation, it was studied a catallaxy approach for PMR, but after analysis it has appeared that it was not credible due to uncertainties. The apparent self-organisation exists only with a strong administration.

Other example of reorganisation of frequency bands has been implemented in GSM sector between GSM operators that were operating 900 MHz band and the last one who received an 1800MHz band. The results of negotiation were benefit for the 3 GSM operators that could operate each the two bands and their agreement was registered and the rights to use frequency bands were modified (see <http://www.arcep.fr>). Other examples exist such as the sharing of ENG/OB with radars; but all are not successfully demonstrated such as wireless systems in 5.8 GHz.

#### THE INTRODUCTION OF NEW TECHNOLOGIES

Two aspects have to be envisaged. i) The first one is an experiment of new technologies and the introduction of systems for few users. After checking the frequency compatibilities, the relevant regulator in charge of the concerned operators gives an authorisation of use of frequencies (if needed, with the agreements of other *affectataires* in the concerned bands). ii) The second case is the introduction for public on a large basis. Of course this case needs to be studied carefully which is made by Agency spectrum engineering department in association with stakeholders (including the concerned industry).

Concerning the uses of underlay and overlay systems, the allocations of frequency are covered by the laws on the *domaine public*, they need a specific authorisation (which can be a general authorization) of use of frequencies, they are not included in an existing authorised use of frequencies (GSM for example). Nevertheless, in order to keep a good quality of spectrum, before to authorise these systems, it must be showed that the spectrum compatibility criteria and parameters are acceptable. So, new technologies, such as UWB to be used by a large numbers of users, need to be considered carefully. Due to that this technology is addressed to global market, it is justified to organise technical studies at the European and international levels to ensure that there will no unforeseen damages to the quality of spectrum (see CEPT ECC TG 3 –Report 63 - <http://www.ero.dk>) and ITU-R TG 1/8. Others new techniques such as SDR, cognitive radios are also under studies for general uses. The quality of spectrum is a concern for all stakeholders, including entrant candidates and the level of quality needs to be clearly accepted by the whole community. The current degradation could be envisaged only if there is no impact for the current uses and if it is benefit for the whole community, covering economical aspects. The ANFR is involved in studies and it is able to play its role of a **trustworthy third party**.

#### THE RELOCATION FUND

The introduction of new applications and new technologies requires access to spectrum. The ultimate goal of spectrum management is to give access to spectrum to interested parties in due time, while ensuring the overall efficiency of spectrum use and avoiding harmful interference between spectrum users. New applications are developed taking into account available spectrum that may be optimised within the constraints inherent to the frequency band selected. Depending on intensity of its utilisation by other entities, the frequency band selected may offer varying degrees of difficulty for accessing for new applications. Some incumbent users have the flexibility to move their equipment from one frequency band to another one and may accept to vacate spectrum, if needed, with provided adequate encouragement or compensation. Others could not accept it, due to high investments not yet depreciated. There is a balance between the goals of the demand and the protection of the investments made, especially for recent public investments.

In recent years, making spectrum available to satisfy **European and/or Global Harmonization** has required the relocation of many users. So, the introduction of innovative technologies such as GSM and IMT-2000/UMTS, RLAN, wireless local loop, digital television broadcasting or a specific demand such as PMR 446 requires access to spectrum to demonstrate their viability and to succeed.

This problem is not new. In the past, the cost of spectrum relocations was supported by the national operators and by administrations. Now, the question of accessing to spectrum and the means of relocating incumbents has appeared with the deregulation of telecommunications, and has been addressed in various ways. The following step of introducing flexibility is depending on the ease to move incumbents.

One theoretical way is “to let the market do it”, for example through secondary trading. However, we can note 1) that users want to continue to operate their networks and to protect their investments. 2) This is not suitable for the introduction of unlicensed uses in frequency bands which are unlikely to be opened to spectrum trading. It is

significant, that in recent year, most of new technologies/applications (e.g. GSM, UMTS, RLANs) have been introduced through spectrum relocations in situations which would be obviously unsuitable for spectrum trading. In such instances where secondary trading may not be a suitable option due to market failures, additional flexibility may be sought by efficiently managing spectrum relocations, through specific tools such as relocation funds.

The fulfilment of this complex task might be possible only by applying specific tools: primarily engineering, but then general regulatory, financial and political measures. Report ECC REP016 (Reforming and secondary trading in a changing radiocommunications world) and Recommendation ITU-R SM.1603 (Spectrum redeployment as a method of national spectrum management) describe the reforming process, associated economic aspects and reforming instruments that can be used as guidelines for national consideration of relocation issues. According to their analysis and conclusion, spectrum relocation is a spectrum management tool, which can be used to cater for new market demand, increase spectrum efficiency, work towards international harmonisation of spectrum usage or respond to changes in international frequency allocations. In addition, spectrum reforming makes it possible to observe the timetable laid down for the availability of frequencies to new entrants.

### **Principles about relocations**

The main principles to be applied in deciding on spectrum relocations can be summarised as follows:

- Keep open competition to be maintained and transparency when introducing new entrants while taking into account economical aspects of existing networks (including governmental networks)
- Avoidance of negative external effects by introducing direct interventions of state
- Avoidance of access barriers for entry in spectrum such as no excessive entry costs (transaction costs for example...), no creation of situations which may allow to retain frequencies or to introduce speculation and no cartelisation and no need of setting up hoarding by a new entrant
- Put the value on the creation of networks and intensive use of frequencies;
- Fight against inertia of capital due to uncertainties, for example, created by asymmetrical information (unknown occupancy of frequencies or in part of concerned spectrum)
- Avoid coordination problems that could be lead to viscosity for investors or possible destabilizing activities, etc and make the discussions easier between incumbents and new entrants (especially by suppressing transaction costs). A centralized authority facilitates this coordination and avoid chaotic management (for example it shows its interest when introducing wide band systems in a frequency and allocated to a narrow band systems operated by a multitude of users)
- Facilitate European and Global harmonisation and innovation
- Keep flexibility in the management of the use of spectrum and again to avoid chaotic situations
- For the State to carry out its duties as owner of State public property, in particular to keep control of spectrum and ensure efficient and timely use
- Give predictable results.

In order to keep advantage of this concept, the body responsible of the management of a Relocation Funds has to be considered as a trusted third party.

### **Results in France**

Since 1997, 75 millions euros have been spent to release frequency bands (altogether a 260 MHz bandwidth) in order to satisfy in particular new market demands such as IMT-2000 (150 MHz), GSM-1800 (25 MHz) and WiFi (83 MHz). Since 2003, the Relocation Fund is also used for the introduction of digital terrestrial television in frequency analogue networks for which there is no yet decision of switch-off. It should be noted that the Relocation Fund **is not a grant** from State but a financial trigger to facilitate the relocations and to avoid delays when frequency bands have been released in due time for interested parties (example of schedule for introducing UMTS). This fund recovers its advance near the beneficiaries. Private participations in this fund are possible and private funds can be organized in parallel. However, this structure seems to create certainty to investors that have subscribed in the important UMTS and digital TV operations, and it is strongly supported by all stakeholders.

### **CONCLUSION**

The French administration opted in 1996 for an organization that gives the management of the radiofrequency spectrum to a government agency and delegates the authorization of the uses of frequencies to regulators. **The duty of the spectrum management organization is not to regulate the operators or to control the contents of broadcasting programs, but to put on the market the amount of spectrum it requires in order to maximise the community benefit and to maintain the quality of this spectrum** corresponding to an expected efficient use.