Authorization

Authorization is the process by which users gain access to the spectrum resource. This may involve assigning specific frequencies to users, allotting certain frequency bands or sub-bands to specific users who may or may not be able to transfer such spectrum rights to others or it may mean simply authorizing the use of specific equipment or categories of equipment. It is important to distinguish between methods for determining who will have access to spectrum versus determining the cost of such access (see also **Section 4** and **Section 5**).

5.3.1 INTRODUCTION TO AUTHORIZATION

With spectrum authorization, the spectrum manager approves the use of radiocommunication equipment and permits the use of radio frequencies to specific users or classes of users, in accordance with the national and international table of frequency allocations. Authorization processes contribute to the proper functioning of national spectrum-management operations and provide access to sufficient amounts of spectrum. Authorization activities include licensing, examination, certification of radio operators, authorization of equipment, type approval, type acceptance and international notification and registration. In terms of licences, there are various types, including individual licences, system licences, class licences, and general authorizations.

The spectrum manager can choose from a mix of authorization mechanisms: traditional administrative, market-based and unlicensed spectrum - as some uses of spectrum are not licensed - and also determine the appropriate spectrum revenue and spectrum pricing objectives, policies, regulations, mechanisms, and fee schedules. Unlicensed spectrum use does not mean unregulated use since the radio equipment and interference parameters will still need to comply with certain technical standards such as FCC Part 15 Rules for Ultra Wideband Devices. Spectrum authorizations promote awareness of users' operational obligations and user rights and that the spectrum manager has sufficient data to ensure effective and efficient operations.

The authorization of spectrum in connection with licensing of telecommunications service providers is important given the expansion of mobile telecom services and the liberalization of telecom markets in developing and emerging economies. It is important that the regulatory process facilitates granting, at virtually the same time, authorizations to operate a telecommunication service and to use the required radio spectrum. There should be no delays or risks of inconsistent regulatory requirements between the two types of authorizations. This is also the case for authorizing broadcasting undertakings and associated spectrum authorizations. If two separate authorizations are issued, they should be issued simultaneously.

There are a number of administrative methods that are used to manage processes by which access to spectrum may be granted. These include “a first come-first served basis”, a reserved basis for certain uses or users in a form of a-priori planning and so-called beauty contests, which may be held to decide who will be assigned certain frequencies or bands of frequencies. Economic methods such as lotteries or auctions may also be employed. There are clear advantages and disadvantages for each method and these are explored in more detail below and in: **Section 5.0 Spectrum Pricing**.

Improved technology used in analyzing spectrum use (**See Spectrum Monitoring Activities Section 6.2**) and information systems are playing more important roles when assigning and keeping track of spectrum use, as well as aiding in administrative functions such as collection of licence fees and preparing submissions of various information to other countries (or to the ITU where required). It is very important to tailor systems and the application of such technologies to the real requirements and to the available resources. Maintenance of any such information systems must be ensured which underlines the need for competency in such systems.

No matter what method is used for assigning frequencies, some level of spectrum engineering support is required to ensure, inter alia, that the use of frequencies authorized will not result in interference or to resolve any cases of intra-national or international interference that might arise. Such capability is also required to assess, for example, some of the newer technologies such as software defined radio equipment.

The next sections discuss: Assigning Frequencies and related sub-topics including Methods for Assigning Frequencies; Relation to Other Authorizations and the important subject of the Impact of Technological Innovation and the Impact on

Authorization; as well as providing an overview of several technical topics, such as Certification of Radio Operators and Equipment Authorization.

RELATED INFORMATION

Authorization of Telecommunications Services Module – Section 6.6 Spectrum Authorization

◂ Box 1 European Union General Authorizations

Source: EU Decision No 676/2002/EC

The Radio Spectrum Decision lays the foundation for a general EU radio spectrum policy and is binding on all Member States. The objective of the Radio Spectrum Decision is to ensure coordination of radio spectrum policy approaches by facilitating harmonized conditions for the availability and efficient use of radio spectrum.

Member States shall facilitate the use of radio frequencies under general authorizations. Where necessary, Member States may grant individual rights of use in order to:

- avoid harmful interference,
- ensure technical quality of service,
- safeguard efficient use of spectrum, or
- fulfill other objectives of general interest as defined by Member States in conformity with Community law.

A number of key recommendations related to spectrum authorization are contained in the European Commission 2007 Review concerning spectrum management. These were as follows:

- **Increased Use of Market Mechanisms** - The current spectrum management and distribution system is generally based on administrative decisions that are insufficiently flexible to cope with technological and economic evolution, in particular with the rapid development of wireless technology and the increasing demand for bandwidth. The undue fragmentation amongst national policies results in increased costs and lost market opportunities for spectrum users, and slows down innovation, to the detriment of the internal market, consumers and the economy as a whole. Moreover, the conditions for access to, and use of, radio frequencies may vary according to the type of operator, while electronic services provided by these operators increasingly overlap, thereby creating tensions between rights holders, discrepancies in the cost of access to spectrum, and potential distortions in the functioning of the internal market;
- **Technology and Service Neutrality1** - Flexibility in spectrum management and access to spectrum should be increased through technology- and service-neutral authorisations to let spectrum users, choose the best technologies and services to apply in a frequency band (hereinafter referred to as the 'principles of technology and service neutrality'). The administrative determination of technologies and services should become the exception and should be clearly justified and subject to regular periodic review;
- **Freedom to Chose** - Spectrum users should also be able to freely choose the services they wish to offer over the spectrum subject to transitional measures to cope with previously acquired rights. It should be possible for exceptions to the principle of service neutrality which require the provision of a specific service to meet clearly defined general interest objectives such as safety of life, the need to promote social, regional and territorial cohesion, or the avoidance of inefficient use of spectrum to be permitted where necessary and proportionate. Those objectives should include the promotion of cultural and linguistic diversity and media pluralism as defined in national legislation in conformity with Community law. Except where necessary to protect safety of life, exceptions should not result in exclusive use for certain services, but rather grant priority so that other services or technologies may coexist in the same band insofar as possible. In order that the holder of the authorisation may choose freely the most efficient means to carry the content of services provided over radio frequencies, the content should not be regulated in the authorisation to use radio frequencies (there is no specific mention of must-carry obligations as typically imposed on cable broadcasters);
- **Spectrum User Rights** - In the interests of flexibility and efficiency, national regulatory authorities should, in bands which will be identified on a harmonised basis, also allow spectrum users to freely transfer or lease their usage rights to third parties, which would allow spectrum valuation by the market. In view of their power to ensure effective use of spectrum, national regulatory authorities should take action so as to ensure that trading does not lead to a distortion of competition where spectrum is left unused.

Decision No 676/2002/EC of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision).

The idea that a spectrum authorization can be issued which is technology neutral is being replaced by a concept of technology flexibility since interference cannot be entirely avoided.

Reference Documents

- Bahrain- Invitation to Apply for Second Mobile Licence

5.3.2 ASSIGNING FREQUENCIES

For spectrum managers, spectrum authorization involves the licencing of radiocommunication equipment and the making of frequency assignments. The administration of licensing contributes to the proper functioning of spectrum management operations. Licensing places controls on the operation of radio stations and the use of assigned frequencies.

Spectrum authorization activities include analyzing requirements for proposed frequencies in accordance with national plans and policies for frequency allocation. They include actions to protect radiocommunication systems from harmful and obstructing interference. Spectrum authorization strategies are used to ensure proper use, facilitate reuse, and achieve spectrum efficiency.

For users and potential users of spectrum, it is important for them to know their rights and obligations with sufficient precision to allow them to make plans and avoid interfering with one another's activities. Except in the case of unlicensed spectrum, this is done at the stage of assignment of frequencies which thus becomes a key aspect of spectrum regulation especially if licences are granted for a long duration.

For example, the Comprehensive Free Trade Agreement being negotiated in 2009, between the EU and ASEAN includes Article 31 which ensures that the requirements for the attribution of frequencies by licensees are adequately specified in the terms of the licence. In the case of spectrum authorizations, this is particularily important when licensees have transfer, leasing or trading rights and the licensee is required to either seek approval from the regulator for the change or simply provide notice of the change.

Precisely what the spectrum manager has to do in order to achieve an effective assignment depends on the method chosen, and also upon linkages with other authorisations such as the issuing of broadcasting licences. New technological developments may change the methods used to issue authorisations and may require 'refarming' of spectrum. The process will require engineering and administrative support and, in some cases, financial support. These issues are discussed in the following sections.

Reference Documents

- **CEPT: Refarming and Secondary Trading in a Changing Radio Communications World: Executive Summary**

5.3.2.1 METHODS FOR ASSIGNING FREQUENCIES

Spectrum Overview - **Section 1.5** above provides an in depth discussion of the three major methods of granting users access to spectrum: by administrative methods, using market-based methods and by permitting access to unlicensed spectrum. For the purposes of the present discussion on spectrum authorization, only the first two are relevant, because the third does not involve assignment to, or licensing of, individual users.

In the case of administrative methods, a spectrum manager specifies detailed rules and constraints affecting how, where, and when spectrum can be used and who has access to spectrum. Minimizing harmful interference lies at the heart of the traditional model which places an emphasis on the technical management of radio spectrum.

Market methods are used at the initial issuance of a spectrum licence, when auctions are used, by allowing spectrum rights to be bought and sold (traded) over the lifetime of a licence, and allowing a change of use and transfer between users of the relevant spectrum.

Administrative methods of assignment and the use of market-based methods such as auctions have many elements in common. In both cases, utmost clarity is required about what rights and responsibilities are entailed by the licence. These must be specified in respect of technology, geography and time.

The most complex is technology. Under administrative assignment of licences to a particular user providing a particular service (a specified form of radar, GSM, etc.), the technological restrictions in the licence are normally defined in terms of the location, power and geographic coverage of the specified apparatus. The specifications are chosen to avoid interference with other users. Any departure by the licensee from these conditions is a breach of the licence. If, however, spectrum licenses are flexible and can be employed for any purpose – following a trade of the licence, for example – apparatus licensing of the kind described above does not work, as each possible use will be associated with different equipment. In these circumstances, licensees will have to face restrictions in what emissions their activities are allowed to make at the boundaries of the licence area – i.e. what spill over they can make into adjoining geographic areas and frequencies. This is considerably more complex.

The geographical scope of a licence is more easily specified once the interference issue noted above has been resolved. It may be the whole territory governed by the spectrum regulator, or a small subset needed for a radar or a local radio

station.

The duration of the licence must also be specified. **Section 4.2.4** on Market-based Methods – Licence Duration of this module discusses the pros and cons of shorter or longer licence durations.

Following the stage of definition of licensee rights and obligations, the administrative and market (auction) methods diverge. If an administrative method is employed, then the regulator must decide how to make the assignment. If there is no excess demand for spectrum licences, the method chosen might be 'first come, first served': the regulator would announce the available licences and invite applications. Applicants might have to be qualified in specified ways but qualified applicants would then be granted licences until they were exhausted.

If excess demand is anticipated, use of a competitive assignment process is normally preferred. For this to be done fairly and transparently, the regulator must set out the various criteria to be employed, relating for example to the technical and financial qualifications of applicants, their access to capital, the scope and geographical range of their services, and so on. Each criterion should have a pre-announced weight, and an objective method of measurement should be specified.

If an auction method is used to make an assignment, the procedures to be employed must be set out in fine detail to ensure that all competitors are on an equal footing. For example, if a sealed bid is employed, the date and place at which it must be lodged have to be clear. If an open auction process is utilised, in which bidders make offers for licences in successive rounds of bidding, a whole range of procedures relating to the frequency of rounds, increments in amounts bid, obligations to make new bids and so on must be specified. These points are discussed further in the Practice Note on auctions.

In all cases, it is vital that the regulatory body abide strictly by the conditions it has specified for the assignment. Any departure or evidence of partiality, prejudice or of conflict of interest will be damaging in several ways. First, legal challenges can delay the start of services of benefit to end users, possibly for many years. Secondly, doubts about the integrity of the process will deter companies from participating in competitive assignment processes. As a result, inferior candidates may be successful, leading to long term harm for consumers.

Reference Documents

- **Are spectrum auctions ruining our grandchildren's future? The Journal of Policy, Regulation and Strategy for Telecommunication Information and Media, Camford Publishing Ltd**
- **Breaking the Chains: Unlicensed Spectrum as a Last-Mile Broadband Solution, New America Foundation, Spectrum Policy Program, Spectrum Series working Paper No.7, June 2003**
- **Canada: Radio Station Licensing Procedure for Radiocommunication Service Providers, 2002**
- **Comments of 37 Concerned Economists**
- **Economic Case for Unlicensed Spectrum Below 3GHz**
- **Fixed Wireless Access (FWA) Spectrum engineering & Frequency Management Guidelines**
- **General Spectrum License for Radiocommunications Systems Related to the Integrated Licensing Regime**
- **India: Spectrum Auctions - Lessons from Experience, Telecommunications Policy (issue 25), 2005**
- **Lessons from the Spectrum Auctions and Beauty Contests , V.**
- **Regulation on Collective Frequencies for License-Exempt Radio Transmitters and on their Use**
- **Spectrum Issues for the 1990s: New Challenges for Spectrum Management**
- **Spectrum Trading in Germany, Austria and the UK: The influence of regulatory regimes and evaluation of criteria on competition in the European Mobile Telecommunications Sector, August 2003**
- **The Path towards Efficient Coexistence in Unlicensed Spectrum, Cargenie Mellon University, IEEE 802.16 Broadband Wireless Access Working Group, 30 April 2000**
- **The Question of Spectrum: Technology, Management and Regime Change, The Economics, Technology and Policy of Unlicensed Spectrum Research Conference (May 2005 Michigan)**

5.3.2.2 RELATION TO OTHER AUTHORIZATIONS

It should be noted that there are often other authorizations that are required in parallel with the spectrum authorization. In the case of telecommunication carriers, often telecom licensing is required (see the **Module 3. Authorization of Telecommunication/ICT Services**). The licensing of such telecom facilities can involve radio and non-radio based facilities, the former being subject to spectrum authorization as well as telecom licensing. In some countries, such licensing of

telecom carriers is performed by the same regulatory body which regulates the use of spectrum whereas in other countries, telecom licensing is carried out by a separate regulatory authority. Similarly, in the case of broadcasting, often a broadcasting licence separate from a spectrum authorization is required. Again, in some countries it is the same regulatory body that issues broadcasting licences as issues spectrum authorizations whereas in other jurisdictions, it is a different regulatory body. In some countries, the regulation of spectrum, telecommunications and broadcasting is all carried out by a single regulatory body.

In addition to these authorizations, there are often additional authorizations required for a radiocommunication facility. For example, if an associated antenna structure is above a certain height and/or within a certain distance of an airport, painting and lighting requirements may enter into play. These requirements are usually set out by the government authority responsible for air navigation safety. Another type of authorization that may be required in some countries is what is often referred to as local planning permission. The siting of antennas may be subject to local land use policies and authorizations confirming conformity with such policies may be required.

RELATED INFORMATION

The following references give examples of regulators in selected jurisdictions who are responsible for multiple service authorizations (television, radio, telecommunications), singular authorizations, and regulations concerning deployment of infrastructure (antenna in municipalities).

Ofcom is the independent regulator and competition authority for the UK communications industries, with responsibilities across television, radio, telecommunications and wireless communications services.

http://www.ofcom.org.uk

The CRTC is an independent agency responsible for regulating Canada's broadcasting and telecommunications systems.

http://www.crtc.gc.ca

The Nepal Telecommunications Authority is responsible for The National Broadcasting Regulation, 2052 (1995) and the licensing of broadcast facilities.

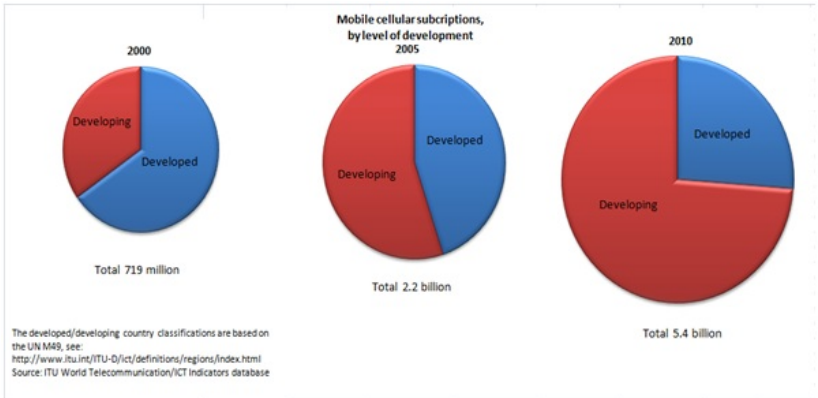
http://www.nta.gov.np/national_broadcasting_regulation_2052.html

Reference Documents

- **Botswana: The National Broadcast Board**

5.3.2.3 LIBERALIZATION AND THE IMPACT ON AUTHORIZATION

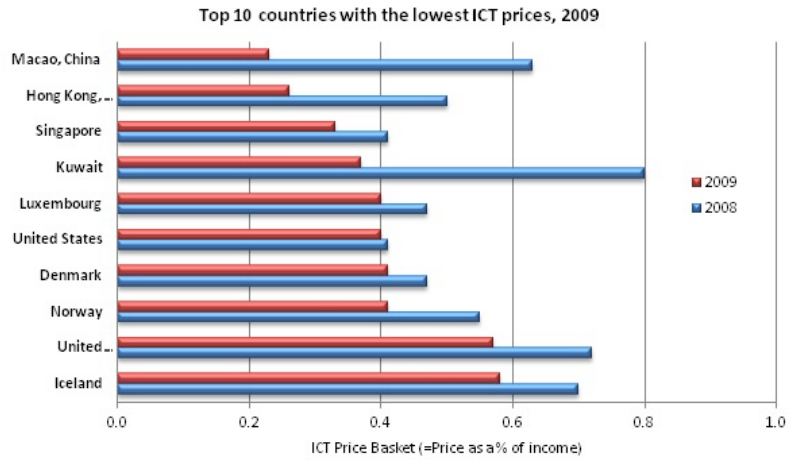
Liberalization, along with deregulation and privatization of telecommunication services, particularly within the mobile and ISP sectors, have been the dominant trends in the past ten years. As a result, competition has increased, demand has risen, ICT prices have fallen, and the quality of services has vastly improved. Mobile penetration in developing countries in Africa and Asia has reached approximately 45 and 62 per cent, respectively, with mobile penetration growing at a phenomenal compound annual growth rate over 22 per cent globally in 10 years. Indeed, amongst the least developed economies, mobile cellular subscribers outnumber fixed lines by more than nine to one. The balance has shifted between developed and developing countries with most of the growth in mobile subscriptions occurring in developing countries, as shown in Figure 3.2.3.1.



◂ Figure 3.2.3.1 Mobile subscribers worldwide by level of development 2000, 2005, 2010.

Photo: Source: ITU World Telecommunication Indicators Database.

The trend in ICT prices, as illustrated in Figure 3.2.3.2, is lower across developed and developing countries, even though new services (3G and mobile data) replace second generation mobile telephony. Correspondingly, new technologies and services (such as mobile data) have been developed alongside tapping into increased demand for services giving consumers and businesses more choice.



◂ **Figure 3.2.3.2 Top Ten Countries with lowest ICT Prices**

Photo: Source: ITU Measuring the Information Society 2010

There has been a shift away from the predominant traditional model, most notably in countries where demand for radio spectrum use is rising fast. Two features of more liberalized telecommunications regulation are:

- **Greater use of market-based mechanisms** - this covers competitive assignments (such as auctions) through to secondary trading. Within this environment, management is delegated as much as possible to participants within the spectrum arena. Spectrum management agencies in this setting perform the role of 'light-handed' regulation;
- **More flexibility in licensing and use** involves the relaxation of constraints on usage and technologies (either as a commons or in the form of managed shared use), as well as the possible expansion of licence-exempt frequencies. However, few countries have opened up large parts of the spectrum as a genuine commons. Most notably the United States has embarked on a path of considerable innovative activity. The use of WiFi, WiMAX and UWB in the US emerged many years before being deployed in most other countries, partly due the size of the market and as a result of regulatory actions designed to promote flexibility and unlicensed use.

Practice Notes

- European Commission – Spectrum Authorization Reform

Reference Documents

- ITU:8th Annual Global Symposium for Regulators - A Discussion Paper on Spectrum Sharing by Adrian Foster, Pattaya, Thailand, 2008

5.3.2.4 TECHNOLOGICAL INNOVATION AND THE IMPACT ON AUTHORIZATION

Technological innovation and wireless are synonymous. When this happens it can alter how radio frequencies should be used and assigned. This can become a problem and create a major challenge for the spectrum manager especially as the rate of change multiplies. Under an administrative procedure, when a licence expires a change of use can be a desirable approach with a new licence can be issued to provide the new service. Where a market regime involving secondary trading and change of use are in place, then spectrum user rights which are linked to the spectrum license permits the alteration to take place without regulatory intervention, if regulatory requirements concerning interference are in place. Indeed one of the arguments for the use of markets is that it takes the regulator out of the process of responding to technological change which is occurring at an increasing rate.

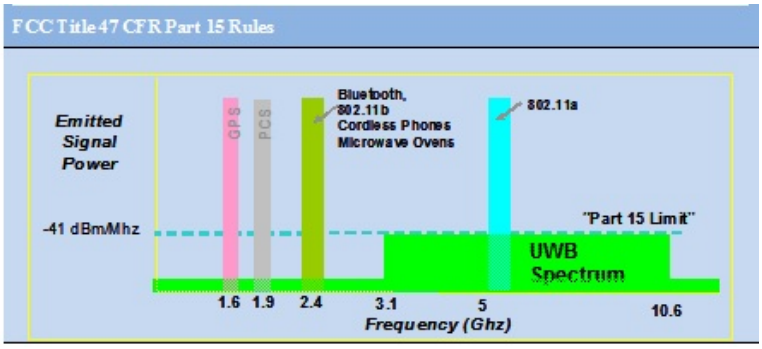
Technological innovation is a leading factor in improving the efficient use of spectrum. At the basic level the fullest possible use of all available spectrum is encouraged. Some measures of technical efficiency are needed to help regulators and users determine the degree of improvement in technical efficiency. Two measures of technical efficiency most commonly used are spectrum occupancy and utilization and data rate. Occupancy, for example, can be used as a measure of technical

efficiency; in the sense of how constant or heavy the usage of spectrum is over time. Data rate means how much data and information can be transmitted for a given amount of spectrum capacity.

In the next several paragraphs several broad categories of innovative technologies are introduced which are altering the landscape. These are Spectrum Underlay and Overlay technologies,

Spectrum Underlay is a spectrum management technique by which signals with a very low spectral power density can coexist, as a secondary user, with the primary users of the frequency band(s). The primary users deploy systems with a much higher power density level. The underlay leads to a modest increase of the noise floor for these primary users. Examples of spectrum underlay technologies include; Ultra-wideband (UWB) and Spread Spectrum,

Ultra-wideband spectrum is an active underlay technology which transmits information spread over a large bandwidth (>500 MHz) while sharing spectrum with other users. The FCC defines UWB in its Part 15 Rules – see Figure 3.2.4.1 below. The ITU defines UWB in terms of a transmission from an antenna for which the emitted signal bandwidth exceeds the lesser of 500 MHz or 20% of the center frequency



◂ **Figure 3.2.4.1 FCC Title 47 CFR Part 15 Rules**
Photo: Source: FCC

Due to the extremely low emission levels currently allowed by regulatory agencies, UWB systems tend to be short-range and indoors applications. However, due to the short duration of the UWB pulses, it is easier to engineer extremely high data rates, and the data rate can be readily traded for range by simply aggregating pulse energy per data bit using either simple integration or by coding techniques.

Spread spectrum is a technique of spreading a signal out over a very wide bandwidth, often over 200 times the bandwidth of the original signal. A spread spectrum transmitter spreads the signals out over a wide frequency range using one of the following techniques:

Direct sequence spread spectrum - Spread spectrum broadcasts in bands where noise is prominent, but does not rise above the noise. Its radio signals are too weak to interfere with conventional radios and have fewer FCC (Federal Communications Commission) restrictions. Data is altered by a bit stream that represents every bit in the original data with multiple bits in the generated stream, thus spreading the signal across a wider frequency band.

Frequency hopping spread spectrum - using this technique, the original data signal is not spread out, but is instead transmitted over a wide range of frequencies that change at split-second intervals. Both the transmitter and the receiver jump frequencies in synchronization during the transmission. CDMA (Code Division Multiple Access) is a digital cellular standard that uses wideband spread spectrum techniques for signal transmission;

There are two types of overlay, passive or active (dynamic).

- The Amateur radio service has shared spectrum with various government users using passive overlay technologies which require the user to look for a CB radio channel that is free. A passive overlay technology is different from an active overlay technology.
- Active overlay technologies are beginning to emerge and be trialed. A major trial is currently taking place in Ireland involving several major manufacturers of equipment and devices. There are several possible approaches being studied.

In 2007, as part of Pakistan's consultation on infrastructure sharing for mobile companies concept of spectrum pooling which is a form of spectrum sharing achieved by overlay was considered. It was pointed out in the consultation report that no country has yet to permit this type. (See ITU GSR 2008 Discussion Paper on Spectrum Sharing, pps. 17-18.)

Dynamic Spectrum Access is in its early stages of development is an advanced approach to spectrum management that is closely related to other management techniques such as flexible spectrum management and spectrum trading. It involves

unitising spectrum in terms of time slots and/or geographically. This allows users to access a particular piece of spectrum for a defined time period or in a defined area which they cannot exceed without re applying for the resource.

It permits communications to work by:

- Monitoring to detect unused frequencies;
- Agree with similar devices on which frequencies will be used;
- Monitoring frequency use by others;
- Change frequency bands and adjust power as needed.

Benefits of increased access to spectrum and better efficiency need to overcome several hurdles including:

- Potential for increased interference and affect on quality of service and compliance with regulations;
- Technical issues related to unseen devices competing for similar frequencies (the hidden node problem) and development of complex equipment.

Dynamic spectrum access is often associated with, although not exclusively dependent on, technologies and concepts such as Software Defined Radio (SDR) and Cognitive Radio which are described in the next paragraphs.

Refarming and Reuse As we have seen, the need for reallocation or re-farming, as it often term can often arise from technological change in several ways:

- it may be that the international table of frequency allocations has changed, as in the case of WRC-07, resulting in the realignment of national table of frequency allocations;
- demand for radio services may be changing and there may be more demand for mobile broadband and less demand for traditional terrestrial TV; and
- sometimes, new spectrum-efficient technologies allow spectrum to be freed up, as in the case of the Digital Dividend.

Reallocation and refarming of spectrum are activities in many spectrum management organizations that continue to pose challenging issues with respect to establishing policy and procedures for governments, regulators, and users alike. Key issues include deciding who pays and the amount that must be paid for reallocation and refarming of spectrum. These issues trigger all sorts of conflicts, some of which that escalate to legal challenges.

Various approaches exist for re-farming which may better suit certain circumstances. For example, in some cases featuring administrative approaches, regulators address the issues; in other cases featuring market-driven approaches, users determine the timing and price. Some approaches simply require the user to absorb the cost. In other cases, the beneficiaries of the change are either invited or required to reimburse all or part of the transition costs of the incumbent user.

There are several examples of tools used by that have proven to be effective including: Spectrum Refarming Funds (e.g., France, UK the US); dispute resolution techniques; and, in some cases, methods for spectrum valuation to determine:

- UK, a Spectrum Efficiency Scheme, administered by the regulator, exists to finance such costs;
- US legislation is in place which allows the auctioning of such spectrum, using as a ‘rescue policy’ the costs of relocation: in other words the process only goes ahead if the displaced party is compensated;

In reality, things can get quite messy. There may be uncertainty over what are the spectrum user's rights. This has been the case in the United Kingdom, for example, where licences have had a reasonable and legally enforceable expectation to receive a notice of an unspecified number of years before they are evicted. In a market regime where licences are of limited duration (e.g. twenty years), there may be a period of uncertainty, when a switch to a new use is desirable but no one is prepared to make the necessary investments to achieve it, because of uncertainty about future access to spectrum.

Another tool which can be used involves the use of auctions. For example, a licensee has a license with a fixed term remaining and the regulator chooses, in advance, to auction the licence for the succeeding period simultaneously making the current licence tradable. The prospective licensee can then bargain with the current licensee to achieve early release of the spectrum, if it is in the parties’ mutual commercial interest to agree such a transfer.

Successful re-assigning or 'refarming' of spectrum is a key element in achieving flexible use which responds to demands for new services.

RELATED INFORMATION

Legal and Institutional Aspects of Regulation Module: Section 4.3.2, Impact of Convergence on Licensing, Spectrum

Reference Documents

- An Essay on Airwave Allocation Policy, 2004 (Need for Reform)
- CEPT: Refarming and Secondary Trading in a Changing Radiocommunications World, 2002
- FCC, Amendment of Parts 2 and 90 of the Commission's Rules to Provide for Narrowband Private Land Radio Mobile Channels in the 150.05-150.8 MHz, 162-174 MHz, and 406.1-420 MHz Bands that are Allocated for Federal Government Use
- Hong Kong: OFTA, Frequency Bands for Broadband Wireless Applications, 2006
- ITU: Low Power Devices - Regulatory Issues, 2004
- Spectrum Efficiency – Drawing a Bead on a Moving Target, Radio Resource, Mission Critical Communications June 2005
- United Kingdom: Ofcom - Spectrum Efficiency Scheme

5.3.2.5 ENGINEERING SUPPORT

Software tools have been developed in house by spectrum management organizations and by the private sector. These tools are designed to support spectrum planning and frequency management in both head office and field applications. These tools assist frequency managers in establishing and maintaining the administrative and technical requirements of radio frequency management. The tools are very sophisticated and perform analyses which require the manipulation of large amounts of data in varying formats and structure. This poses several problems for regulators in both developed and developing countries. The capability to acquire and manage data and the development of innovative techniques have been developed for extracting and manipulating critical data elements and databases so as to transform data into useful frequency management information.

Engineering support is also required to determine which radio services and applications can share the same frequency band. Complex engineering calculations are often required in order to pack as many users and uses as possible into a given portion of the radio frequency spectrum. Analysis of cases of national or international harmful interference and coordination of frequencies with other countries requires engineering expertise. Engineering support is important when making proposals to change bilateral or multilateral treaties and agreements (e.g. at ITU World Radiocommunication Conferences) and when analyzing the proposals of others.

RELATED INFORMATION

SMS4DC Version 2.0 - Spectrum Management System for Developing Countries Edition 2008

ITU-D Regional Development Forum for the Arab Region: "Access to spectrum, including broadcasting services trends and technologies"

Reference Documents

- Europe: Fixed Wireless Access, Spectrum engineering & Frequency Management Qualitative Guidelines

5.3.2.6 ADMINISTRATIVE SUPPORT

Substantive spectrum management tasks such as authorization involving planning, engineering, and authorization tasks cannot be effectively performed without support from other staff units with expertise in legal, finance, and information management, as well as various clerical and administrative activities. The table below lists several administrative functions and responsibilities in addition to the mainstream spectrum management activities of planning, engineering, etc.

Some of the administrative functions will be associated with some of the routine tasks and methods associated with licensing of radiocommunications, approval of radio equipment type, and routine monitoring. These routine tasks should be supported by well-defined administrative processes, which can be dramatically improved and made more cost-effective through the use of efficient information management systems. Quality of service can be improved by placing service points of presence close to clients and users.

Other will be associated with some of the more technical areas involved in planning and authorization. Legal, finance and

economic expertise will be required to support planning activities and implementation of new practices. For example, preparation of band plans, spectrum fees, licensing processes, spectrum occupancy analysis and surveillance and competitive bid processes create new business processes. The analysis of business processes will lead to an understanding of needs in information, data, and application. At this point, planning can shift to a consideration of technical architecture and technology platforms.

Spectrum Management Functions
Spectrum Management Policy and Planning: Allocation of Spectrum
Frequency Assignment and Licensing
Standards, Specifications, and Equipment Authorization
Spectrum Control (enforcement and monitoring)
International Coordination
Liaison and Consultation
Spectrum-Engineering Support
Computer Support
Administrative Legal Support

◂ **Table 1 Spectrum Management Functions**

Source: ITU Spectrum Management Handbook

Practice Notes

- **Canada: On-line licencing services web site - Industry Canada**

Reference Documents

- **How to Apply for Type Approval or Type Acceptance of Radio Equipment**
- **Resolution ITU-R 11-3 Development of an Upgraded Spectrum Management System**

5.3.3 CERTIFICATION OF RADIO OPERATORS

The ITU Radio Regulations set out the need for certain operators of radio equipment to possess a radio operator's certificate. Chapter 8 of the Radio Regulations deals with the requirements within the aeronautical environment while Chapter 9 deals with requirements in the maritime environment. In addition, Article 25 of the Radio Regulations and ITU-R Recommendation M.1544 which is incorporated by reference deals with the requirements for amateur radio operators. Ensuring conformity with these and with any additional national radio operator requirements involves examinations and the issuance of radio operator certificates of various types. In most countries, the conducting of these examinations is delegated to a public or private sector entity closely associated with the respective field i.e., aeronautical, maritime and amateur. Often such bodies will also conduct courses covering the material required for operator certification. In some cases, the delegated authority also issues the operator certificate on behalf of the government regulator.

Reference Documents

- **Canada: Restricted Operator's Certificate (Maritime)**
- **USA: FCC - First Class Radiotelegraph Operator's License Certificate Process Description**

5.3.4 EQUIPMENT AUTHORIZATION

Radiocommunication equipment (often referred to as radio apparatus) must be authorized for use even if the use of the specific equipment does not require a licence. Ensuring that equipment meets certain technical standards reduces the possibility of harmful interference.

Reference Documents

- **Regulation on Collective Frequencies for License-Exempt Radio Transmitters and on their Use**
- **Unlicensed and Unshackled: A Joint OSP-OET White Paper on Unlicensed Devices and their Regulatory Issues,**

Federal Communications Commission, May 2003

5.3.4.1 EQUIPMENT CERTIFICATION

Equipment certification and/or type approval provides assurance that, in terms of design, the licensed radio equipment will meet regulatory requirements and will enable radio equipment and radio stations to coexist within acceptable limits. These limits are considered in conjunction with practical economic considerations of efficient spectrum use. Accessible records of approved equipment and licensed equipment facilitate the licensing and assignment processes.

The spectrum management authority or a designated agent maintains a listing of equipment categories which require either certification or type approval. Acceptance, sometimes referred to as voluntary certification, allows listed telecommunication equipment to be either marketed or used without having to obtain an equipment certification (type approval certification). Certification requires that equipment intended for sale or use be certified as approved prior to either its use or sale within the country of jurisdiction.

Reference Documents

- Canada: Standards and Certification of Radio Apparatus and Electronic Equipment Used in Canada
- EU: Mutual Recognition Agreements
- Fees and Application Guidelines for Telecommunications/Radiocommunications Equipment Type Approval.
- Hong Kong: Equipment Evaluation and Certification Scheme
- Japan: Radio License Procedures and System for Conformity
- Mauritius: Type Approval Guidelines

5.3.4.2 LABORATORY CERTIFICATION

Testing of radiocommunication equipment to establish compliance with national standards is performed by government operated testing facilities or in private sector laboratories. In recognition of the dynamic nature of technological change and innovation and the high cost of test equipment, national governments are increasingly favouring private sector facilities. Due to the importance of testing and certification, the complexity involved and the reliance placed on results, policies and regulations have evolved around the harmonization of standards across regions and markets. Harmonization has also been promoted by the adoption of consistent approaches through the certification of Conformity Assessment Bodies (CAB's). CAB's are organizations recognized by the spectrum management authority to conduct testing and certification of radiocommunication equipment.

A CAB in one country can be recognized in another country by way of agreement. Mutual Recognition Agreements (MRA's) facilitate trade among countries. They are established on a bilateral or a regional basis, and streamline the conformity assessment procedures for a wide range of telecommunication and telecommunication-related equipment. One such example is the Asia-Pacific Economic Cooperation Telecommunications MRA. These steps reduce the cost of supply of radiocommunication equipment and ensure both quality and conformity. An MRA provides for the mutual recognition by the importing parties of CAB's and mutual acceptance of the results of testing and equipment certification procedures undertaken by those bodies in assessing conformity of equipment to the relevant technical regulations.

Practice Notes

- EU Directive: Definitions for Mutual Recognition Agreement and Conformity Assessment Bodies

Reference Documents

- EU: Mutual Recognition Agreements
- European Union: Telecommunications equipment and Mutual Recognition Agreement
- System of Certification under Conformity with Technical Standard

Next: 5.4 Spectrum Sharing ➔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