



**Report ITU-R SM.2015-2**  
(07/2022)

# **Methods for determining national long-term strategies for spectrum utilization**

**SM Series**  
**Spectrum management**



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## Foreword

The role of the Radiocommunication Sector is to ensure the rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including satellite services, and carry out studies without limit of frequency range on the basis of which Recommendations are adopted.

The regulatory and policy functions of the Radiocommunication Sector are performed by World and Regional Radiocommunication Conferences and Radiocommunication Assemblies supported by Study Groups.

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| <b>SM</b> | <b>Spectrum management</b>                                                           |

***Note:** This ITU-R Report was approved in English by the Study Group under the procedure detailed in Resolution ITU-R 1.*

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## REPORT ITU-R SM.2015-2

**Methods for determining national long-term strategies for spectrum utilization**

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## TABLE OF CONTENTS

*Page*

|                                                                                                          |    |
|----------------------------------------------------------------------------------------------------------|----|
| Chapter 1 .....                                                                                          | 2  |
| 1 Introduction .....                                                                                     | 2  |
| 2 National long-term planning process.....                                                               | 3  |
| 2.1 Spectrum requirements definition.....                                                                | 3  |
| 2.2 Spectrum availability .....                                                                          | 4  |
| 2.3 Spectrum planning options .....                                                                      | 4  |
| 2.4 Spectrum planning implementation.....                                                                | 4  |
| 2.5 The iterative process .....                                                                          | 4  |
| 3 The management or administrative body .....                                                            | 4  |
| Annex 1 to Chapter 1 – Influencing Factors .....                                                         | 5  |
| Annex 2 to Chapter 1 – Methodology of the long-term spectrum management plan<br>development .....        | 7  |
| Chapter 2.....                                                                                           | 14 |
| 1 Introduction .....                                                                                     | 14 |
| 2 The consultative approach.....                                                                         | 14 |
| 2.1 Inquiry into future spectrum/service requirements.....                                               | 15 |
| 2.2 Interaction among/with representative groups.....                                                    | 15 |
| 2.3 Analysis of usage trends .....                                                                       | 16 |
| 2.4 Example .....                                                                                        | 16 |
| 3 The analytical approach.....                                                                           | 17 |
| 3.1 Introduction.....                                                                                    | 17 |
| 3.2 Steps for the analytical approach development .....                                                  | 17 |
| 3.3 The use of the analytical technique in the long-term spectrum requirements<br>planning process ..... | 18 |

|                                                                                                             |    |
|-------------------------------------------------------------------------------------------------------------|----|
| Chapter 3.....                                                                                              | 19 |
| 1 Identification of long-term spectrum management objectives .....                                          | 19 |
| 2 Evaluation of current spectrum management process .....                                                   | 19 |
| 3 Transition procedures .....                                                                               | 20 |
| 3.1 Encourage effective spectrum utilization .....                                                          | 20 |
| 3.2 Enhance spectrum use flexibility .....                                                                  | 22 |
| 3.3 Maximize the social and economic benefits that can be achieved by appropriate spectrum management ..... | 22 |
| 3.4 Ensure that the spectrum is used in all regions of the country where it is needed .....                 | 23 |
| 3.5 Build a skilled work force and develop proper spectrum engineering tools .....                          | 23 |
| List of abbreviations.....                                                                                  | 28 |

## Chapter 1

### Long-term planning process

#### 1 Introduction

Recommendation ITU-R SM.1047 – National spectrum management, adopted in 2012, recommends that the development of national spectrum management programs should address the spectrum planning among other subject areas. Moreover, administrations are guided by the appropriate sections of the ITU-R Recommendations, Reports and ITU Handbooks. The Handbook on National Spectrum Management adopted in 2015 defines terminologies related to spectrum planning on Chapter 2 “Spectrum Planning”.

According to the Handbook, spectrum planning can be classified by time (short term, long term and strategic) and the areas covered (spectrum use and spectrum management systems). And ‘long term planning’ means planning that considers issues needing resolution or systems to be implemented within five to ten years, whereas ‘short term planning’ is to be implemented within three to five years. In comparison, strategic planning is involving the identification of a limited number of key issues, which require concentrated spectrum management attention for solutions that need more than ten years to be implemented.

Therefore, long-term strategy is about a defining vision and mission to solve key issues which will be implemented over ten years related to spectrum management for spectrum utilization.

At present, most spectrum planning is relatively short-term. However, if spectrum resources are to adequately support national goals and objectives, long-term planning is essential. It can provide a basis for effective spectrum management to ensure that spectrum is efficiently allocated and assigned, to accommodate constantly evolving spectrum requirements by new systems and their applications. It also facilitates decision-making by providing a basis for the practical consideration and evaluation of alternative courses of action.

Long-term planning should endeavour to:

- make today's decisions on spectrum planning strategies in view of their consequences for the future;
- identify the impact of past decisions on the future;
- periodically adjust decisions to changing circumstances.

It should be sufficiently comprehensive to accommodate the national spectrum requirements of both known and anticipated radiocommunication systems within its stated timeframe.

It also leads to:

- revision of the national table of frequency allocations;
- the development of national positions on international radio conference agendas; and
- revision to spectrum regulations, policies and standards.

## 2 National long-term planning process

The development of national long-term strategies for spectrum use will require the implementation of a national long-term spectrum planning process.

One part of such process can be the development and implementation of a Plan of the spectrum prospective usage. Such plan should be revised and adjusted according to new information every 1 to 3-5 years. It should be based on civil and government users' spectrum requirements investigations as well as trends of new technologies development. An example of such plan is provided in Table 1.

TABLE 1  
An example of a Plan of the spectrum prospective usage

| Frequency band<br>(kHz, MHz, GHz) | Existing and planned<br>services /applications                                                                                                              | Specifics                        | Planned changes                                                                                                              | Notes |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------|
| 915-921 MHz                       | ARNS<br>Space operation service<br>for telemetry, tracking,<br>and control purposes<br>Mobile, except<br>aeronautical mobile on<br>secondary basis.<br>RFID | ARNS operate on<br>primary basis | Decommissioning<br>of ARNS after<br>the end of<br>depreciation<br>period and<br>deployment same<br>service in other<br>bands |       |

The stages of the development of the Plan as well as factors that need to be taken into account are given below. A methodology that can be used to develop long-term spectrum utilization plan is given in Annex 2 to this Chapter.

### 2.1 Spectrum requirements definition

Spectrum requirements definition determines future broad-based national spectrum requirements for all radio services and technological, policy and economic factors (see Annex 1 to this Chapter) which may influence spectrum use.

Spectrum requirements can be defined based on the evaluation of potential scenarios (see Chapter 2). Traditionally, spectrum use scenarios have been evaluated based on consultative inputs from

concerned parties including national spectrum planning organizations within governmental departments or agencies, individual user requests, and the public.

Recently, steps have been taken to perform scenario evaluation based on analytical modelling techniques (see Chapter 2, also applicable to the spectrum availability and spectrum option phases).

## **2.2 Spectrum availability**

The objective of this phase is to assess the availability of spectrum across all national radio services and to accommodate the spectrum requirements identified in the requirements definition phase. Inputs are primarily derived from within the administration itself but also can come from the ITU International Frequency List, ITU allotment Plans and any existing regional spectrum planning studies.

## **2.3 Spectrum planning options**

The aim of this phase is to develop suitable spectrum planning options to satisfy spectrum requirements on the basis of the data from the two preceding phases. Any analysis for the development of spectrum options would need to take account of technical, policy and economic factors. The analysis would also assess the various opportunities for services given existing and projected radiocommunication environments and/or allocations. Recommendations regarding those service requirements unable to be accommodated within current national allocations will be based on these analyses and any available spectrum monitoring results. Allocation options are developed and the relative costs of any reallocation to and/or movement of existing spectrum users assessed.

## **2.4 Spectrum planning implementation**

This phase would provide for the implementation of various spectrum planning strategies (see Chapter 3) and could be expected to be an on-going process. The introduction of new services may require changes to national spectrum allocation tables and revisions to national and ITU regulations. Revisions to international regulations would be undertaken at the ITU World Radiocommunication Conferences (WRCs).

## **2.5 The iterative process**

Previous decisions can be re-evaluated periodically or triggered by specific events and, if necessary, modified based on the updated information. The planning process is therefore a continuous process of exploration and data processing rather than a linear process.

A record of all changes can be maintained to provide a history of developments in the long-term plan.

## **3 The management or administrative body**

The establishment of a management or administrative body providing leadership and supervision for the implementation of the spectrum planning programme is necessary to ensure that issues relating to long-term spectrum utilization strategies can be addressed. This will include the introduction of an early recognition system within the framework of its planning procedures. However, the body may be supported by special planning bodies such as project groups and task forces.

Long-term planning is usually a primary task at management level and one that cannot be delegated, due to the consequences and significance of the decisions to be taken. Such planning bodies are responsible for:

- developing detailed strategic policies and solving problems concerning the conversion of strategic policies into operational plans;

- allocating financial and human resources;
- strategic review of procedures, results and requirements in conjunction with the implementation of strategies;
- any necessary recommendations concerning adjustments to organization and management systems, and
- updating the planning data used as a basis for frequency management.

## **Annex 1 to Chapter 1**

### **Influencing factors**

The following is the list of influencing factors to be considered in the long-term planning process:

- 1 Policy and legal factors
  - 1.1 Regulatory factors
    - 1.1.1 International frequency allocation (ITU-R)
    - 1.1.2 Regional frequency management bodies
    - 1.1.3 National frequency allocation procedure
    - 1.1.4 Frequency management procedures of neighbouring administrations
    - 1.1.5 Standardizations policy
    - 1.1.6 Telecommunications infrastructure factors
  - 1.2 Industrial factors
- 2 Economic factors
  - 2.1 User mobility
  - 2.2 Globalization
  - 2.3 Overall economic development
  - 2.4 Market factors
    - 2.4.1 Structure of prices and tariffs for equipment and services
    - 2.4.2 Market needs and marketing factors
    - 2.4.3 Procedures and practices used by service providers
    - 2.4.4 Spectrum auctioning
  - 2.5 The impact of new services and technologies
- 3 Social factors
  - 3.1 Changes in demand as a result of changes in the social structure
  - 3.2 Changes in demand as a result of changes in the daily and life-time working hours
  - 3.3 Security and public safety

- 3.4 Public acceptance of radio applications
- 4 Ecological factors
  - 4.1 Electromagnetic pollution and radio-frequency interference
  - 4.2 Public dislike of large antenna structures and proliferation of sites
  - 4.3 Debris in space
- 5 Technical factors
  - 5.1 Basic technologies
    - 5.1.1 Microelectronics
    - 5.1.2 Signal processing
    - 5.1.3 Equipment components
      - 5.1.3.1 Power supplies
      - 5.1.3.2 Batteries
    - 5.1.4 Communication media
  - 5.2 Coding and modulation techniques
    - 5.2.1 Source coding
    - 5.2.2 Channel coding
    - 5.2.3 Modulation techniques
  - 5.3 Channel access techniques
    - 5.3.1 Time division multiple access (TDMA)
    - 5.3.2 Frequency division multiple access (FDMA)
    - 5.3.3 Code division multiple access (CDMA)
    - 5.3.4 Orthogonal frequency division multiple access (OFDMA)
  - 5.4 Transmission modes
    - 5.4.1 Diversity techniques
      - 5.4.1.1 Time diversity
      - 5.4.1.2 Frequency diversity
      - 5.4.1.3 Antenna diversity
      - 5.4.1.4 Space diversity
      - 5.4.1.5 Direction diversity
    - 5.4.2 Spatial multiplexing techniques
      - 5.4.2.1 Direct multiplexing
      - 5.4.2.2 Transmit beamforming techniques
    - 5.4.3 Spread spectrum techniques
  - 5.5 Antennas
    - 5.5.1 Antenna optimization

- 5.5.1.1 Use of new technologies and manufacturing methods to reduce side lobe level and reduce correlation among antennas
- 5.5.1.2 New methods in antenna development
- 5.5.1.3 Massive multiple-input multiple-output (MIMO) antennas
- 5.6 Data processing in telecommunications

## **Annex 2 to Chapter 1**

### **Methodology of the long-term spectrum management plan development**

The main aim of the development of a long-term spectrum management plan is efficiency of frequencies usage. Depending on its goals an Administration can choose technical, economic, policy criteria of efficiency.

The process of the development of a long-term spectrum management plan includes the following steps (see Fig. 1):

- 1 The evaluation of the current spectrum utilization by different technologies and applications.
- 2 The development of the list of perspective technologies.
- 3 The assessment of frequency resource that is required and sufficient for the following systems and applications: mobile, fixed, broadcasting, satellite, short-range devices (SRD).
- 4 The development of measures to provide perspective technologies with sufficient amount of spectrum.

FIGURE 1

**The evaluation of the current spectrum utilization by different technologies and applications**

