SPECTRUM MANAGEMENT

ITU-D and BDT activities

Spectrum Management - summary

- Spectrum management
  - Spectrum Management Tool for Developing Countries (SMS4DC)
  - Assistance in Cross Border Frequency Coordination (HCM4A)
  - Spectrum Management Assessment, SM Master Plans
  - Spectrum Management Training Program (SMTP)
- Others
  - ITU-D Study Group Questions (Resolution 9, Q7/2)
  - WSIS Action Lines (C2, C3, C7 e-science, C9)

Cross Border Frequency Coordination

- Harmonized Coordination Method for Africa (HCM4A)
  - Set a standard on a mutually beneficial approach by consensus
  - Provide a solid basis for bilateral and mutual agreements
  - Oblige each country to take account of other stations
- Implementation of HCM4A in four phases
  1. Assessment of existing administrative and technical procedures
  2. Multilateral agreement proposal by technical working group
  3. Validation workshop to adopt draft agreement
  4. Development of HCM4A software
- HCM4A involves 4 sub regions
  - Central, East, Southern and West Africa

Spectrum Management Assessment

ITUWTDC BUENOS AIRES 2017 9-20 October

- Case studies funded mainly by Canada
  - Europe: Hungary (Benchmark study)
  - ASP: Timor-Leste, Cambodia, Lao PDR
  - Africa: Sierra Leone, Zimbabwe, Gabon
  - America: Suriname, Barbados
- Areas considered
  - Country Background, National Telecom Market, Legal Framework, Institutional Structure, Spectrum Allocation, Licensing processes, Spectrum pricing, Interference Management, Type Approval, Cross-border coordination, stakeholder participation, Research Collaboration
- Assistance in establishing Spectrum Management Master plan (funded by MSIP Korea)
  - Selected 6 Asia Pacific and 3 Caribbean countries for assessment and recommendation in the area of spectrum management

Rome, 29-31 May 2017

Recent Activities on Spectrum Management

- Spectrum Management Master Plan (SM MP)
- Spectrum Management Software (SMS4DC)
- Master Plans for and country assistance in Spectrum Management (planned ITU-Korea project)
- Other activities
- Trainings, workshops

Spectrum Management Master Plan

ITU-KOREA Projects

Objectives and Targets

- To assist governments and regulators of developing countries in the Americas Region (in particular on Caribbean Countries) and in Asia-Pacific region in developing national spectrum management master plans
- At least for 3 beneficiary countries (with extension 6 for **ASP**)
  - Assessment of the spectrum management scheme: spectrum policy, spectrum use, authorization, spectrum sharing, spectrum monitoring…
  - Provision of advices concerning each beneficiary country's development of relevant policies, legislations and regulations based on request and interest of the countries
- Human capacity building [3 seminars, 60 participants in total]
- Provision of guidance during implementation of the master plans, where requested by beneficiary country and agreed by ITU

Activities

- Job Description and Experts recruitment: ITU in consultation with beneficiary countries and CTU for Americas region
- 1st phase focused on assessment of overall aspects: data gathering, 5 days mission (meeting with Government, interviews with stakeholders), preparation of a draft
- 2nd phase focused on a Master Plan for specific recommendation reflecting request and interest of beneficiary countries: preparation of advices, 5 days mission (presentation and discussion), preparing final report
- Comment and Approval: review and comments by ITU, approval of governments for the release of final report
- Seminars: topics and materials will be decided in consultation with experts and beneficiary countries
- Assistance: to beneficiary countries for the preparation of implementation plans for Master plans; on request

SM Master Plan Project in ASP

- **Project first phase**
  - **Bangladesh**
  - **Fiji**
  - **Brunei**
- **Project extension**
  - **Pakistan**
  - **Thailand**
  - **Samoa**

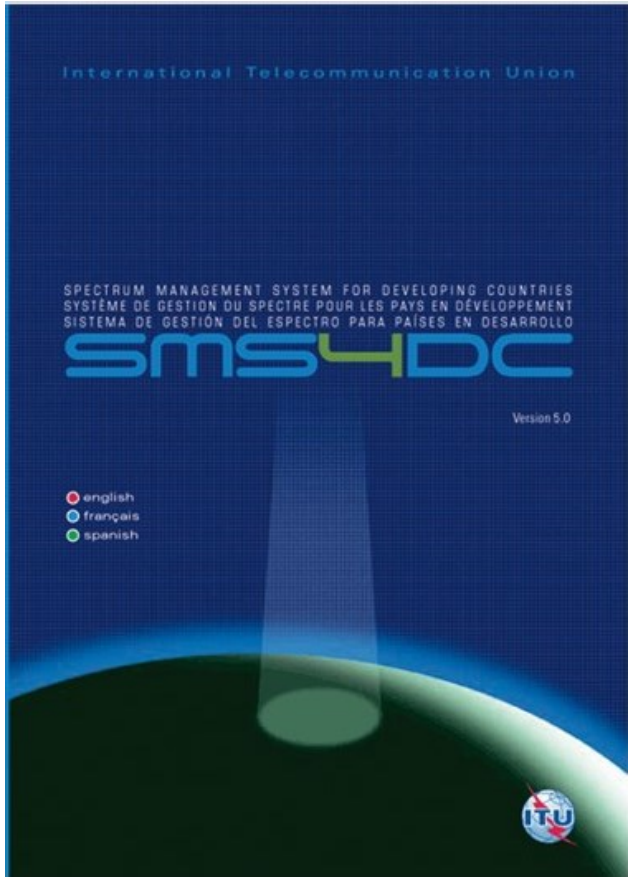
SM Master Plan Project in Caribbean

- **Project beneficiaries**
  - Jamaica
  - St. Vincent and the Grenadines
  - Grenada

ITU Spectrum Management System for Developing Countries (SMS4DC)

ITUWTDC BUENOS AIRES 2017 9-20 October

- SMS4DC is software designed by ITU based on ITU recommendations
- Developed to assist the administrations of developing countries to undertake their spectrum management responsibilities more effectively;
- SMS4DC covers terrestrial fixed, mobile, sound and television broadcasting services in the bands above 30 MHz, including GE-06 as well as frequency coordination of Earth stations
- Made available in 2007, current version is 5.0. Subscribers: around 50 countries



CELEBRATING 25 YEARS OF ACHIEVEMENTS

SMS4DC subscribers

Version 5

- Addition of a general data interface between monitoring software and SMS4DC
- Adding propagation models based on the latest version of P.452, P.530 and P. 1812, P.1546
- Further development of built-in and user specified administrative reports
- Preparation of a general method to import data to SMS4DC
- SMS4DC software also in Spanish
- Preparation of the training material for assisting self-learning training of the software (PPT and Video)
- Time limited version as a demo tool which can be used for introduction of SMS4DC
- Version 5 released

Development of version 5.1

- Insertion of fee calculation models
- Inclusion of Dynamic Link Library (dll) for Harmonised Calculation Method (HCM)
- Inserting results of WRC-15 (Article 5 of RR and other decisions, IFIC import adjustment)
- Website design in order to provide relevant news and a forum for users to discuss their experiences. Renewal of subscription via web

Master Plans for Spectrum Management and Country Assistance in Spectrum Management

ITU-KOREA Project

The Scope of the Project

- Assessment of spectrum management
- Customized recommendation for national spectrum management
- Assistance in developing a draft of cross border radio frequency (RF) interference coordination agreements
- Specific items requested by beneficiaries and agreed to by ITU
  - Update of National Frequency Allocation Table
  - Update of license database
  - Consulting on the procurement of spectrum management and/or monitoring system
  - Recommendation to adopt a new technology
  - Assistance in understanding and adopting the outcomes of WRC-15
- Project Period: January 2016 ~ December 2018

Other activities

- **CTU SM Task Force**
  - Regional and national table of frequency allocation
  - Cross-border frequency coordination
  - Spectrum pricing
  - Digital switch-over and white space management
- **ITU-D SG1 Q8/1 and Resolution 9 meeting**
  - 15-19 February 2016, Budapest, Hungary
  - 17 February Workshop on customer support and spectrum fee http://www.itu.int/oth/D0705
- **Regional Seminar on Spectrum Management and Broadcasting**
  - 21-23 March 2016, Bucharest, Romania.
- **ITU Regional Workshop for CIS and Georgia, Yerevan, 27-29 June 2016**
  - Decisions of RA-15 and WRC-15 with Special Relevance to Developing Countries
- **Cross-border Frequency Coordination Workshop, ITU-CRASA**
  - 16-17 August 2016 Windhoek, Namibia
  - HCM4A implementation
- **International Workshop on Frequency Policy and Spectrum Engineering**
  - 8-9 September 2016, Wroclaw, Poland

  http://www.fpse2016.nit.eu/

Trainings, workshops

- ITU Arab regional training workshop on the SMS4DC, Djibouti, 14-18 June 2015
- NBTC/GSMA/ITU seminar, Bangkok, Thailand, 25 June 2015
- ITU-NBTC workshop on Cross-Border frequency coordination, Bangkok, Thailand, from 29 June to 1 July 2015.
- APT Training Workshop for Radio Spectrum Management and Services in the Pacific, Fiji, 6-9 July 2015
- ITU Seminar on Spectrum Management and terrestrial TV broadcast in Pacific, Fiji, 10 July 2015
- ITU-Global Forum Workshop, 25-28 April 2016, Bangkok, Thailand
- ASP CoE (SRMC – China)
  - Online course (together with BR): Satellite Launch Coordination Procedures and International Regulations with (June 2015)
  - Face to Face RF monitoring training in Beijing (4 -13 August 2015)
- Workshop on Spectrum Management: *Economic Aspects*
  - Tehran, Iran (Islamic Republic of), *21 – 23 November 2016*
- SMS4DC users' meeting,
  - 8-9 December 2016, Geneva

SPECTRUM MANAGEMENT IN THE COUNTRIES OF ITU-BDT/KOREAN PROJECT

2014 – 2016

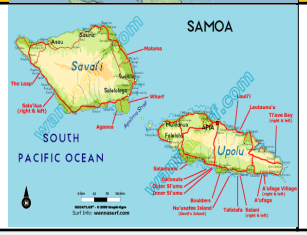
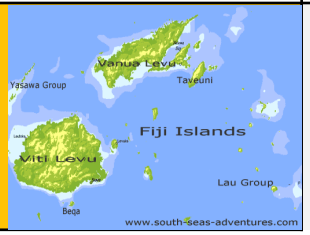
ITU-BDT

Origins and Goals of the Project

1. **Initiators:** Partnership of ITU and Ministry of Science, ICT and Future Planning of the Republic of Korea
2. **Period:** 2014 – 2016
3. **Background:**
   - ❑ WTDC-2014 Objective 2 – ICT Infrastructure Development; priority areas of the Program 1 – Spectrum Management.
   - ❑ Asia-Pacific Regional Initiative 5 – Telecommunication/ICT policy and regulation in the Asia-Pacific region.
4. **Scope:**
   - ❑ Assistance to regulators in assessing, reviewing and developing new spectrum management (SM) framework.
   - ❑ Building human capacity and competency in spectrum management.
   - ❑ Development of Spectrum Management Master Plans.

Countries Within the Scope of the Project

Asia-Pacific Region Countries

Bangladesh		**Thailand**		**Brunei Darussalam**	
Pakistan		**Samoa**		**Vietnam**	
Fiji					

Caribbean Islands Countries

Jamaica		**Grenada**		**St. Vincent And Grenadines**	

Criteria of Spectrum Management Assessment

Criteria for Assessing Current Situation in Spectrum Management

1. Establishing and maintaining SM entity responsible for administering the radio spectrum in the public interest.	**6.** Adopting decisions that are technologically neutral and allow for evolution to new radio applications.
2. Promulgation of mature primary legislation in SM.	**7.** Imposing spectrum charges ensuring the optimal use of scarce resources to foster the development of innovative services and competition.
3. Promulgation of mature secondary legislation (statutory instruments) in SM.	**8.** Encouraging radio communications policies leading to flexible spectrum use, including transfer of spectrum usage rights.
4. Making national frequency allocation plans and frequency assignment data public to encourage openness and to facilitate development of new radio technologies.	**9.** Adopting sustainable regulation with regard to spectrum reallocation and re-farming.
5. Harmonizing, as far as practicable, effective domestic and international spectrum policies.	**10.** Adopting sustainable regulation with regard to spectrum sharing.

Regulatory Entity in Charge of Spectrum Management

	Features
Establishing and maintaining SM entity responsible for administering the radio spectrum in the public interest	SM entity either separate or as a part of telecommunication authority should be created. Independence of spectrum regulator should be provided in two ways: 1) Independence from any operator, service provider, and investors. 2) Independence from the Government. It must be able to adopt independent decisions based on technical, economic, social, financial, rather than political considerations and should manage its own staff without excessive interference from the Government.

Countries Under Consideration

Achieved	Grenada, St. Vincent and Grenadines, Pakistan	No particular actions required
Largely Achieved	Vietnam, Thailand, Brunei Darussalam, Samoa	There are still outstanding issues to align after transition to independent/converged model
Partly Achieved	Fiji, Jamaica, Bangladesh	Actions to establish standalone/converged regulator should be further undertaken
Not Achieved	–	–

Primary Legislation in Spectrum Management Area

Promulgation of mature primary legislation in SM	Features
	Primary legislation is a basic set of provisions establishing legal basis to govern spectrum usage, coordinating it among parties involved and providing relevant national policy together with specific regulations. In some countries, the provisions related to SM are included in general telecommunications legal act. Usually it is the dedicated spectrum related chapter in national Telecommunications Law. It is more astute to proceed with the separate piece of legislation by adopting a Radiocommunications Act encompassing the full scope of SM aspects.

Countries Under Consideration

Achieved	Vietnam, Thailand, Pakistan	No particular actions required
Largely Achieved	Brunei, Grenada, St. Vincent and Grenadines, Bangladesh, Samoa	Some outstanding issues regarding rights and obligations of regulatory entities to be clarified.
Partly Achieved	Fiji, Jamaica	Current primary legislation complicates SM or not complies with the existing institutional structure of regulation.
Not Achieved	–	–

Subsidairy Legislation in Spectrum Management Area

Promulgation of mature secondary legislation (statutory instruments) in SM	Features
	Secondary legislation should embrace statutory instruments dealing with broad area of regulations and procedures such as radiocommunications regulations, regulations on operation of radio stations, or spectrum licensing regulations. A number of practical rules should also exist, including codes of practice, standards of performance, advisory guidelines, etc.

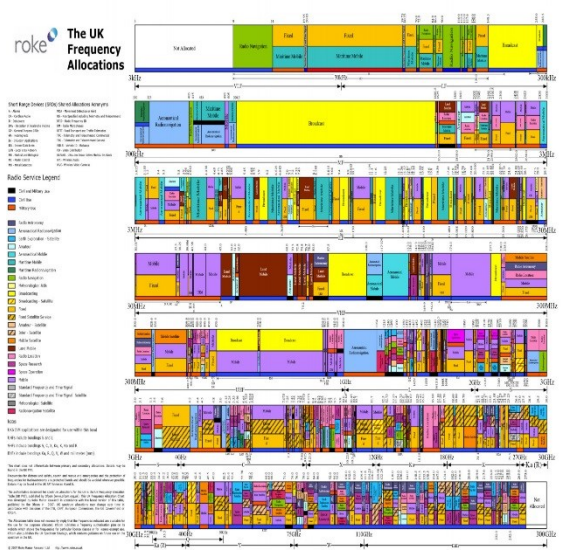
Countries Under Consideration

Achieved	Pakistan, Grenada, St. Vincent and Grenadines	No particular actions required
Largely Achieved	Vietnam, Fiji, Brunei Darussalam, Jamaica, Samoa	The detailed analysis of the required subsidiary legal instruments arising from new primary laws or innovations in institutionary structures should be performed.
Partly Achieved	Thailand, Bangladesh	Comprehensive secondary legislation should be adopted as a matter of urgency to improve current operational and regulatory practice.
Not Achieved	–	–

Spectrum Allocation and Utilization Plans

Making national frequency allocation plans and frequency assignment data public	Features
	National Frequency Allocations Table (NFAT) is a principal legal planning instrument in SM. Pursuant to primary legislation, SM authority should produce national frequency allocation plan and spectrum utilization plan legally binding on a regulator. NFAT and spectrum utilization plan should be publically available in order to deliver essential information on the existing spectrum usage, as well as some future oriented information for specific frequency bands.

Countries Under Consideration



Achieved	Vietnam, Thailand, Pakistan	No particular actions required
Largely Achieved	Brunei Darussalam, Jamaica, Grenada, St. Vincent and Grenadines, Bangladesh, Samoa	Primary legislation need to include details on NFAT periodic modification.
Partly Achieved	Fiji	As the matter of urgency to update NFAT and provide spectrum utilization plan with the standard ITU format.
Not Achieved	–	–

Spectrum Management Harmonization Practices

	Features
Harmonizing, as far as practicable, effective domestic and international spectrum policies	National SM practice should correlate with the requirements of international obligations primarily based on ITU Radio Regulations (RR). Regulators may also be bound by other obligations in its commitments to regional organizations or under bilateral or multilateral agreements. Preferably, specific international and national standards should be included in the national primary and secondary legislation in order to guarantee coordinated regulatory practices.

Countries Under Consideration

Achieved	Vietnam, Brunei, Grenada, St. Vincent and Grenadines, Jamaica, Pakistan	No particular actions required
Largely Achieved	Thailand, Fiji	Lack of regional efforts to establish structured approach to border coordination in some APT countries.
Partly Achieved	Bangladesh, Samoa	ITU notification and Regional coordination agreements should be developed as the matter of urgency
Not Achieved	–	–

Technologically Neutral Regulation

Adopting decisions that are technologically neutral and allow for evolution to new radio applications	**Features**
	Technological neutrality is the essential component in liberalization of SM regime. It allows licensees more discretion in the way they use spectrum that has been awarded to them. The licensee has the choice of technology to use in providing the specified type of services without seeking for permission from regulator. From its ideology, technological neutrality provides quicker adaptation of service supply to customers following the evolution of demand for these services. It also results in decreasing the costs of services supplied at the market.

Countries Under Consideration

Achieved	–	–
Largely Achieved	Pakistan	Neutrality is stipulated by policy documents and is in implementation phase
Partly Achieved	Vietnam, Thailand, Brunei Darussalam, Jamaica, Samoa	The need to identify the licensing policy/subsidiary instruments that require amendments in view of technology neutral regulation
Not Achieved	Fiji, Grenada, St. Vincent and Grenadines, Bangladesh	Technology neutrality should be included in SM practice

Spectrum Pricing

Imposing spectrum charges ensuring the optimal use of scarce resources	**Features**
	Spectrum pricing should seek only to cover the administrative costs incurred in issuing, managing, control and enforcement of the individual licences. With scarce bands SM authorities should impose charges reflecting the need to ensure the optimal use of these resources. Those charges should be non-discriminatory and take into account the need to foster the development of innovative services and competition. Under no circumstances should SM entities consider spectrum charges to be the additional source of incomes to a Federal Budget.

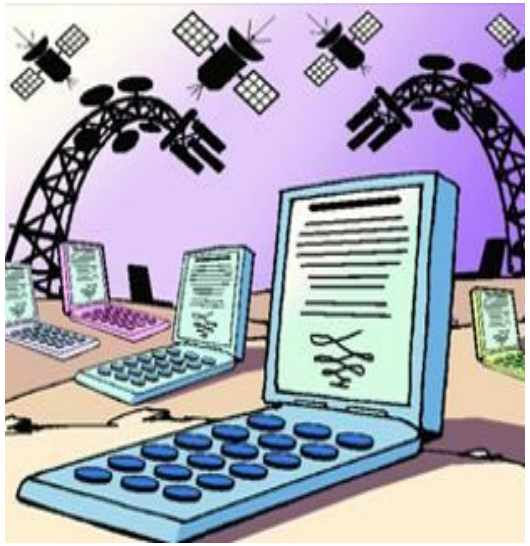
Countries Under Consideration

Achieved	–	–
Largely Achieved	Vietnam, Pakistan, Brunei Darussalam, Bangladesh, Samoa	Spectrum pricing framework established and can be updated based on implementation results.
Partly Achieved	Jamaica, Grenada, St. Vincent and Grenadines,	The economic methods should be introduced including the use of administrative incentive pricing.
Not Achieved	Thailand, Fiji	The review is urgent since the fee structure was adopted many years ago and it does not reflect the cost of managing the spectrum resources.

Spectrum Trading and Spectrum Rights

SM policy leading to flexible spectrum use, including transfer of spectrum usage rights.	**Features**
	Implementation of secondary trading provides greater flexibility, spectral efficiency, competition and an incentive to innovate and invest. It offers potential benefits to spectrum users in many ways, enabling them to buy, sell, lease, aggregate spectrum that would not be used. Trading enables operators to enter wireless market in those instances where they have not participated in a procedure for primary spectrum assignment. In order to provide efficient trading, spectrum rights of the users should be duly defined.

Countries Under Consideration



Achieved	–	–
Largely Achieved	Vietnam	Basic principles of transferring spectrum rights are included in legislation.
Partly Achieved	Fiji, Jamaica, Brunei Darussalam	Spectrum trading and rights are subjects of current legislation but not actively introduced.
Not Achieved	Thailand, Grenada, St. Vincent and Grenadines, Bangladesh, Pakistan, Samoa	Spectrum trading is out of the scope of legal basis and SM practices.

Spectrum Reallocation and Re-farming

Adopting sustainable regulation with regard to spectrum reallocation and re-farming	**Features**
	Modern SM should provide legal and procedural instruments to deal with spectrum reallocation and re-farming. The best cases demonstrate that regulators are including those aspects directly into the primary legislation. Sometimes the details of redeployment are defined through subsidiary legal instruments. Reallocation is achieved typically by providing incumbents with alternative bands or incentivizing them with switching to wired technologies. The mechanism of compensations to incumbent users being subject to redeployment should be established.

Countries Under Consideration

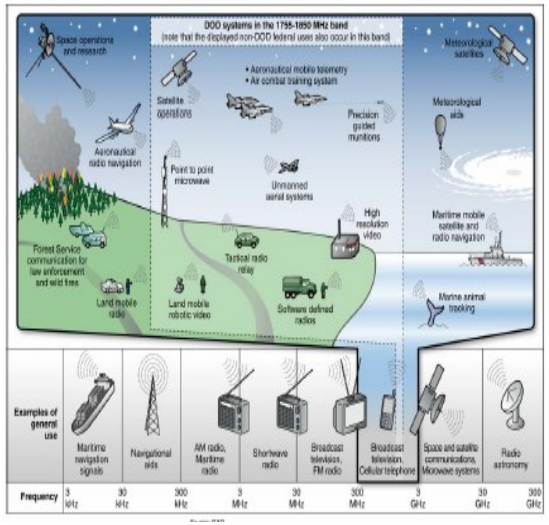
Achieved	–	–
Largely Achieved	Pakistan	Basic principles of spectrum reallocation are included in legislation being in the implementation stage.
Partly Achieved	Vietnam, Thailand, Samoa	Although having some references current legislation does not provide the prescribed mechanism of spectrum re-allocation
Not Achieved	Fiji, Brunei Darussalam, Jamaica, Grenada, St. Vincent and Grenadines, Bangladesh	Spectrum reallocation is out of the scope of legal basis and SM practices. Need to be developed.

Adopting sustainable regulation with regard to spectrum sharing

Features

Spectrum sharing is the consequence of the combination of the increased demand for spectrum in key bands, and the recognition that much spectrum is heavily underused. New real-time technologies for sharing are now available which enable different users to respond dynamically to changing conditions of congestion.
Regulation should react on technological innovations making special arrangements for overlays and underlays, TVWS, dynamic spectrum access, licenced shared access etc.
Public-sector spectrum is the most amenable to change in this regard.

Countries Under Consideration



Achieved	–	–
Largely Achieved	Pakistan	Spectrum sharing is stipulated by policy documents and is in implementation phase
Partly Achieved	Vietnam, Samoa	The need to identify the primary/subsidiary legislation requiring amendments in view of spectrum sharing issues
Not Achieved	Thailand, Fiji, Brunei Darussalam, Jamaica, Grenada, St. Vincent and Grenadines, Bangladesh	Provisions on spectrum sharing should be included in SM legislation and practices

Conclusions and Recommendations

1. The countries covered by the Project have been analyzed on the subject of current SM regulatory framework. Achievements were classified in three categories following SM criteria chosen. Special attention of the majority of regulators under analysis should be drawn to Category 3.

Category 1. Largely Achieved	Category 2. Partly Achieved	Category 3. Not Achieved
Independent/converged SM regulator	Subsidiary SM legislation	Spectrum sharing
Primary SM regulation	Spectrum pricing	Spectrum reallocation and re-farming
Frequency allocation tables and utilization plans		Spectrum trading ands spectrum rights
Harmonization in SM regulation		Technologically neutral regulation in SM

2. Spectrum Management Master Plans (SMMP) have been developed, agreed and delivered to the National Radiocommunications Administrations of the countries covered by the Project. SMMP were supplemented with the recommendations on actions to be taken and vision on future utilization of the most valuable spectrum bands.

3. In defining future regulatory framework, national administrations should consider a set of factors influencing spectrum management:

- ❑ Further spectrum harmonization
- ❑ Flexible advanced radio technologies
- ❑ Further technological and service neutrality
- ❑ Enhanced licence-exempt usage
- ❑ Broad spectrum sharing
- ❑ Vital spectrum reallocation and re-farming
- ❑ Agile spectrum usage data bases
- ❑ Advanced spectrum engineering tools

ITU Spectrum Management Training Program (SMTP)

Addressed problem

- Efficient running of Spectrum Management (SM) requires well educated professionals;
- Today there are no formal holistic SM education programmes;
- Spectrum managers must also have a clear understanding of legal and economic issues;
- Large institutions train SM staff by seconding them to experienced workers, but this offers narrowed vision and no formal quality check. This is not possible in smaller institutions.

The solution: SMTP

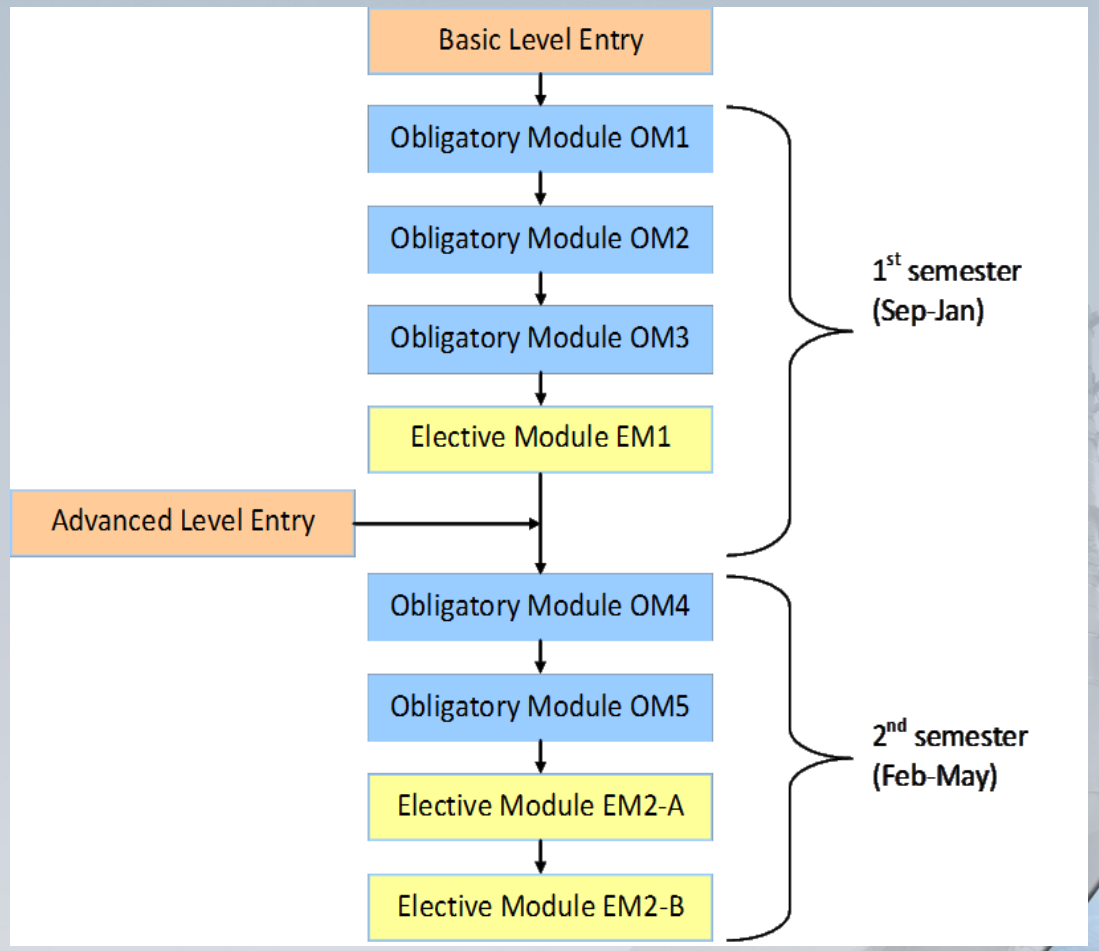
- First in a series of ITU training programmes
- It offers access to SM training and forward-looking professional vision
- Full set of high level materials prepared by high caliber subject-matter experts
- Materials sanitized through Quality Assurance Mechanism
- Designed for anyone either a beginner or a specialist
- Provision of certain level of knowledge
- Different certification options
- International recognition, with possible option of university credits/diploma

Programme objectives

- Provide ITU membership with capacity building solutions in SM
- Provide access to the latest learning tools
- Build human and institutional capacity by designing and making available high quality training materials

The vision

- Two entry levels
- Specialisation possibility:
  - Technical
  - Legal/economic
- Accordingly structured set of obligatory modules and specialised electives.



COMPOSITION OF THE PROGRAMME

BASIC LEVEL

Obligatory Modules (OM):

- **OM1** "Legal Basis and Regulatory Framework of SM"
- **OM2** "Spectrum Engineering Fundamentals"
- **OM3** "Wireless Telecommunications Technologies"

Elective Module 1 (EM 1)includes 6 options:

- **EM1-1** "Spectrum Monitoring"
- **EM1-2** "Enforcement and Type Approval of Equipment"
- **EM1-3** "SM for Satellite Systems"
- **EM1-4**"SM for HF Systems, Science, Maritime and Amateur Services"
- **EM1-5**"SM for Aeronautical and Radio Determination Services and Military Systems"
- **EM1-6**"Computer-aided Spectrum Management"

COMPOSITION OF THE PROGRAMME

ADVANCED LEVEL

Obligatory Modules (OM):

- **OM4** "Economic and Market Tools of Spectrum Management"
- **OM5** "Strategic Planning and Policies for Wireless Innovation"

Elective Module 2 (EM2):

Legal Specialization:

- **EM 2-1**"Advanced Spectrum Authorization Regimes"
- **EM 2-2**"Socio-Economic Impact of Spectrum Regulation; Competition and Consumer Protection"

Technical Specialization:

- **EM 2-3**"Terrestrial TV Broadcasting Planning and Digital Transition"
- **EM 2-4**"Opportunistic Spectrum Access and Cognitive Radio"

Conclusions

- The SMTP is a first high quality training solution in the domain of SM
- SMTP will be a part of the ITU Academy library
- SMTP will help to bridge the SM gap and will provide necessary tools and skills

- Pilot test: end of 2014

ITU-R documents database search facility

Overview

- RAG (2012) invited the Director to develop a search database facility for ITU-R Recommendations for assisting membership to identify ITU-R Recommendations.
- Voluntary Contribution USD 290,000 kindly provided by the Ministry of Internal Affairs and Communications (MIC), Japan in April 2014
  - Expedite the database development
  - Expand this search function to ITU-R Questions, Reports, Handbooks, Resolutions
  - Make it more accessible for ITU members, including developing countries
  - Consider the equipment of functions to make it more effective and useful

Main Activities

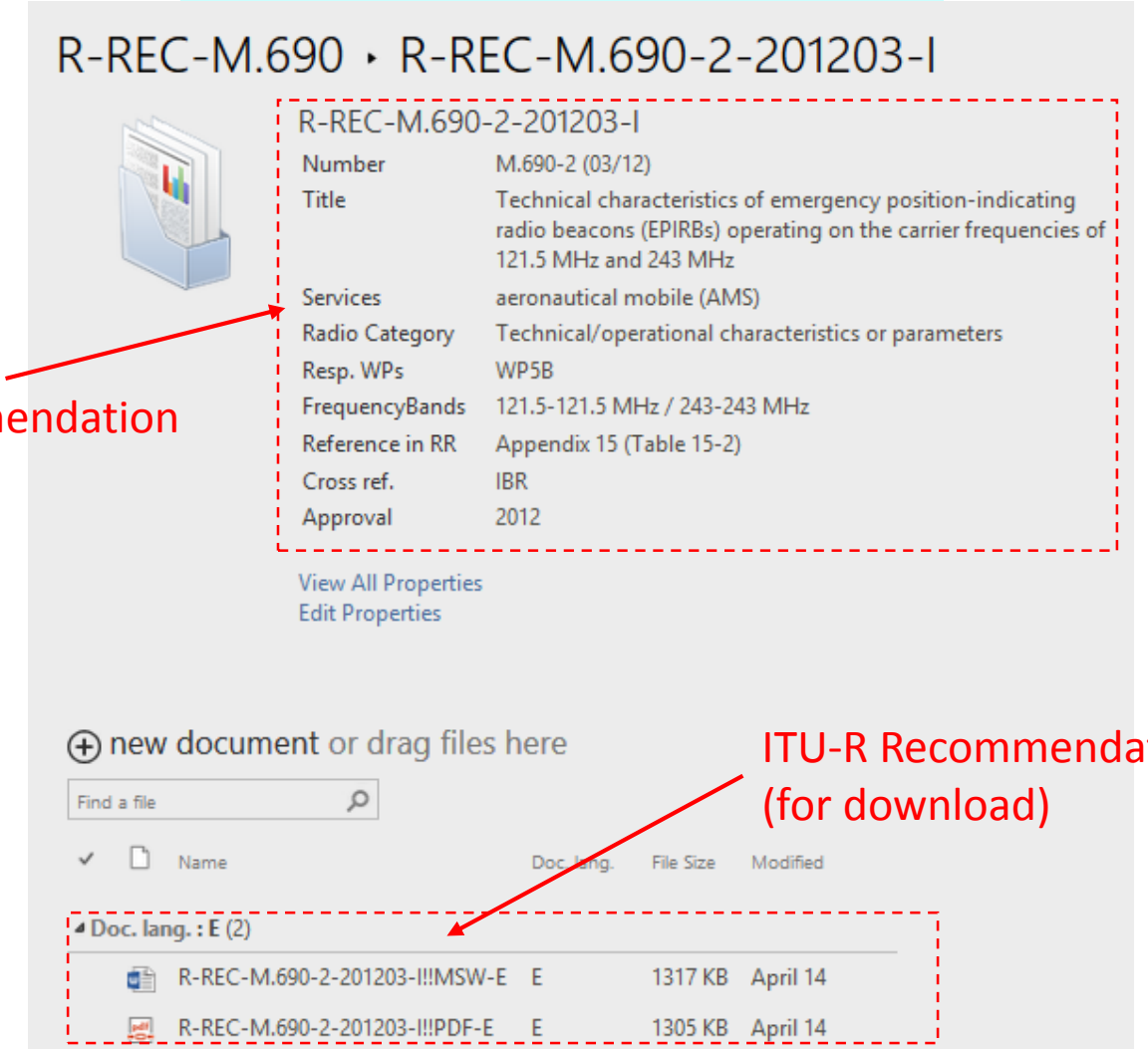
1. ITU-R Documents review & identify/extract search elements
2. Database develoment on ITU Sharepoint Platform
3. Document the working procedures specifying roles & responsiblities of the ITU/BR and ITU-R SGs/WPs to maintain the database
4. Develop a search application accessible by mobile terminals

Target documents and main search elements

- **ITU-R Recommendations**
  - Metadata Search (Search Criteria)
    "ITU-R Recommendation Series", "Radio Category", "Radio Services", "Cross Reference", "Responsible SGs/WPs" and "Approval Year"
  - Frequency Search
    Search by frequency range (min and max frequencies)
- **ITU-R Questions**
  - Metadata Search (Search Criteria)
    "Responsible SGs/WPs", "Approval Year", "Target Year" and "Category" (Resolution ITU-R 5)
- **ITU-R Reports [demo version, data verification is required]**
  - Metadata Search (Search Criteria)
    "ITU-R Recommendation Series", "Radio Category", "Radio Services", "Responsible SGs/WPs" and "Approval Year"
  - Frequency Search
    Search by frequency range (min and max frequencies)
- **ITU-R Resolutions and ITU Handbooks [under development]**

ITU-R Recommendations Search

ITU-R Recommendation Profile Page



Detail Profile of selected Recommendation

ITU-R Recommendation file (for download)

Thank you !

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