



ITU-R studies on Spectrum Management



International spectrum management framework



ITU Constitution,
Convention

Plenipoten-
tiary Conf.

High level principles

Radio Regulations
Bi/multilateral Agreements

WRC
RRC
RRB

Rights and Obligations
Table of Frequency Allocations
Satellite orbit/terrestrial Plans
Frequency coordination
Frequency registration
Interference
Rules of Procedure...

ITU-R Recommendations

RA

Technical characteristics
Sharing criteria/assessment
Spectrum management
Operational aspects ...

ITU-R Reports,
Handbooks, software tools

Study Groups
WPs, TGs

RRB: Radio Regulations Board
RRC: Regional Radiocommunication Conference
WRC: World Radiocommunication Conference

RA: Radiocommunication Assembly
WPs: Working Parties
TG: Task Groups



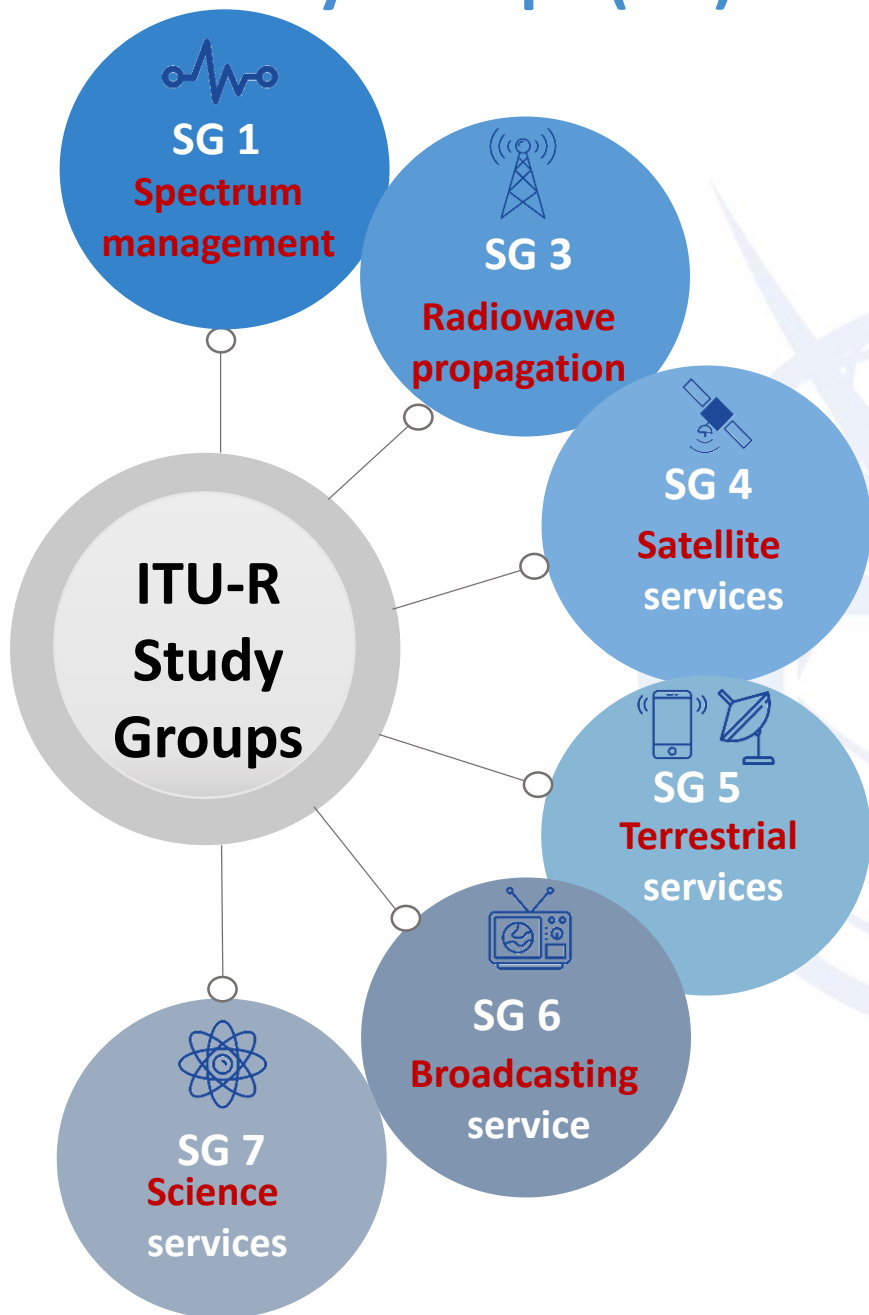
Radiocommunication Assembly 2019

- Held on 21 – 25 October 2019, in Sharm El-Sheikh, Egypt
- **521** participants, **91** ITU Member States, **48** ITU-R Sector members
- Maintained the ITU-R structure with **6 ITU-R Study Groups**, **CCV**, **RAG** and **CPM**, Appointed **Chairmen and Vice-Chairmen** of these groups (see [Res. ITU-R 4-8](#) & [Doc. 84](#))
Approved **programme of work/Questions** ([Res. ITU-R 5-8](#)) & **working methods** (Res. ITU-R [1-8](#) & [2-8](#))
- Approved **23** revised **ITU-R Resolutions** and **2** new **ITU-R Resolutions** (on broadcasting)
- Approved **5** ITU-R Recommendations (including one on frequency arrangements for terrestrial IMT)





ITU-R Study Groups (SG)



SG 1

- [WP 1A](#) – Spectrum engineering techniques
- [WP 1B](#) – Spectrum management methodologies and economic strategies
- [WP 1C](#) – Spectrum monitoring

SG 3

- [WP 3J](#) – Propagation fundamentals
- [WP 3K](#) – Point-to-point propagation
- [WP 3L](#) – Ionospheric propagation and radio noise
- [WP 3M](#) – Point-to-point and Earth-space propagation

SG 4

- [WP 4A](#) – Efficient orbit/satellite utilization for FSS and BSS
- [WP 4B](#) – Systems, air interfaces, performance and availability objectives for FSS, BSS and MSS (incl. IP-based applications and SNG)
- [WP 4C](#) – Efficient orbit/satellite utilization for MSS and RDSS

SG 5

- [WP 5A](#) – Land mobile > 30 MHz, fixed WAS, amateur & amateur-satellite
- [WP 5B](#) – Maritime and aeronautical mobile services and radiodetermination
- [WP 5C](#) – HF and other systems < 30 MHz in the fixed and land mobile services
- [WP 5D](#) – IMT systems

SG 6

- [WP 6A](#) – Terrestrial broadcasting delivery
- [WP 6B](#) – Broadcast service assembly and access
- [WP 6C](#) – Programme production and quality assessment
- [TG 6/1](#) – **WRC-23 agenda item 1.5** (use of the band 470-960 MHz)



SG 7

- [WP 7A](#) – Time signals and frequency standard emissions
- [WP 7B](#) – Space radiocommunication applications: space operation, space research, Earth exploration, meteorological satellite services
- [WP 7C](#) – Remote sensing systems (active and passive): Earth exploration-satellite, MetAids, space research services
- [WP 7D](#) – Radio astronomy

ITU-R Study Groups Products

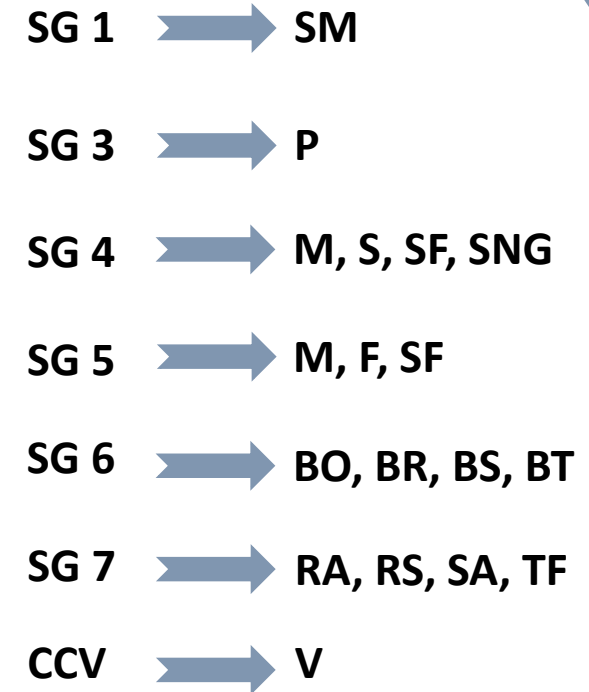
- ITU-R Recommendations
- ITU-R Reports and Handbooks
- Technical bases for radio conferences





ITU-R Recommendations/Report series

Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects



[BR Publication Search Tool](#)



Description of the texts* assigned to the ITU-R Study Groups and sub-groups

- **Spectrum Management** (SG 1, see [Doc. 1/1](#))
- **Radiowave Propagation** (SG 3, see [Doc. 3/1](#))
- **Satellite Services** (SG 4, see [Doc. 4/1](#))
- **Terrestrial Services** (SG 5, see [Doc. 5/1](#))
- **Broadcasting Service** (SG 6, see [Doc. 6/1](#))
- **Science Services** (SG 7, see [Doc. 7/1](#))

* ITU-R Questions,
Recommendations,
Reports, Handbooks,
Resolutions, Opinions,
Decisions
W(A)RC Resolutions
and Recommendations

ITU-R Collaboration with other sectors and organizations

- ITU-T ([Res. ITU-R 6-3](#))
- ITU-D ([Res. ITU-R 7-4](#))
- Other relevant organizations, incl. ISO, IEC & CISPR ([Res. ITU-R 9-6](#))

Economic aspects of SM* (incl. redeployment/refarming)

* Spectrum Management

✓ Report ITU-R SM.2012-6 at www.itu.int/pub/R-REP-SM.2012 (approved in June 2018)

- Includes lists of **legal, economic and reality principles** for financing and promoting efficient **NSM**** (rights, auctions, fees) (Chapter 2)
- Describes **methods to assess spectrum's economic benefits** and **factors affecting benefits** (incl. for international comparison of fee levels) (Chapter 3)
- Provides **guidelines on methodologies for establishment of spectrum fees formula and system** (incl. for applying a new fees system) (Chapter 4)
- Includes **Administrations' experiences with fees** (Chapter 5) from **AUS, CAN, CHN, CLM, D, INS, ISR, KGZ, RUS, UK, USA, B, KOR**

✓ [Rec. ITU-R SM.1603-2](#) (approved in August 2014) ON **spectrum redeployment** (or refarming)

- Includes examples on **Redeployment cost & fund, etc.**, with **ADMs' experiences** from **F, UAE, BEN, UKR, USA**

** National SM

➤ Regular updates of this information may be provided to every WP 1B meetings!

On-going work on Economic aspects of SM

✓ Studies on Question ITU-R 240/1 (approved in September 2017) on

Assessment of **spectrum efficiency and economic value**

- ✓ **Quantification of coverage & capacity** assists to ensure quality of service
- ✓ **Spectrum fees may assist to optimize the use of spectrum**
- ✓ To go **beyond info.** in Rep. ITU-R SM.2012 and **def. of spectrum use & efficiency of a radio system** (Rec. ITU-R SM.1046), e.g. **provide assessment of capacity** (bit/s/Hz)
 - **Method to quantify spectrum efficiency?**
 - **Factors that define the economic value of spectrum?**
 - **General model to assess the economic value of spectrum?**
 - The working document towards a draft new Report on these subjects will be further developed at the next WP 1B meeting.

➤ Opportunities to contribute to the next WP 1B meeting (24 Nov. – 2 Dec. 2020)

Digital dividend and Dynamic access to spectrum

✓ Report ITU-R SM.2353-0 at www.itu.int/pub/R-REP-SM.2353 (approved in June 2015)

Challenges and opportunities for SM resulting from the transition to digital terrestrial television in the UHF bands

- Provide a **definition**; some **SM aspects** relevant to the **digital dividend** (Planning principles, International & regional harmonization; Cross-border Coordination; others (technical, socio-economic, societal, consumer demand, etc.)

✓ Report ITU-R SM.2405-0 at www.itu.int/pub/R-REP-SM.2405 (approved in June 2017)

SM principles, challenges & issues related to dynamic access to frequency bands by means of radio systems employing Cognitive¹ capabilities

- Describes **possible Techniques, Challenges and related Issues**: Protection of incumbent services; Cross-border coordination; Geolocation issue; Sensing technology; NRA responsibility and Database complexity; etc..
- Includes **Study cases from CEPT, RUS, CHN, BOT, PHL, KOR**
- On-going revision of this Report to add a new study case of CLM

➤ Opportunities to contribute to the next WP 1B meeting (24 Nov. – 2 Dec. 2020)

¹ [Rep. ITU-R SM.2152](#)
Def. of CRS & SRD

Evolving Spectrum Management Tools

✓ Report ITU-R SM.2404-0 at www.itu.int/pub/R-REP-SM.2404 (approved in June 2017)

Regulatory tools to support enhanced shared use of the spectrum

- Describes following approaches (with experiences of use):
 - Licensed Shared Access (LSA)
 - Shared Spectrum Access for Similar Technologies(SSA-ST)

✓ WTDC-17 Report at www.itu.int/pub/D-STG-SG01.RES09.2-2017 (jointly approved by R-SG 1 in June 2017)

Evolving spectrum management tools to support development needs

- Summarizes **technical solutions** (IMT, WAS/RLAN, HAPS, Satellites, etc.) to provide **wireless broadband (BB)** coverage in wide-areas (incl. unserved & underserved areas)
- Indicates **SM solutions** for the spectrum use and sharing: **Licensed** (mobile BB, DTT, etc.); **License-exempt** (e.g. SRDs); **Dynamic spectrum access** techniques/mechanisms (e.g. DFS, geolocation DB, LSA, TVWS, etc.) and **associated challenges**
- Assess some **economic aspects** of these solutions
- Describes some **SM activities & resources** (NTFA, spectrum monitoring, international activities such as WRCs).

On-going work on Spectrum Management Methodologies

- ✓ Studies on **Question ITU-R 241/1** (approved in August 2019) on **Methodologies for assessing or predicting spectrum availability**
 - ✓ **Larger and more complex SM data** in the viewpoint of data science
 - ✓ May require **advanced data analysis methods** including machine learning
 - **Criteria and information?**
 - **Methodologies?**
 - **Technical approaches**, such as **data-driven management**, etc., that may **improve overall spectrum utilization?**

➤ Opportunities to contribute to the next WP 1B meeting (24 Nov. – 2 Dec. 2020)

ITU-R Harmonization for Short-Range Devices

✓ Report ITU-R SM.2153-7 at www.itu.int/pub/R-REP-SM.2153 (approved in June 2019)

Technical and operating parameters and spectrum use for SRDs

- Definition of SRD (operating on a non-interference & non-protected basis)
- Describes some **SRD Applications** (e.g. Telecommand, RFID¹, Alarms, etc.)²
- Provides radiated power or magnetic/electric field-strength limits
- Describes **Administrative requirements** (Certification and verification; **Mutual agreements** between countries/regions)
- Provides **information on national/regional rules** ¹ [Rep. ITU-R SM.2255](#)
(CEPT, USA, CHN, J, KOR (and some other APT countries), ² LPWAN in [Rep. ITU-R SM.2423](#), B, UAE, RCC)

✓ [Rec. ITU-R SM.2103-0](#) (approved in September 2017) on **SRD categories**

✓ [Rec. ITU-R SM.1896-1](#) (approved in September 2018) on **Frequency ranges for global or regional harmonization of SRD**

➤ Considering new range around 1.6 GHz for **Assistive Listening Systems**

➤ Opportunities to contribute to the next WP 1B meeting (24 Nov. – 2 Dec. 2020)

EMC/EMI & other studies for protection of radio services

- ✓ **Wireless Power Transmission (WPT)** (Question ITU-R 210-3/1 being revised; Rec. ITU-R [SM.2110](#), [SM.2129](#); Reports ITU-R [SM.2303](#), [SM.2392](#), [SM.2449](#), [SM.2451](#))
 - WPT applications via radio frequency beam
 - Other WPT applications (mobile/portable devices, electric vehicle, etc.)
- ✓ **Power Line Telecommunication (PLT)** (Question ITU-R 221-2/1; Recommendation ITU-R [SM.1879](#); Reports ITU-R [SM.2157](#), [SM.2158](#), [SM.2212](#))
 - Multiple input multiple output (MIMO) operation in PLT
- ✓ **Power/smart grid management systems** (Q. ITU-R 236/1; Rep. ITU-R [SM.2351](#))
- ✓ **Evaluation of radiated EM disturbances of household appliances (IoT)**
- ✓ **Estimating radiated emission limits in product-based standards**
- **Close collaboration with ITU-R and other SDOs (e.g. IEC/CISPR) in respect of ways of minimizing radiated disturbances & radio noise**

Other studies on new applications/spectrum use

✓ **Active services in frequency ranges above 275 GHz** (Question ITU-R 237/1;
Reports ITU-R [SM.2352](#), [SM.2450](#))

- Technology trends of active services
- Sharing and compatibility studies with passive services

✓ **Visible light for broadband communications (VLC)** (Question ITU-R 238/1;
Report ITU-R [SM.2422](#))

- Characteristics for use of VLC
- Advantages and disadvantages
- Possible applications/services
- Spectrum management aspects, etc.

➤ Opportunities to contribute to the next WP 1A meeting (24 Nov. – 2 Dec. 2020)

Studies on Spectrum Monitoring

✓ Use of **Drones and Small Satellites for Spectrum Monitoring**

- for e.g. EMF measurements, locating interference, etc.

✓ **Population coverage measurement** with public wireless networks

- Main principles and approaches of population coverage estimation

✓ New information on **EMF measurements** to assess human exposure

- e.g. 2020 ICNIRP guidelines

✓ Reporting **harmful interference** in support of Radio Reg. Appendix 10

✓ Performance evaluation of **mobile DF units** in operational environment

✓ Test procedures for measuring monitoring systems:

- **Field strength measurement accuracy** in the VHF/UHF frequency range
- **Geolocation accuracy of TDOA emitter location systems**

✓ Revision of the **Handbook on Spectrum Monitoring**

➤ Opportunities to contribute to the next WP 1C meeting (24 Nov. – 2 Dec. 2020)

Guidance on the regulatory framework for NSM*

✓ Report ITU-R SM.2093-3 at www.itu.int/pub/R-REP-SM.2093 (approved in June 2018)

✓ **Based on international principles to govern the spectrum use** and on **bi/multi-lateral agreements using ITU instruments** (CS, CV, RR, ITU-R Recommendations, etc)

* National Spectrum Management

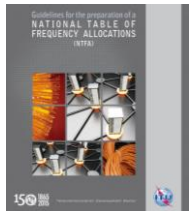
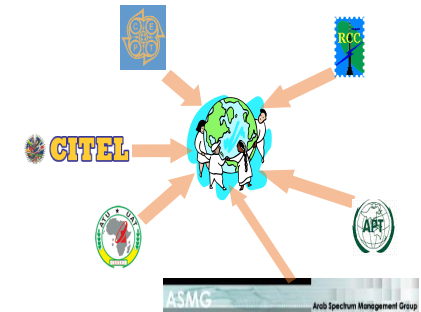
✓ **Need for regional harmonization and standardization** (APT, ASMG, ATU, CEPT, CITEC, RCC)

✓ **Linkage between international and national regulations** (allocations, assignments, licensing, monitoring, interference) **preserving States' rights and obligations**

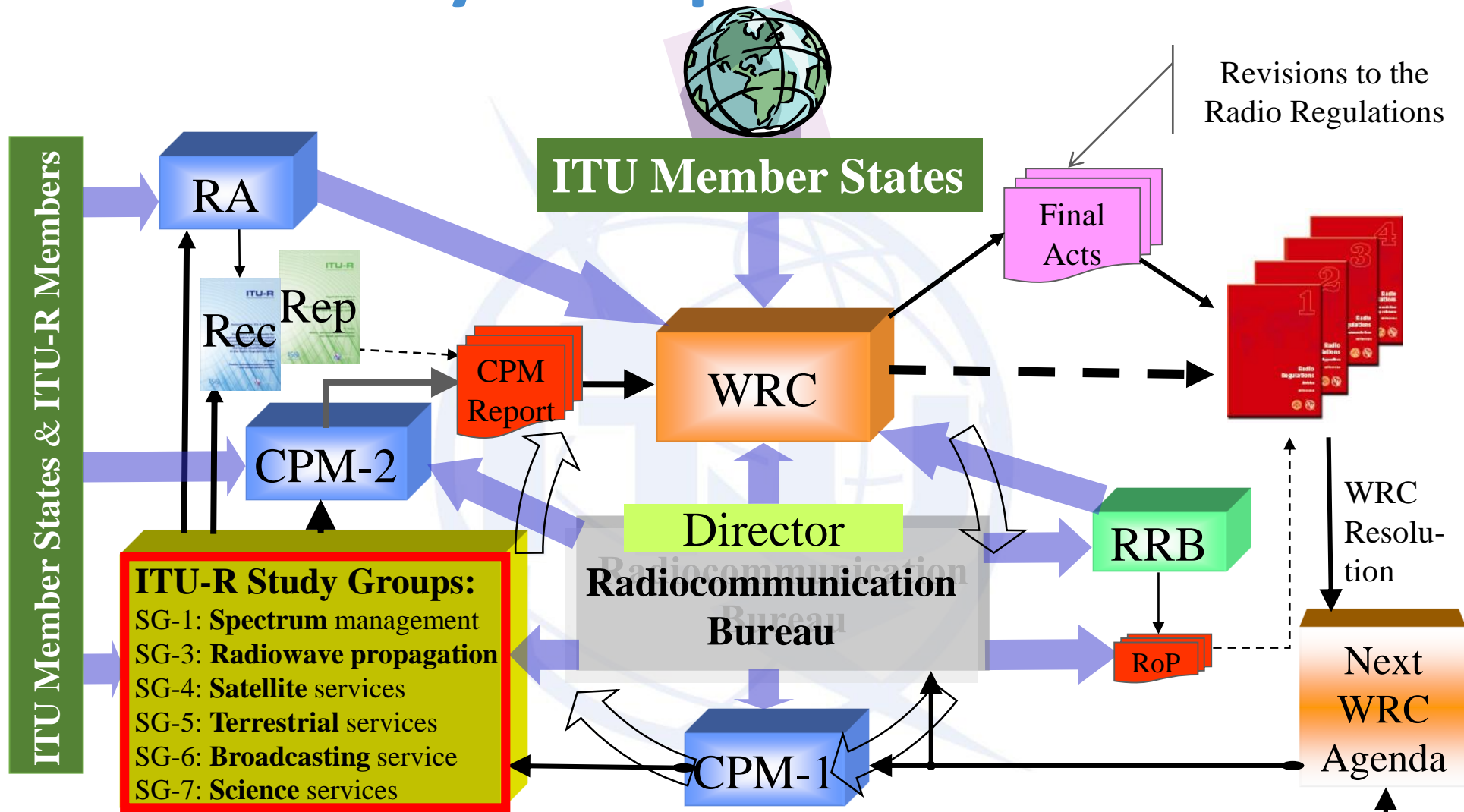
✓ **Need for national legal framework/regulation to take account of national specificities** (geographical, geopolitical, cultural, social, economical, etc.)

✓ Describes also **examples of National SM organizations** (F, UK, USA, CAN, NZL, CME, KOR, SUI, JOR, B, IND, CHN, UAE)

✓ See also the [ITU Guidelines for the preparation of NTFA](#) (2015) and [A Standard Approach for Assessing the SM needs](#) of Developing Countries (2016)



ITU-R Study Groups in WRC Process



RRB: Radio Regulations Board
SGs: Radiocommunication Study Groups
RA: Radiocommunication Assembly
WRC: World Radiocommunication Conference

CPM: Conference Preparatory Meeting
Rec: ITU-R Recommendation
RoP: Rules of Procedure
RR: Radio Regulations (treaty status)

Adopted
 by ITU
Council

Thank you!



[ITU-R Study Groups](#)