Spectrum Global Harmonization: role of WRC and ITU-R

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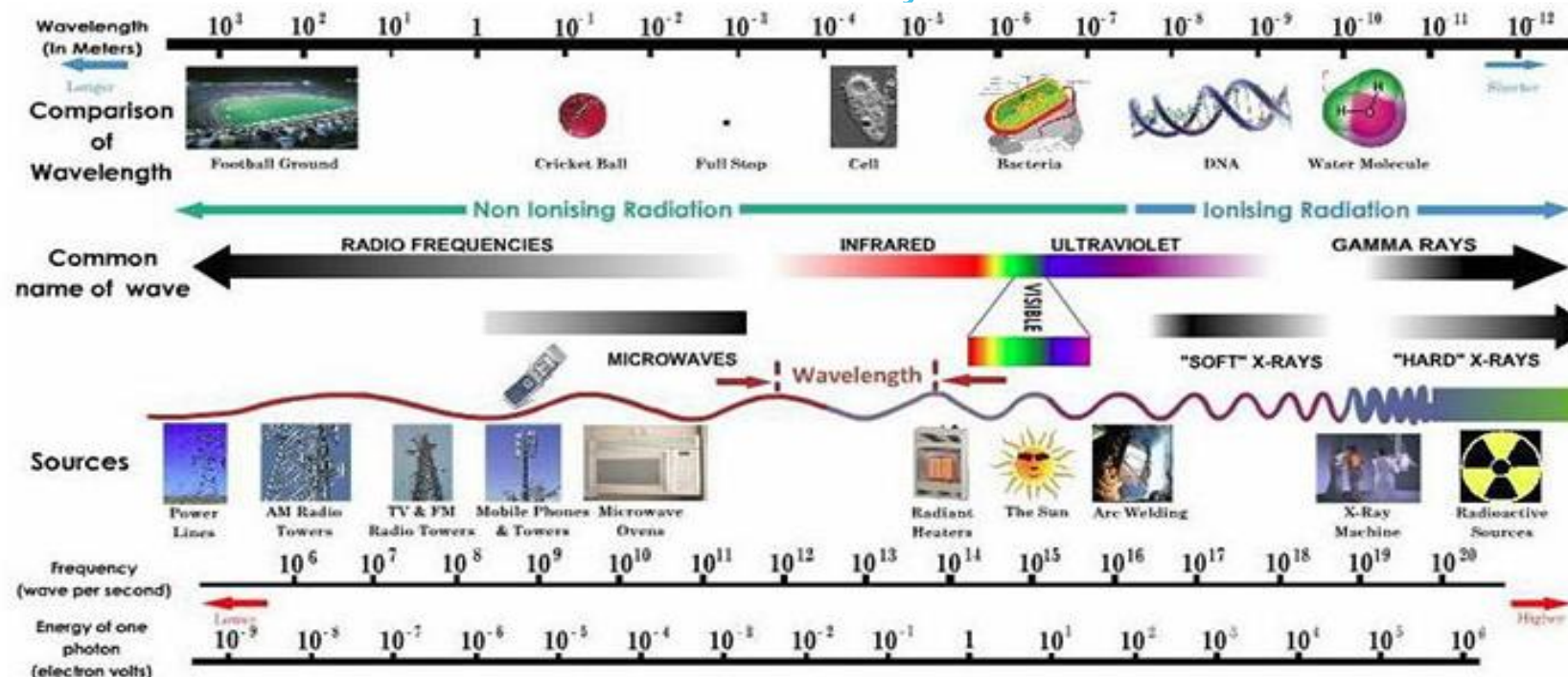
RADIOELECTRIC SPECTRUM

RR 1.3: Telecommunication: *Any transmission, emission or reception of signs, signals, writings, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.*

RR 1.5: Radio waves (or hertzian waves): *Electromagnetic waves of frequencies arbitrarily lower than 3000 GHz, propagated in space without artificial guide."* *(usually refers as: "**radio**")*

RR. 1.6 Radiocommunication: *Telecommunication by means of radio waves*

RADIOELECTRIC vs. ELECTROMAGNETIC SPECTRUM

- **Radioelectric Spectrum:** lower part of Electromagnetic Spectrum, used for Telecommunications

- Expression: "*Spectrum*" refers by default to Radioelectric Spectrum

- Communications systems that **DO NOT** use Spectrum (in red) may be regulated (National/International); but their regulatory framework is different than *Spectrum R*egulations

	Frequencies < 3.000 GHz?	Free Propagation?	Radioelectric Spectrum?
Infra-red Wireless link	NO	YES	NO
Cable TV (Coaxial)	YES	NO	NO
Optical Fiber	NO	NO	NO
Broadcasting TV	YES	YES	YES

ITU RADIO REGULATIONS, RR

Spectrum cannot be limited to a given territory; international coordination is necessary

ITU Radio Regulations (RR) is an International Treaty, elaborated and revised by administrations and membership, during World Radio Conferences (WRC); RR has a binding nature for ITU Member states.

ITU acts as depositary of RR

Last version: RR-20 (as revised during WRC-19)

RR can be downloaded, free of charge, for the general public, in the 6 UN Languages, at: https://www.itu.int/pub/R-REG-RR-2020

RR: KEY DEFINITIONS

RR, No. 1.19 Radiocommunication service: *A service involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes.*

RR, No. 1.61 Station: *One or more transmitters or receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service*

Terrestrial Services (**NO** satellite links)		
Fixed		
Broadcasting		
Mobile	Land mobile	
	Aeronautical mobile	
	Maritime mobile	
Radiodetermination	Radionavigation	
	Radiolocation	

but also

Amateur	
Standar Frequenct and Time	
Meteorogical Aids	
.	
.	

and more

Space Services (satellite links)		
Fixed-satellite		
Broadcasting-satellite		
Mobile-satellite	Land mobile-satellite	
	Aeronautical mobile-satellite	
	Maritime mobile-satellite	
Radiodetermination-satellite	Radionavigation-satellite	
	Radiolocation-satellite	

but also

Amateur-satellite	
Radio Astronomy	
Space Research	
.	
.	

and more

41 different types of Services (RR 1.20 to 1.60)

53 different types of Stations (RR 1.65 to 1.115)

RR: ALLOCATIONS vs. ASSIGNMENTS

RR, No. 1.16 allocation (of a frequency band): Entry in the Table of Frequency Allocations* of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned.

RR, No. 1.17 allotment (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions.

RR 1.18 assignment (of a radio frequency or radio frequency channel): Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions.

Frequency distribution to	French	English	Spanish	Arabic	Chinese	Russian
Services	Attribution (attribuer)	Allocation (to allocate)	Atribución (atribuir)	توزيع (يوزع)	划分	распределение (распределять)
Areas or countries	Allotissement (allotir)	Allotment (to allot)	Adjudicación (adjudicar)	تعيين (يعين)	分配	выделение (выделять)
Stations	Assignation (assigner)	Assignment (to assign)	Asignación (asignar)	تخصيص (يخصص)	指配	присвоение (присваивать)

Allocations are granted to Radiocommunications **Services**
Assignments are granted to Radiocommunications **Stations**

NOTE: *Most of dictionaries display the expressions "**Allocation**" and "**Assignment**" as being **synonymous**; in the context of Spectrum Management and Regulation **they are different**.*

RR: OTHER CONCEPTS

Other concepts: although not explicitly defined, on the RR when dealing with band allocations (Art. 5), the use into footnotes of expressions: "*identified*" and "*designated*" express the interest/intention of some administrations on a future use of that band for a specific application; that **in benefit of a mid- and long-term harmonization of the use of that band**.
 Examples*:
RR, Nos. 5.138, 5.150,...: Bands *designated* for industrial, scientific and medical (**ISM**) applications.
RR, No. 5.552A.... : Bands *designated* for use by high Altitude Platform Stations (**HAPS**)
RR, No. 5.516B......: bands *identified** for use by High-Density applications in the fixed-satellite service   *(also named: High Througput Satellites,* **HTS***)*
RR, Nos. 5.286AA, 5.313.A,....: Bands *identified** for International Mobile Telecommunications (**IMT**)

*: Footnotes stated that: "*This identification does not preclude the use of this band by any application Fon of the services to which it is allocated and does not establish priority in the Radio Regulations*"**.**

ITU

RR: ALLOCATION PRINCIPLES

RR is technically neutral*, hence, it
1. Does <u>allocate</u> frequency <u>bands</u> to radiocommunication <u>services</u>
2. Does <u>not</u> allocate to specific <u>applications</u>
3. Does <u>not</u> allocate to particular <u>technologies</u>
4. Does <u>not</u> define user <u>profiles</u> (official, commercial, private, etc.)

e.g.: allocation can be made to:
"*mobile*" (*service*; by default: terrestrial, land) →NFAT: shall be aligned with **RR**
  - not specifically to : National Standards: ITU-R Recommendations
a) cellular networks (*application*) :
b) GMS, LTE, Wimax, etc. (*technology*)
c) Official/commercial/particular (*user profile*)

RR: CATEGORIES OF SERVICES

5.25 a) services in "CAPITAL CASE" (example: FIXED) are "PRIMARY" category (primary basis)

5.26 b) services in "Normal cases" (example: Mobile) are "Secondary" category (secondary basis)

5.48 3) services are listed by category then in alphabetical order (French language). The order of listing does not indicate relative priority within each category.

Stations of secondary service: **Non-Interference/Non-Protection (NI/NP)** *vs PRIMARY service*

a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date;

c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date**
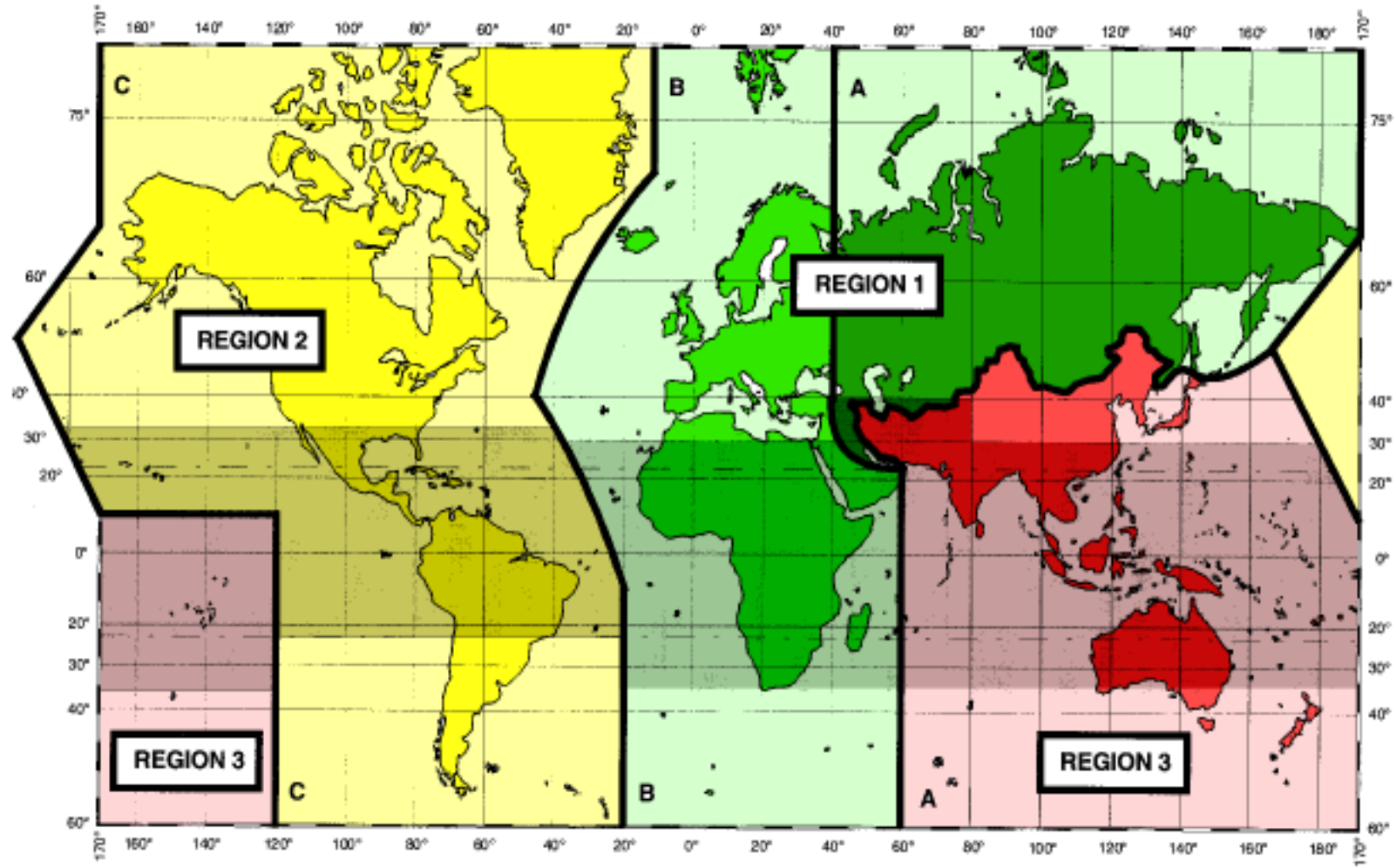
(**first in time, first in right)

* Arabic & Chinese versions, PRIMARY → bold characters:

متنقلة بحرية	**无线电定位**
متنقلة بحرية	无线电定位

RR: WORLD REGIONS

RR: TABLE OF FREQUENCY ALLOCATIONS (Art. 5)

Frequency Band →

Harmonized ←

PRIMARY ←

Secondary ←

Regional Band Split

Footnote (right)

CO-PRIMARY

Shared: PRIMARY and Secondary

Footnote (below)

Allocation to services		
Region 1	Region 2	Region 3
495-505	MARITIME MOBILE	
505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	505-510 MARITIME MOBILE 5.79	505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Land mobile
	510-525 MARITIME MOBILE 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	

90-110	RADIONAVIGATION 5.62 Fixed 5.64	

RR: COUNTRY(ies) FOOTNOTES (Examples*)

137-137.025	SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208A 5.208B 5.209 SPACE RESEARCH (space-to-Earth) Fixed Mobile except aeronautical mobile (R) 5.204 5.205 5.206 5.207 5.208

FIXED
MOBILE

Different Category of Service:
Same Services
but
**Different Categories**

137-137.025	SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208A 5.208B 5.209 SPACE RESEARCH (space-to-Earth) Fixed Mobile except aeronautical mobile (R) 5.204 5.205 5.206 5.207 5.208

+
BROADCASTING

Additional Allocation:
Same Services
+
More Services

137-137.025	SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5 SPACE RESEARCH (space-to-Earth) Fixed Mobile except aeronautical mobile (R) 5.204 5.205 5.206 5.207 5.208

FIXED
MOBILE
BROADCASTING

ALTERNATIVE Allocation:
Replaces the allocations indicated in the Table

No actual footnotes, for illustrative purpose only

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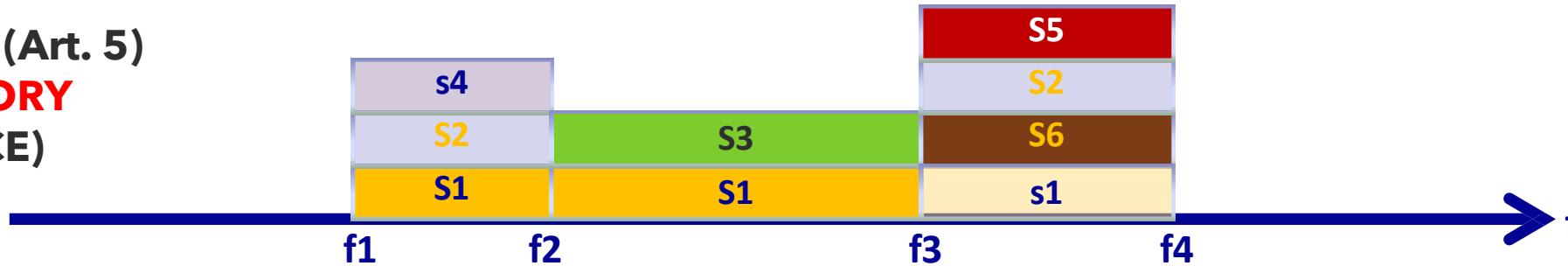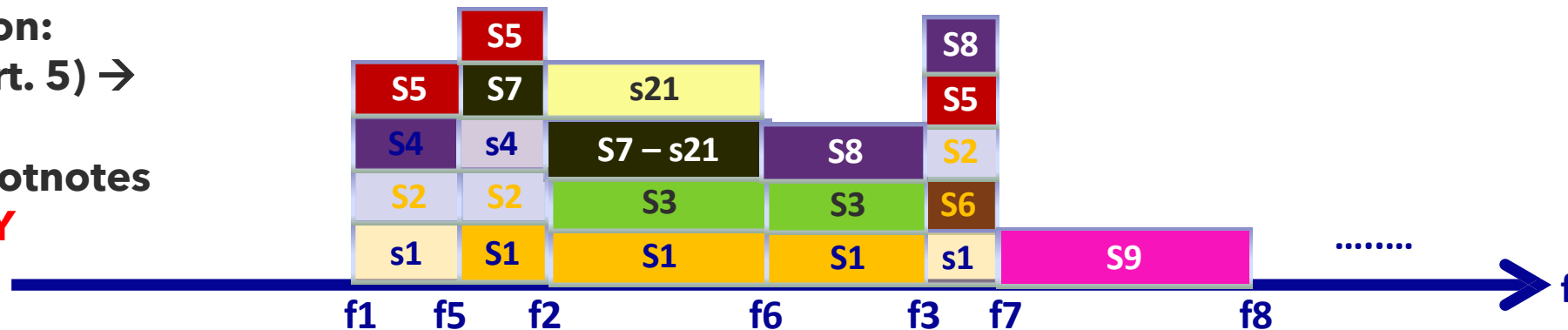
Bands Harmonization

- Harmonized utilization of spectrum by different nations is an essential need to support international roaming, to facilitate interconnection and to provide more economical radiocommunication services,

- Frequency bands can be utilized at same point, in same time, almost once while there could be more than one demand for utilization,

Global Harmonization: Ultimate goal (as possible); <u>RR Recommendation 34</u>: *recommends that future world radiocommunication conferences:*

- Uncoordinated electromagnetic radiation of individual and independent spectrum users increase interferences matters

- *2. <u>Should, wherever possible, allocate frequency bands on a worldwide basis</u> (aligned services, categories of service and frequency band limits) taking into account safety, technical, operational, economic and other relevant factors;*

- *3. Should, wherever possible, keep the number of footnotes in Article 5 to a minimum when allocating frequency bands through footnotes, in line with the Resolution 26*

RR: Terrestrial vs Space Services

	TERRESTRIAL	SPACE
KEY PLAYERS	**ITU**, NRA	**ITU**, **COPUOS**, NRA et al
RESOURCE	FREQUENCIES	FREQUENCIES **+ ORBITS**
ALLOCATION	**RADIO REGULATIONS** then NFAT	**RADIO REGULATIONS (Uplink, Downlink, Sat-Sat)** then NFAT
ALLOTMENT*	**NATIONAL RULES (Uplink, Downlik)** *(voluntary: ITU-R Rec)*	**RADIO REGULATIONS** (Uplink, Downlink, Sat-Sat)** then NATIONAL RULES
ASSIGMENT*	**NATIONAL RULES (Uplink, Downlik)**	
LICENSING		**NATIONAL RULES COPUOS**

vs

* Excluding Vol 2 (Appendices)
** International Recognition of a Satellite Network doesn't conduct to any national "*landing right* "
that is a autonomous and sovereign right of every administration

Purpose of WRCs

- Create regulatory certainty for a multi-trillion dollars activity that provides radiocommunications services to billions of people in all countries worldwide, playing an increasingly important role in the development of our societies

- Strike the right balance between the spectrum requirements of all radiocommunication services

- Creating certainty requires consensus in order to achieve stable results on a sustainable use of orbit/spectrum resources

- Reaching consensus requires time, efforts and patience

- This is the price to pay for developing and maintaining a sustainable ecosystem for radiocommunications and avoid massive disruptions

World Radiocommunication Conference (WRC)

Held every four years
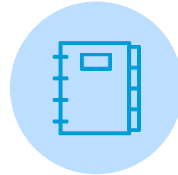
Reviews and revises the Radio Regulations

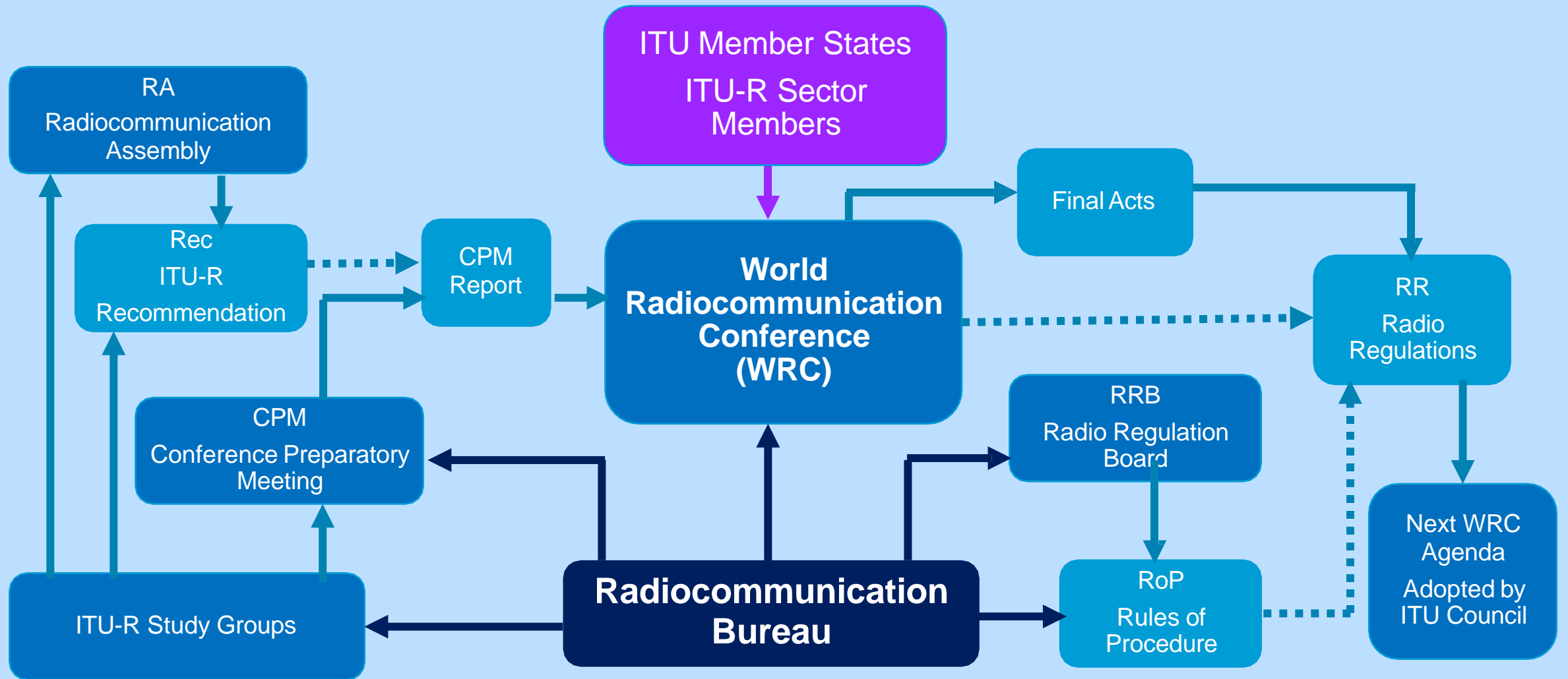Addresses any radiocommunication matter of worldwide implication

Considers evolution of existing, emerging and future applications, systems and technologies

Considers results of ITU-R studies on spectrum needs, sharing and compatibility

Considers proposals from ITU Member States

WRC process

WRC-23 in numbers

3987 Delegates

163 Member States

967 Docs.

4 weeks
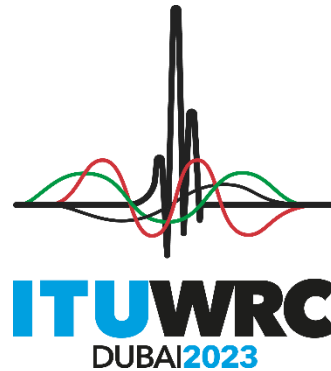
151 observers

6024 proposals

Region	%
Africa	20%
Americas	17%
Arab States	11%
Asia & the Pacific	18%
Independent States)	3%
Europe	32%

Country	
United States	287
China	280
Japan	164
United Kingdom	153
United Arab Emir...	149
Saudi Arabia	122
Germany	117
France	116
Türkiye	93
Nigeria	82
Korea (Rep. of)	77

WRC Cycle

WRC-23

Modified the RR (2020), Defined the agenda for WRC-27

CPM27-1

Allocated the work of the agenda items to relevant working parties of ITU-R Study Groups, defines chapter Rapporteur and the structure of the CPM Report

ITU-R Study Groups

Conducts studies for 4 years and prepares draft CPM text

ITU-R Study Groups:
• SG-1: Spectrum management
• SG-3: Radiowave propagation
• SG-4: Satellite services
• SG-5: Terrestrial services
• SG-6: Broadcasting service
• SG-7: Science services

CPM27-2

Consolidates the results of studies in CPM text that includes the methods to solve each agenda item

RA-27

Appoints the chairmen and vice chairmen of the Study Groups, revises the structure of the Study Groups, approves ITU-R recommendations, revises ITU-R resolutions

WRC-27

Modifies the RR (2024) (e.g. allocates frequencies), Defines the agenda for WRC-31

Regional Groups / Multi-countries
Consolidates Regional and multi-country proposals

WRC-27

ITU-R Study Groups and their Working Parties

SG 1 — Spectrum management

SG 3 — Radiowave propagation

SG 4 — Satellite services

SG 5 — Terrestrial services

SG 6 — Broadcasting service

SG 7 — Science services

CCV

All groups are supporting and contributing to the studies.

ITU-R Responsible Groups for studies on WRC-23 agenda items/topics

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-area** 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 (excl. IMT)**, **fixed WAS** in the **FS**, **amateur** & **amateur-satellite services**
WP 5B – **Maritime** (incl. GMDSS) and **aeronautical** mobile services & **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) – *Work completed*

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** (incl. planetary sensors)
WP 7D – **Radio astronomy**

Studies developed by the ITU-R SGs & WPs

ITU-R Study Groups and their Working Parties carry out regular activities within their mandate and they also perform studies in response to requests from WRCs and RAs.

Studies to revise and maintain the existing publications

Maintenance and update of existing publications to adapt them to the technology evolution.

Studies to develop new technology and new publications

Discussion and studies on new trends and publication of standards and reports on the emerging technologies.

Studies in application of WRC and RA Resolutions

Development of studies in response to the requests from WRCs and RAs.

Regular activities of ITU-R SGs and WPs

Activities of ITU-R SGs and WPs related to WRC and RA

CPM role and structure

Resolution ITU-R 2-8 *"Conference Preparatory meeting"*

First session of the CPM

- Identifies the topics for study in preparation for the next WRC **(WRC agenda items)** and, to the extent necessary, for the subsequent WRC.

- Identifies a single **responsible ITU-R SG or WP or TG or JTG** for each agenda item, as well as the contributing groups.

- Appoints the **Chapter Rapporteurs** for each agenda item.

Responsible WPs/TGs

- Carry out ITU-R preparatory studies and produce CPM texts for each WRC agenda item they are responsible for.

- These CPM texts are put together and compose the **draft CPM Report**.
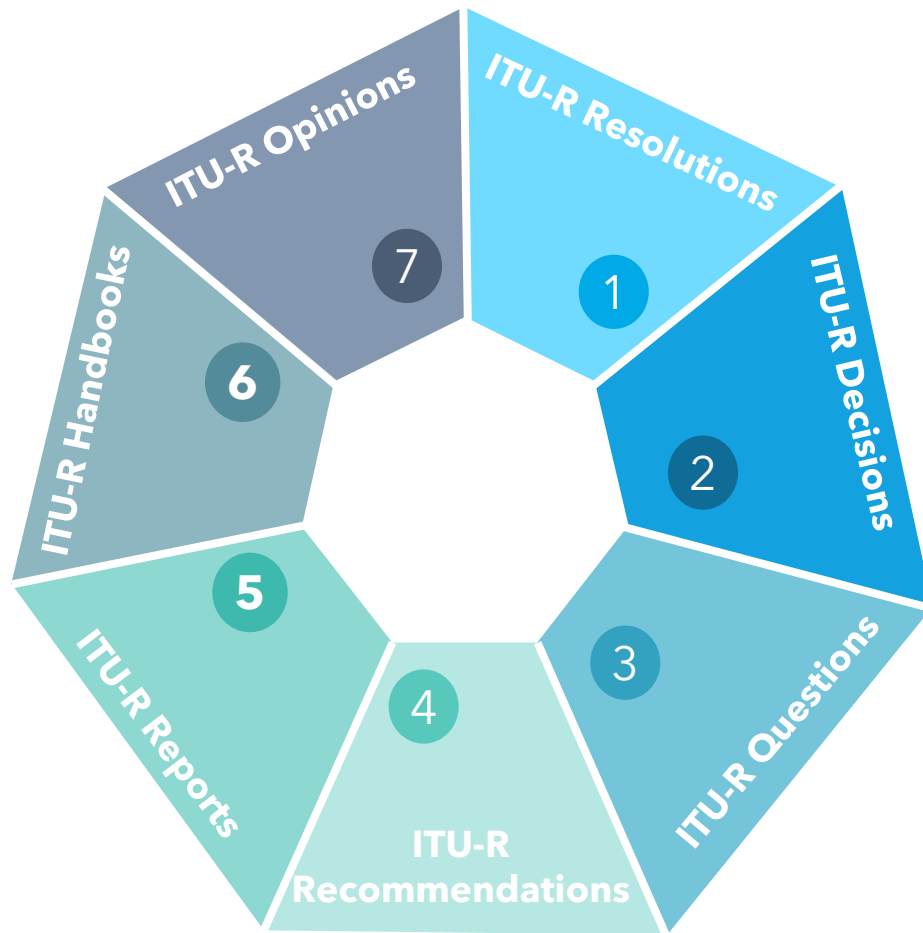
Second session of the CPM

- Using the **draft CPM Report** as a basis and input contributions, it compiles and approves the CPM Report to the next WRC.

Output

CPM Report to the next WRC

Documentation of ITU-R Study Groups

1. A text giving instructions on the organization, methods or programmes of RA or SG work. (*§ A2.3.1 of Res. ITU-R 1-8*)

2. A text giving instructions on the organization of the work of a Study Group. (*§ A2.4.1 of Res. ITU-R 1-8*)

3. A statement of a technical, operational or procedural study, generally seeking a Recommendation, Report or Handbook. (*§ A2.5 of Res. ITU-R 1-8*)

4. An answer to a Question or part(s) of a Question or other topics defined in Annex 1 (*§ A1.3.1.2 of Res. ITU-R 1-8*)

5. A technical, operational or procedural statement, prepared by a Study Group on a given subject. (*§ A2.7 of Res. ITU-R 1-8*)

6. Provide a statement of the current knowledge, the present position of studies, or of good operating or technical practice. (*§ A2.8.1 of Res. ITU-R 1-8*)

7. A text containing a proposal or a request destined for another and not necessarily relating to a technical subject (*§ A2.9.1 of Res. ITU-R 1-8*)
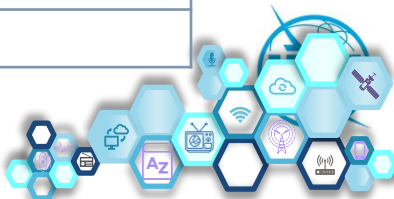
ITU-R Study Groups publications

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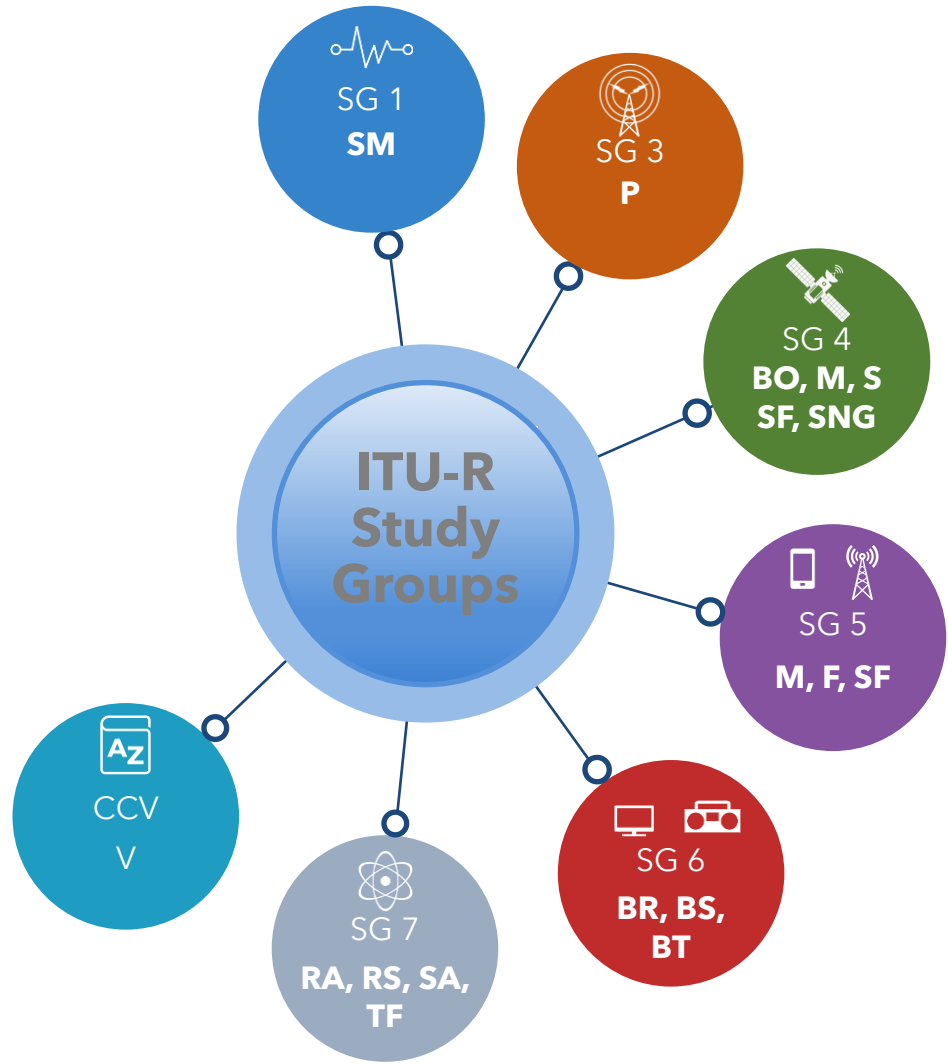
Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M/M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy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

ITU-R Recommendations

ITU-R Reports

SERIES	TOPIC	Study Group*	SG matters	Recommendations	Reports
BO	Satellite delivery	SG4 & SG6		45	29
BR	Recording for production, archival and play-out; film for television	SG6	Broadcasting service	4	0
BS	Broadcasting service (sound)	SG6	Broadcasting service	82	47
BT	Broadcasting service (television)	SG6	Broadcasting service	161	99
F	Fixed service	SG5	Terrestrial services	146	19
M	Mobile, radiodetermination, amateur and related satellite services	SG4 & SG5		247	166
P	Radiowave propagation	SG3	Radiowave Propagation	86	11
RA	Radio astronomy	SG7	Science services	14	9
RS	Remote sensing systems	SG7	Science services	38	22
S	Fixed-satellite service	SG4	Satellite services	141	22
SA	Space applications and meteorology	SG4 & SG7		58	28
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems	SG4 & SG7		20	1
SM	Spectrum management	SG1	Spectrum Management	92	46
SNG	Satellite news gathering	SG4	Satellite services	9	0
TF	Time signals and frequency standards emissions	SG7	Science services	15	0
V	Vocabulary and related subjects	(CCV)	Coordination Comitee for Vocabulary	5	0
TOTAL				**1163**	**499**

*SGs mainly involved; due to transversal nature, some series also involves other(s) SG

SG	SG1	SG3	SG4	SG5	SG6	SG7	Special Supplements	TOTAL
	Spectrum Management	Radiowave Propagation	Satellite Services	Terrestrial Services	Broadcasting Services	Science Services		
Handbooks	4	8	4	13	7	6	1 (1-4) - MSS	43

THANKS ☺
GRACIAS ☺

Further info:
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