Spectrum Allocation for 5G International Framework

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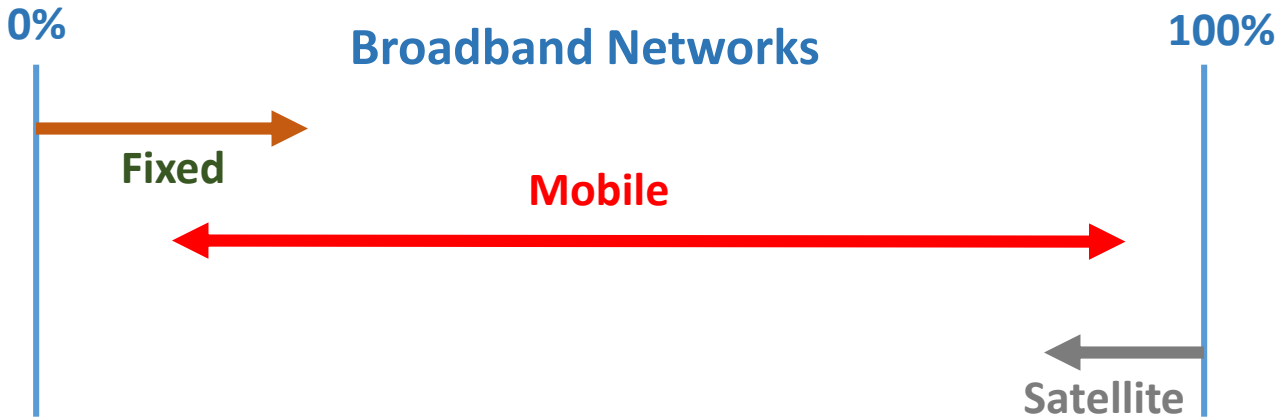
ITU Regional Economic Dialogue on
Information and Communication Technologies for Europe and CIS (RED-2019)
regulatory and economic tools for a dynamic ICT market place
Odessa, Ukraine, October 30-31, 2019

Broadband Access: Fixed vs. Mobile

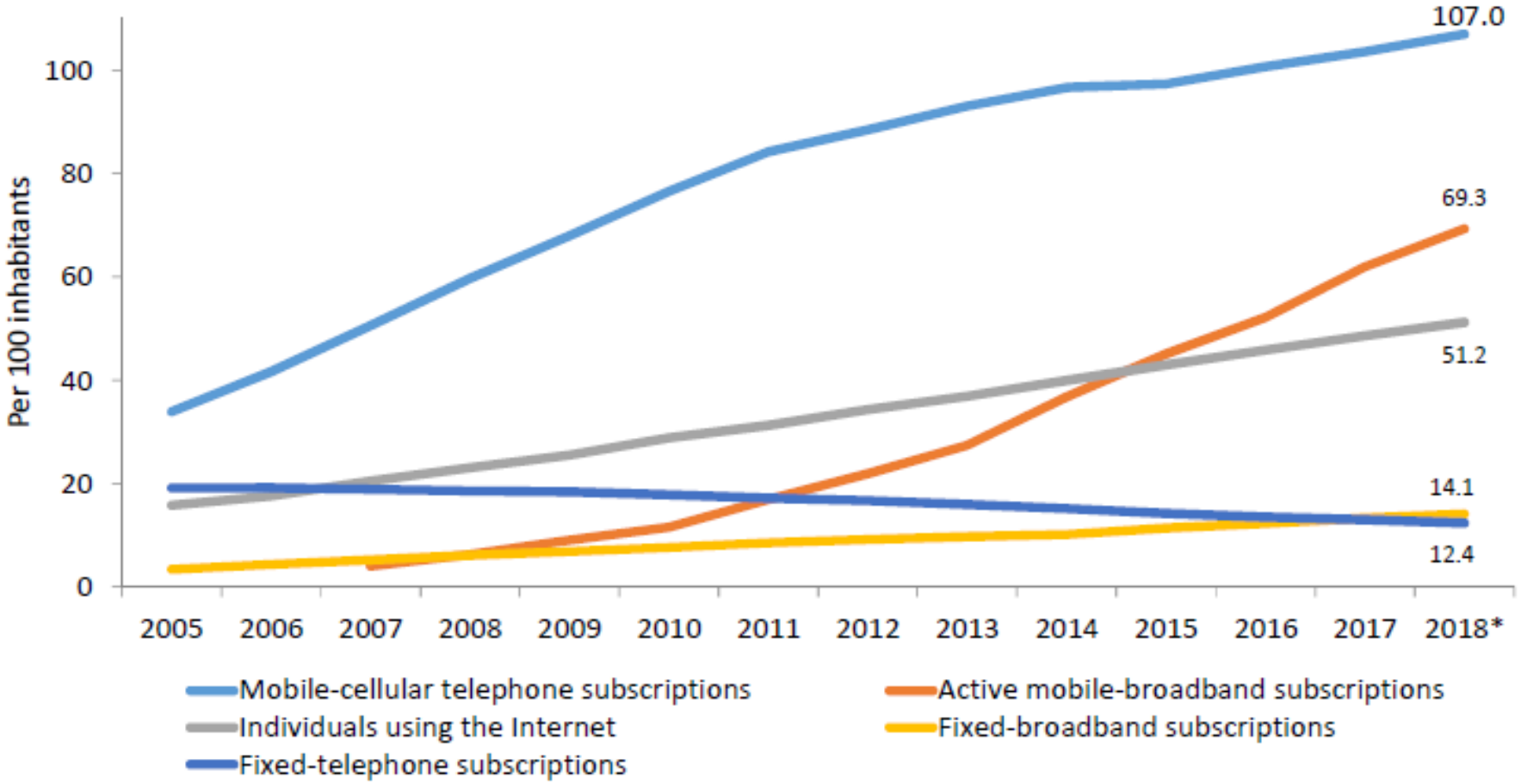


Broadband services infrastructure is based upon 3 types of final access networks (last km, last mile):

- Fixed: copper, coaxial, fiber
- Wireless (Terrestrial): cellular, Wi-Fi?
- Satellite

Broadband penetration is topped by the penetration of these networks

Broadband Access: Fixed vs. Mobile



	Region	% Prepaid
Developing	*Africa*	*96%*
	Asia	*91%*
	Latinamérica	*89%*
Developed	*Asia*	*15%*
	Norteamérica	*22%*
	Europa	*33%*

- Fixed Networks in slight decline
- Mobile Networks in high growth, near saturation
- increasing Gap between developed and developing world.
- Broadband Universal Service in developing world: **Mobile & Prepaid**

Mobile Networks Evolution

5G (IMT2020)

4G* (IMT-Advanced)
- Digital System, IP-based
- Service Convergence: Telecom & Datacom
- Very High Data rate (Broadband); multimeda format, Video
- Seamless Roaming
- Global Radio Access / Global Solution

3G (IMT-2000)
- Digital System
- Service Concepts and Models: Multimedia Apps.
- High Data rate (Broadband)
- Seamless Roaming
- Global Radio Access / Global Solution

2G
- Digital System
- More Services: Digital Voice; Text-based Apps.
- Low data speed (Narrowband)
- Advanced Mobility (Roaming)
- Towards Global Compatibility

1G
- Analog System
- Very basic Services (mostly voice)
- Basic Mobility
- Systems Incompatibility

2016
4 Years
2012
5 Years
2007
7 Years
2000
10 Years
1990

For over 30 years, ITU has been developing the standards and spectrum arrangements to support International Mobile Telecommunications (IMT)

First Generation (1G)

1G analogue systems provided two key improvements over the first radiotelephone services:

- the invention of the microprocessor; and
- digitization of the control link between the mobile phone and the cell site.

1970s

Frequencies for mobile services allocated in the Radio Regulations

Second Generation (2G)

2G systems digitized not only the control link but also the voice signal - better quality and higher capacity at lower cost.

Regional/global operation was hampered by:
- multiple incompatible standards;
- different frequency bands and channels in different parts of the world.

1980s-1990s

ITU-R develops the international mobile telecommunication system (IMT) to address these issues – first global IMT frequencies identified at WRC-92

IMT-2000 – Third Generation (3G)

ITU's IMT-2000 global standard for 3G unanimously approved at the ITU Radiocommunication Assembly 2000 – digital voice and data.

Global standard and harmonized frequencies:
- global roaming;
- massive economies of scale;
- innovative applications and services.

2000s

WRC-2000 and WRC-07 identify additional frequency bands for IMT in the Radio Regulations

Fourth Generación (4G) – IMT Advanced

Multimedia

- **4G Systems,** provides:
  - IP based
  - Very high data speeds
  - Convergence of Services
  - Web access, television, videogames, videoconferences ...
  - IMT-Advanced Specifications were approved during Radio ITU Radio Assembly 2012
  - Mobile Broadband became the largest method to internet access

2010s

WRC-15 harmonized and identified several additional frequency bands for IMT on the Radio Regulations

		Real World (avg)		Theoretical (max)		Availability
		Download	Upload	Download	Upload	
2.5G	GPRS	32-48Kbps	15Kbps	114Kbps	20Kbps	Today
2.75G	EDGE	175Kbps	30Kbps	384Kbps	60Kbps	Today
3G	UMTS	226Kbps	30Kbps	384Kbps	64Kbps	Today
	W-CDMA	800Kbps	60Kbps	2Mbps	153Kbps	Today
	EV-DO Rev. A	1Mbps	500Kbps	3.1Mbps	1.8Mbps	Today
	HSPA 3.6	650Kbps	260Kbps	3.6Mbps	348Kbps	Today
	HSPA 7.2	1.4Mbps	700Kbps	7.2Mbps	2Mbps	Today
Pre-4G	WiMAX	3-6Mbps	1Mbps	100Mbps+	56Mbps	Today
	LTE	5-12Mbps	2-5Mbps	100Mbps+	50Mbps	End 2010
	HSPA+	-	-	56Mbps	22Mbps	2011
	HSPA 14	2Mbps	700Kbps	14Mbps	5.7Mbps	Today*
4G	WiMAX 2 (802.16m)	-	-	100Mbps mobile / 1Gbps fixed	60Mbps	2012
	LTE Advanced	-	-	100Mbps mobile / 1Gbps fixed	-	2012+

Figure taken from: http://sudhakarreddymr.wordpress.com/2011/06/01/difference-between-1g-2g-2-5g-3g-pre-4g-and-4g/

1G → 2G : Analog to Digital

2G → 3G : Narrowband to Broadband

3G → 4G : Broadband evolution (Multimedia)

4G → 5G : High Broadband to connect **People** and **machines**

IMT Definition

*From: Recommendation ITU-R M.1224**

International Mobile Telecommunications (IMT) systems are mobile systems that provide access to a wide range of telecommunication services including advanced mobile services, supported by mobile and fixed networks, which are increasingly packet-based

IMT systems support low to high mobility applications and a wide range of data rates in accordance with user and service demands in multiple user environments. IMT also has capabilities for high quality multimedia applications within a wide range of services and platforms, providing a significant improvement in performance and quality of service.

IMT encompasses both IMT-2000 & IMT-Advanced, …and IMT-2020

* 1st release ITU-R M.1224-0 (02-97); current version ITU-R M.1224-1 (03-12)

IMT Key Features

From: Recommendation ITU-R M.1224

1. A high degree of commonality of functionality worldwide while retaining the flexibility to support a wide range of services and applications in a cost efficient manner;
2. Compatibility of services within IMT and with fixed networks;
3. Capability of interworking with other radio access systems;
4. High quality mobile services;
5. User equipment suitable for worldwide use;
6. User-friendly applications, services and equipment;
7. Worldwide roaming capability;
8. Enhanced peak data rates to support advanced services and applications.

These features enable IMT to address evolving user needs and the capabilities of IMT systems are being continuously enhanced in line with user trends and technology developments

IMT Requirements

From: Recommendation: ITU-R M.1822-0 (10/2007)

1. Seamless connectivity
2. Mobility management
3. Interoperability
4. Constant connection
5. Application scalability
6. Security
7. Prioritization
8. Location
9. Broadcast/multicast
10. Presence
11. Usability
12. Voice recognition
13. User-friendly human-to-machine interface
14. Support for a wide range of services

IMT and Mobile Labels

- **IMT:** Devised within ITU through the work of *ITU Study Groups* (worldwide participation, amongst all stakeholders: Regional Organizations, Regulators, operators, manufactures, universities and R&D Centers,, etc.)
Unique set of Definitions and Specifications (through ITU-R publications)
IMT encompasses all its versions: IMT2000, IMT-Advanced, IMT 2020

- **xG:** Devised by operators and mobile community.

There is no unique set of definitions and specifications.

- **IMT-2000 and 3G:** there was consensus about matching both these concepts and associated specifications.
- **IMT-Advanced and 4G:** no consensus was reached:

- Some Regulators demanded that a 4G brand must comply with IMT-Advanced specifications.
- Other Regulators recognized 4G as those technologies providing an enhanced performance in comparison to IMT-2000 Specifications.

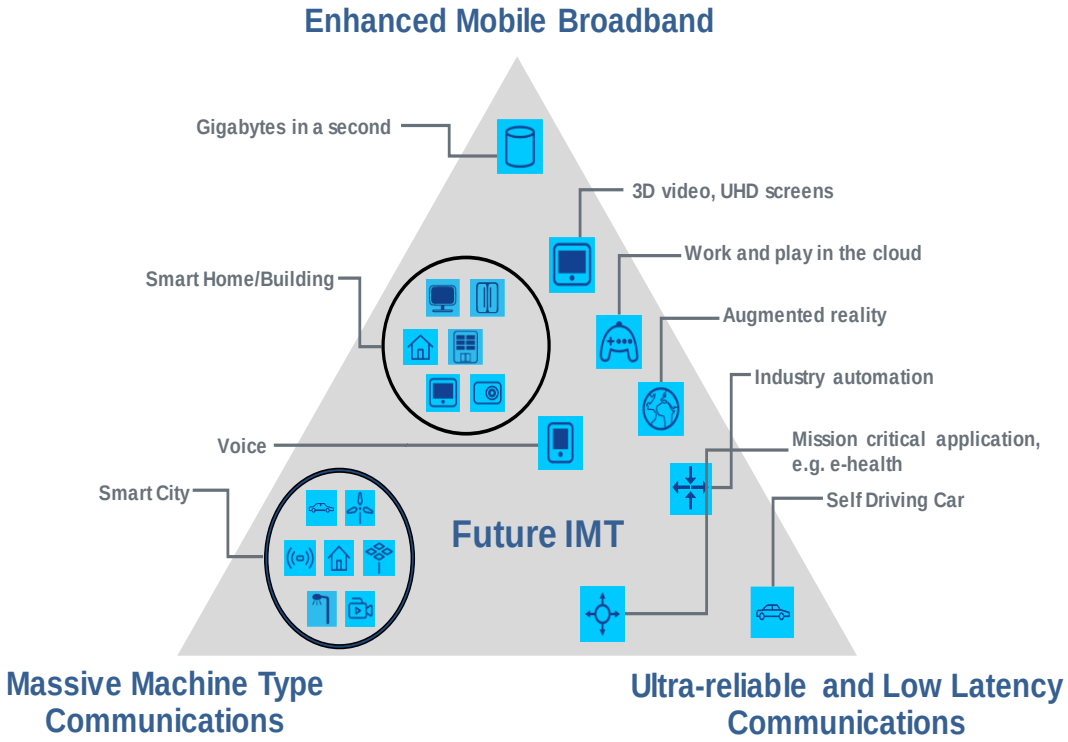
IMT-2020 and 5G: consensus achieved

5th Generación (5G) – IMT 2020

Connecting Peopke and Things

The 5G systems (IMT-2020) will provide:

- Improved performance for mobile broadband
- Actual data rates> 100 Mbps
- Peak rate of up to 20 Gbps
- M2M communications and smart devices
- 1 000 000 devices per km2
- Receptive and ultra reliable communications for mission critical applications
- Less than 4 ms of latency

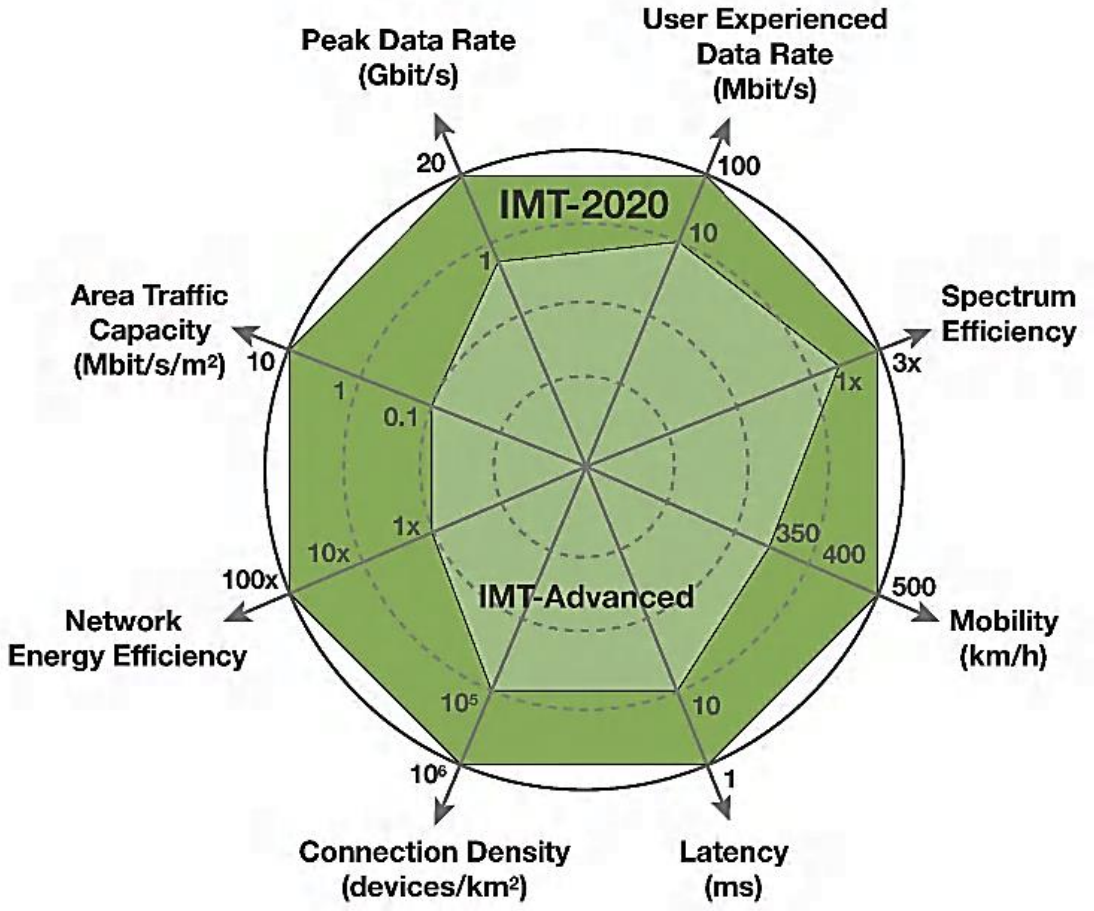


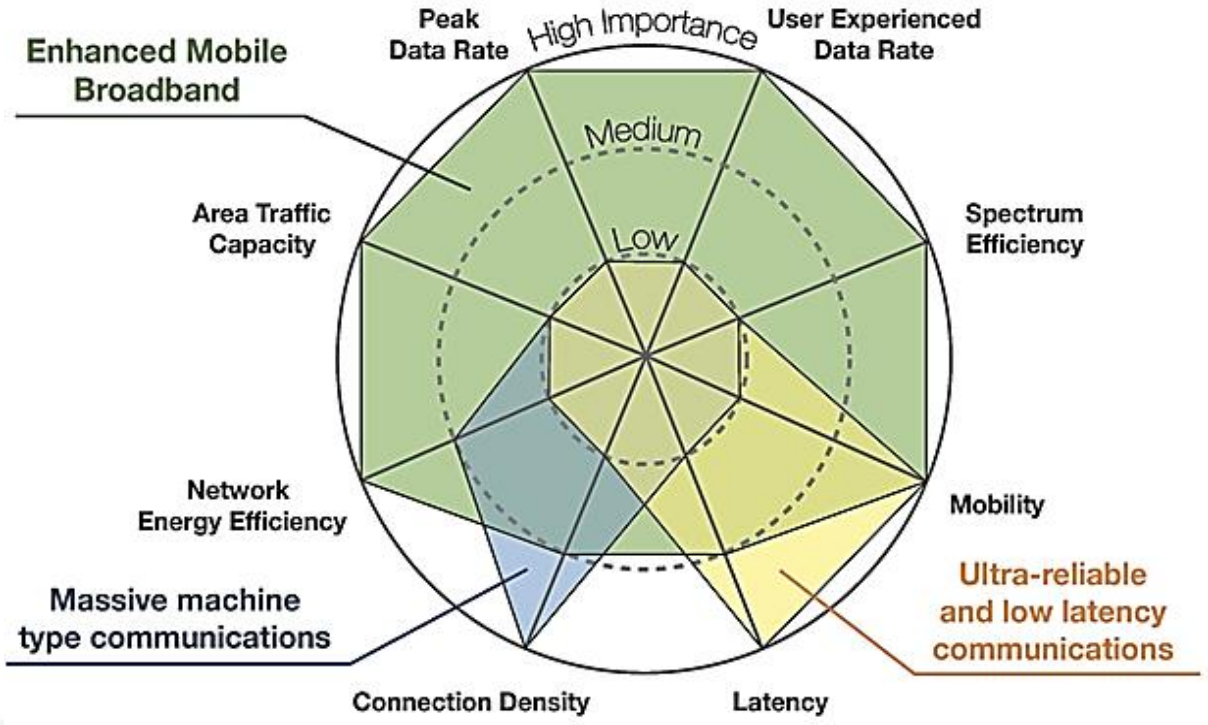
2020s

WRC-19 will consider which frequencies above 24 GHz could be identified for IMT in the Radio Regulations

5th Generation (5G) – IMT2020

IMT performances: from IMT-Advanced to IMT2020





IMT-2020

- ITU-R Study Group 5 Process
- IMT-2020 Vision, overall requirements, radio interface specifications
- ITU membership, other standard making bodies
- Industry driven

- ITU WRC Process
- Mobile spectrum allocations and IMT identifications
- ITU membership, ITU-R Study Groups, Regional Groups, International organisations
- Member States driven

SPECTRUM AS NATURAL RESOURCE

- Natural Resource: phenomena of nature
- Non replicable: cannot be reproduced (as agriculture)
- Scarce: quantity of information (Mbps per MHz) that can be transmitted is limited
- Need to be "shared" by stations using same frequency
- Spectrum Management and Regulation aim to guarantee and efficient and rational use of Spectrum, both and national and international levels

Main goal: prevent and control Interferences: maximize sharing while minimize prejudicing

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-16 (as revised during WRC-15)

RR can be downloaded, free of charge, for the general public, in the 6 UN Languages, at:

http://www.itu.int/pub/R-REG-RR-2016

Spectrum for IMT

World Radio Conference, WRC

The **World Radiocommunication Conference (**WRC) modifies and updates the **Radio Regulations**

(for example, allocation / identification of frequency bands)

They are conducted every 4 years.

The next WRC will be in October 2019 (4 weeks)

Preceded by the **World Radiocommunication Assembly,** AR-19

RADIO REGULATIONS, RR

VOLUME 1: Articles (60)

VOLUME 2: Appendices (23)

VOLUME 3: Resolutions (160) and Recommendations (24)

VOLUME 4: ITU-R Recommendations incorporated by reference (40)

MAPS: Set of Maps for App. 27

* Non consecutive numbering, some with number and letters

RR: FREQUENCY MANAGEMENT (Sect. II)

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, No. 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.*

*Regulators commonly refers to it as: International Table of Frequency Allocations, IFTA, to easily remind its links to their respective national counterpart: National Table of Frequency Allocations, NFTA

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

CATEGORY OF SERVICES

Category of Services (basis) might be in a:

- a) PRIMARY basis (indicated by capital letters)*; e.g.: FIXED
- b) Secondary basis (indicated by lower case); e.g.: Fixed

RR, No. 5.28 *Stations of a secondary service:*

RR, No. 5.29 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;

RR, No..30 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;

*RR, No. 5.31 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)

* In Arabic and Chinese versions, allocations in a primary basis are indicated by bold characters, it, e.g.:

- Primary:

- Secondary: متنقلة بحرية 无线电定位

متنقلة بحرية 无线电定位

RR: FREQUENCY MANAGEMENT

Allocations are granted to Radiocommunications **Services**

Assignments are granted to Radiocommunications **Stations**

RR in general does not deal with Allotments nor Assignments*, because it is an sovereign and autonomous right of administrations

However, national Allotments and farther Station Assignments shall be consistent with its NTFA and also the RR (No. 4.4) e.g.: assignment of a TV Station, in a channel/area as defined on the National TV Plan, and only into a band allocated to Broadcasting Services

Art. 4.4: *Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations*.

* Due to their inherent international coverage nature, some services in some bands need an allotment, that can be also accompanied by an international assignment of their associated stations (so called: Planned Bands, contained on Vol. 2: Appendices)

RADIO REGULATIONS PRINCIPLES

RR is technically neutral, hence, it

1. Does allocate frequency bands to radiocommunication services
2. Does not allocate to specific applications
3. Does not allocate to particular technologies
4. Does not define users profile

e.g.: allocation can be made to: "*mobile*" (*service*; by default: terrestrial, land)

- not specifically to :

a) cellular networks (*application*)

b) GMS, LTE, Wimax, etc. (*technology*)

c) Official/commercial/particular use

RADIO REGULATIONS

Other concepts: In the allocation of frequencies (Art. 5), the use in the footnotes of the expressions: "*identified*" and "*designated*" expresses **in a non-binding manner** (there is no regulatory definition) the interest / intention of some administrations in a future use of that band for a specific application in view of the harmonization of the use of that band in the medium and long term*

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

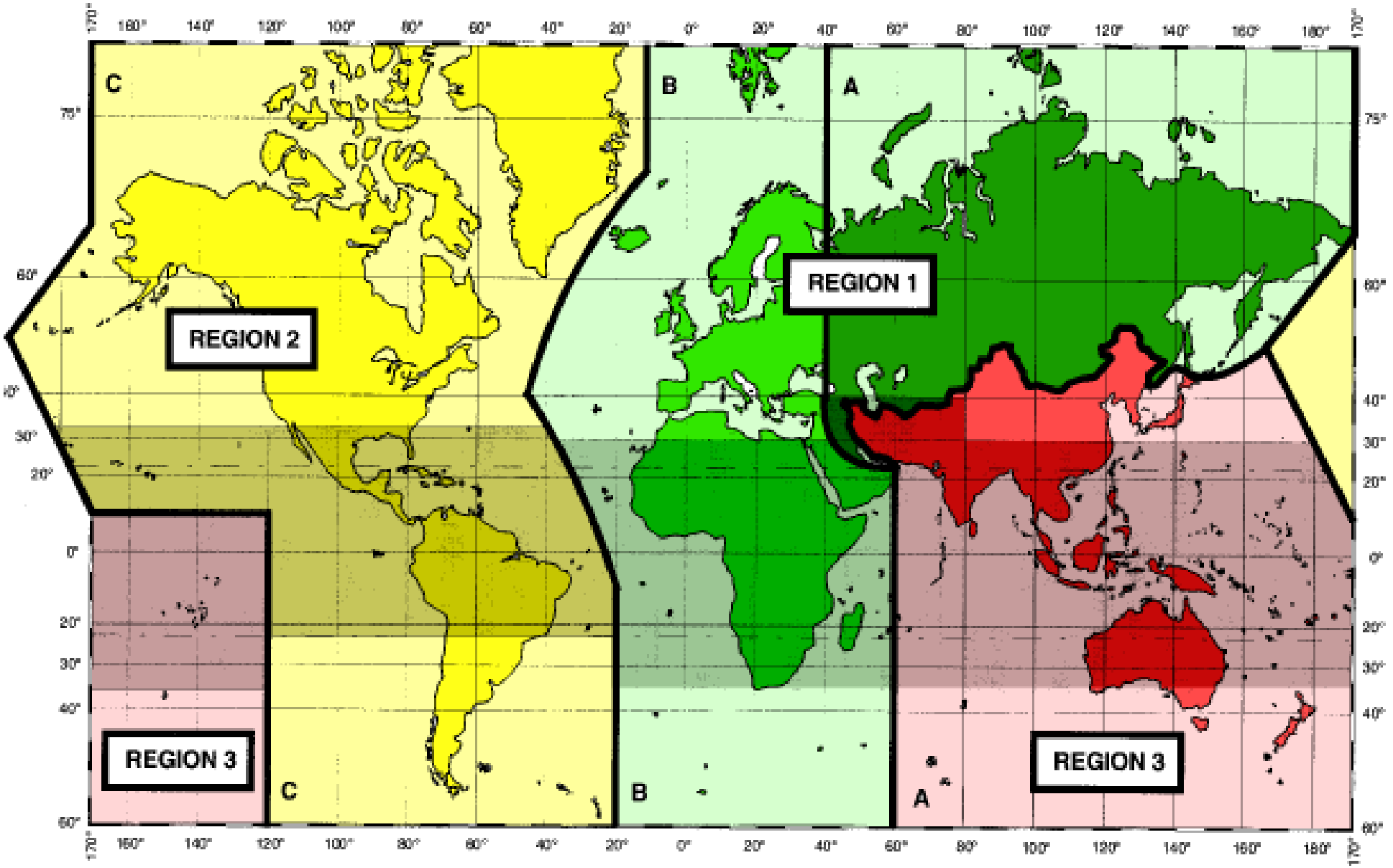
RR, No. 5.516B: bands ***identified**** for use by high-density applications in the fixed-satellite service

RR, Nos. 5.286AA, 5.313.A, 5.317A, 5.3: 84A, 5.388, 5.430A. 5432A, 5.432B, 5.433A: Bands ***identified**** for International Mobile Telecommunications (IMT)

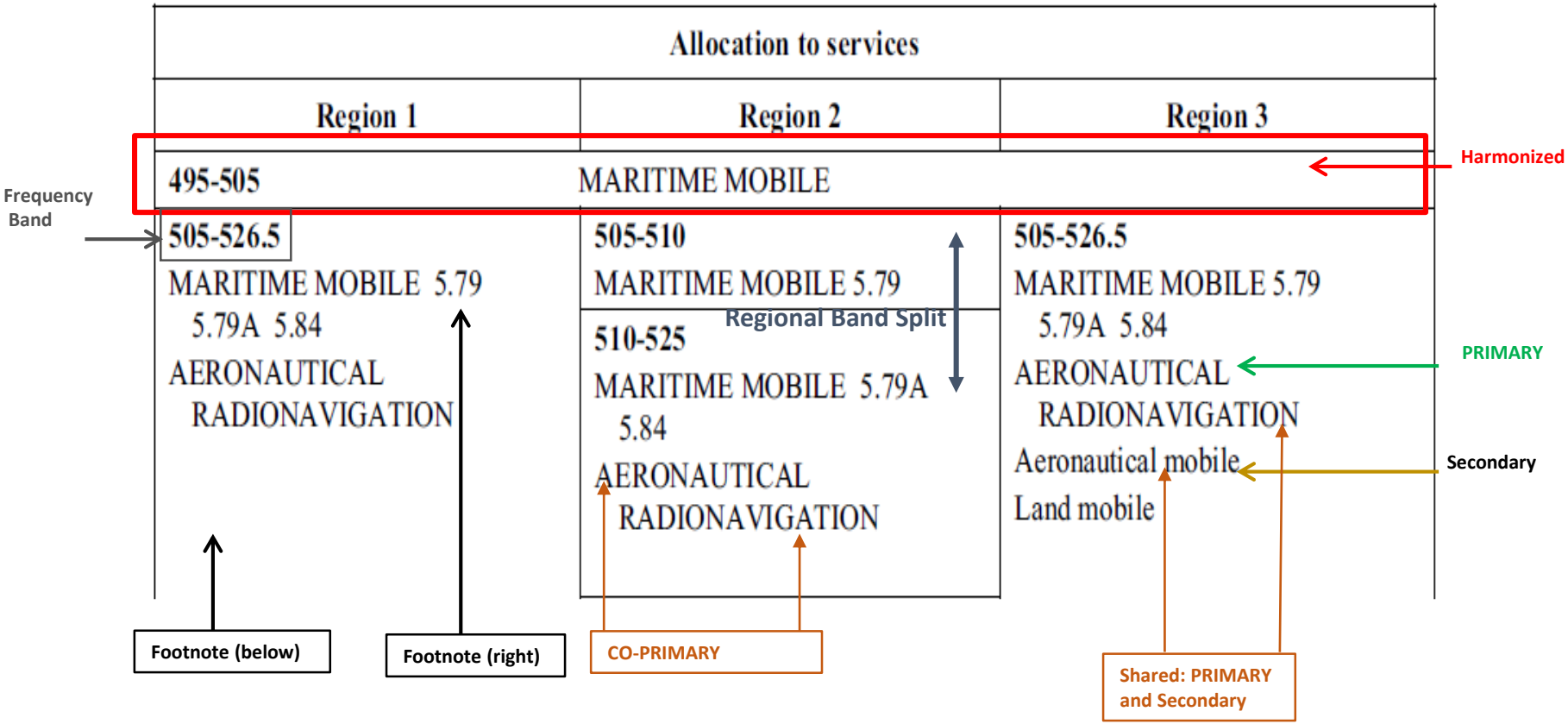
* Despite its non-binding nature, "identification" has been very useful for regulatory agencies that have taken it as a support to award (at national level) these bands to IMT applications

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

RR REGIONS



RR: Table of Frequency Allocations



IMT from RR to National Spectrum Rules

Band (MHz)	BW (MHz)	Footnote RR
450 - 470	20	5.286AA
470 - 698	*228*	*5.295, 5.296A, 5.308A*
698 - 960	262	5.313A, 5.317A
1 427 - 1 518	91	5.341A, 5.341B. 5.341C, 5.346, 5.346A
1 710 - 2 025	315	5.384A, 5.388
2 110 - 2 200	90	5.388
2 300 - 2 400	100	5.384A
2 500 - 2 690	190	5.384A
3 300 - 3 400	100	5.429B, 5.429D, 5.429F
3 400 - 3 600	200	5.430A, 5.431B, 5.432A, 5.432B, 5.433A
3 600 - 3 700	100	5.434
4 800 - 4 990	190	5.441A , 5.441B

Radio Regulations		
1. Allocation	Mobile Service (Terrestrial) PRIMARY	Art.5: TFA
2. Indentification	IMT	Footnotes Art.5 (TFA)
National Regulations		
1. Allocation	Mobile Service (Terrestrial) PRIMARY	Art.5: TFA
2. Allotment	IMT	Frequency Plans (e.g.: associated to NTFA)
3. Asigment	Broadband Mobile Operators	Frequency Register

Total: 12 Bands, 1, 886 MHz (RR 2016, with WRC-15 updates)

The *identifications* do not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations".

IMT Spectrum

There is not identification for a specific version of IMT (indentifying IMT, not IMT-2000 or IMT-2020)

There is not a specific set frequencies exclusively reserved/planned for 5G (IMT 20200)

- The behavior of millimeter waves match pretty well with New 5G applications spectrum requirements
- But 5G can be also use lower bands (3.5 GHz, < 1GHz)
- In reciprocity, whether a particular case/need be identified, millimeter waves can be also used for providing prior generations (3G, 4G)

WRC-15 numbers

- 4 weeks; preceded from the ITU Radio Assembly RA-15 (1 week); followed by WRC-19 CPM-1 (2 days)
- Around 3300 participants from 162 Member States,
- Around 500 participants representing 130 other entities, including industry, also attended the conference as observers
- 667 Documents submitted before WRC-15 which include 2700 proposals
- WRC-15 addressed over 40 topics related to frequency allocation and frequency sharing for the efficient use of spectrum and orbital resources.

Main WRC-15 key achievements

1. Providing spectrum for mobile broadband (IMT) on a global basis
2. Providing frequencies for Global Flight Tracking
3. Making new allocations to the FSS, MMSS and EEESS
4. Authorizing frequency bands and establishing regulatory conditions for unmanned aircraft systems
5. Providing required spectrum for WAIC as well as for
6. automotive and maritime transports
7. Improving the satellite frequency assignments regulatory procedures

These results have demonstrated once again the **ITU ability** to **keep up with the pace of technological advancements** and to **timely respond to the urgent needs of the Membership**

Spectrum for mobile broadband

agenda items 1.1 and 1.2

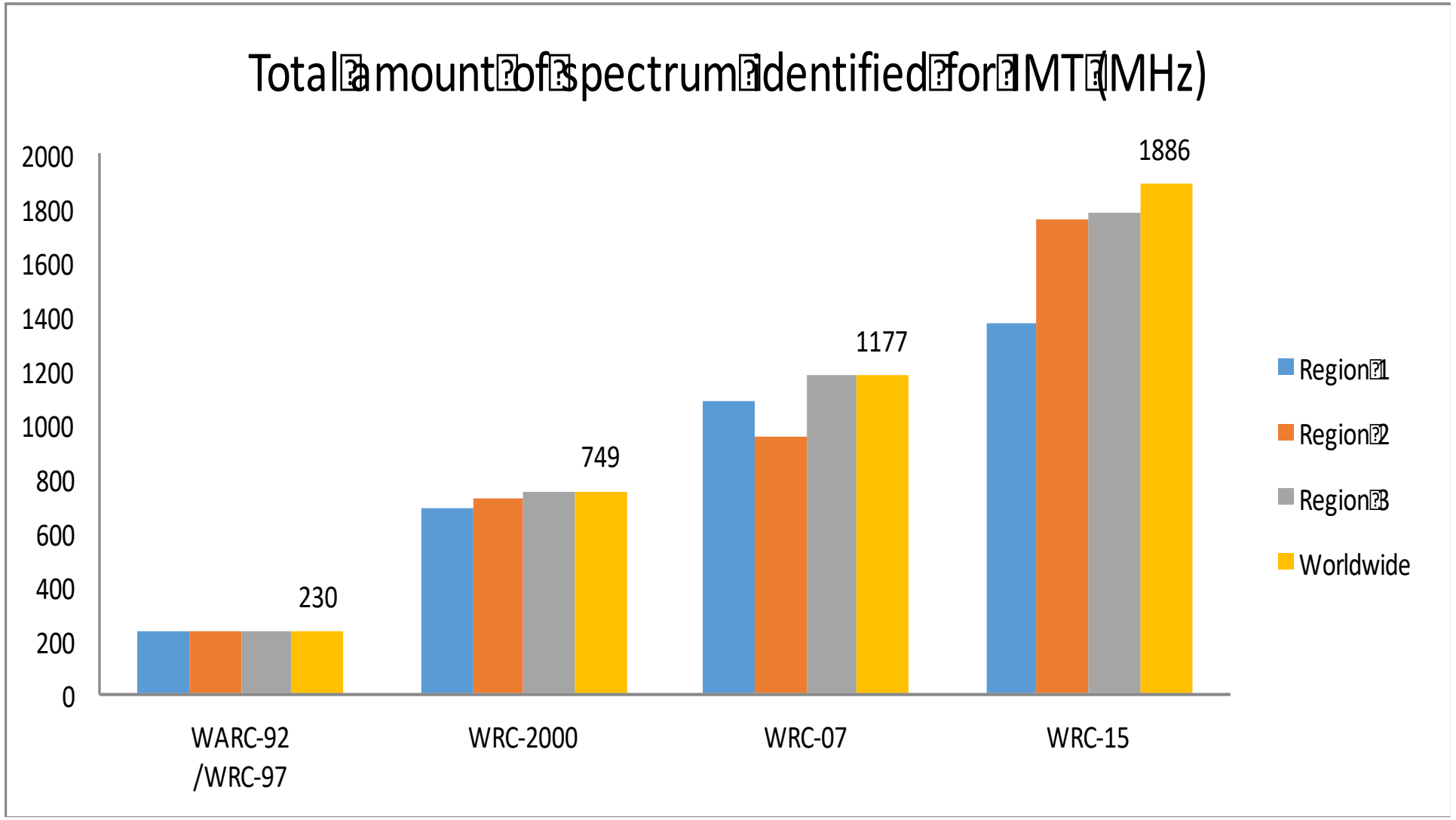
- **Background**
- Satisfy growing traffic requirements for IMT (estimated IMT additional spectrum by 2020: from 159 to 1075 MHz)
- Bands considered: 470 MHz -6425 MHz. Harmonized bands were highly desirable to facilitate global roaming and economies of scale
- WRC-15 had to specify conditions for mobile service in 694-790 MHz already allocated by WRC-12
- **WRC-15 results:** Allocations to mobile service and/or identifications for IMT in:
- 470-694/698 MHz, 694-790 MHz (Region 1),1427-1518 MHz, 3300-3400 MHz, 3400-3700 MHz, 4800-4990 MHz
- 470–698 MHz: IMT identification of parts of this band for 14 Regions 2, 3 countries (9.21, non-interference basis). For R1: consideration at WRC-23
- 1427-1518 MHz: IMT identification in R2 and 3. Also in R1, except 1452–1492 MHz that identified only in 54 R1 countries (9.21 for R.1, 3)
- 3300 -3400 MHz: allocation to, or upgrade of MS in 36 countries worldwide. IMT identification in 33 R1, 6 R2 and 6 R3 countries
- 3400 -3600 MHz: upgrade of MS and identification for entire R.1, 2 and for 11 R3 countries (subject to 9.17, 9.18, 9.21 and pfd limit)
- 3600 -3700 MHz: IMT identification in 4 Region 2 countries subject to coordination under 9.17, 9.18, 9.21
- 4800–4990 MHz IMT identification in 1 Region 2 and 3 Region 3 countries

RADIO REGULATIONS: IMT Bands

	BW (MHz)	Band (MHz)	RR Footnote	Global?
< 1 GHz	20	**450-470**	5.286AA	100%
	228	**470-698**	5.295 5.296A 5.308A 5.317A	<5%
	262	**698-960**	5.313A 5.317A	~100%
1 GHz to 3 GHz	91	**1427-1518**	5.341A 5.341B 5.341C 5.346 5.346A	~100%
		1518-1710		
	315	**1710-2025**	5.384A 5.388	100%
		2025-2110		
	90	**2110-2200**	5.388	100%
		2200-2300		
	390	**2300-2690**	5.384A	100%
3 GHz to 5 GHz	100	**3300-3400**	5.429B 5.429D 5.429F	~20%
	200	**3400-3600**	5.430A 5.431B 5.432A 5.432B 5.433A	>85%
	100	**3600-3700**	5.434	2%
		3700-4800		
	190	**4800-4990**	5.441A 5.441B	2%

All footnotes related to IMT indicates that:

the band X MHz is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations


Total amount of spectrum identified for IMT (MHz)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
230
749
1177
1886
WARC-92 /WRC-97
WRC-2000
WRC-07
WRC-15
Region 1
Region 2
Region 3
Worldwide

IMT and Mobile Broadband

UHF band: 470-698 MHz

Identified by some Administrations

DIGITAL DIVIDEND

700 MHz – Quasi-Global Harmonization

Except some Administrations in Region 3

L-Band: 1427-1518 MHz – Quasi-Global Harmonization

Except some Administrations in Region 1 in the 1452-1492 MHz band

C-Band: 3400-3600 MHz – Quasi-Global Harmonization

Except some Administrations in Region 3

3300-3400 MHz, 3600-3700 MHz, 4800-4990 MHz Bands

Identified by some Administrations

IMT-2020 spectrum bands

Coverage

Indoor coverage

Rural and Remote areas

Long range - Macro cells

Less infrastructure required

Capacity/Coverage

Bridging coverage/capacity

Urban and Suburban areas

Capacity

Extremely high data rates

Short range - Small cells

High bandwidth backhaul

Dense Urban areas

Infrastructure sharing

Below 1GHz

E.g. 700 MHz

1GHz to 6GHz

E.g. 3.4 GHz

Above 24GHz

WRC-19

WRC-19 Process

WRC-15	CPM-1	UIT-R	APT	CPM-2	RA	WRC-19
• Defines the agenda for WRC-19	• Allocates the work of the agenda items to relevant study groups, defines chapter rapporteur and the structure of the CPM report	• Conducts studies for 4 years and prepares draft CPM text	• Attempts to consolidate Regional positions	• Consolidates the CPM text that includes the methods to solve each agenda item	• The Radio Assembly appoints the chairmans and vice charmans of the study groups, revises the structure of the study groups, approves or revises ITU-R resolutions.	• Modifies the Radio Regulations (e.g. allocation/identification of frequency bands)

WRC-19 standing agenda items

1. List of **specific agenda items** from 1.1 to 1.16 (see next slide)
2. **Incorporated by reference** in the RR of revised **ITU-R Rec**ommendations
3. **Consequential RR changes & amendments** as decided by the WRC
4. **Review of Res**olutions and **Rec**ommendations of **previous WRCs**
5. Review of the **Report from the Radiocommunication Assembly**
6. Identify items requiring **urgent action by ITU-R SGs** for the next WRC
7. Review the **RR procedures** related to **coordination-notification-registration of satellite network** frequency assignments, to facilitate rational, efficient, and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit;
8. Consider **deletion of country names in footnotes** of RR Art. 5 TFA
9. Consider and approve the **BR Director's Report** on:

9.1 ITU-R activities (see 2nd next slide); 9.2 Difficulties/Inconsistencies in RR; 9.3 Res.80

10. **Agenda Next WRC** ([in 2023]) & preliminary agenda subsequent WRC

Topics on the WRC-19 Agenda

17 specific & 6 standing items, Res.809 (WRC-15)

1.13
1.14
1.15
1.16

Fix. & Mob. BB Apps (24.25 < IMT < 86 GHz, HAPS, Apps.Id>275 GHz, WAS/RLAN @ 5 GHz)

Maritime (GMDSS modernization (+Sat.), use of radio devices, VDES Sat component)

1.8
1.9.1
1.9.2

1.1

Amateur in R1 @ 50-54 MHz (4WW allocation)

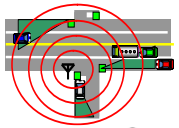
WRC 2019

Aeronautical (GADSS needs)

1.10

Satellite issues (BSS/FSS @12 GHz, ESIM, regul. for N-GSO FSS @ 37.5 to 51.4 GHz)

1.4, 1.5, 1.6



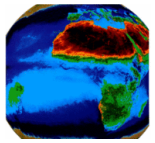
1.11
1.12

New Transport systems (harmonized bands for railways, ITS)

Regulatory issues (Sat. regulations, harmonization of spectrum use, etc.)

7
8

1.2
1.3
1.7



Earth resources & Climate monitoring Weather forecast, DCS improvement, TT&C for N-GSO Sat. of short duration

➢ See additional information in the slides attached to this presentation

Note: WRC-19 agenda item numbers indicated in italic

New spectrum: Bands under study for WRC-19

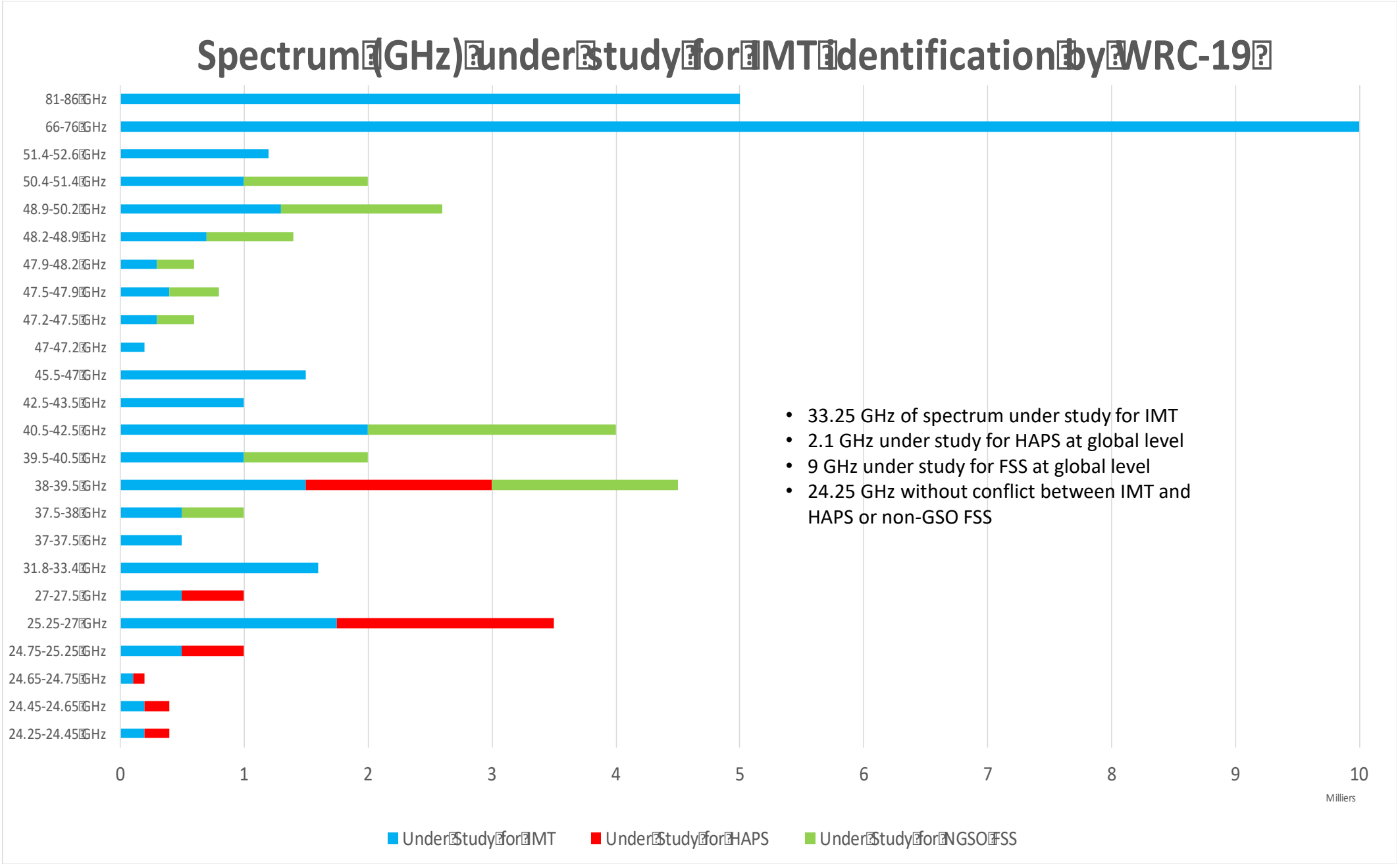
BW (GHz)	Existing mobile allocation	No global mobile allocation	Gaps
3.25	24.25 GHz – 27.5 GHz		
			27.5-31.8 GHz
1.6		31.8 – 33.4 GHz	
			33.4-37 GHz
3.5	37 – 40.5 GHz		
2		40.5 – 42.5 GHz	
			42.5-45.5 GHz
1.5	45.5 – 47 GHz		
0.2		47 – 47.2 GHz	
3	47.2 – 50.2 GHz		
			50.2-50.4 GHz
2.2	50.4 – 52.6 GHz		
			52.6-66 GHz
10	66 – 76 GHz		
			76-81 GHz
5	81 – 86 GHz		

Overlapping frequency bands (GHz) between some WRC-19 agenda items

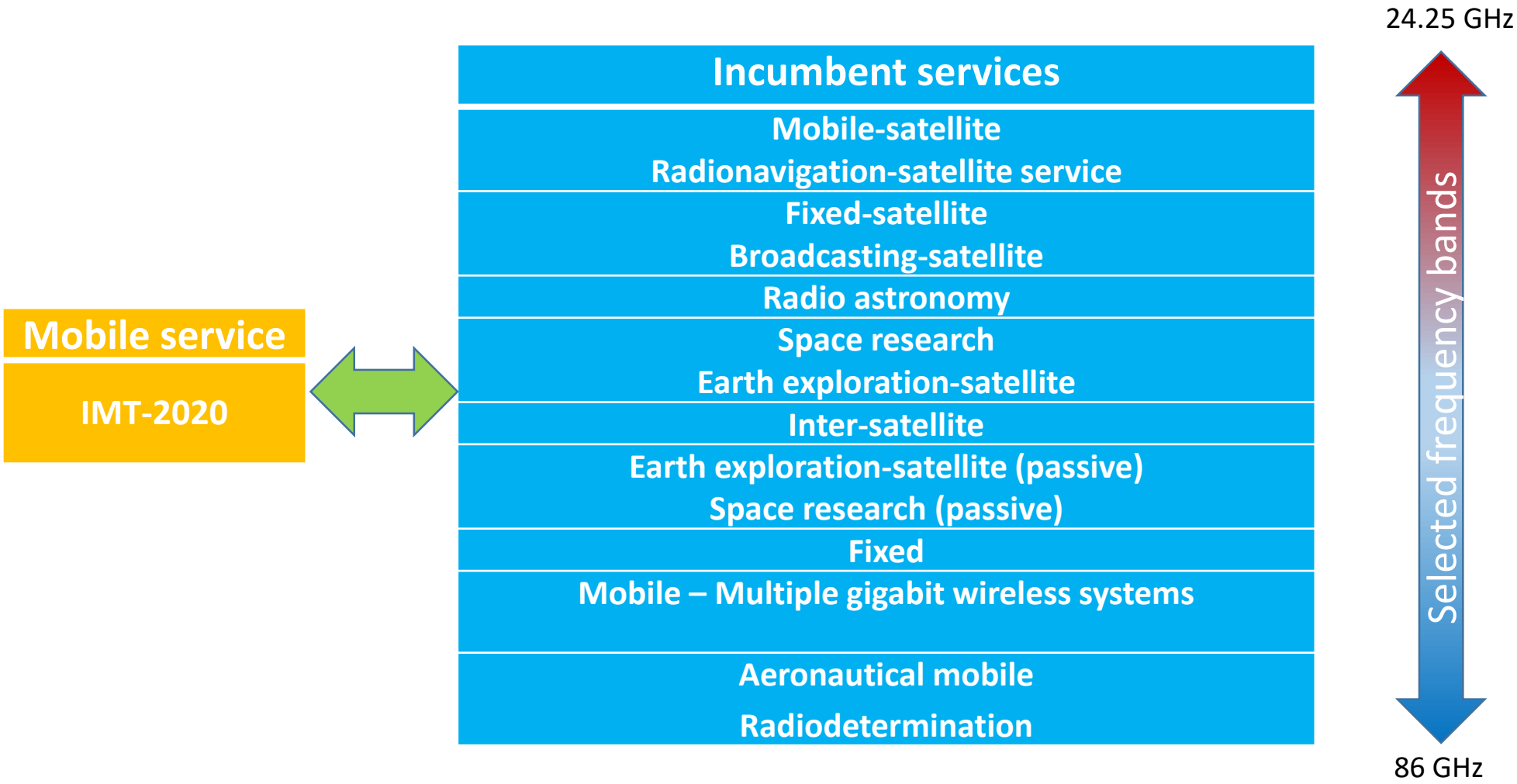
AI1.6 – NGSO FSS Res. 159 (WRC-15)	AI1.13 – IMT Res. 238 (WRC-15)	AI1.14 – HAPS Res. 160 (WRC-15)	AI9.1 (9.1.9) – FSS Res. 162 (WRC-15)
	24.25-27.5	24.25-27.5 (Reg. 2)	
37.5-39.5 (s-E*)	37-40.5	38-39.5 (globally)	
39.5-42.5 (s-E*)	40.5-42.5		
47.2-50.2 (E-s*)	47.2-50.2		
50.4-51.4 (E-s*)	50.4-52.6		51.4-52.4 (E-s*)
* E-s: Earth-to-space; s-E: space-to-Earth.			

Studies to **address mutual compatibility & sharing feasibility** among the **services/applications** for which **allocation/identification is envisaged** under the corresponding Res. relating to the AI in the overlapping bands

WRC-19 Challenges



WRC-19 AI 1.13 sharing & compatibility studies



Frequency bands under study for WRC-19

Spectrum

	Frequency bands (GHz) mentioned in Resolution 238 (WRC-15) in which studies are focused/prioritized											
	24.25-27.5	31.8-33.4	37-40.5	40.5-42.5	42.5-43.5	45.5-47	47-47.2	47.2-50.2	50.4-52.6	66-71	71-76	81-86
CEPT	X			X	X					X		
ASMG	X	X		X	X							
RCC	X	X		X						X		
APT	X	X	X	X	X					X	X	X
ATU	X		X	X	X							
CITEL												

Reference docs:
https://www.itu.int/en/ITU-R/conferences/wrc/2019/Pages/reg-prep.aspx
APT: indication in grey reflects the views of some administrations with regards to studies /identification
ATU: frequency bands as priority candidates for IMT identification

Main Steps towards WRC-19

WRC-15: WRC-19 Agenda - Resolution 809 (WRC-15)

1st Session of Conference Preparatory Meeting: CPM19-1

30 Nov – 1 Dec. 2015; **Results @CA/226 of 23/12/2015**

C-16: WRC-19 agenda & dates in **Res. 1380** with **MOD** venue @ C-17

Text of Res. 1380 (C-17) at www.itu.int/md/S17-CL-C-0141, see also the WRC-19 booklet

CL No. 17/52 of 18 Dec. 2017 confirmed RA-19 & WRC-19 venue in Sharm el-Sheikh (Egypt)

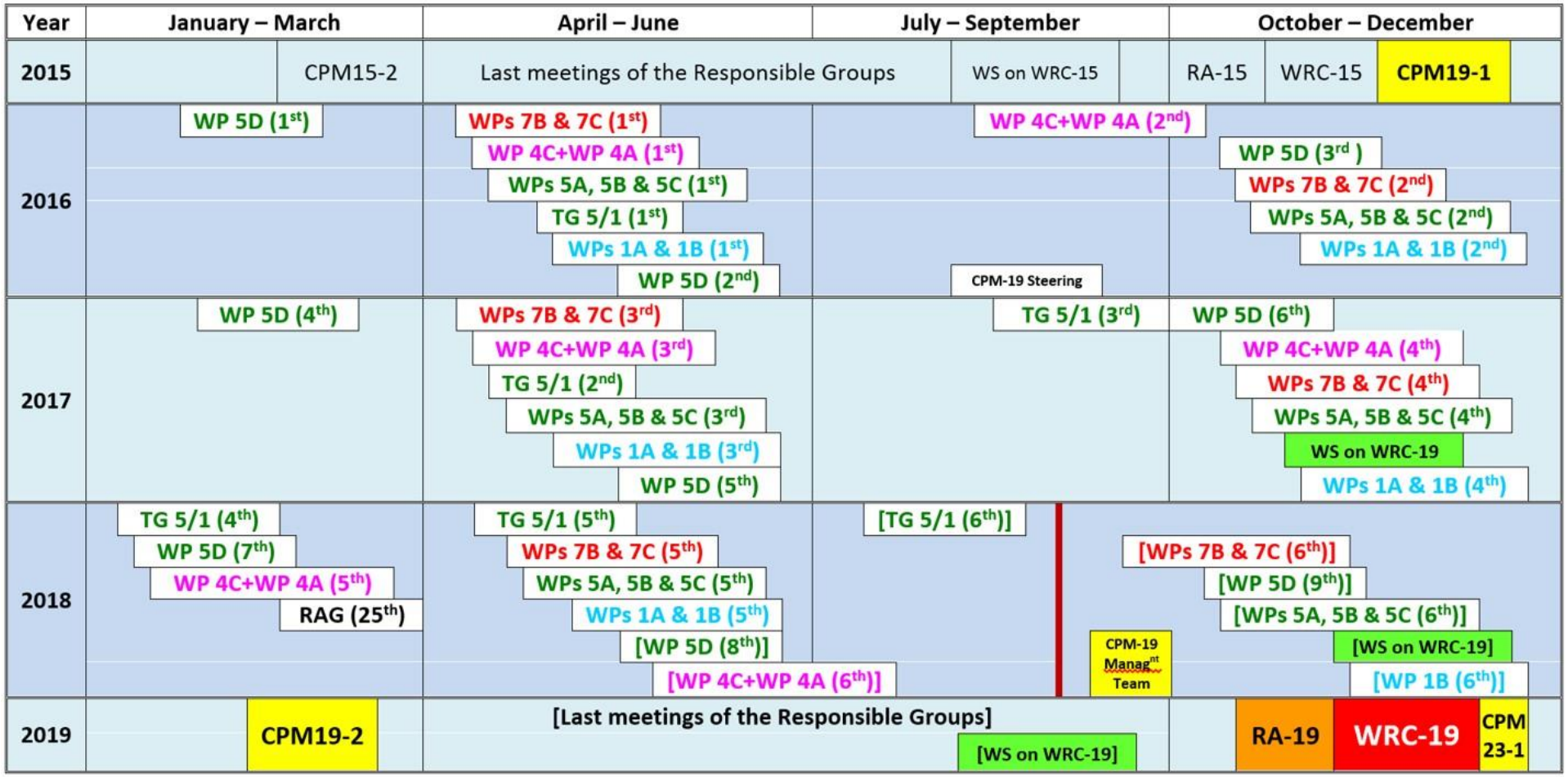
2nd Session of Conference Preparatory Meeting: CPM19-2

Planned dates at CICG in Geneva from 18 to 28 February 2019

Final meetings of regional groups
Member States' proposals to WRC-19

RA-19: **21 to 25 Oct. 2019 ;** WRC-19: **28 Oct. to 22 Nov. 2019**

Overview of the ITU-R Calendar towards WRC-19



[…] = planned meetings

WS on WRC-19 = ITU Inter-regional Workshop on WRC-19 Preparation

Up-to-date information on ITU-R meetings at: www.itu.int/en/events/Pages/Calendar-Events.aspx?sector=ITU-R

Information on CPM19-2 Preparation (e.g. dates, deadlines) at: www.itu.int/md/R00-CA-CIR-0226

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