Millimeter Waves from a Regulatory and Policy Perspective: International Tutorial

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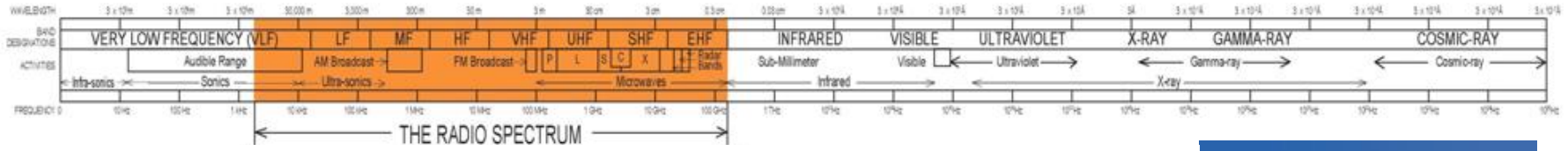
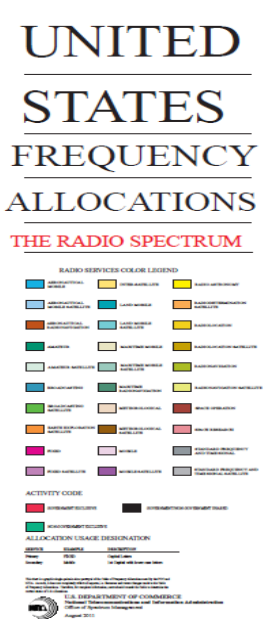
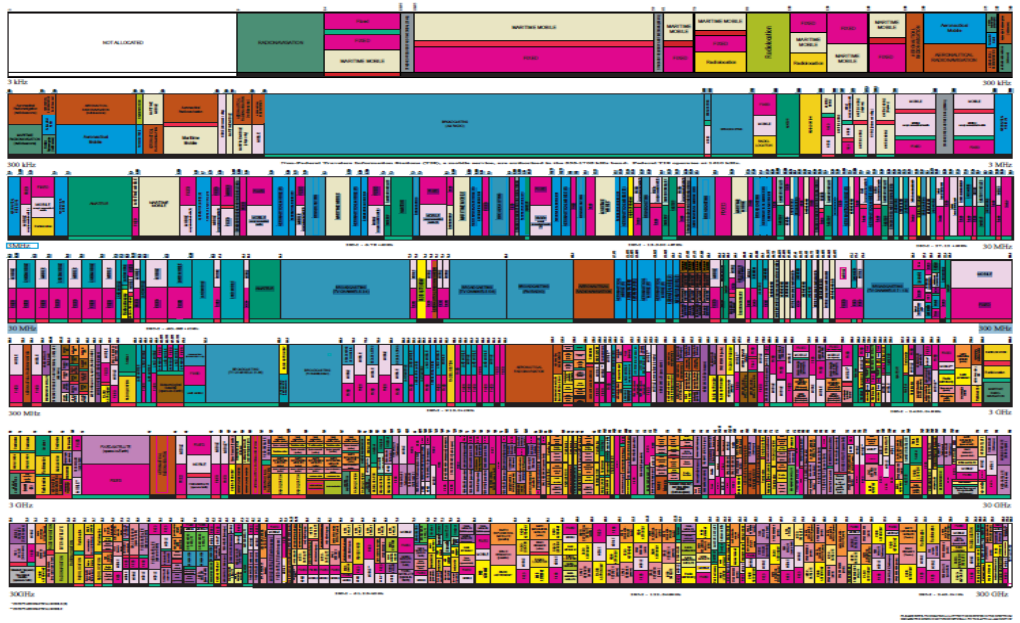
Agenda

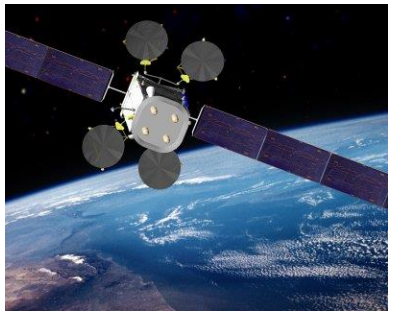
- **Introduction: Global Spectrum Management**
- **ITU & the Radio Regulations**
- **Millimeter Waves at WRC-19**

Radiofrequency Spectrum Management

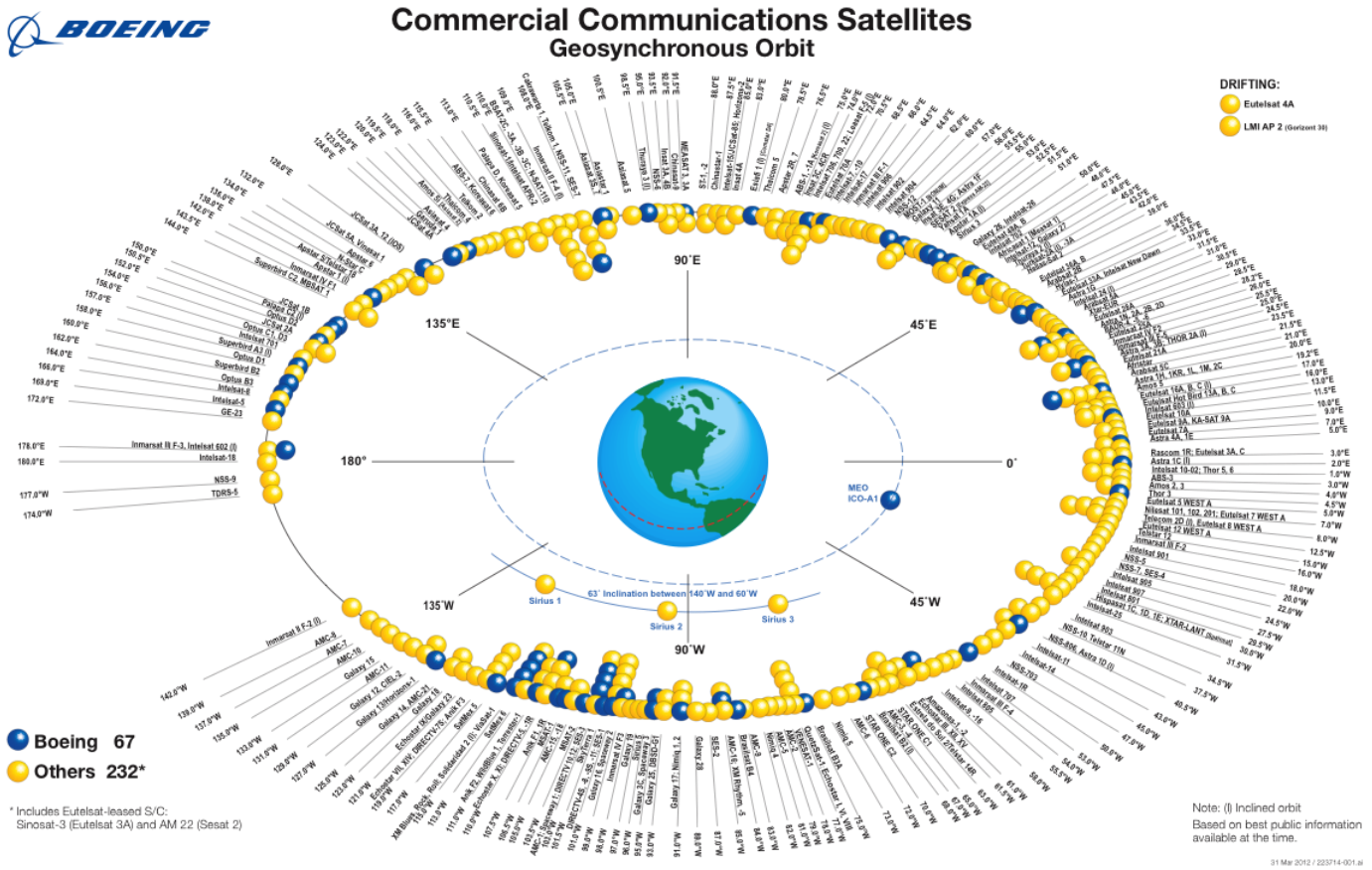


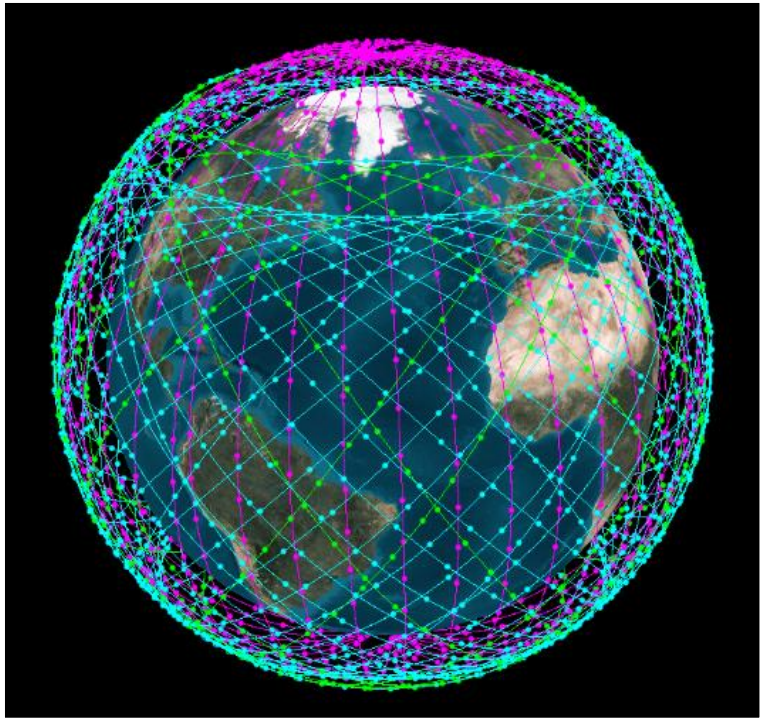






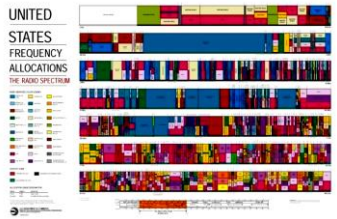
Spectrum Management in Orbit

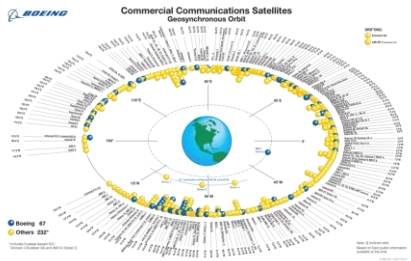




Why ITU?

- Each country is sovereign and may control access to spectrum within its territory.
- Many radio systems are inherently international – maritime, aeronautical, space.
- Terrestrial mobile systems also benefit from harmonization of spectrum and standards.
- ITU's Radio Regulations set the global foundation for spectrum and orbit use and coordination to protect radio operations from harmful interference.
- Countries seek access to orbital resources through the ITU and must coordinate with existing and planned users.





International Telecommunication Union

International Telecommunication Union

- Founded in 1865
- United Nations specialized agency
- Nearly universal Membership – 193 Member States
- Includes “Sector Members” - 673
- Manages access to orbits and international coordination of radio stations
- Maintains Master Register of International Frequency Assignments (MIFR)
- Adopts global standards for international telecommunications (“Recommendations”)
- Convenes World Radio Conferences to amend the international Radio Regulations

Source: ITU

Purposes of the ITU

- Maintain and extend international cooperation among all Member States for the improvement and rational use of telecommunications of all kinds;
- Promote and offer technical assistance to developing countries in the field of telecommunications;
- Promote the extension of the benefits of new telecommunications technologies to all the world's inhabitants
- Promote use of telecommunications to facilitate peaceful relations;
- Harmonize the actions of Member States and promote fruitful and constructive cooperation and partnership between Member States and Sector Members in attainment of those ends; and
- Promote at the international level, the adoption of a broader approach to the issues of telecommunications in the global economy and society.

Source: ITU Constitution, Article 1

What the ITU Does

1. effect allocation of bands of the radio-frequency spectrum, the allotment of radio frequencies and registration of radio-frequency assignments and for space services, of any associated orbital positions in the geostationary-satellite orbit or of any associated characteristics of satellites in other orbits, in order to avoid harmful interference between radio stations of different countries;
2. coordinate efforts to eliminate harmful interference between radio stations of different countries and to improve the use made of the radio-frequency spectrum for radiocommunication services and of the geostationary-satellite and other satellite orbits;
3. Facilitate the worldwide standardization of telecommunications, with a satisfactory quality of service;
4. Coordinate efforts to harmonize the development of telecommunications facilities; notably those using space techniques;

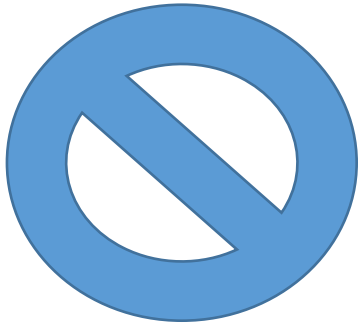
Source: ITU Constitution, Article 1

Private Sector Role in ITU

- Companies play a significant role in the development of ITU's contribution-driven work.
- Companies join as Sector Members through their host government.
- Companies can actively participate in lower level activities (without vote), and observe at conferences and Council.
- Private companies may also participate as members of state delegations and assist in preparing proposals.
- Minimum annual Sector Member contribution: 31,800 CHF
- Associates may participate in the work of one Study Group for 10,600 CHF.
- Newest category of participation: Academia

What the ITU is Not!

- Not a regulatory body – no power to regulate
- Not a supra-national entity – no authority over sovereign Member States.
- Not led by a Director-General.
- Not the spectrum/orbit police – limited enforcement powers.

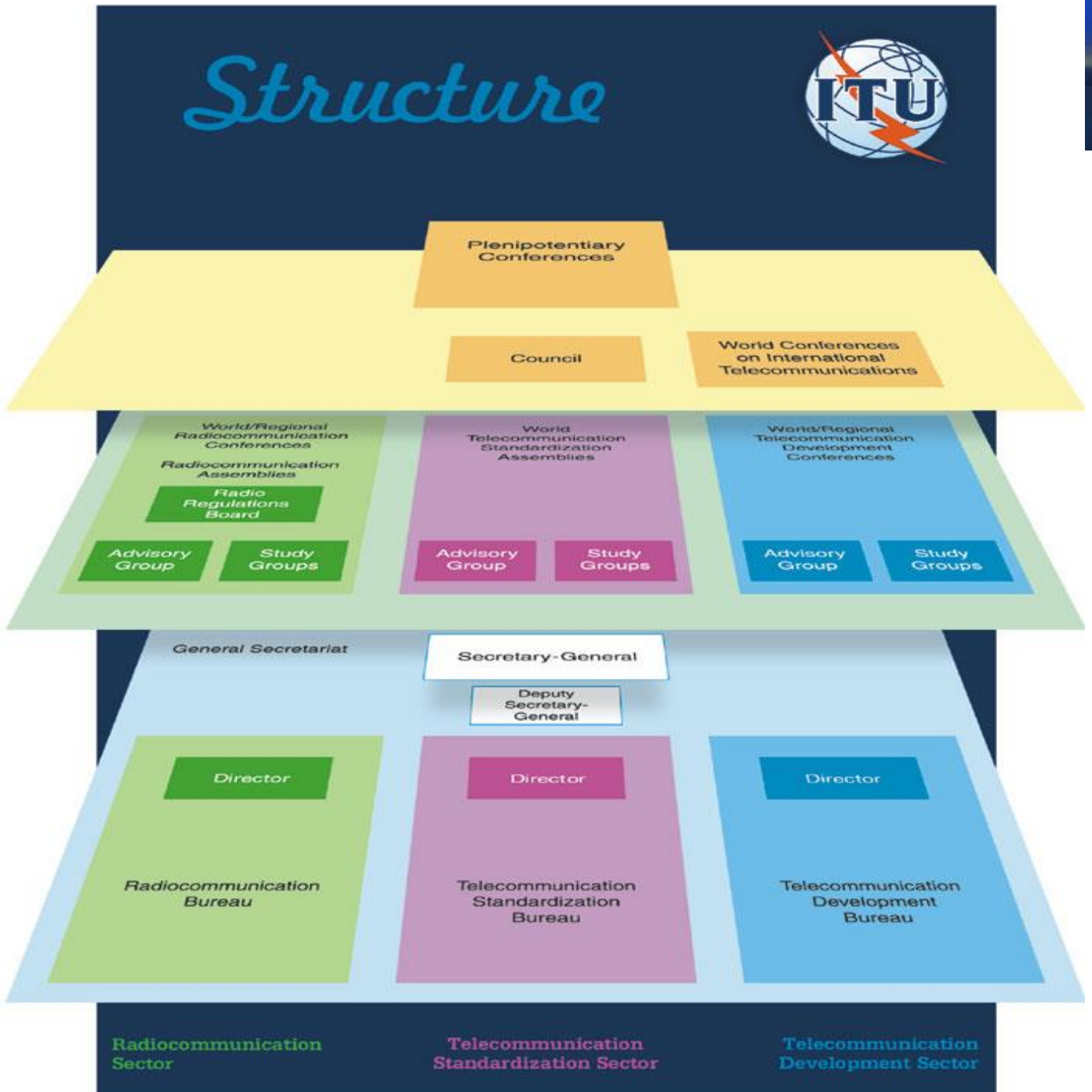


The ITU is a contribution-driven organization which has successfully functioned for a century and a half on the basis of cooperation among nations and stakeholders.

Radio Regulations

- Statutory International Law
- >2 000 pages, 4 Volumes
- Cover 9 kHz to 1000 GHz
- Define 43 radio services
- Modified at WRCs on basis of negotiations among countries to reconcile frequency requirements and spectrum capacity
  - Spectrum Allocations
  - Notification procedures
  - Administrative and Operational Procedures

Source: ITU


Structure
ITU
Plenipotentiary Conferences
Council
World Conferences on International Telecommunications
World/Regional Radiocommunication Conferences
Radiocommunication Assemblies
Radio Regulations Board
Advisory Group
Study Groups
World Telecommunication Standardization Assemblies
Advisory Group
Study Groups
World/Regional Telecommunication Development Conferences
Advisory Group
Study Groups
General Secretariat
Secretary-General
Deputy Secretary-General
Director
Radiocommunication Bureau
Director
Telecommunication Standardization Bureau
Director
Telecommunication Development Bureau
Radiocommunication Sector
Telecommunication Standardization Sector
Telecommunication Development Sector

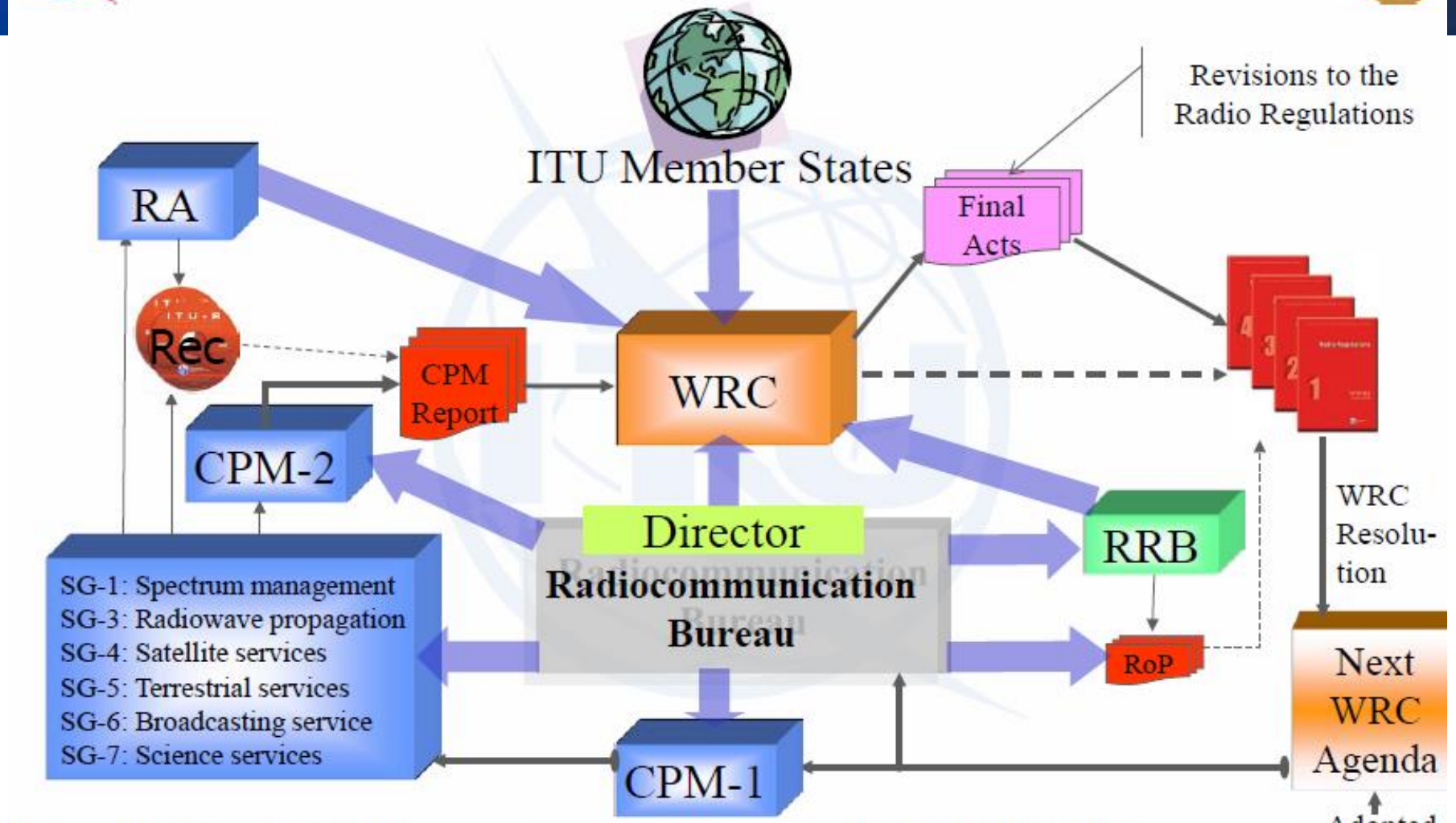
Source: ITU

World Radiocommunication Conference

- Normally held every 3-4 years
- 4 weeks duration
- 6 languages
- Considers items on Agenda recommended by last WRC and approved by Council
- Revises the Radio Regulations, incl spectrum allocations, regulatory procedures, plans.
- Adopts technical studies and work plan for 6-8 years
- Traditionally operates by consensus
- WRC-15: 3,300 delegates from 163 countries
- Next WRC: October 28 – November 22, 2019, Egypt

Source: ITU

The WRC Cycle

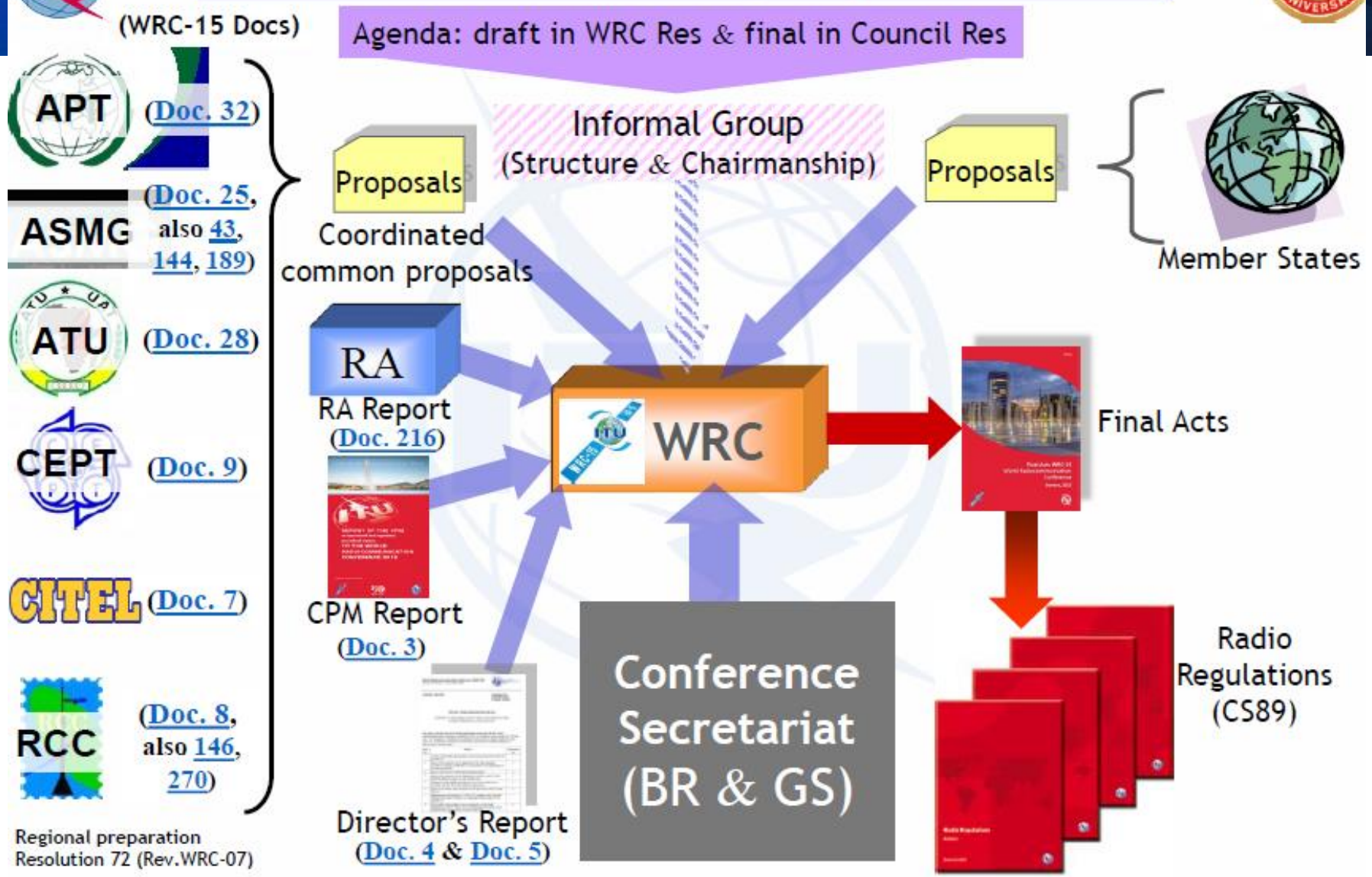


CPM: Conference Preparatory Meeting
Rec: ITU-R Recommendation
RoP: Rules of Procedure
RR: Radio Regulations (treaty status)

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

Source: ITU-R

Overview of the preparations



Source: ITU-R

Topics on the WRC-19 Agenda

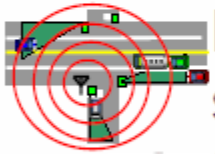
17 specific & 6 standing items, Res.809 (WRC-15)

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)

1.1 

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



New Transport systems (harmonized bands for railways, ITS)

1.11 1.12 

WRC 2019

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

1.8 1.9.1 1.9.2

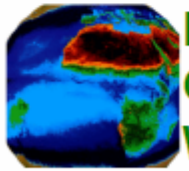
Aeronautical (GADSS needs)

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

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

Note: WRC-19 agenda item numbers indicated in italic

Source: ITU-R

WRC-19 Agenda Items on Millimeter Waves

	Agenda Items
1.5	Consider use of frequency bands 17.7-19.7 GHz (s-E) and 27.5-29.5 GHz (s-E) by earth stations in motion communicating with GSO FSS
1.6	Develop regulatory framework in the 50/40 GHz band for non-GSO FSS satellite systems
1.13	Identification of frequency bands for development of IMT in the frequency range between 24.25 and 86 GHz
1.14	Regulatory actions for high-altitude platform stations (HAPS)
9.1.9	Possible allocation of the frequency bands 51.4-52.4 GHz to the FSS

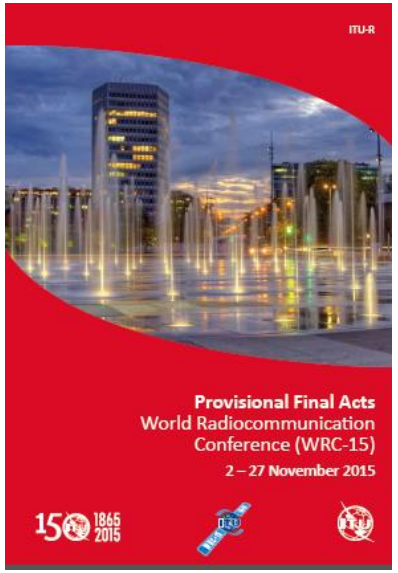
WRC-19 Overlap in Frequency Bands for Study

1.6 NGSO FSS Res. 159 Frequencies in GHz	1.13 IMT Res. 238 Frequencies in GHz	1.14 HAPS Res. 160 Frequencies in GHz	[9.1 (issue 9.1.9) Res. 162 Frequencies in GHz
	24.25-27.5	24.25-27.5 (Region 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.			

AI 1.6 on Satellite Systems above 37.5 GHz

- **AI 1.6 seeks to develop a regulatory framework to facilitate efficient operation of NGSO FSS systems in the V-band; 37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz**
- **Next-generation broadband GSO and NGSO satellites have the ability to bridge the broadband gap through their inherent ability to deliver advanced communications services to all users regardless of location**
- **Recent technological advancements in satellite and user terminal technology can foster this use, enhance spectrum efficiency, increase broadband competition, and facilitate the deployment of broadband services to all regions of the world, including the most unserved and underserved regions.**
- **Satellite Allocations already exist. Need to update regulatory provisions to foster sharing between GSO and non-GSO in these bands under RR Article 22**
- **FSS sharing issues are being studied in WP-4A.**
- **Sharing studies between IMT and FSS under WRC-19 AI 1.6 are being carried out in Task Group 5/1.**

Agenda Item 1.13 – Spectrum for IMT



Source: ITU

AI 1.13: WRC-19 will consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis over several bands that are of concern to FSS operators: 24.25-27.5 GHz, 37-40.5 GHz, 42.5-43.5 GHz, 45.5-47 GHz, 47.2-50.2 GHz, 50.4-52.6 GHz, 66-76 GHz, and 81-86 GHz (per Resolution 238 (WRC-15)).

Preparations for AI 1.13

- **Task Group 5/1 is lead group for conducting sharing and compatibility studies; develops final CPM Report text.**
- **Working Party 5D is responsible for conducting studies on spectrum needs, technical and operational characteristics including protection criteria, and deployment scenarios for terrestrial IMT.**
- **Study Group 3 tasked to develop propagation models.**
- **Other Working Parties input technical criteria for sharing studies for co-frequency incumbent services and adjacent services, *e.g.*, Working Party 4A on satellite services.**
  - **WP-4A seeks to ensure protection of FSS systems and availability of spectrum for the future development of commercial and government FSS, including NGSO systems, for provision of broadband services.**
  - **Conducting studies to promote maximum spectrum efficiency and enable new services while protecting existing and future operations of incumbent services.**

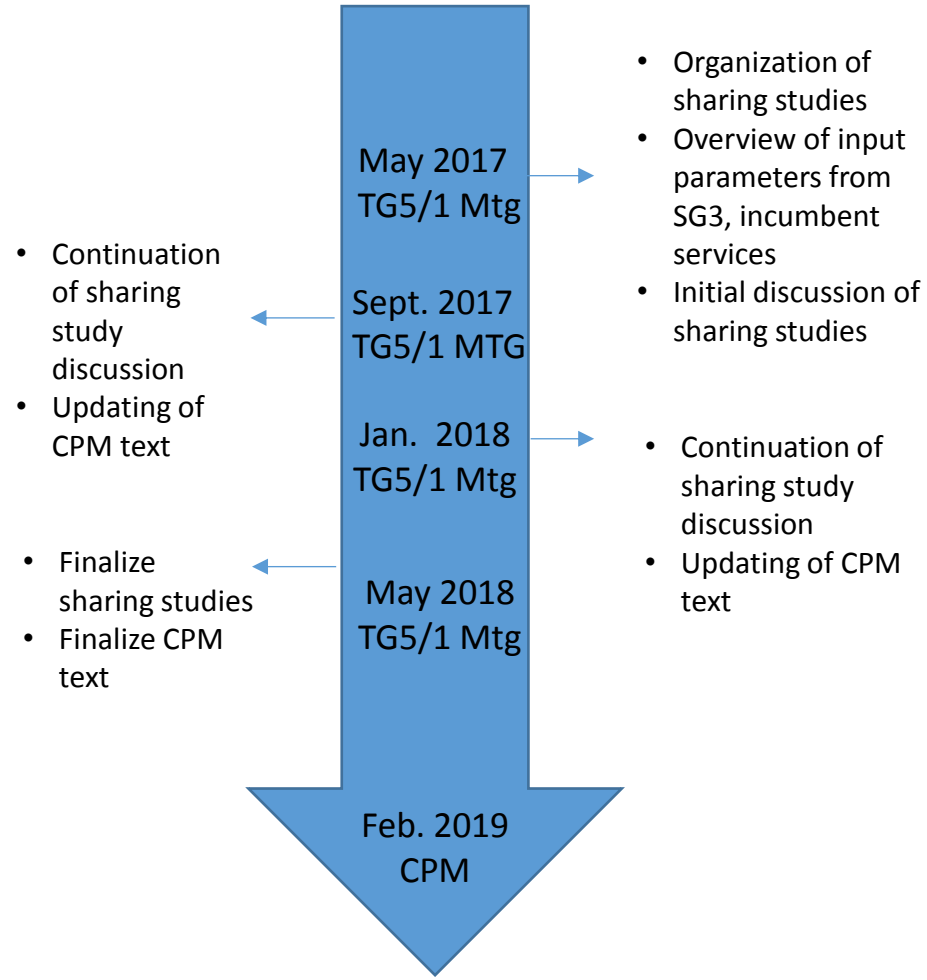
Status of Preparations for AI 1.13

- 2 meetings of TG5/1 completed. 3 more scheduled.
- Next TG 5/1 meeting is September 19–28 in Abu Dhabi, UAE.
- All concerned Working Parties and incumbent services have submitted technical characteristics of their systems for use in sharing studies.
- May meeting of TG5/1 considered parameters, developed methodologies for studies, and organized the work for developing sharing studies
- Current chairman's report includes the results of initial sharing studies, organized by frequency band and incumbent services
- Upcoming meeting will discuss further inputs on sharing studies

Timeline for IMT Studies

Organization of Sharing Studies within ITU-R TG5/1		
Service	Frequency band	Located in TG51 Chairman's Report
EESS/SRS	25.5-27.5 GHz	Attachment 1 to Annex 03
EESS/RAS(passive)	23.6-24 GHz	Attachment 2 to Annex 03
FSS	24.65-25.25 and 27-27.5 GHz	Attachment 3 to Annex 03
ISS	24.45-24.75 and 25.25-27.5 GHz	Attachment 4 to Annex 03
RNS	31.8-33.4 GHz	Attachment 1 to Annex 04
SRS (deep space) (s-E)	31.8-32.3 GHz	Attachment 2 to Annex 04
EESS (passive)	31.3-31.8 GHz	Attachment 3 to Annex 04

Studies Discussed at May, 2017 meeting of ITU-R TG5/1			
Service	Frequency band	Located in TG5/1 Chairman's report	Notes
FSS (space-to-Earth)	37.5-42.5 GHz, 47.5-47.9 GHz, 48.2-48.54 GHz, 49.44-50.2 GHz	Attachment 1 to Annex 05	Includes FSS bands assigned to 50 GHz group due to convergence in studies to be done by SWG 40 GHz.
EESS/SRS	37-38 GHz, 40-40.5 GHz	Attachment 2 to Annex 05	
EESS/SRS (passive)	36-37 GHz	Attachment 3 to Annex 05	Study to address unwanted emissions from IMT above 37 GHz into EESS/SRS in adjacent band.
EESS (passive)	47.2-50.2 GHz 50.4-52.6 GHz	Attachment 1 to Annex 08 Attachment 1 to Annex 09	Received from the United States and the European Space Agency.



WRC-19 (Oct. 28-Nov. 22, 2019)

Conclusions

- Studies are well underway in the ITU-R study groups to prepare for WRC-19 agenda items concerning use of millimeter wave bands.
- US entities engage in the US preparatory process for submissions to ITU-R meetings (U.S. National Committee).
- US entities engage in parallel processes to prepare US positions and proposals for WRC-19, and to seek joint Inter-American Proposals through meetings of the Inter-American Telecommunications Commission (CITEL).
- ITU-R will convene a Conference Preparatory Meeting to adopt a Report on all WRC-19 Agenda Items, February 15-28, 2019, in Geneva.
- WRC-19 will consider action on all its Agenda Items from October 28-November 22, 2019, Sharm-el-Sheikh, Egypt.