ITU Regional Training Workshop on
"Spectrum Management: Strategic Planning and Policies for Wireless Innovation"

Understanding Current Use and Limitations – International and National Planning for Allocations and Standards

Place: Algiers

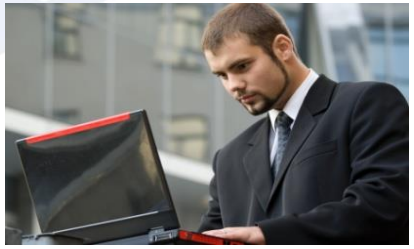
Date: 1-5 December 2019

Presenter : Jan Verduijn

Session Objectives

The aim of this session is to provide an overview of the key agenda topics and decisions at recent World Radio Conferences and provide additional detailed focus on significant work done on broadcast and mobile services.

STUDENTS



Module Topics

- Overview of the WRC process
- Highlights of key Decisions at WRC-15 and WRC-19
- WRC 2023 Agenda Topics

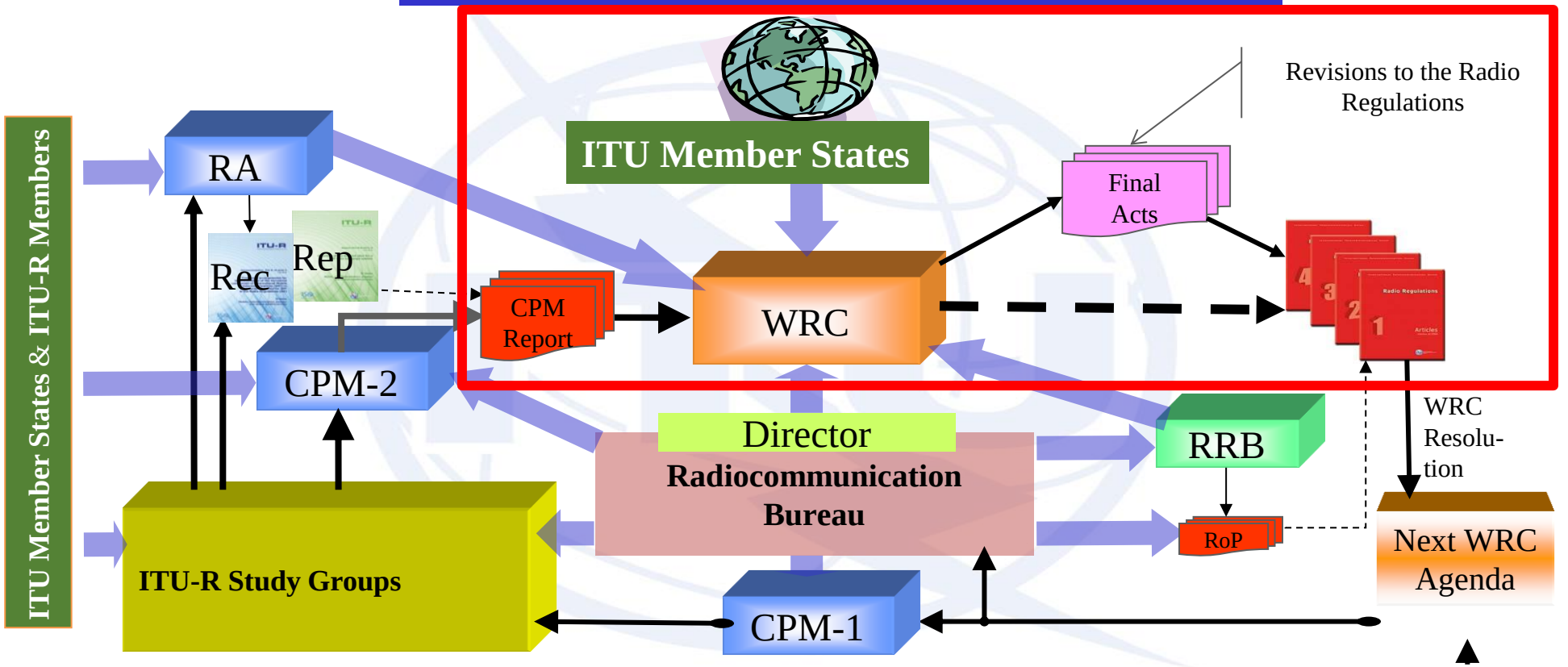
World Radiocommunication Conference (WRC)

WRC – the highest decision making body in international spectrum management.

WRC changes the Radio Regulations (RR):

- Makes new allocations to accommodate emerging services
- Modifies administrative and operational procedures;
- Adopts Resolutions / Recommendations on radiocommunications;
- WRCs take place every 3 – 4 years;
- Participants: national administrations, telecom operators, industry, other international organizations;
- WRC-15: 2800 delegates from 161 administrations and 94 observer organizations;
- WRC-19: over 3300 delegates from 165 Member States and observer organisations

The WRC Cycle



RRB: Radio Regulations Board
RA: Radiocommunication Assembly
WRC: World Radiocommunication Conference

CPM: Conference Preparatory Meeting
Rec: ITU-R Recommendation
RoP: Rules of Procedure

Key outcomes of WRC-15

Extra spectrum or regulatory provisions for:

- Mobile Broadband Services (1427-1518 MHz & part of 3.4-3.6GHz) as well as enhanced capacity 694-790MHz (Reg1);
- Amateur radio service (5351.5 – 5366.5 kHz);
- Emergency communications - PPDR (Parts of 694-894 MHz);
- Search & Rescue – Extra protection (406 -406.1 MHz)
- Earth Observation satellites for environmental Monitoring (7-8 GHz & 9 – 10 GHz);
- Unmanned aircraft and wireless avionics systems;
- Enhanced maritime communications systems (161.9375-161.9625 MHz and 161.9875-162.0125 MHz for maritime MSS)
- Global flight tracking for civil aviation (1087.7-1092.3 MHz for aeronautical MSS Earth-to Space);
- Road Safety via SRR 79 GHz;
- Deployment of Operation of broadband satellite systems: Earth Stations in Motion (e.g. trains, vessels);

Future studies:

- Universal Time for **future reference time-scales (WRC2023)**

Decisions of WRC-15 on Mobile Service-IMT

Background:

There is a need to satisfy rapidly growing traffic requirements for IMT (estimated IMT additional spectrum by 2020: from 159 to 1075 MHz depending on Region and user density);

Bands considered: 470 MHz - 6 425 MHz. Harmonized bands were highly desirable to facilitate global roaming and economies of scale ;

As for 700 MHz band in R1, 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

Allocations are subject to various conditions, e.g. non-interference basis, pfd limits, 9.21 -> to secure protection of incumbent services;

Action “Identification for IMT” was for the first time associated with regulatory/technical conditions imposed on this application in MS

Decisions of WRC-15 on Mobile Service

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 ;

1 427 – 1 518 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);

3 300 – 3 400 MHz: allocation to, or upgrade of MS in 36 countries worldwide. IMT identification in 33 R1, 6 R2 and 6 R3 countries;

3 400 – 3 600 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);

3 600 – 3 700 MHz: IMT identification in 4 Region 2 countries subject to coordination under 9.17, 9.18, 9.21 and a pfd limit;

4800–4990 MHz IMT identification in 1 Region 2 and 3 Region 3 countries;

694 – 790 MHz in Region 1: allocation to MS and identification for IMT.

In force from 28.11.2015. Provides harmonized worldwide allocation of this band. Ensures compatibility with broadcasting and ARNS (Res. 224, 760). Accommodates applications ancillary to broadcasting in 470 – 694 MHz

WRC-2019

World Radiocommunication Conference 2019 (WRC-19), 28 October to 22 November 2019

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About the World Radiocommunication Conference

World radiocommunication conferences (WRC) are held every three to four years. It is the job of WRC to review, and, if necessary, revise the Radio Regulations, the international treaty governing the use of the radio-frequency spectrum and the geostationary-satellite and non-geostationary-satellite orbits. **More >**

Preparatory Process

- Conference Preparatory Meeting (CPM) for WRC-19
- ITU Inter-Regional Workshops on WRC-19 Preparation
- Regional preparation for WRC-19

Contacts

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Agenda and References

WRC-19 Agenda and Relevant Resolutions

Council Resolution 1380 (C-16)
Place, dates and agenda of the World Radiocommunication Conference (WRC-19)

Radio Regulations - Edition of 2016

WRC-19 www.itu.int/go/wrc-19

Agenda and Relevant Resolutions in relation to terrestrial use (1):

- **1.1** to consider an allocation of the frequency band 50-54 MHz to the amateur service in Region 1, in accordance with Resolution 658 (WRC-15);

- **1.8** to consider possible regulatory actions to support Global Maritime Distress Safety Systems (GMDSS) modernization and to support the introduction of additional satellite systems into the GMDSS, in accordance with Resolution 359 (Rev.WRC-15);

- **1.9.1** regulatory actions within the frequency band 156-162.05 MHz for autonomous maritime radio devices to protect the GMDSS and automatic identifications system (AIS), in accordance with Resolution 362 (WRC-15);

- **1.10** to consider spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS), in accordance with Resolution 426 (WRC-15);

- **1.11** to take necessary actions, as appropriate, to facilitate global or regional harmonized frequency bands to support railway radiocommunication systems between train and trackside within existing mobile service allocations, in accordance with Resolution 236 (WRC-15);

WRC-19 www.itu.int/go/wrc-19

Agenda and Relevant Resolutions in relation to terrestrial use (3):

- **1.12** to consider possible global or regional harmonized frequency bands, to the maximum extent possible, for the implementation of evolving Intelligent Transport Systems (ITS) under existing mobile-service allocations, in accordance with Resolution 237 (WRC-15);

- **1.13** to 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, in accordance with Resolution 238 (WRC-15);

- 1.15 to consider identification of frequency bands for use by administrations for the land-mobile and fixed services applications operating in the frequency range 275-450 GHz, in accordance with Resolution 767 (WRC-15);

- 1.16 to consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution 239 (WRC-15);

Studies for WRC-2019

WRC-19 agenda Item (Chapter)	Issue	WRC Resolution (*)	Responsible Group(s)	Information from Responsible Group(s) TIES
1		-	-	-
1.1 (5)		Res. 658 (WRC-15)	WP 5A	Doc. 5A/844 Annexes 4 (c) & 5 (b)
1.2 (4)		Res. 765 (WRC-15)	WP 7B	Doc. 7B/326 Annex 1 (c)
1.3 (4)		Res. 766 (WRC-15)	WP 7B	Doc. 7B/326 Annex 2 (c)
1.4 (3)		Res. 557 (WRC-15)	WP 4A	Doc. 4A/675 Annexes 9, 26 (b) & 27 (c)
1.5 (3)		Res. 158 (WRC-15)	WP 4A	Doc. 4A/675 Annexes 10, 11, 12, 13, 14, 15, 28 (b) & 29 (c)
1.6 (3)		Res. 159 (WRC-15)	WP 4A	Doc. 4A/675 Annexes 1, 6, 7, 8, 30 (b) & 31 (c)
1.7 (4)		Res. 659 (WRC-15)	WP 7B	Doc. 7B/326 Annex 3 (c)
1.8 (5)		Res. 359 (Rev.WRC-15)	WP 5B (1)	Doc. 5B/538 Annexes 1 (c) & 2 (b)
1.9 / 1.9.1 (5)		Res. 362 (WRC-15)	WP 5B	Doc. 5B/538 Annexes 3 (c) & 4 (b)
1.9 / 1.9.2 (5)		Res. 360 (Rev. WRC-15)	WP 5B	Doc. 5B/538 Annexes 5 (c), & 6 (b)
1.10 (5)		Res. 426 (WRC-15)	WP 5B	Doc. 5B/538 Annex 7 (c)
1.11 (1)		Res. 236 (WRC-15)	WP 5A	Doc. 5A/844 Annexes 6 (c), & 7 (b)
1.12 (1)		Res. 237 (WRC-15)	WP 5A	Doc. 5A/844 Annexes 8 (c) & 9 (b)
1.13 (2)		Res. 238 (WRC-15)	TG 5/1 (2)	Doc. 5-1/406 Annex 2 (c) and the other annexes
1.14 (1)		Res. 160 (WRC-15)	WP 5C	Doc. 5C/531 Annexes 10 (c), 11 (b) & 14 to 20
1.15 (1)		Res. 767 (WRC-15)	WP 1A (3, 4, 5)	Doc. 1A/340 Annexes 1 (c), 2 (b) & 3
1.16 (2)		Res. 239 (WRC-15)	WP 5A	Doc. 5A/844 Annexes 10 (c) & 11 (b)

WRC-19, 28 October - 22 November 2019

WRC-19
Over 3300 Participants
165 Member States, Observers

ITUWRC
SHARM EL-SHEIKH2019
28 October - 22 November
Sharm El-Sheikh, Egypt

Next WRC will be in 2023.
Place and dates to be decided by ITU Council

References for further reading:

- Provisional Final Acts of the WRC-19:

https://www.itu.int/en/ITU-R/conferences/wrc/2019/Documents/PFA-WRC19-E.pdf

Key outcomes of WRC-19 (1)

Additional spectrum allocations agreed for IMT-2020 (5G mobile)

- WRC-19 identified additional globally harmonized (millimetre wave) frequency bands for International Mobile Telecommunications (IMT), including IMT-2020 (otherwise known as 5G mobile), facilitating diverse usage scenarios for enhanced mobile broadband, massive machine-type communications and ultra-reliable and low-latency communications. This will unlock a host of applications facilitating Intelligent Transport Systems, creating smart cities and making communities more sustainable while allowing for effective climate action, improved health care, sustainable agricultural practices, and greater energy efficiency.

Key outcomes of WRC-19 (2)

Earth monitoring and space research satellite services protected

At the same time, protections were accorded to the Earth-exploration satellite service (EESS) as well as meteorological and other passive services in adjacent bands, such as the space research service (SRS) to ensure that space-based monitoring of the earth and its atmosphere remain unhindered. Satellite services supporting meteorology and climatology that aim to safeguard human life and natural resources will be protected from harmful radio-frequency interference, as will systems used by radio astronomers for deep space exploration.

Steps were also taken to ensure that radio astronomy stations would be protected from any harmful radio interference from other space stations or satellite systems in orbit.

Key outcomes of WRC-19 (3)

- **Additional bands for IMT** identified in the 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz bands, facilitating development of fifth generation (5G) mobile networks.
- **Earth exploration-satellite (EESS) service** – Protection accorded to EESS with the possibility of providing worldwide primary allocation in the frequency band 22.55-23.15 GHz in order to allow its use for satellite tracking, telemetry and control.
- **Non-Geostationary Satellites** – **Regulatory procedures established for non-geostationary satellite constellations in the fixed-satellite service**, opening the skies to next-generation communication capabilities. Mega-constellations of satellites consisting of hundreds to thousands of spacecraft in low-Earth orbit are becoming a popular solution for global telecommunications, as well as remote sensing, space and upper atmosphere research, meteorology, astronomy, technology demonstration and education.
- Regulatory changes introduced to facilitate rational, efficient and economical use of radio frequencies and associated orbits, including the geostationary-satellite orbit.

Key outcomes of WRC-19 (4)

- **High-altitude platform stations (HAPS)** – Additional frequency bands Identified for High Altitude Platform Systems – radios on aerial platforms hovering in the stratosphere – to facilitate telecommunications within a wide coverage area below for affordable broadband access in rural and remote areas.
- **WiFi networks** – Regulatory provisions revised to accommodate both indoor and outdoor usage and the growth in demand for wireless access systems, including RLANs for end-user radio connections to public or private core networks, such as WiFi, while limiting their interference into existing satellite services.
- **Railway radiocommunication systems between train and trackside (RSTT) –** Resolution approved on Railway radiocommunication systems to facilitate the deployment of railway train and trackside systems to meet the needs of a high-speed railway environment in particular for train radio applications for improved railway traffic control, passenger safety and security for train operations.

Key outcomes of WRC-19 (5)

- **Intelligent Transport Systems (ITS)** – ITU Recommendation (standard) approved to integrate ICTs in evolving Intelligent Transport Systems (ITS) to connect vehicles, improve traffic management and assist in safer driving.
- **Broadcasting-satellite service (BSS)** – Protection of frequency assignments, providing a priority mechanism for developing countries to regain access to spectrum orbit resources.
- **Global Maritime Distress and Safety System (GMDSS)** – Expanded coverage and enhanced capabilities for GMDSS.
- **Earth stations in motion (ESIM)** – The decision on ESIMs will connect people while in planes, ships, and trains to communication links with geostationary satellites.

VISION 2023: A LOOK INTO SOME AREAS OF THE WRC-23 AGENDA

- **Earth stations in motion (ESIM) –** Conditions to be further defined for communications of ESIMs with non- geostationary space stations in the fixed-satellite service to provide reliable and high-bandwidth Internet services to aircraft, ships and land vehicles.
- **High-altitude IMT base stations (HIBS)** – Possible use of same frequency bands as ground-based IMT base stations on HAPS for extended mobile broadband connectivity to underserved communities and remote areas.
- **Aeronautical mobile applications** – Modernizing aeronautical HF radio, new non-safety aeronautical mobile applications for air-to-air, ground-to-air and air-to-ground communications of aircraft systems, and possible new allocations to the aeronautical mobile satellite service to support aeronautical VHF communications in the Earth-to-space and space-to-Earth directions.
- **Global Maritime Distress and Safety System (GMDSS)** – Improved communications and additional spectrum and satellite resources to enhance maritime capabilities in GMDSS, such as e-navigation.

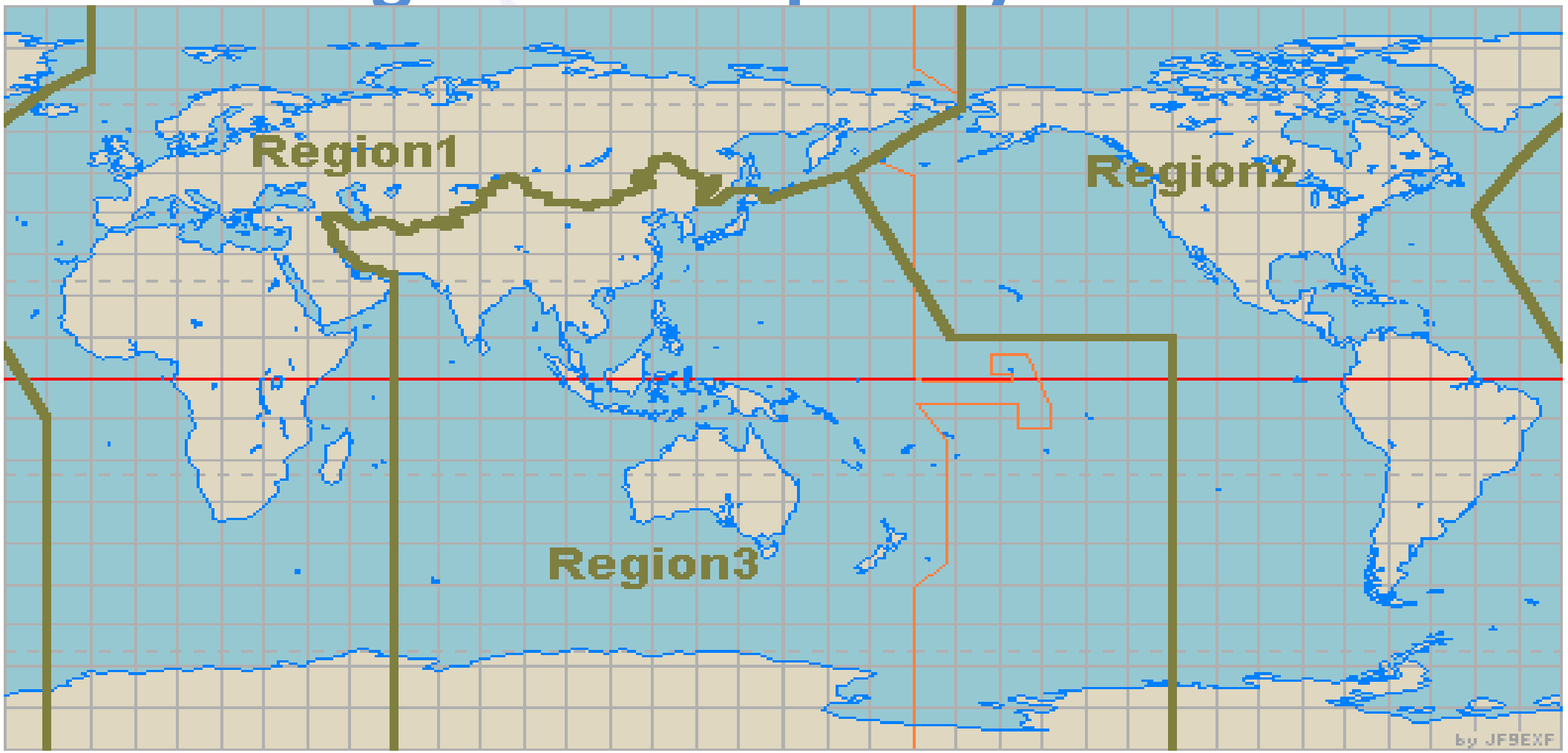
Background Slides

Refresher on International Framework

International Framework

- International – governance of spectrum use on a global basis is a core responsibility of the International Telecommunication Union (ITU). ITU Radio Regulations, Article 5.
- Table of Frequency Allocations establishes a basis for developing a national frequency allocation table
  - One of the first steps in long and medium-term planning.
  - The ITU International Allocation Table contains more radio services allocated to a band than may be required or desired in a national setting and some aspects of the international regulatory provisions may not apply in the given country.
- Regional – Coordination and Planning to influence international efforts.
  - CITEL, CEPT, ASMG, RCC, APT, ATU

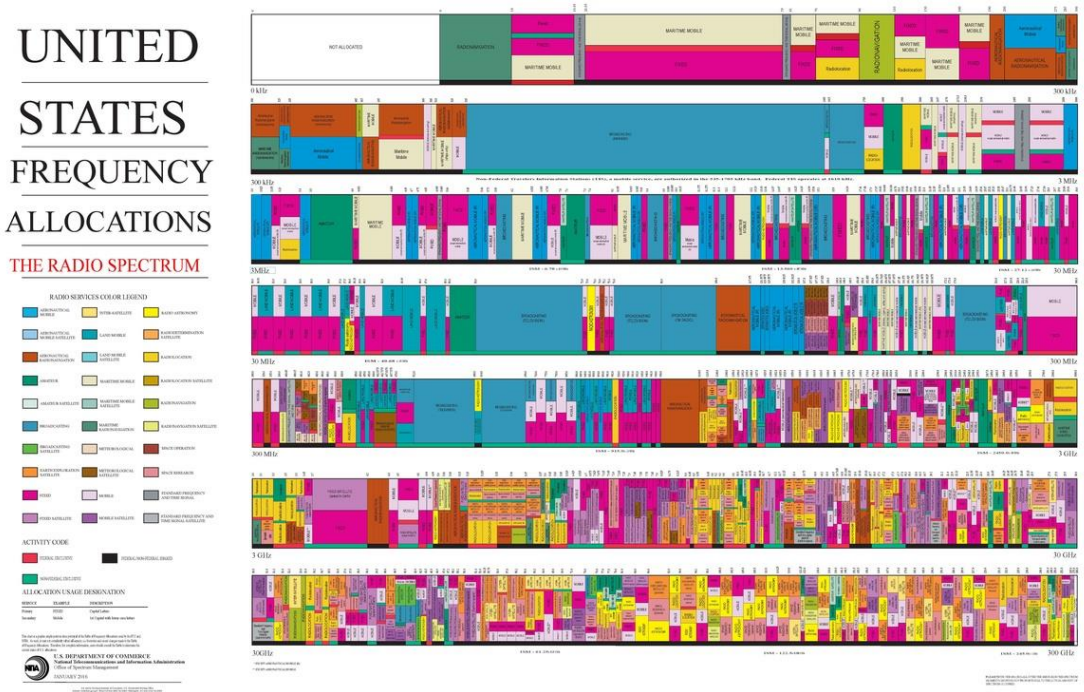
ITU Regions – Frequency Allocations

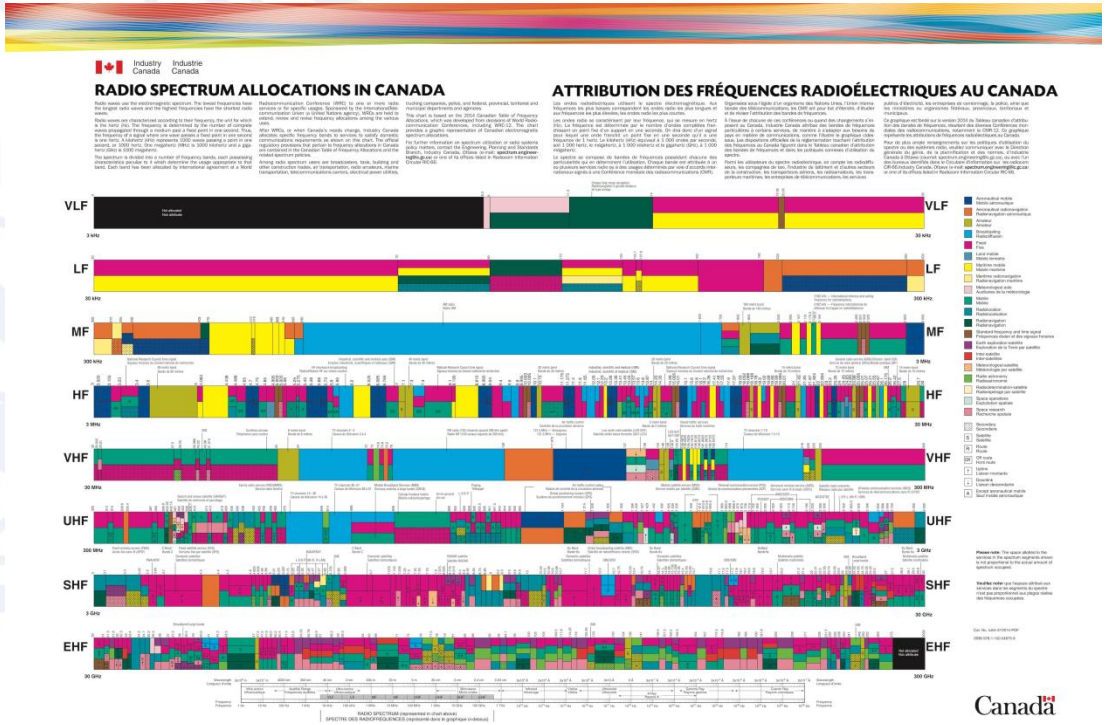


RR Article - 5 Table of Frequency Allocations

Allocation to services		
Region 1	**Region 2**	**Region 3**
5 850-5 925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	**5 850-5 925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 5.150	**5 850-5 925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation 5.150
5 925-6 700	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C 5.149 5.440 5.458	
6 700-7 075	FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE 5.458 5.458A 5.458B 5.458C	

Examples National Frequency Allocation Tables





National Table of Frequency Allocations

- Market Considerations
  - NTFA is an important Building Block for Sector Development:
    - Growth
    - Affordability of Access
  - Formulating the NTFA is central to Planning Process
    - Involves Stakeholder Input

National Table of Frequency Allocations

Technical Considerations

Band	Frequency	Range	Use	Bandwidth	Interference
VLF	3-30 KHz.	1000km plus	Long-range radio navigation	Very narrow	Wide Spread
LF	30-300 KHz.	1000km plus	Same as VLF strategic comm's	Very Narrow	Wide Spread
MF	.3-3 MHz.	2-3000km	Same as VLF strategic communications	Moderate	Wide Spread
HF	3-30 MHz.	< 1000 km	Global broadcast and Pt. to Pt.	Wide	Wide Spread
VHF	30-300 MHz.	2-300km	Broadcast, PCS, Mobile, Wide Area Networking (WAN)	Very Wide	Confined
UHF	.3-3 GHz.	< 100km	Broadcast, PCS, Mobile, Wan	Very wide	Confined
SHF	3-30 GHz.	Varies 30km to 2000km	Broadcast, PCS, Mobile, Wan, Satellite Comm's	Very Wide up to 1 GHz.	Confined
EHF	30-300 GHz.	Varies 20km to 2000km	Microcell, Pt. to Pt.,PCS and Satellite Comm's	Very Wide up to 10 GHz.	Confined

Thank you