Introduction to International Telecommunication Union (ITU)

Space Policy & Law Course, 2016

Chuen Chern Loo

ITU Radiocommunication Bureau

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LONDON INSTITUTE OF SPACE POLICY AND LAW

AGENDA

1. ITU at Glance
2. ITU Radiocommunication Sector (ITU-R)
3. ITU-R Study Groups
4. ITU Radiocommunication Bureau (BR)
5. ITU Academia

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International Telecommunication Union

Founded at Paris in 17 May 1865 as the International Telegraph Union. Present name in 1932

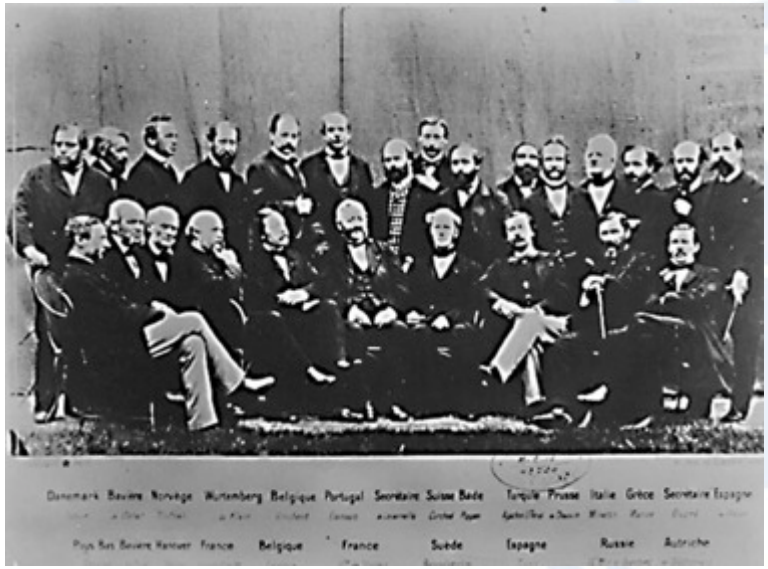
In 1947, ITU became a specialized agency of the United Nations, responsible for issues concerning Information and Communication Technologies

ITU coordinates the shared global use of the radio spectrum and satellite orbits, works to improve telecommunication infrastructure in the developing world, and assists in the development and coordination of worldwide technical standards.

This year: 150th Anniversary!

ITU in brief

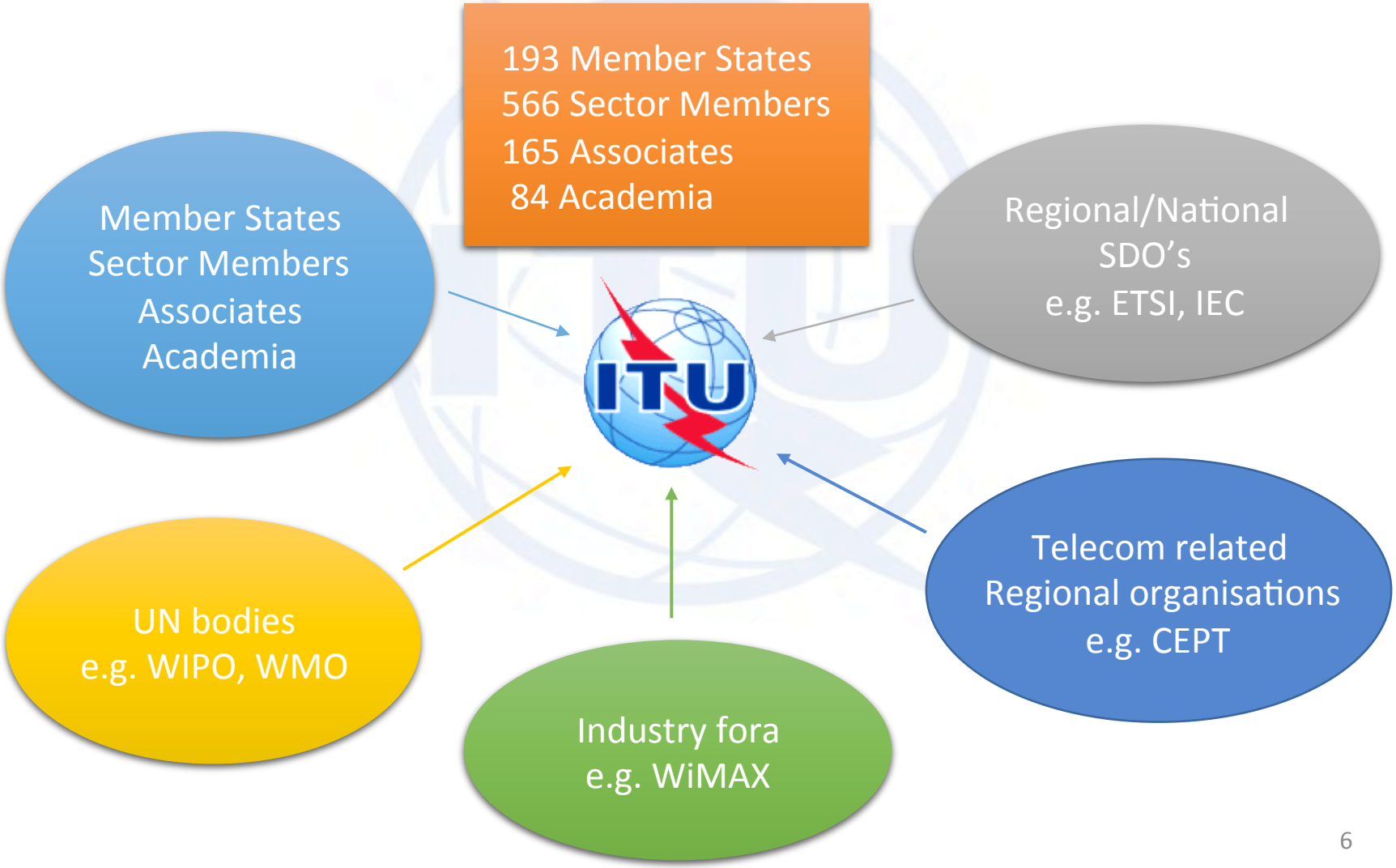
- Founded on 17 May 1865



- 193 Member States
> 700 Sector Members & Associates
- 750 staff / 70 nationalities
- Annual budget = $*140,000,000*
- http://www.itu.int

- ITU is the leading UN agency for information and communication technologies

International Telecommunication Union



ITU has a global presence

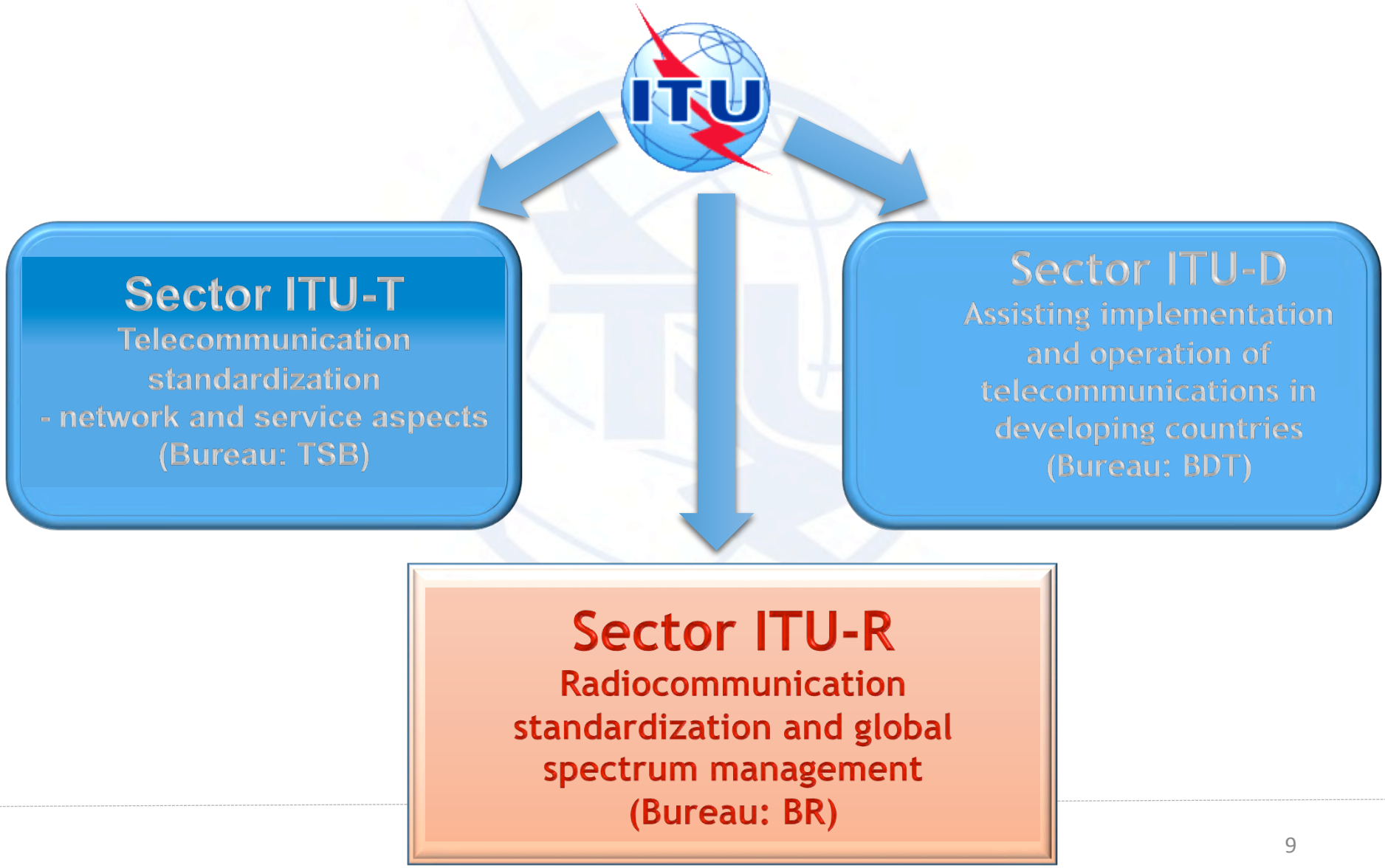
5 regional offices, 8 area offices

Radiocommunications
- regulations
- standards

Standardization

Development

ITU Structure

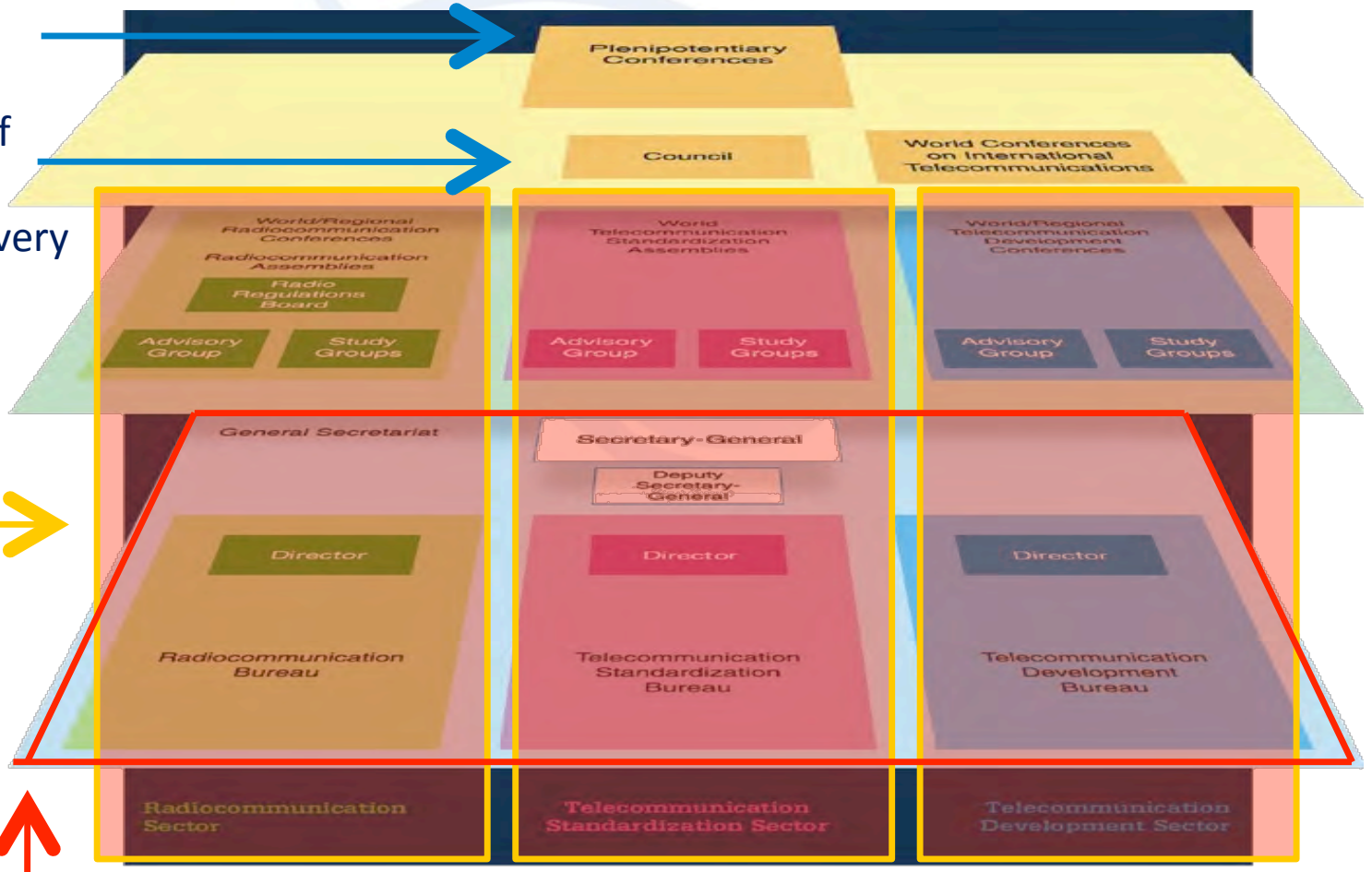


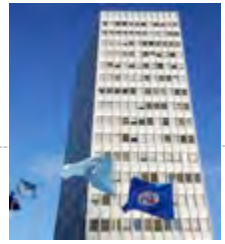
ITU's decision making process…

The PP is the main body of decision making
(meets every 4 years)

Council is made of 25% of Member States (elected every 4 years)
(meets annually)

Each Sector is overseen by Advisory groups and world conferences





The ITU Secretariat

ITU Legal Instruments

ITU is ruled by their basic legal instruments, configured as international treaties and therefore binding for all signatory States. These legal instruments are:

- The Constitution of the International Telecommunication Union
- The Convention of the International Telecommunication Union
- The Administrative Regulations governing the use of Telecommunications:
  - a. International Telecommunication Regulations, ITRs
  - b. Radio Regulations, RR (including Rules of Procedure, RoP)
- Optional Protocol on the Compulsory Settlement of Disputes Relating to the Constitution, Convention and Administrative Regulations

ITU Governance

ITU is governed by the Plenipotentiary Conference (PP) and the Administrative Council.

Plenipotentiary Conference, PP

Supreme organ of the Union. It is the decision making body which determines the direction of the Union and its activities. PP is held every 4 years:

- PP10: Guadalajara, Mexico, October 2010
- PP14: Busan, Korea, October 2014
- PP18: United Arab Emirates, 4Q218

http://www.itu.int/en/plenipotentiary/2014

Plenipotentiary Conferences, PP

PP main functions:

- Review ITU Basic Texts: Constitution and
- Review ITU Strategic Plan and Budget
- Elect ITU Council Members (States)
- Elect ITU Officials:
  - ❑ General Secretary
  - ❑ Deputy Secretary
  - ❑ ITU Bureaux Directors: BR, TSB, BDT
- Elect Radio Regulations Board (12 members)
- Elect ITU Council (48 States)

ITU Basics Texts (Constitution, Convention, PP: Decisions, Resolutions, Recommendations) are available free of charge for general public (download) at:
http://www.itu.int/pub/S-CONF-PLEN-2011
(updated version with PP14 decision, very soon)

Plenipotentiary Conferences, PP

Recent PP-14 elected officials (from 01-01-2015 to 31-12-2018)

- **Secretary General** : **Houlin Zhao**, China
- **Deputy-Secretary General**: **Malcolm Johnson**, United Kingdom
- **ITU Radiocommunications Bureau (BR): François Rancy**, France
- **ITU Standardization Bureau (TSB)**: **Chaesub Lee**, Korea
- **ITU Development Bureau (BDT): Brahima Sanou**, Burkina Faso
- **Radio Regulations Board:**
  - **Americas**: Ricardo Teran, Argentina; Joanne Wilson, USA
  - **West Europe**: Alfredo Magenta, Italy; Lilian Jeanty, Netherlands
  - **East Europe, North Asia**: Victor Strelets, Russia; Ievgen Khairov, Ukraine
  - **Africa**: Stanley Kibe, Kenya; Simon Koffi, Côte d'Ivoire; Mustapha Bessi, Morocco
  - **Asia**: Yasuhiko Ito, Japan; Nasser Bin Hammad, UAE; Doan Hoan, Vietnam

http://www.itu.int/en/plenipotentiary/2014/Pages/results.aspx

ITU Council

ITU Council acts as the Union's governing body in the interval between Plenipotentiary Conferences.

Council is formed with 48 Administrations elected during PP (less than 25% of Member States)

ITU Council meets every year

Its role is to consider broad telecommunication policy issues to ensure that the Union's activities, policies, strategies, and budget, fully respond to today's dynamic, rapidly changing telecommunications environment.

http://www.itu.int/en/council/Pages/default.aspx

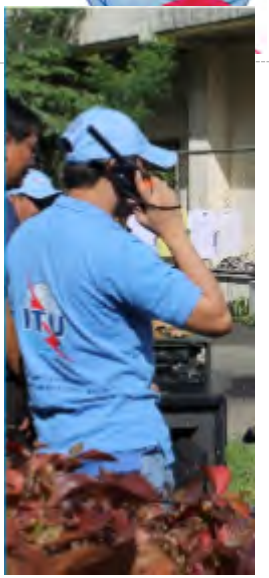
ITU Council

New Council is composed by (from 01-01-2015 to 31-12-2018):

- **Region A (Americas): 9 seats;** Argentina, Brazil, Canada, Costa Rica, Cuba, Mexico, Paraguay, United States, Venezuela
- **Region B (Western Europe): 8 seats;** France, Germany, Greece, Italy, Lithuania, Spain, Switzerland, Turkey
- **Region C (Eastern Europe and Northern Asia): 5 seats;** Azerbaijan, Bulgaria, Poland, Romania, Russian Federation
- **Region D (Africa): 13 seats;** Algeria, Burkina Faso, Egypt, Ghana, Kenya, Mali, Morocco, Nigeria, Senegal, Rwanda, Tanzania, Tunisia, Uganda
- **Region E (Asia and Australasia): 13 seats;** Australia, Bangladesh, China, India, Indonesia, Japan, Korea (Republic of), Kuwait, Pakistan, Philippines, Saudi Arabia, Thailand, United Arab Emirates

Emergency Telecommunications

- First response – mobile satellite phones and VSAT
- Assistance in the repair of the telecommunication networks
- Through telecommuniations, ITU facilitates
  - Search and resuce operations
  - Delivery of medicine, food and shelter
  - Communication between victims and loved ones
  - Establishment of telemedicine facilities linking doctors at disaster sites and specialists



ICTs & Climate Change

- **Climate change is a critical global challenge for the world citizens**
- **ICTs not identified as part of the problem but provides solutions:**
  - ICTs contribute 2-2.5 % of greenhouse gas (GHG) emissions
  - Energy-efficient devices, applications & networks
  - Encourage environment-friendly design
  - Reduce carbon footprint of the ICT industry
- **ITU & Climate Change**
  - Reduce impact by promoting Next-generation networks (NGN)
  - Developing standards for smart technologies, allocating spectrum for satellite remote sensing, intelligent transport systems…

WSIS

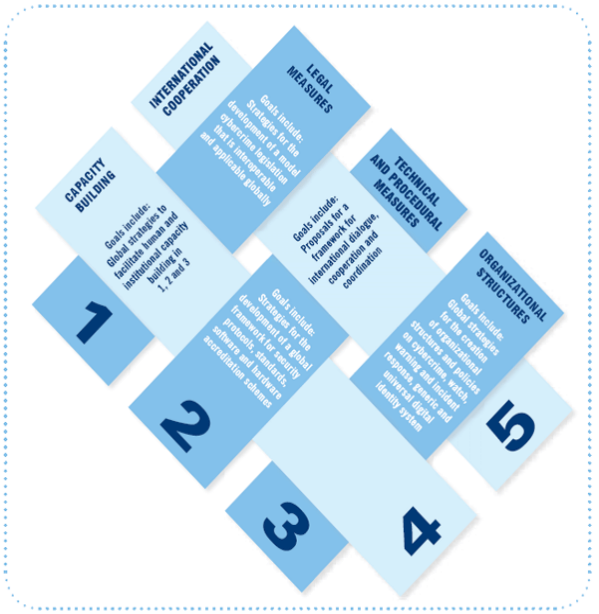
- The World Summit on the Information Society (WSIS) was held in two phases.
  - The first phase took place in Geneva in 2003, and
  - The second phase took place in Tunis in 2005
  - True Multi-Stakeholder Process
- Outcomes
  - Geneva Declaration of Principles
  - Geneva Plan of Action
  - Tunis Commitment
- Current Stage: Implementation, follow up and review process
  - *Next event:* WSIS Forum, 12–16 June 2017, Geneva

Please visit the WSIS interactive forum at http://groups.itu.int/Default.aspx?tabid=740

Cybersecurity

- **ITU's goal is to build trust, confidence and security in the use of ICTs**
- **ITU works under the five pillars of the Global Cybersecurity Agenda:**

1. Legal Measures
2. Technical and Procedural Measures
3. Organizational Structures
4. Capacity Building
5. International Cooperation



Summarizing …

The ITU-R coordinates global wireless communication and technical standards

The ITU-D provides technical assistance to the un-connected, emergency communication, ICT

The ITU-T produces interoperable technical ICT standards

The ITU GS provides *intersectorial* coordination, management, promotion for the whole organization

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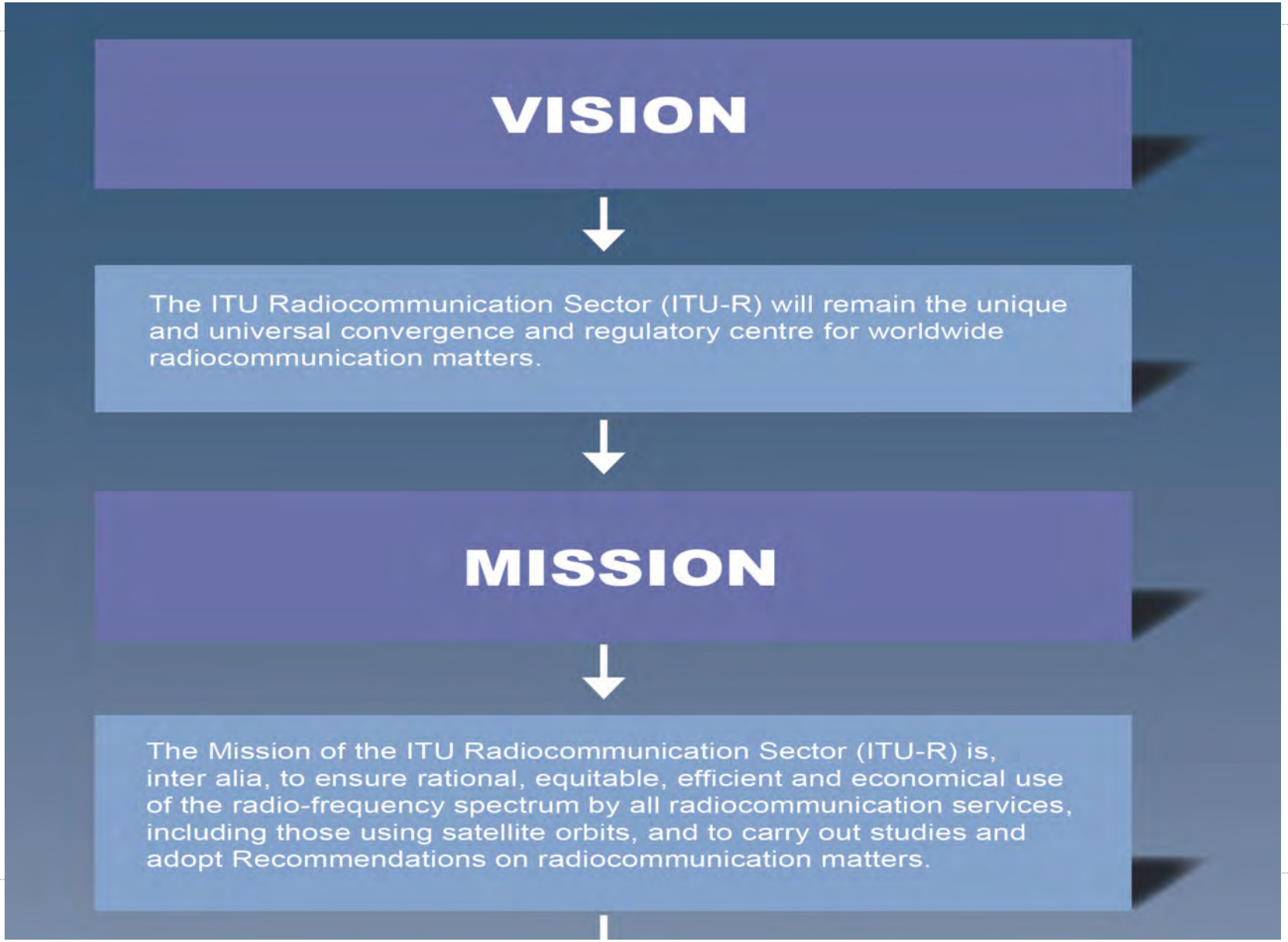
ITU-R Strategic Plan



ITU-R Strategic Plan

http://www.itu.int/en/ITU-R/information/Pages/operational-plans.aspx

ITU-R Main Functions

1. Organization of World and Regional Radiocommunication Conferences to expand and adopt Radio Regulations and Regional Agreements on the use of radio spectrum;

2. Studies by ITU-R Study Groups, in the framework established by the Assemblies, on the technical characteristics and operational procedures of the services and radio systems;

3. Coordination of efforts to eliminate harmful interference between radio stations of different countries;

4. Updating the Master International Frequency Register;

5. The establishment of information dissemination mechanisms, including seminars and workshops to contribute to the capacity building of Member States on Spectrum Management.

ITU-R mission

"To ensure rational, equitable, efficient and economical use of the radio-frequency spectrum by all radiocommunication services, including those using satellite orbits, and to carry out studies and adopt recommendations on radiocommunication matters."

Role conducted through *(inter alia)*:

- ✓World and Regional Radio-communication Conferences
- ✓Radiocommunication Study Groups
- ✓Radio Regulations Board
- ✓Radiocommunication Bureau

In implementing this mission, the actions in ITU-R aim at creating the conditions for harmonized development, *interference free* and efficient operation of existing and new radiocommunication systems, taking due account of all parties concerned

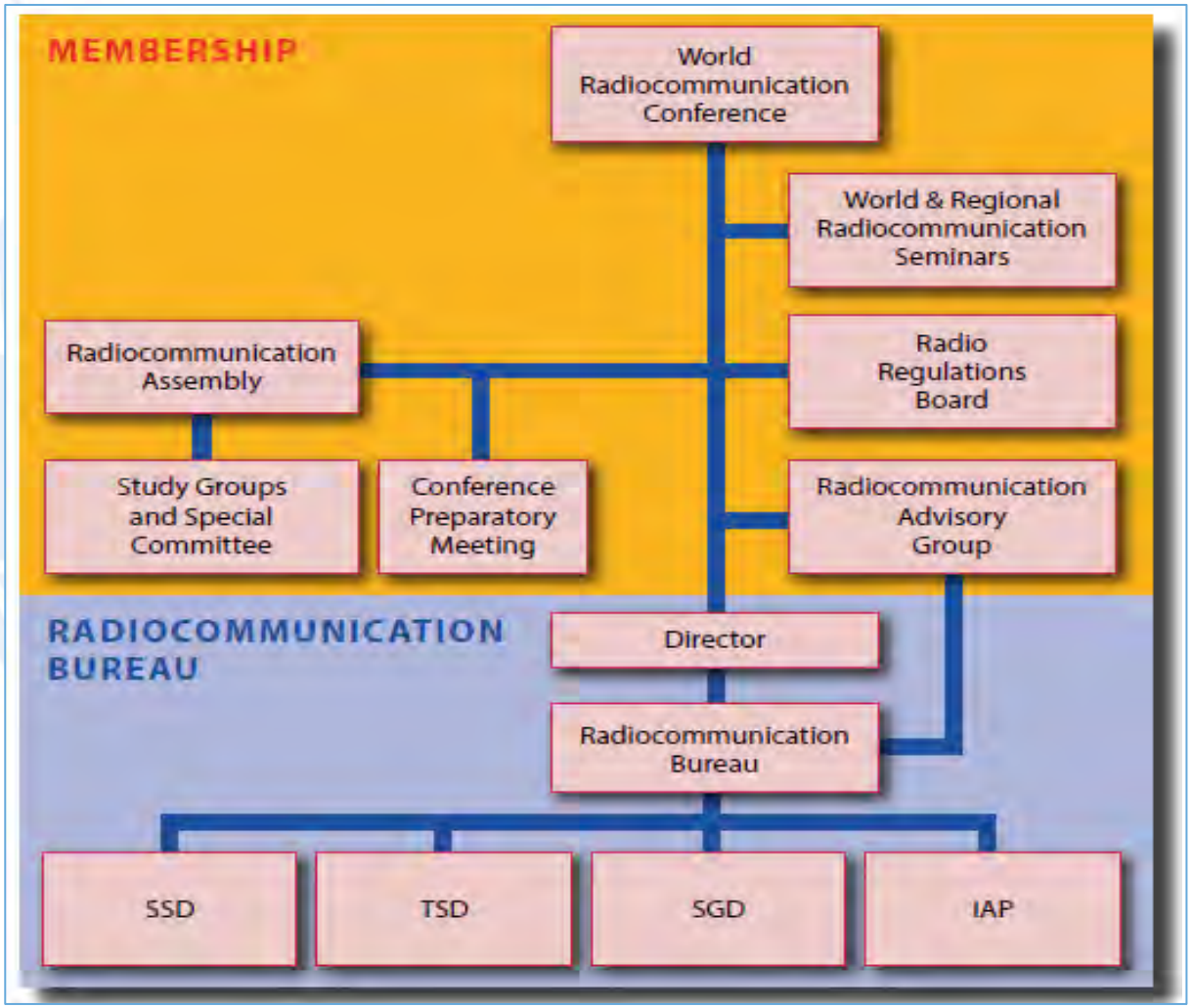
ITU-R Structure

SSD: Space Services Dept.

TSD: Terrestrial Services Dept.

SGD: Study Groups Dept.

IAP: Informatics, Administration and Publications Dept.



World Radio Conferences, WRC

WRC performs a complete and detailed review of the Radio Regulations (RR), and updates them by considering technological developments on Radio sector, its realities and challenges, to respond early and appropriately to these.

WRC has the authority to modify the RR by addenda, modifications or deletions they deem pertinent. These are made by consensus, and only if necessary, would vote (one vote per administration).

WRC can also:

1. Consider any radiocommunication matter of worldwide character
2. Develop instructions to the Radio Regulations Board and the Radiocommunication Bureau, and review their activities
3. Determine issues to be considered by Radiocommunication Assemblies and Study Groups as part of the preparatory work for future WRCs
4. Set the draft agenda for the next WRC

WRC AGENDA

- The Agenda for the next WRC is drafted during the past WRC
- The Agenda has to be approved by the ITU Council
- Resolution 1380 - Place, dates and agenda of the World Radiocommunication Conference (WRC-19) available at http://www.itu.int/md/S16-CL-C-0130/en

The WRC Process

Agenda: in WRC Res, finalized in Council Res

Informal Group
(Structure & Chairmanship)

Proposals

Coordinated common proposals

RA

CPM Report

Director's Report

WRC

Conference Secretariat (BR & GS)

Proposals

Member States

Final Acts

Radio Regulations (CS89)

Regional preparation
Resolution 72 (Rev.WRC-07)

WRC Calendar

WRCs take place every 4 years (Res.77, PP14); they are normally held in Geneva, Switzerland, for a period of 4 weeks

Last WRC: Geneva, Switzerland November 2015 (WRC-15)

Next WRC: Geneva, Switzerland, November 2019 (WRC-19)

Followed by: Geneva, Switzerland 2023 (WRC-23)

Between WRCs, Preparatory Meetings (CPM) are held, typically two:

1st : the week after the WRC; 2nd : ~ 6 months before next WRC.

Regional Preparatory Meetings are held, usually by each Regional Telecommunication Organization, 6 to 12 months before each WRC.

WRC15 web site: http://www.itu.int/en/ITU-R/conferences/wrc

Radiocommunications Assembly, RA

Radiocommunication Assemblies (RA) are responsible for the structure, programme and approval of radiocommunication studies. RA duties include to:

- **Assign** conference preparatory work and other questions to the Study Groups
- **Respond** to other requests from ITU conferences
- **Suggest** suitable topics for the agenda of future WRCs
- **Approve** and issue ITU-R Recommendations and ITU-R Questions developed by the Study Groups
- **Set the programme** for Study Groups, and disband or establish Study Groups according to the need

RA are convened every 4 years (Res. 77 PP14), associated in time and place with WRC (the week before)

- Last RA: Geneva, Switzerland 26-30 October 2015 (RA-15)
- **Next RA: Geneva, Switzerland October 2019 (RA-19)** (the week before WRC-19)
- Followed by: Geneva, Switzerland 2023 (RA-23)

RA web site: http://www.itu.int/en/ITU-R/conferences/RA

Radiocommunication Advisory Group

Radiocommunication Advisory Group (RAG) is tasked to:

- **Review the priorities and strategies adopted in the Sector**
- **Monitor progress of the work of the Study Groups;**
- **Provide guidance for the work of the Study Groups;**
- **Recommend measures to foster cooperation and coordination with other organizations and with the other ITU Sectors.**
- **Provide advice on these matters to the Director of the Radiocommunication Bureau (BR)**

Radiocommunication Assemblies (RAs) may refer specific matters within its competence to the RAG.
The RAG may be authorized to act on behalf of the RA between two Assemblies.

RAG meets yearly at Geneva.
- Last meeting: May 2016
- Next meeting: 25-27 April 2017

RAG meetings are open to ITU-R Members only.

RAG website: http://www.itu.int/en/ITU-R/conferences/rag

Radiocommunications Regulatory Board

RRB, addresses the correct and accurate application of the Radio Regulations (RR) and Rules of Procedures (RoP).

RRB comprises of 12 members, elected during PP, who perform their functions independently and on a part time basis.

Their functions include:

- Approving the Rules of Procedure (RoP) used by the ITU-R to implement the provisions of RR, and registering frequency assignments submitted by Member States;
- Considering matters referred to the BR that cannot be solved by applying the RR and Rules of Procedure;
- Considering research reports on unresolved cases of harmful interference and make recommendations accordingly;
- Advising the WRC and RA;
- Considering appeals against decisions taken by the BR regarding frequency assignments;

RRB meets 3 - 4 times per year at the ITU headquarters in Geneva, Switzerland.

RRB website: http://www.itu.int/en/ITU-R/conferences/RRB

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ITU-R Study Groups

ITU-R Study Groups develop the technical bases for decisions taken at WRCs and develop global standards (Recommendations), Reports and Handbooks on radiocommunication matter. Particular attention is paid to the radiocommunication needs of developing countries.

ITU-R SGs gathers more than 4000 specialists, from: ITU Member States, Sector and Associate Members, and Academia participate on ITU-R SG activities; ITU-R SG work in cooperation with other international radiocommunication organizations.

ITU-R counts with 6 SG, composed by 21 Working Parties, WP

WP meets twice a years (some WP 1 or 3), normally at Geneva.

SG meets yearly (after sessions of their respective WP)

http://www.itu.int/en/ITU-R/study-groups

All ITU-R Rec, Rep, Op, and the Spectrum Management related Handbooks are of public access (download), free of charge

http://www.itu.int/en/ITU-R/Documents/BD_Flyer_A4_E.pdf

ITU-R Study Groups

CCV: Coordination Committee for Vocabulary
CPM: Conference Preparatory Meeting
SC: Special Committee on regulatory/procedural matters

SG 1: Spectrum management; 3 WP
SG 3: Radiowave propagation; 4 WP
SG 4: Satellite services; 3 WP
SG 5: Terrestrial services; 4 WP
SG 6: Broadcasting service; 3 WP
SG 7: Science services; 4 WP

- **"Standards" in areas of spectrum management and radio technology**
- **Result of consensus from meetings of world-wide experts**
- **Some referred to in RR**
- **Used by spectrum planners and system designers**
- **1142 Recommendations, 410 Reports, 44 Handbooks in force**

ITU-R SG1: Spectrum Management

Scope: Spectrum management principles and techniques, general principles of sharing, spectrum monitoring, long-term strategies for spectrum utilization, economic approaches to national spectrum management, automated techniques and assistance to developing countries in cooperation with the Telecommunication Development Sector.

In addition, inter-service sharing and compatibility (urgent studies by request), including the development of Recommendations(s) or Reports(s) to the Conference Preparatory Meeting in answer to those urgent Questions concerning inter-service sharing and compatibility requiring special attention.

Structure

- WP 1A : Spectrum engineering techniques
- WP 1B : Spectrum management methodologies and economic strategies
- WP 1C: Spectrum monitoring

ITU-R SG3: Radiowave Propagation

Scope: Propagation of radio waves in ionized and non-ionized media and the characteristics of radio noise, for the purpose of improving radicommunication systems.

Structure

- 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

ITU-R SG4: Satellite Services

Scope: Systems and networks for the fixed-satellite service, mobile-satellite service, broadcasting-satellite service and radiodetermination -satellite service.

Structure

- WP 4A: Efficient orbit/spectrum utilization for the fixed-satellite service (FSS) and broadcasting-satellite service (BSS)
- WP 4B: Systems, air interfaces, performance and availability objectives for the fixed-satellite service (FSS), broadcasting-satellite service (BSS) and mobile-satellite service (MSS), including IP based applications and satellite news gathering (SNG)
- WP 4C: Efficient orbit/spectrum utilization for the mobile-satellite service (MSS) and the radiodetermination-satellite service (RDSS).

ITU-R SG5: Terrestrial Services

Scope: Systems and networks for fixed, mobile, radiodetermination, amateur and amateur-satellite services.

Structure

- WP 5A: Land mobile service above 30MHz (excluding IMT); wireless access in the fixed service; amateur and amateur-satellite services
- WP 5B: Maritime mobile service including the Global Maritime Distress and Safety System (GMDSS); the aeronautical mobile service and the radiodetermination service
- WP 5C: Fixed wireless systems; HF and other systems below 30 MHz in the fixed and land mobile services
- WP 5D: IMT systems

ITU-R SG6: Broadcasting Services

Scope: Radiocommunication broadcasting, including vision, sound, multimedia and data services principally intended for delivery to the general public; it encompasses the production and distribution of programmes (vision, sound, multimedia, data, etc.) as well as contribution circuits among studios, information gathering circuits (ENG, requirements for SNG, etc.), primary distribution to delivery nodes, and secondary distribution to consumers.

Structure

- WP 6A: Terrestrial broadcasting delivery
- WP 6B: Broadcast service assembly and access
- WP 6C: Programme production and quality assessment

ITU-R SG7: Scientifc Services

Scope: "Science services" refer to the standard frequency and time signal, space research (SRS), space operation, Earth exploration-satellite (EESS), meteorological-satellite (MetSat), meteorological aids (MetAids) and radio astronomy (RAS) services.

Structure

- WP 7A: Time signals and frequency standard emissions: Systems and applications (terrestrial and satellite) for dissemination of standard time and frequency signals;

- WP 7B: Space radiocommunication applications: Systems for transmission/ reception of telecommanded and tele-metry data;

- WP 7C: Remote sensing systems: for space operation and for space research;

- WP 7D: Radio astronomy: remote sensing systems and applications for Earth exploration meteorology and plantetary sensing

ITU-R Publications

- *ITU-R Recommendations:* http://www.itu.int/pub/R-REC
- *ITU-R Reports:* http://www.itu.int/pub/R-REP
- *ITU-R Opinions:* http://www.itu.int/pub/R-OP
- *ITU-R Handbooks:* http://www.itu.int/pub/R-HDB

All ITU-R Rec, Rep, Op, and the SM related Handbooks are of public access (download), free of charge

Compliance with ITU-R Recommendations is not mandatory. However, while some are incorporated by reference in the ITU Radio Regulations,

ITU-R Recommendations are developed by radiocommunication world experts, thereby enjoying a high reputation and worldwide implementation, having the status of international standards in their domain of application.

There are 1142 Recommendations and 410 Reports in force (Dec 2014)

ITU-R Publications Series

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

Example Nomenclature: Rec. ITU-R BO.2063.-0 (09/2014)

Type Sector Serie.Number-version (issued: Month/year)

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Radiocommunication Bureau, BR

The Radiocommunication Bureau is the executive arm of ITU-R. BR is headed by an elected Director responsible for the coordination of the work of the Sector, managing professional and administrative teams of BR.

The Radiocommunication Bureau:

✓**Provides** administrative and technical support to WRCs, RAs, ITU-R SG, including WPs and Task Groups;

✓**Applies** the provisions of the Radio Regulations and various Regional Agreements;

✓**Records and registers** frequency assignments and also orbital characteristics of space services, and maintains the Master International Frequency Register, MIFR

✓**Provides advice to Member States** on the equitable, effective and economical use of the radio frequency spectrum and satellite orbits, and investigates and assists in resolving cases of harmful interference;

✓**Coordinates** the preparation, editing and dispatch of circulars, documents and publications developed within the Sector;

✓**Provides** technical information, organizes seminars on national frequency management and radiocommunications, and works closely with the ITU Telecommunication Development Bureau (BDT)

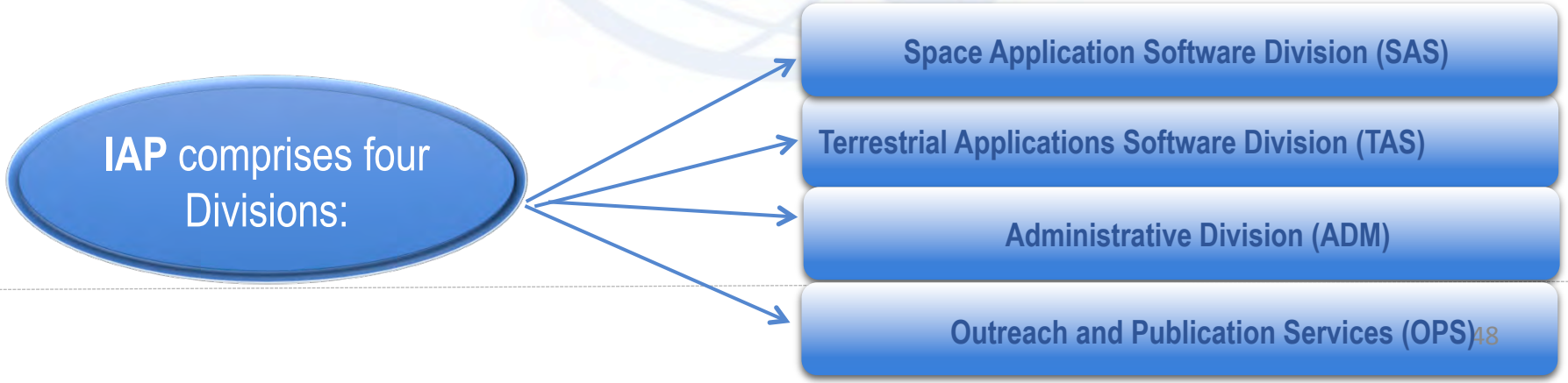
http://www.itu.int/ITU-R/go/space/en

BR: IAP Department

IAP is responsible for the **development and maintenance of major software packages** used by the BR as well as software adapted to national frequency management units. IAP carries out studies related to policies for the technologies to be used for the information handling within the BR and administrations in the fields of management of the radio frequency spectrum and satellite orbits.

IAP undertakes activities related to:

- ITU-R Publications;
- Website development;
- Membership and outreach in coordination with the General Secretariat and the other Bureaux.
- Also centralizes the IT resources of ITU-R. I
- IAP undertakes actions and activities relating to development and enhancement of the automation tools for the support of all the other activities and outputs of the Sector. In addition, VI) IAP is responsible for the general administrative functions of BR, including the correspondence registry, document and delegate registration management for conferences and meetings. It also oversees all BR financial and personnel matters



BR: SG Department

The Study Group Department (SGD) supports the work of the ITU-R Study Groups following the working methods and work programs as adopted by the Radiocommunication Assembly.

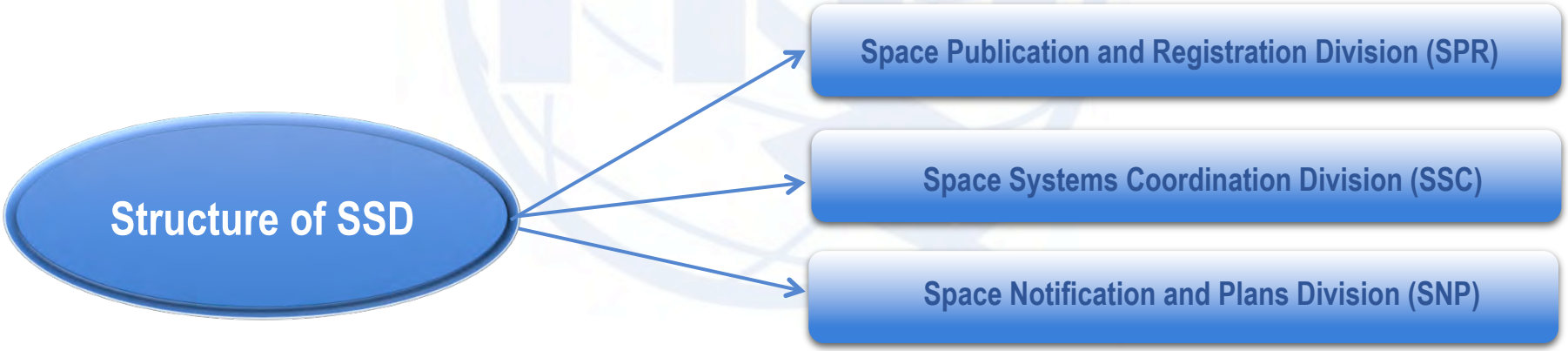
- They provide the Secretariat to every ITU-R SG, headed by each SG Counsellor:

- Study Group 1 (SG 1): Spectrum management
- Study Group - 3 (SG 3): Radiowave propagation
- Study Group 4 (SG 4): Satellite services
- Study Group 5 (SG 5): Terrestrial services
- Study Group 6 (SG 6): Broadcasting service
- Study Group 7 (SG 7): Science services
- Coordination Committee for Vocabulary (CCV)
- Conference Preparatory Meeting (CPM)
- Special Committee on Regulatory/Procedural Matters (SC)

BR: Space Services Department

The Space Services Department (SSD) is responsible for coordination and recording procedures for space systems and earth stations. The Department handles capture, processing and publication of data and carries out examination of frequency assignment notices submitted by administrations for inclusion in the formal coordination procedures or recording in the Master International Frequency Register (MIFR).

SSD is also responsible for managing the procedures for space related assignment or allotment plans of the ITU and for provision of assistance to administrations on all of the above issues.

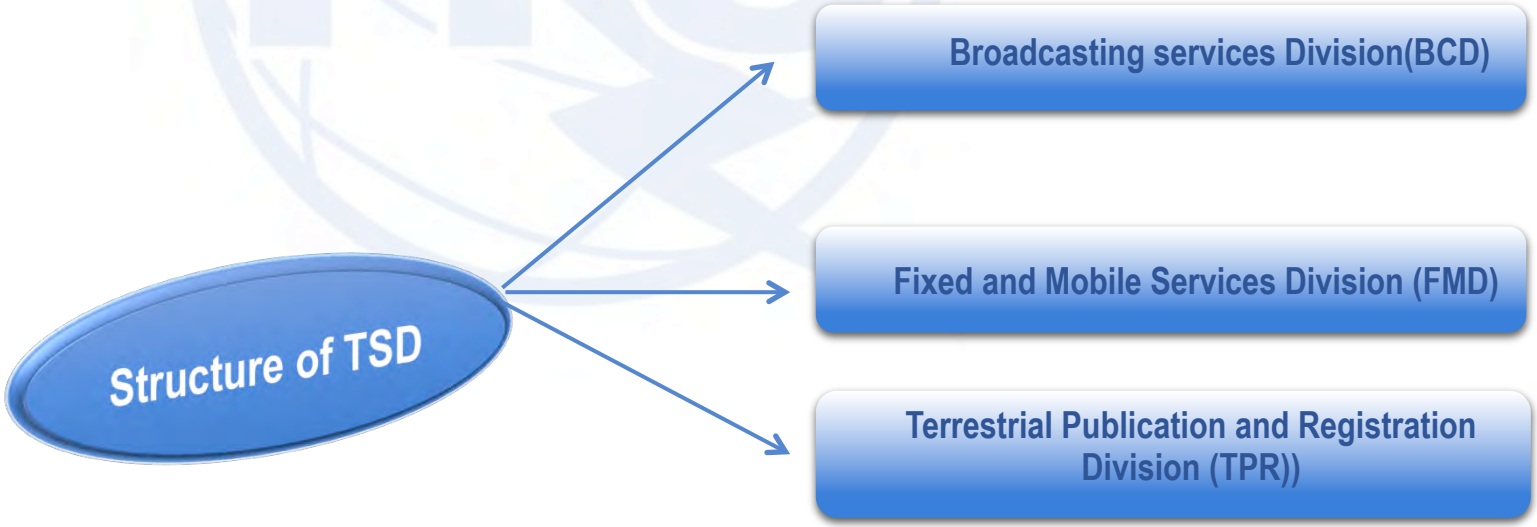


http://www.itu.int/ITU-R/go/space/en

BR: Terrestrial Services Department

The Terrestrial Services Department (TSD) carries out technical and regulatory functions and provides assistance to administrations in the domain of international management of the RF spectrum, as specified in the Radio Regulations and various Regional Agreements, concerning terrestrial services (broadcasting, fixed, maritime mobile, aeronautical mobile, etc.).

It processes notifications of frequency assignments, maintains the Master Register and Plans concerning terrestrial services and publishes their updates at regular intervals. It also applies various administrative regulations dealing with allocation of international means of identifications (call sign series, MIDs) and with safety of life.



http://www.itu.int/ITU-R/go/terrestrial/en

AGENDA

1. ITU at Glance
2. ITU Radiocommunication Sector (ITU-R)
3. ITU-R Study Groups
4. ITU Radiocommunication Bureau (BR)
5. ITU Academia

ITU & Academia

Academia Members play an important role in standards and regulation development by bringing their expertise to decisions with global implications.

Academia and ITU SG:
Academia has the unique opportunity to influence the global ICT community's thinking and actions on topics relevant to their expertise.

Each ITU Sector has a number of SG related to their specific field. This is where ICT stakeholders from around the world come together to develop new standards and approaches which shape the future of ICT.

Key Themes of Study Groups:
Cybersecurity / Emergency Telecommunications / Climate Change / Spectrum and Satellite Management / Broadband / Digital Divide / Optical Fiber / Cloud Computing / Radiowave Propagation and more...

ITU-R Free Publications

Radio Regulations: www.itu.int/pub/R-REG-RR-2012
Rules of Procedure: www.itu.int/pub/R-REG-ROP-2012
WRC-15 Agenda and Resolutions: www.itu.int/go/ITU-R/WRC-15-Agenda
ITU-R Handbooks:
Computer-aided Techniques for Spectrum Management (CAT): www.itu.int/publ/R-HDB-01
Spectrum Monitoring: www.itu.int/publ/R-HDB-23
National Spectrum Management: www.itu.int/publ/R-HDB-21
Use of Radio Spectrum for Meteorology: Weather, Water and Climate Monitoring and Prediction: www.itu.int/pub/R-HDB-45
ITU-R Study Group Outputs:
ITU-R Recommendations: www.itu.int/pub/R-REC
ITU-R Reports: www.itu.int/pub/R-REP
ITU-R Questions: www.itu.int/pub/R-QUE
ITU-R Opinions: www.itu.int/pub/R-OP
ITU-R/ITU-T Terms and Definitions: www.itu.int/pub/R-TER
ITU-R Booklets:
ITU-R Book of Resolutions: www.itu.int/pub/R-VADM-RES
ITU-R Radiocommunication: Committed to connecting the world: www.itu.int/pub/R-GEN-OVW
ITU-R Radiocommunication: Study Groups: www.itu.int/pub/R-GEN-SGB
ITU-R Radiocommunication: Climate Change: www.itu.int/pub/R-GEN-CLC

ITU-R Free Databases

Terrestrial Services:

Terrestrial Services Software: www.itu.int/pub/R-SOFT-TER
Global Administration Data System (GLAD): www.itu.int/pub/R-SOFT-GLAD
Maritime Mobile Access and Retrieval System (MARS): www.itu.int/pub/R-SOFT-MARS
Emergency (Res.647): www.itu.int/net/itu-r/terrestrial/res647
Monitoring reports: www.itu.int/ITU-R/go/terrestrial-monitoring

Space Services:

Space Network List (SNL): www.itu.int/pub/R-SOFT-SNL
Space Network Systems (SNS): www.itu.int/pub/R-SOFT-SNS (available as a free service for TIES registered users only)

Others:

SG3 Databanks (Radiowave propagation): www.itu.int/pub/R-SOFT-SG3
ITU Patent Statement and Licensing Declaration Information: www.itu.int/pub/R-SOFT-PAT
ITU Digitized World Map (IDWM) and Subroutine Library(32bit): www.itu.int/pub/R-SOFT-IDWM

Both of free resources are available online on the ITU-R homepage: www.itu.int/ITU-R
Tab: “Free Resources”
in six languages of ITU (Arabic, Chinese, English, French, Russian, Spanish) whenever possible.

Questions?

Chuen Chern Loo

Chuen-chern.loo@itu.int

Space Publication and Registration Division (SPR)

ITU Radiocommunication Bureau

ITU Orbit Spectrum Regulations and Procedures

Space Policy & Law Course, 2016

Chuen Chern Loo

ITU Radiocommunication Bureau

11 October 2016, London

LONDON INSTITUTE OF SPACE POLICY AND LAW

UN Legal Framework

- United Nations Outer Space Treaty (1967)

Outer space free for exploitation and use by all states in conformity with international regulations

States retain jurisdiction and control over objects they have launched into outer space

States shall be liable for damage caused by their space objects

ITU Legal Framework

Extraordinary Administrative Radio Conference
EARC-63
to allocate frequency bands
for space radiocommunication purposes
First Space Radiocommunication Conference
(Geneva, *1963*)

- Principles of use of orbit/spectrum
- Allocation of frequency bands to services
- Procedures, Plans, operational measures
- Instruments (CS, CV, RR, RoPs, Recs)

ITU Constitution

Article 44

Use of the Radio-Frequency Spectrum and of the GSO-Satellite and other Satellite Orbits

↓

Radio frequencies & satellite orbits are *limited natural resources*

↓

Rational, Efficient, Economical Use

↓

Equitable Access

ITU Constitution

Article 45
Harmful Interference

- Each Member State *is responsible* to ensure that the stations licensed by them *(CS 198)*
- shall not cause harmful interference to radio services of other member states *(CS197)*

Why is ITU important for Satellite communication ?

International Legal Framework for Space Services

UN Outer Space instruments (*on space objects*)		ITU Instruments (*on radio frequencies*)
free "exploration and use" *under international law*	⇨	Equitable access and rational use of spectrum *under international law*
States "responsibility" & "licensing" "jurisdiction & control"	⇨	State - must license transmitting radio stations - shall not cause harmful interference
States "liable" for damage	⇨ (crossed out)	No liability clauses

Propagation of Radio waves

- Laws of physics
- Radio waves do not stop at national borders

Interference

- possible between radio stations of different countries
- This risk is high in Space Radiocommunications

➢ **Radio Regulations (RR)**

- One of its main purposes - Interference-free operation of Radiocommunications

ITU Radio Regulations - 1

- **Intergovernmental Treaty – *legal bindings* on all Member states, governing the use of *spectrum/orbit* resources by administrations**
- **Define the *rights* and *obligations* of Member States in respect of the use of these resources**
- **The ITU Radio Regulations incorporates the decisions of WRCs, including all Articles, Appendices, Resolutions, Recommendations and ITU-R Recommendations incorporated by reference.**

- Two main concepts:
  - Frequency block *allocations* to defined *radio services* (FA Table - Article 5)
  - Mandatory or voluntary *regulatory procedures* (Coordination, Plan, Notification) and Recording in the Master International Frequency Register (*MIFR*) that are adapted to the frequency allocation structure

ITU Radio Regulations - 2

OBJECTIVES:

- to facilitate *equitable access to* and *rational use* of the natural resources of the *radio-frequency spectrum* and *any associated orbits*;
- to ensure the *availability and protection* from harmful interference of the frequencies provided for *distress and safety purposes*;
- to assist in the *prevention and resolution of cases of harmful interference* between the radio services of different administrations;
- to facilitate the *efficient and effective operation of all radiocommunication services*;
- to provide for and, where necessary, *regulate new applications* of radiocommunication technology.

ITU Radio Regulations - 3

Status
RIGHT for international recognition
OBLIGATION to eliminate harmful interference
Art 7-8

Frequency
TABLE
(9kHz-275GHz)
Art 4-6

Interference
& Monitoring
Art 15-16
Aps 9-10

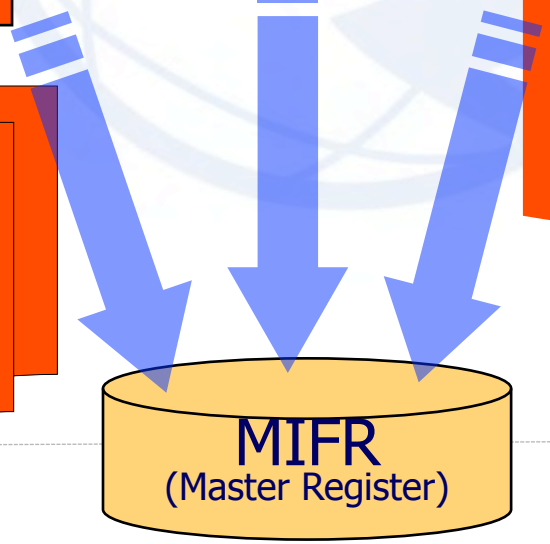
Definitions – Art 1-3, AP 14, 42
Administrative
Secrecy/Licences/
Interception/Identification of stations/
call signs/Service Publications
Art 17-20
Bureau & RRB – Art 13-14

Procedures
Coordination,
Notification &
Recording
Art 9, 11
AP 4-8

Limits
technical/operational
Arts 21, 22
APs 1-3

Services
Aeronautical – Art 35-45
Maritime – Art 46-58
Amateur, broadcasting,
fixed, radiodetermination,
standard freq. & time – Art 12, 23-29
AP 11-13, 16, 19

Plans
Maritime HF, VHF (AP 17-18)
Maritime coast stations (AP 25)
Aeronautical (OR) (AP 26)
Aeronautical (R) (AP 27)
Broadcasting-satellite(AP30-30A)
Fixed-satellite (AP 30B)



GMDSS
Art 30-34
AP 15

RADIO REGULATIONS - 4

RR classifies services that use radio communications, according to several parameters, namely:

1. Link type: Terrestrial (earth to earth) or satellite (earth-satellite, satellite-earth, satellite-satellite)

2. Type of coverage: land, maritime, aeronautical

3. Station type: fixed, mobile

4.Type of use: communications, broadcasting, navigation, meteorological, scientific, earth observation, time standard, astronomy, amateur satellite, etc.

RADIO REGULATIONS - 5

RR is technically and technologically neutral, it

- does allocate frequency bands to radiocommunication services
- for example allocation for mobile (terrestrial) *service*

- Does not allocate to specific applications
- Does not allocate to particular technologies

- not for *Application or technology (*GSM, LTE, Wimax, etc.)

Radio & regulations history - 1

Prince Heinrich interoperability claim

Titanic disaster

1st World War
Better radio technology
(e.g., spectrum efficient vacuum tube transmitters)
Beginning & expansion of broadcasting

Spark transmitter phasing-out

1906 Radio Conference (Berlin)

1st Radio Regulations; interoperability provision; identification of frequencies;
SOS code; *International Bureau* in Bern

1912 Radio Conference (London)

Obligatory installation of radio aboard ships & continuous radio watch; new radio services, (e.g, meteorology); new identified frequencies

1927 Radio Conference (Washington)

Allocation of frequency bands (10 kHz - 60 MHz) to defined classes of radio users called "services"; procedures for rights to use of specific radio channels free from interference from stations of other nations; participation of private companies; establishment of a technical committee:
CCIR *(Comité Consultatif International pour la Radio)*

Economic value of spectrum

Radio & regulations history - 2

1932 Radio and Telegraph Conference (Madrid)

1932 (unification of ITU)

- **80 countries agreed on creation of the *International Telecommunication Union* (ITU) which replaced the International Telegraph Union.**

The new ITU Convention included the following regulations:

- **the Telegraph Regulations**
- **the Telephone Regulations**
- **the Radio Regulations**

By that time, the basic international institutional arrangements for radiocommunication were conceived & implemented: regular meetings to prepare technical & operational standards, review of Table of Frequency Allocations, collection, recording and publication of telecommunication information by a central Bureau

MARITIME, BROADCASTING, AERONAUTICAL, FIXED, AMATEUR

Radio spectrum

Notification to the Bureau: rights & recognition

Radio & regulations history - 3

1938
(Radio expansion)

Radio Conference (Cairo)

Allocations to: intercontinental air routes, additional frequency bands to broadcasting, radar and broadcasting developments.

Radiocommunications important for post-war reconstruction and propaganda: expansion and sophistication of radio technology and use.

1947
(Birth of modern ITU)

Radio Conference (Atlantic City)

Creation of the International Frequency Registration Board (IFRB): members are "custodians of international public trust"
(proposed as a kind of international court of justice for disputes on the use radio spectrum); extensive change to the Table of Frequency Allocation (higher frequencies < 10.5 GHz & new services, Regions 1/2/3). *ITU joined the "UN system"*

New different approach to spectrum management:

"planned" X "notified"

Radio & regulations history - 4

1951

Radio Conference (Geneva)
Plans for fixed, aeronautical & maritime services

Planning period

Development of draft plans for HF & tropical broadcasting, fixed and land mobile
But Plans are only fragments; bulk of bands still used on an unplanned basis!

1963

Extraordinary Administrative Radio Conference to Allocate Frequency Bands for Space Radiocommunication Purposes (Geneva)

- No more insistence on a-priori allotment plan approach
- Table of Frequencies up to 40 GHz
- Introduction of the satellite service

...

1992

Special ITU Conference merged the CCIR and IFRB to the ITU-R sector directed by a Director of the Bureau

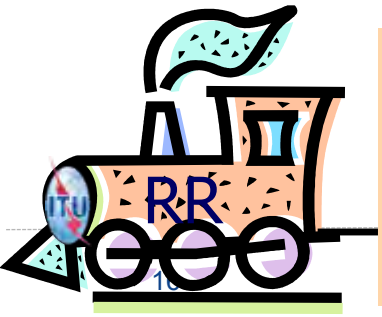
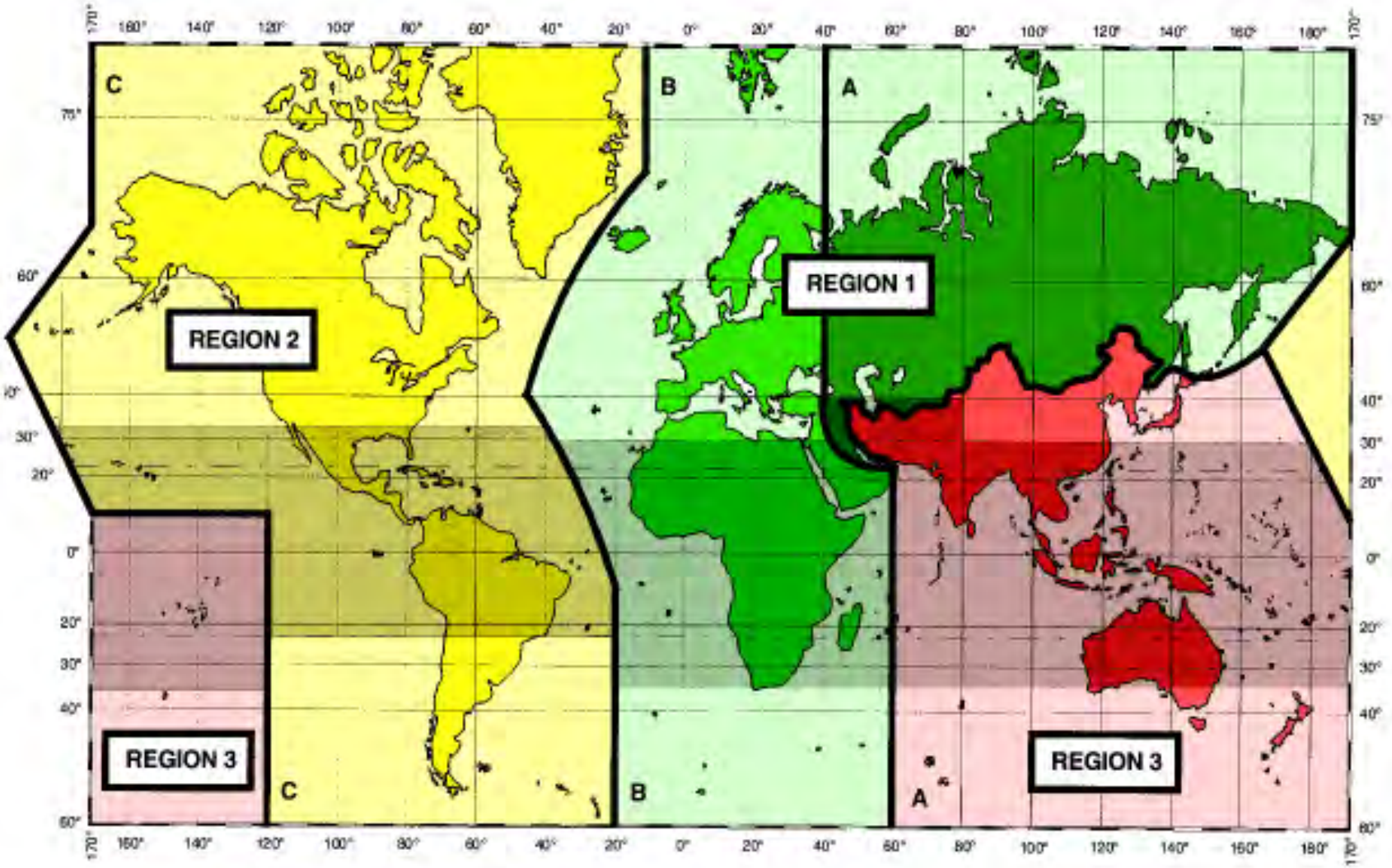


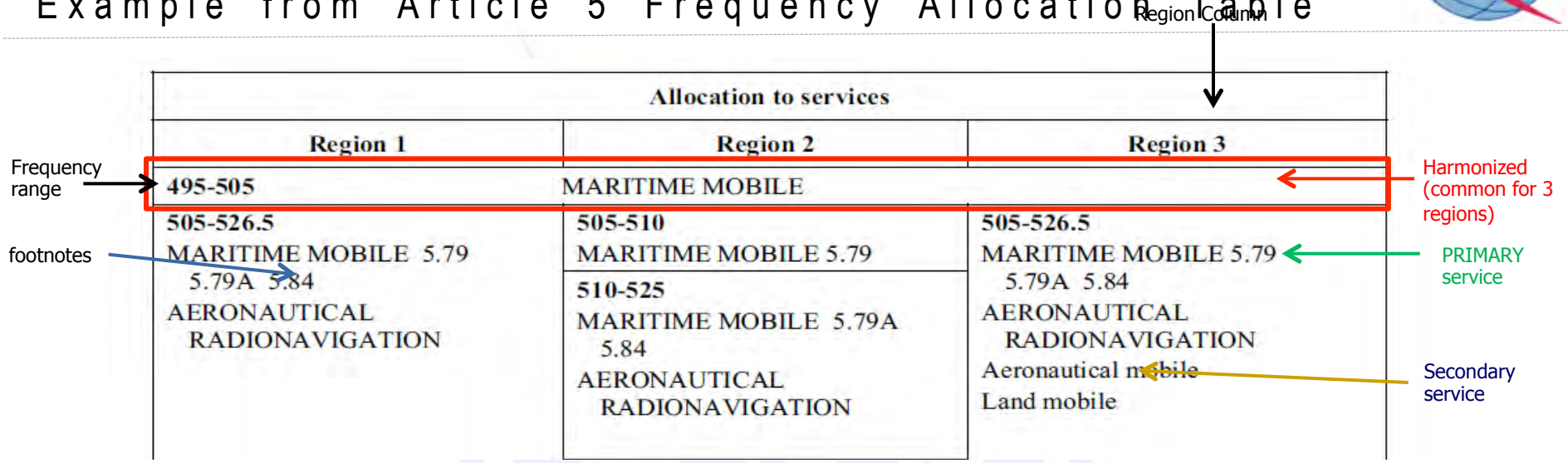
Table of Frequency Allocations (bands & services) – Planned & unplanned bands (procedures & standards) – Notification & rights + international recognition – ITU-R

RR REGIONS



RR Global Harmonization

Example from Article 5 Frequency Allocation Table



Global Harmonization:

- ultimate goal (as far as possible)
- *should, wherever possible, allocate frequency bands on a worldwide basis (aligned services, categories of service and frequency band limits) taking into account safety, technical, operational, economic and other relevant factors;*
- *should, wherever possible, keep the number of footnotes in Article 5 to a minimum when allocating frequency bands through footnotes*

Radio Regulations Mechanisms - 1

Control of Interference

ALLOCATION

Frequency separation of stations of different services

POWER LIMITS

PFD to protect TERR services / EIRP to protect SPACE services / EPFD to protect GSO from Non-GSO

MONITORING

International monitoring system

COORDINATION

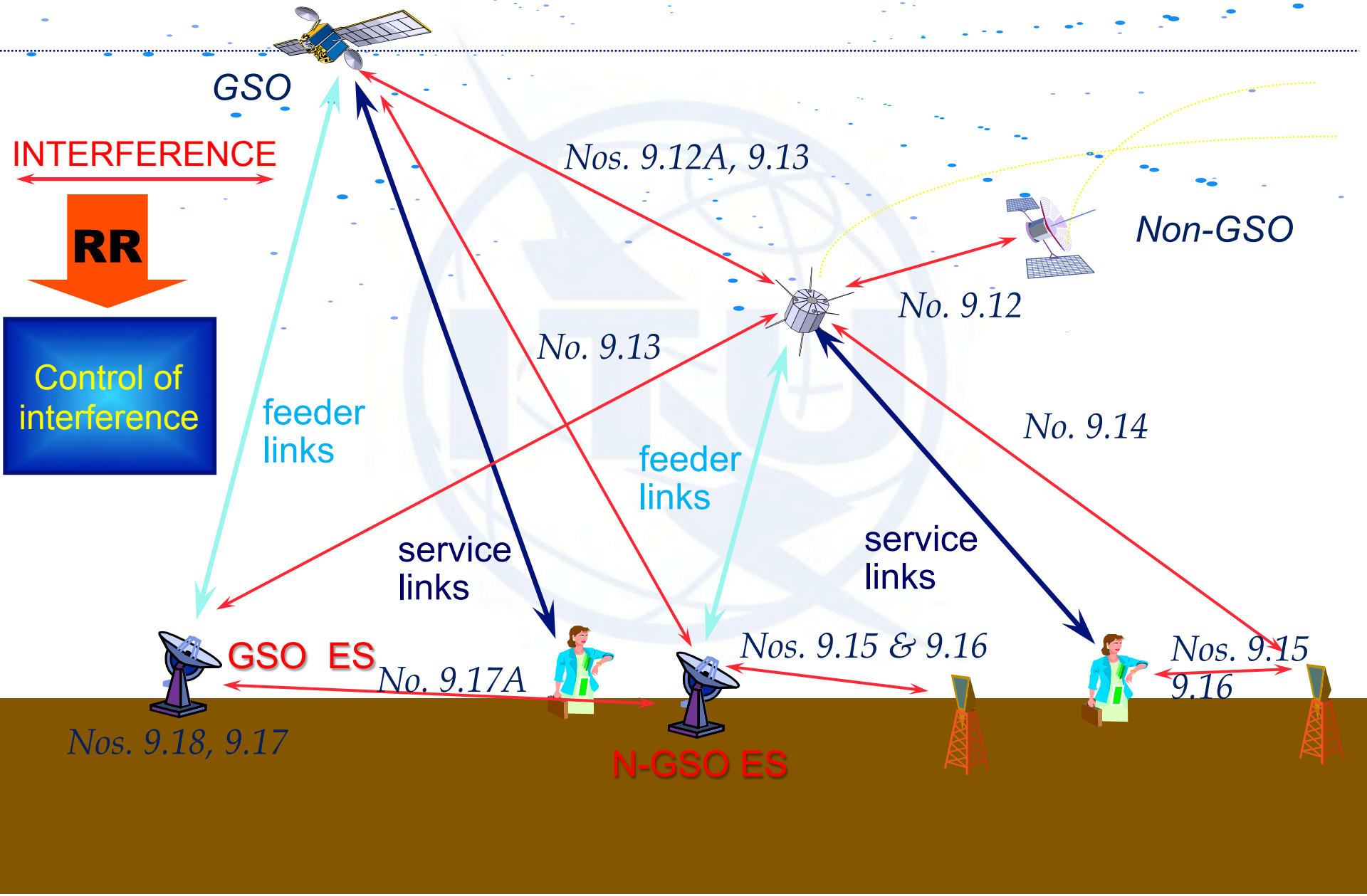
between Administrations to ensure interference-free operations conditions

RECORDING

In the Master International Frequency Register (MIFR)

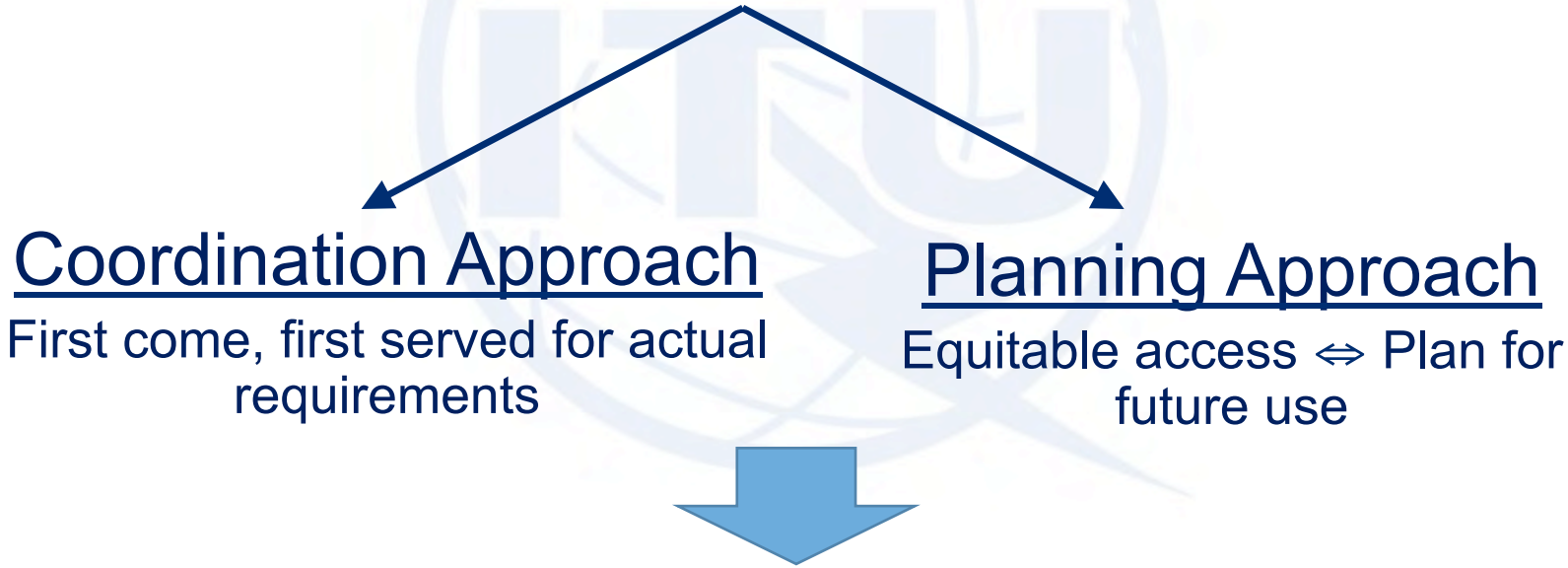
International recognition

Coordination provisions & interference



Radio Regulations Mechanisms - 2

- Two mechanisms of sharing orbit / spectrum
- Rights & obligations + applicable procedures



Two Approaches to Regulation

Coordination Approach

It is a "First come, first served" approach based on current requirements.

It can be an efficient and economical approach for the first to use it. As the spectrum/orbit is a limited resource, late comers may not have access to it as the early users have consumed it all.

Planning Approach

It is a distribution of some of the spectrum/orbit resources based on current and future requirements

Provides equitable access as each ITU Member State gets a pre-determined allocation of part of the spectrum/orbit resources protected from harmful interference for current and future use. However, it can be argued that it may not be as efficient and economical as it may prevent access to a part of that limited resource to others having the current capability to use it.

Parking lot analogy

Coordination Approach

Planning Approach

Coordination Approach

First come, first served for actual requirements

- Rights acquired through coordination with administrations concerning actual usage
- Efficient spectrum / orbit management
- Dense/irregular orbital distribution of space stations

Equitable Access

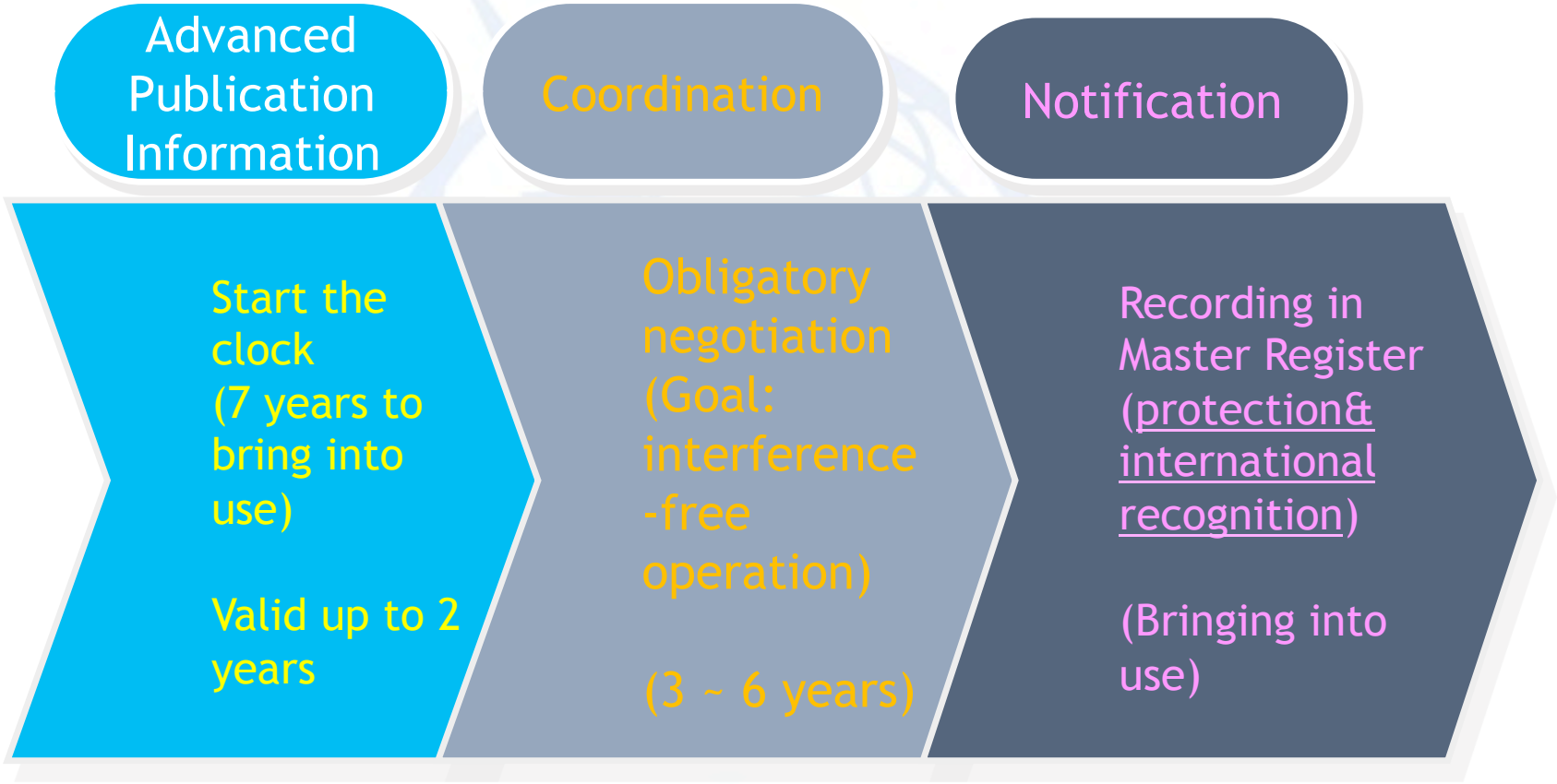
Planning Approach

Plan for future use

- Congestion of the GSO
- Frequency / orbital position plans
- BSS and FSS plans
- Guarantee for equitable access to the spectrum / orbital resources
  - Spectrum set aside for future use by all countries
  - Predetermined orbital position & frequency spectrum

Coordination Approach

First come, first served for actual requirements



Common Space Services

- Fixed-satellite service (including feeder link for other services)
- Broadcasting-satellite service (sound or video)
- Mobile-satellite service (land, maritime, or aeronautical)
- Radionavigation-satellite service
- Earth exploration-satellite service (remote sensing, including active or passive sensors)
- Space research service (including active or passive sensors)
- Meteorological-satellite service
- Space operation service (for TT&C)
- …..

Example: Earth exploration-satellite service (EESS)

- **Sensor data acquisition**
  - If sensor is optical, then no need to include this information in the satellite filing.
  - However if sensor is using RF frequencies (e.g. Synthetic aperture radars), then the frequency bands should be included in the satellite filing.
- **Sensor data downlink**
  - The transmission of sensor data to earth station, either directly or indirectly via a data relay satellite, is carried through the satellite bus and its data handling system. This data link will be called the science data or EESS data downlink, and will have to be provided in frequency bands where there is allocation for EESS.
- **Satellite bus links for TT&C**
  - The primary functions – telemetry, tracking, and command (TT&C) are operations functions associated with the satellite bus. The satellite bus provides the necessary support functions for the operation of the instruments (payload).
  - The allocations near 2 GHz for the EESS provide reliable, weather independent links for Earth exploration satellites and may be used for the TT&C functions. Other bands are also available for the TT&C including bands for EESS.
- **Typically, the satellite bus links require relatively low bandwidths as they support a data rate of about 1 Mbit/s and often much less, while the science data rates typically are in the order of a hundred Mbit/s.**

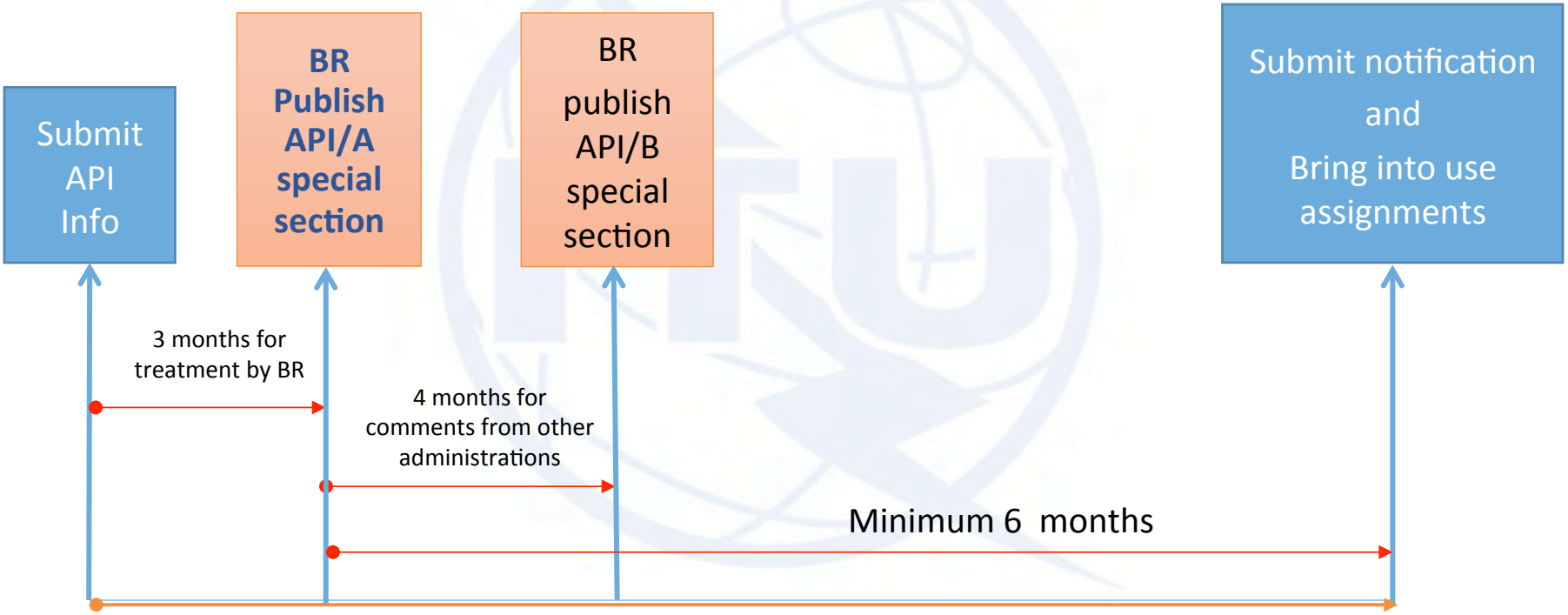
What assignments should be notified for recording in the Master International Frequency Register (MIFR) (Article 11)?

- **Any frequency assignments of transmitting and receiving earth and space stations**
  - if the use of that assignment is capable of causing harmful interference to any service of another administration; or
  - if that assignment is to be used for international radiocommunication; or
  - if it is desired to obtain international recognition for that assignment
  - if that assignment is subject to a world or regional frequency allotment or assignment plan which does not have its own notification procedure; or
  - if that assignment is subject to the coordination procedure of Article 9 or is involved in such a case; or
  - if it is a non-conforming assignment under No. 8.4 and if the administration wishes to have it recorded for information
  - ……

Status of frequency assignments recorded in the MIFR (Article 8)

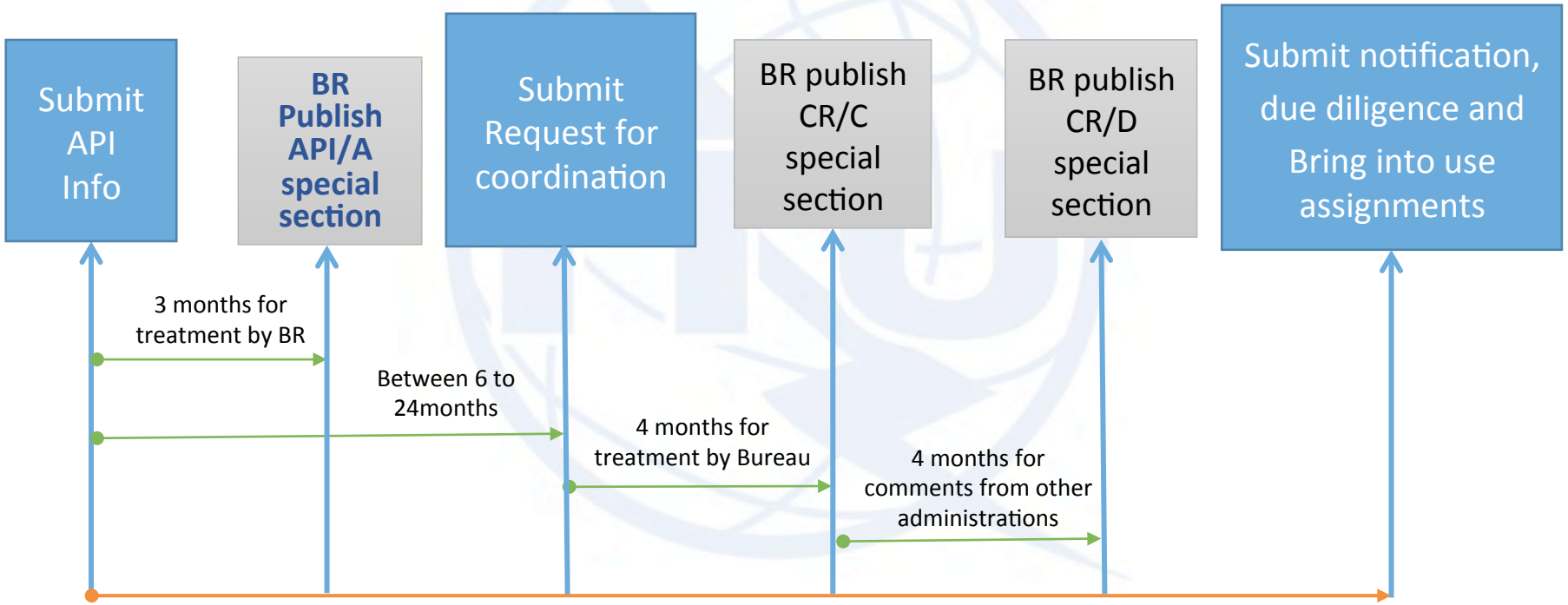
- The international rights and obligations of administrations in respect of their own and other administrations' frequency assignments shall be derived from the recording of those assignments in the MIFR
- Any frequency assignment recorded in the Master Register with a favourable finding shall have the right to international recognition.
- For such an assignment, this right means that other administrations shall take it into account when making their own assignments, in order to avoid harmful interference.

Timeline for satellite networks not subject to coordination



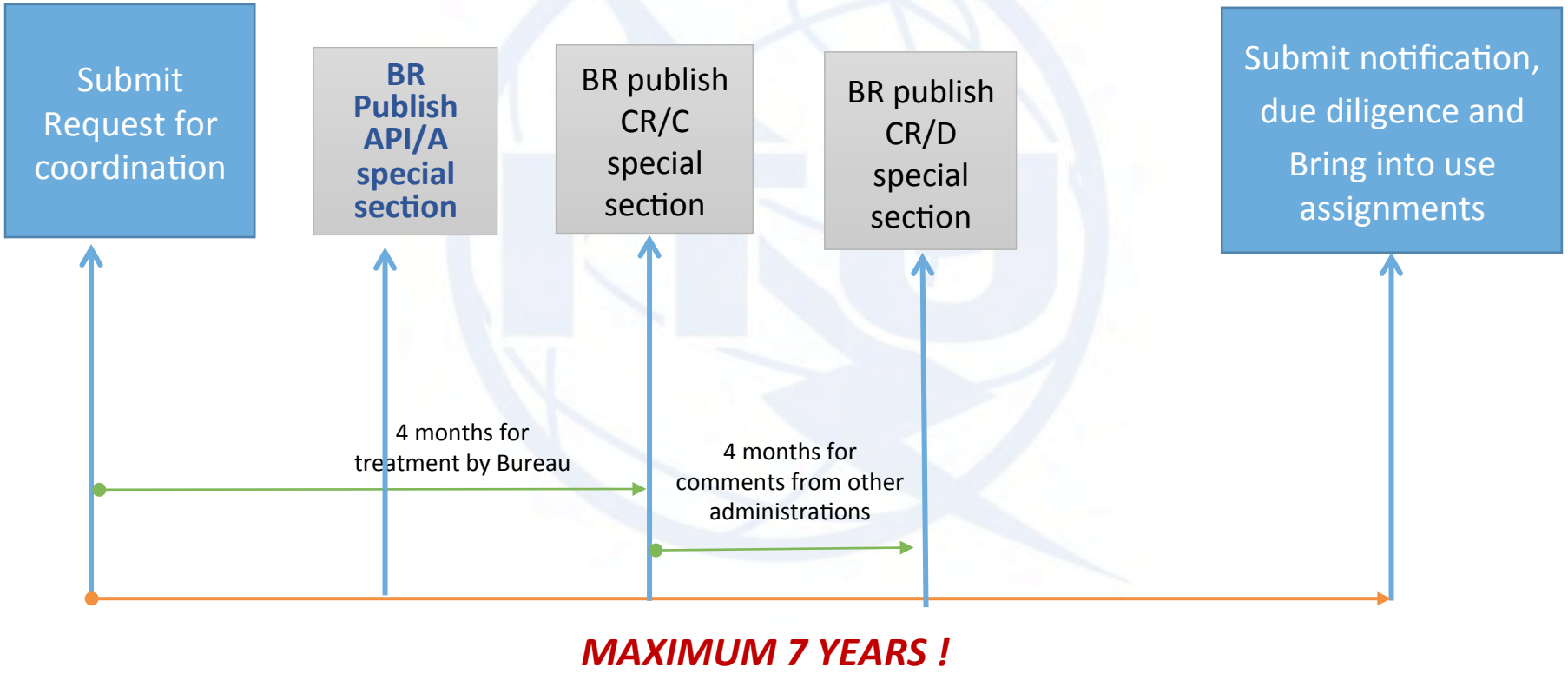
MIN 9 MONTHS, MAX 7 YEARS!

ITU Process for satellite network subject to coordination (current)



MAXIMUM 7 YEARS !

ITU Process for satellite network subject to coordination (from 1.1.2017)



MAXIMUM 7 YEARS !

Bringing into Use for satellites in GSO

- **Date of bringing into use informed through notification**
  - "Notified date of bringing into use" (No. **11.44**)
  - Date of bringing into use "required only for notification" (Ap4, A.2.a)
- **Conditions for frequency assignments to a space station in GSO to be considered brought into use (No. 11.44B)**
  - space station has capability of transmitting or receiving that frequency assignment
  - deployed and maintained at notified position for 90 days
  - Inform BR within 30 days after the end of 90-day period (i.e. 120 days after the date of bringing into use)
  - If notification is received more than 120 days after the date of bringing into use, then administration must certify the above for a continuous period of time from the notified date of bringing into use until the date of receipt of the notification

Suspension of Use for satellites in GSO (No.11.49)

- Possibility for suspension for up to 3 years while retaining all rights and protection.
- Bureau must be informed of the date of suspension within 6 months of the date of suspension
- Additional requirements introduced by WRC-15:
  - If Bureau is informed later than 6 months, then the 3 year suspension period shall be reduced by the amount of time that has elapsed between the end of the six-month period and the date that the Bureau is informed of the suspension.
  - If Bureau is informed more than 21 months, the frequency assignment shall be cancelled.
- The requirements for bringing back to use is the same as those for first bringing into use (i.e. continuous period of 90 days etc.)

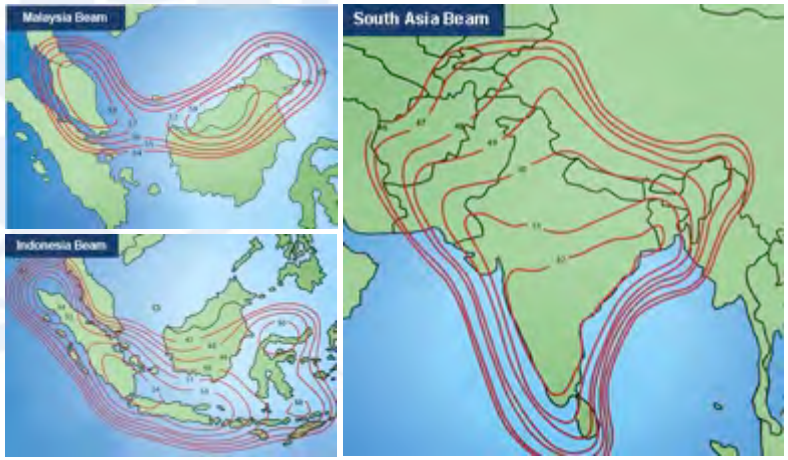
Continuous Use (No.13.6)

- whenever it appears from reliable information available that a recorded assignment has not been brought into use, or is no longer in use, or continues to be in use but not in accordance with the notified required characteristics as specified in Appendix **4**,
- the Bureau shall consult the notifying administration and request clarification
- In the event of a response and subject to the agreement of the notifying administration the Bureau shall cancel, suitably modify, or retain the basic characteristics of the entry.
- In the event of a response and subject to the agreement of the notifying administration the Bureau shall cancel, suitably modify, or retain the basic characteristics of the entry.
- If the notifying administration does not respond within three months, the Bureau shall issue a reminder. In the event the notifying administration does not respond within one month of the first reminder, the Bureau shall issue a second reminder. In the event the notifying administration does not respond within one month of the second reminder, action taken by the Bureau to cancel the entry shall be subject to a decision of the Board.
- In the event of non-response or disagreement by the notifying administration, the entry will continue to be taken into account by the Bureau when conducting its examinations until the decision to cancel or modify the entry is made by the Board. In the event of a response, the Bureau shall inform the notifying administration of the conclusion reached by the Bureau within three months of the administration's response.
- In case of disagreement between the notifying administration and the Bureau, the matter shall be carefully investigated by the Board, including taking into account submissions of additional supporting materials from administrations through the Bureau within the deadlines as established by the Board.

Continuous Use

- Under No. 13.6, " .. continues to be in use but not in accordance with notified required characteristics as specified in Appendix 4, the Bureau shall consult the notifying administration and request clarification .. "
- Steerable beams (global/semi-global) vs partially operational beams

Ku-band beam
Recorded
Globally steerable
Confirmed BIU



Ku-band beam
Operational

Article 15 - Interference
Infringement of the Constitution or Radio Regulations

- All stations are *forbidden* to carry out *unnecessary transmissions*, or the transmissions of *superfluous signals*, or the transmission of *false or misleading signals* or the transmission of *signals without identification*. (No.15.1)
- The station which is causing harmful interference *shall immediatly eliminate* this harmful interference
- *This assumes a legal link between the transmit station and the administration under the jurisdiction of which it is placed*
- This is the purpose of the licence (Article 18 of the RR)

International Monitoring

- **Draft Cooperation Agreement, developed by Bureau, aims to establish a framework to assist ITU**
  - Perform measurements related to harmful interference pursuant to Art. 15 and No. 13.2 or reported interference due to coordination issues related to No. 11.41
  - Verify actual operational characteristics of space station in GSO with those recorded in MIFR
- **On 6 Aug 2013, reminder on 27 Jan 2015, a draft Cooperation Agreement was sent to administrations part of the international monitoring system requesting comments and suggestions**
- **The Cooperation Agreement**
  - contains objective, scope, procedures and protocols to report interference or compliance with MIFR
  - could be concluded with administrations having monitoring facilities

Nano/pico satellites

- **Over 500 satellites under development, mostly operating in amateur-satellite service or meteorological-satellite service**
- **Growing number puts great pressure on the frequency bands currently in use**
- **No clear definition or characteristics in Appendix 4 to differentiate NGSO vs nano/picosatellites**
- **SG7/WP7B studying characteristics, spectrum requirements and services of nano and pico satellites**
- **WRC-15 Agenda Item 9.1.8 - *Regulatory aspects for nano- and picosatellites*;**
  - WRC-12 adopted Resolution 757 (WRC-12) *Regulatory aspects for nanosatellites and picosatellites*.
  - This issue was studied in ITU-R WP-7B between 2012-2015, which came up with 2 reports:
    - *ITU-R Report ITU-R SA.2312 - Characteristics, definitions and spectrum requirements of nanosatellites and picosatellites, as well as systems composed of such satellites; and*
    - *ITU-R Report ITU-R SA.2348 - Current practice and procedures for notifying space networks currently applicable to nanosatellites and picosatellites;*
  - Conclusion was that there was no need for special regulatory arrangements for nano and picosatellites
- **WRC-15 Decision – Suppression of Resolution 757**

Nano/pico satellites – RA Resolution 68

- **ITU Radiocommunication Assembly (RA) Resolution ITU-R 68**
- ***invites administrations***
  - to inform their national entities involved in the development, manufacturing, operation and launch of small satellites, in particular of those satellites whose mass is less than 100 kg (such as nanosatellites and picosatellites), about the applicable ITU and national regulatory provisions for the coordination, notification and use of orbital resources (i.e. orbits and frequencies);
  - to encourage their national entities aiming to launch and deploy in outer space the satellites mentioned above to initiate the relevant ITU registration procedures as soon as possible before the launch of the satellite,

Nano/pico satellites - Resolution 659 (WRC-15)

- ***Studies to accommodate requirements in the space operation service for non-geostationary satellites with short duration missions***
  - assess the suitability of using existing SOS allocations below 1 GHz to accommodate the telemetry, tracking and command (TT&C) requirements for non-geostationary satellites with short duration missions and if those allocations are determined to be unsuitable, consider possible new allocations or an upgrade of the existing allocations to the SOS within the frequency ranges 150.05-174 MHz and 400.15-420 MHz while protecting the incumbent services, both in-band as well as in adjacent bands.
- **This study is being carried out in ITU-R WP-7B, and the results of the studies will be submitted by consideration by WRC-19.**
- **Next meeting of WP 7B: 24 – 28 October 2016**

Outcome of WRC-15

Allocations to the fixed-satellite service in 10 – 17 GHz

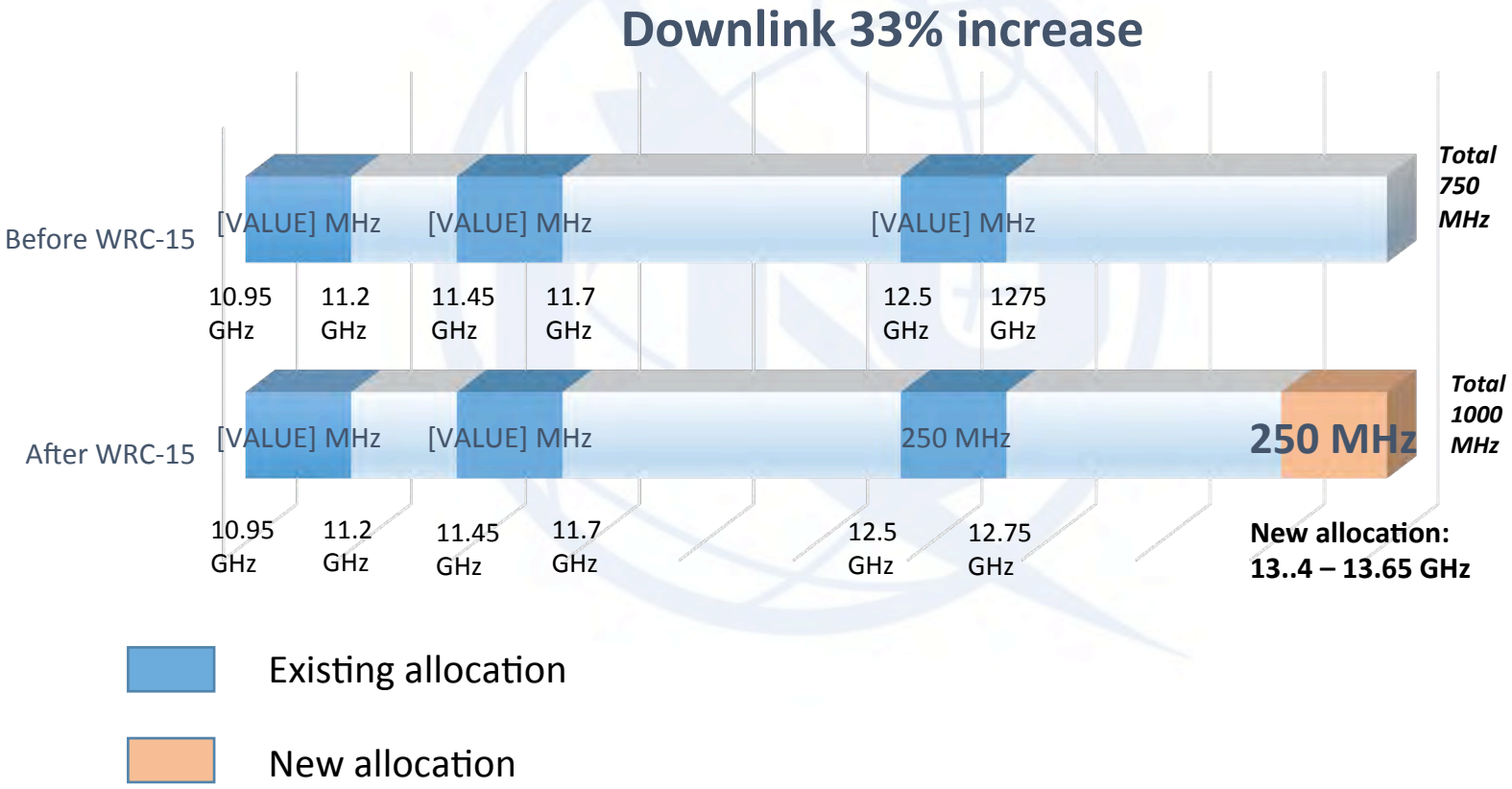
agenda item 1.6

- **Background**
  - Before WRC-15, for unplanned FSS in the Ku band:
    - *Region 1: 750 MHz of spectrum both for uplink and downlink*
    - *Region 2: 1000 MHz of spectrum for downlink, only 800 MHz for uplink*
    - *Region 3: 1050 MHz of spectrum for downlink, only 750 MHz for uplink*
- **Results of WRC-15**
  - New allocations for the FSS
  - in the space-to-Earth direction (Downlink)
    - *13.4-13.65 GHz in Region 1*
  - in the Earth-to-space direction (Uplink)
    - *14.5-14.75 GHz, limited to 30 countries in Regions 1 and 2*
    - *14.5-14.8 GHz, limited to 9 countries in Region 3*

- **Better balance between uplink/downlink and between Regions**
  - *1000MHz (UP/Down) in **Region 1**; 1050MHz (UP), 1000MHz (Down) in **Region 2**; 1050MHz (UP/Down) in **Region 3***

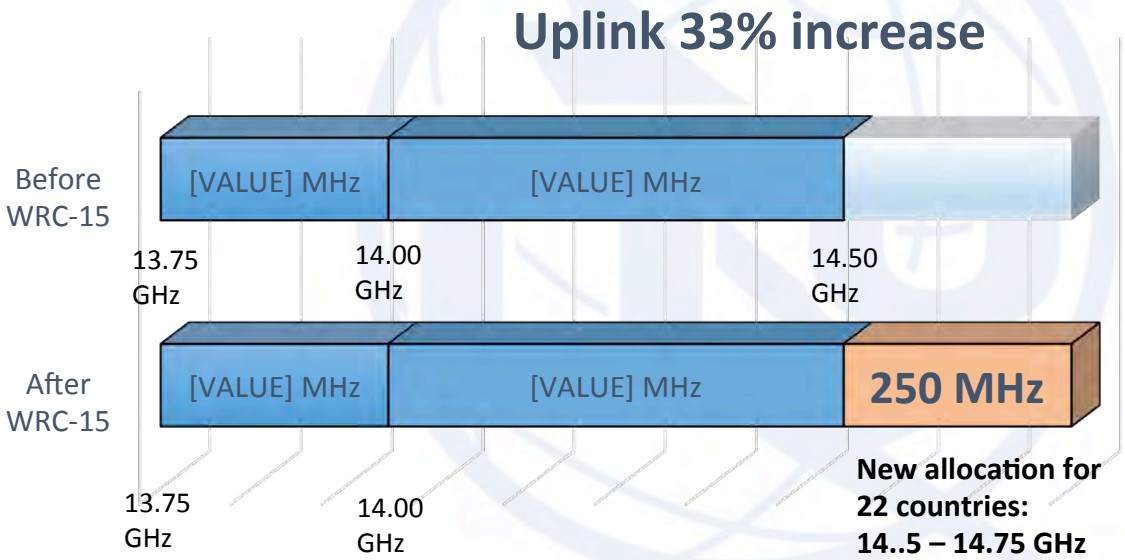
Ku-band frequency allocation for unplanned FSS Downlink (R1)

agenda item 1.6



Ku-band frequency allocation for unplanned FSS uplink (R1)

agenda item 1.6



Total 750 MHz

Total 1000 MHz

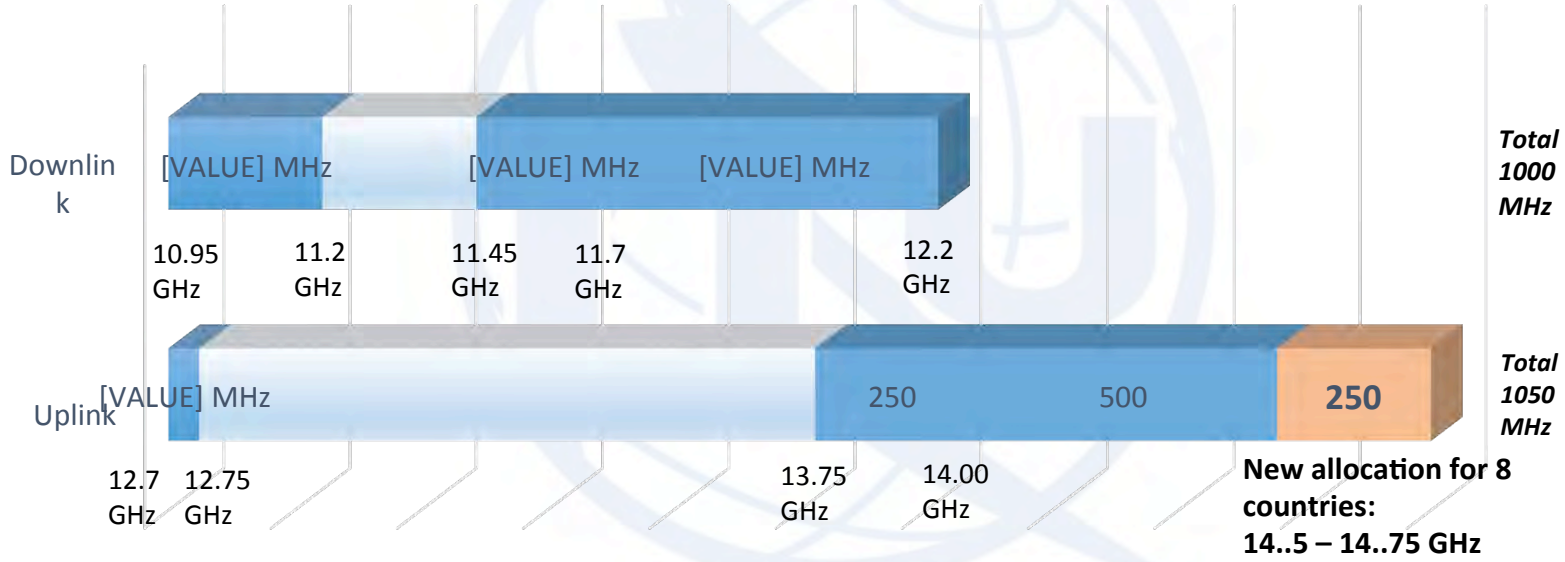
Existing allocation

New allocation

Ku-band frequency allocation for unplanned FSS (Region 2)

agenda item 1.6

Improved balance between uplink and downlink



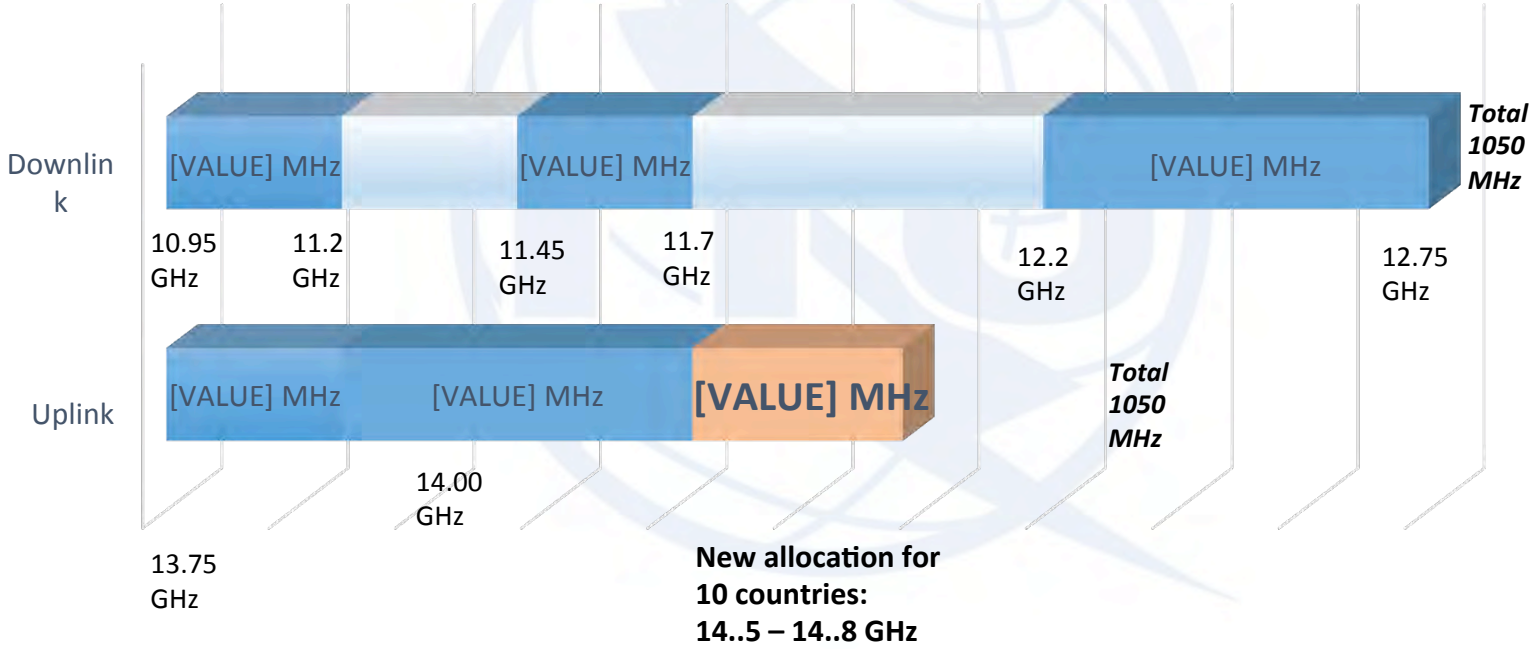
Existing allocation

New allocation

Ku-band Frequency allocation for unplanned FSS (Region 3)

agenda item 1.6

Improved balance between uplink and downlink



Existing allocation

New allocation

Allocations to FSS in 10 – 17 GHz

agenda item 1.6

- **Conditions of utilization (to protect incumbent services)**
  - Downlink: 13.4 – 13.65 GHz
    - *Limited to GSO*
    - *power flux density limits specified in No.**21.16***
    - *Coordination procedures under Nos.**9.7** and **9.21***
  - Uplink: 14.5-14.8 GHz in Region 3, 14.5-14.75 GHz in Regions 1 and 2
    - *Limited to GSO*
    - *Limited to specific countries, subject to several limitations, e.g.:*
    - minimum earth station antenna diameter, power spectral density limits, power flux density limits towards the coast, power flux density limits towards the geostationary-satellite orbit, minimum separation distance of earth stations from the borders of other countries.
    - *Coordination procedures under No.**9.7** and Article 7 of **AP30A***
- **Implications**
  - Increased and balanced allocations will facilitate development of various applications e.g. VSAT, video distribution, broadband networks, internet service, satellite news gathering, backhaul link etc.

AI 1.6 - Uplink: 14.5-14.8 GHz in Region 3 and 14.5-14.75 GHz in Regions 1 and 2

➢ Conditions of utilization (to protect incumbent services)

- Limited to GSO
- Minimum Earth Station Antenna diameter 6m
- Maximum Power spectral density -44.5dBW/Hz at the input of the antenna
- Earth stations shall be notified at known locations on land
- location of earth stations at least 500 km from the border(s) of other countries unless shorter distances are explicitly agreed
- PFD limit for earth stations −151.5 dB(W/(m^2 · 4 kHz)) produced at all altitudes from 0 m to 19 000 m above sea level at 22 km seaward from all coasts
- PFD limit for earth stations −76 dB(W/(m^2 · 27 MHz)) at any point in the geostationary-satellite orbit
- Coordination Requirements
  - *Coordination under 9.7 - Coordination Arc ±6 degrees*
  - *Coordination under Article 7 of Appendix 30A - Threshold PFD values*

Earth stations located on board vessels (ESVs)

agenda item 1.8

➢ *Background*

- **5.457A** and Res. **902 (WRC-03)** provide technical, regulatory and operational conditions under which ESVs may communicate with space stations of FSS in bands 5 925-6 425 MHz and 14-14.5 GHz

➢ Results of WRC-15

- Possibility to use smaller (1.2m) antenna for ESVs transmitting in the frequency band 5 925-6 425 MHz
- Resolution **902 (WRC-03)** continues to apply

	Before WRC-15		After WRC-15		
Frequency band	5 925-6 425 MHz	14-14.5 GHz	5 925-6 425 MHz		14-14.5 GHz
Minimum diameter of ESV antenna	2.4 m	0.6 m	2.4 m	1.2 m	0.6 m
Minimum distance from the low-water mark as officially recognized by the coastal State beyond which ESVs can operate without the prior agreement of any administration	300 km	125 km	300 km	330 km	125 km

➢ Implications

- Increased use and further development of ESVs in the frequency band 5 925-6 425 MHz with sufficient protection to the terrestrial services

7375-7750/8025-8400 MHz for maritime-mobile satellite

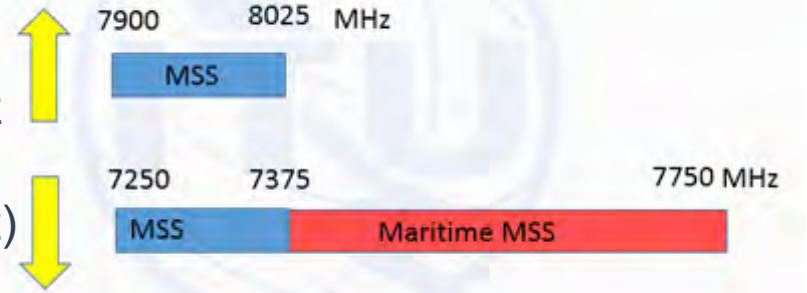
agenda item 1.9.2

Background

- spectrum shortfall for current and future applications in 7/8GHz

Results of WRC-15

- New allocation to MMSS in 7 375 – 7 750 MHz in the space-to-Earth direction
- No allocation for uplink in 8025-8400 MHz (traffic demand in uplink is much less and sharing with incumbent services is difficult)



Increase of 400% of spectrum in the downlink!

Conditions of utilization

- Limited to GSO
- Earth stations in MMSS shall not claim protection, nor constrain use of fixed and mobile stations, except aeronautical mobile. **5.43A** does not apply.

Implications

- Additional bandwidth for downlink data transmissions of the next-generation satellites in the MMSS

Earth exploration-satellite service (EESS) in 7-8 GHz

agenda item 1.11

Background

- The need for uplink large amounts of data for operations plans and dynamic spacecraft software modifications, which might not be accommodated by heavily used 2 025-2 110 MHz and 2 200-2 290 MHz TT&C bands

Results of WRC-15

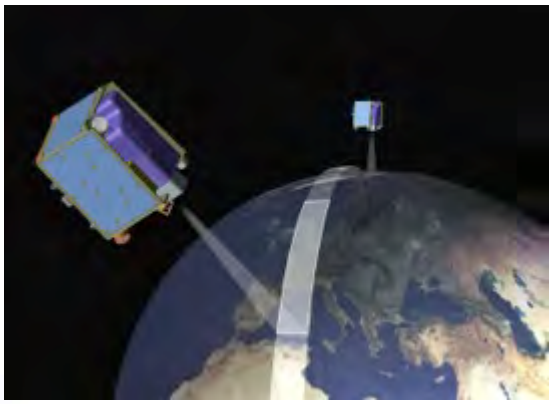
- New primary EESS up link allocation limited to tracking, telemetry and command (TT&C) in the 7 190-7 250MHz band (34% increase)
- Provision to protect existing and future stations in the fixed, mobile and space research services from the new allocation

Implications

- In combination with existing EESS downlink allocation in 8 025-8 400 MHz this new allocation will lead to simplified on-board architecture and operational concepts for future missions of EESS

Earth exploration-satellite service (active) in 8-9 GHz

agenda item 1.12



Background

- EESS (active) bandwidth in 8-9 GHz was 600MHz. Growing demand for higher resolution to satisfy global environmental monitoring raised the need to increase the bandwidth up to 1200 MHz in total.

Results of WRC-15

- New primary EESS(active) allocations totally of 600 MHz in the 9 200-9300MHz, 9 900-10 000MHz and 10.-10.4GHz bands (100% increase)
- Provision to protect existing and future fixed and mobile stations

Implications

- Development of modern broadband sensing technologies and space-borne radars on active sensing EESS that provides high quality measurements in all weather conditions with enhanced applications for disaster relief and humanitarian aid, large-area coastal surveillance

Reduction of the coordination arc

agenda item 9.1.2

- **Background**
  - Appendix **5** provides technical conditions for identification of administrations to coordinate with under Article **9**.
- **Results of WRC-15**
  - Reduction of coordination arc in App. **5** from 8 to 7 degrees in C band and from 7 to 6 degrees in the Ku band
  - New Res. **762** with pfd for uplink in C band and up/downlinks for Ku band outside coordination arc to consider no potential for harmful interference
  - These pfd criteria in the Resolution shall be used in No. **11.32A** examination. A new footnote was added to No. **11.32A**
- **Implications**
  - The reduction of the coordination arc and new Resolution **762 (WRC-15)** will facilitate the rational and efficient use of, as well as the access to, radio frequencies and associated geostationary-satellite orbit.

Earth Stations in Motion (ESIM)

Background

- **5.526** provides conditions for ESIM communications with GSO FSS space stations in 19.7-20.2 GHz and 29.5-30 GHz in Region 2 as well as 20.1-20.2 GHz and 29.9-30 GHz in Regions 1 and 3.

Results of WRC-15

- New **5.527A** and new Res. **156** to set conditions for ESIM communication with GSO FSS space stations in 19.7-20.2, 29.5-30.0 GHz in all Regions
- This Res. extends the possibility offered for ESIM by **5.526** in the bands 19.7-20.2 GHz and 29.5-30 GHz in Region 2 and in bands 20.1-20.2 GHz and 29.9-30 GHz in Regions 1 and 3.

Implications

- Increased use and further development of ESIM in the frequency bands 19.7-20.2 and 29.5-30.0 GHz in all Regions with sufficient protection to other GSO satellite networks and terrestrial services

Satellite regulatory procedures

agenda item 7

Background

Articles **9**, **11** and **13** provide the regulatory procedures for advance publication, coordination, notification and recording of frequency assignments pertaining to satellite networks

Results of WRC-15: various improvements of the procedures, e.g.:

- *Mod. **11.49** to reduce regulatory period of suspension day-by-day when the information of suspension is received beyond 6 month after suspension*
- *Sup. Requirement for submission of Advance Publication Information for networks subject to coordination*
- *New Res. **40 (WRC-15)** to increase transparency when one space station is used to bring into use assignments to GSO networks at different orbital locations within a short period of time*
- *Mod. **13.6** to include reason for BR' query and specify period for BR to inform administration of its conclusion in response to administrations' replies*

Implications

- Facilitate the rational, efficient and economical use of radio frequencies and any associated orbits, including the geostationary-satellite orbit.

Article 48

Background

- This special provision recognizes the unique nature of installations for national defence services and allows for the possibility that a Member State may, when necessary, operate military radio installations in a manner that does not meet all the obligations set forth in the instruments of the Union.
- When faced with an inquiry under No. **13.6** of the Radio Regulations, some administrations have indicated to the BR that the frequency assignment in question is being used under the provisions of Article **48**. The BR then discontinues the inquiry, understanding the special circumstances involved.
- Sometimes the reply to an inquiry under RR No. **13.6** is somewhat ambiguous. For example, an administration may state that the frequency assignments are being used for "strategic governmental purposes" without mentioning either Article **48** or military radio stations. The BR and the Board understood such responses also fall under the umbrella of Article **48** of the Constitution pending further clarification as to the application of this provision with respect to the process under RR No. 13.6.

Results of WRC-15

- WRC-15 noted that Article 48 refers to "military radio installations" and not to stations used for governmental purposes in general and decided that BR should not infer that an administration refers to Article 48 of the Constitution in its answer to an inquiry under RR No. 13.6, unless this administration has explicitly invoked Article 48.

Satellite Hopping (Resolution 40)

- **Use of one space station to bring frequency assignments at different orbital locations into use within a short period of time (GSO)**

- **Background:**
  - Cases where satellite moved to one orbital position, stayed 90 + α days and then moved again
  - No. 11.44B requirements satisfied even though satellite may not be intended to be operated at that position
  - Thus, regulatory lifetime could be extended by 3 years with suspension under No. 11.49
  - How to distinguish genuine cases from abuse ?

- **Results of WRC-15**
  - when informing the Bureau of the bringing into use, or bringing back into use after a suspension, the notifying administration shall indicate to the Bureau whether or not this action has been accomplished with a space station that has previously been used to bring into use at a different orbital location within the three years prior to the date of submission of this information
  - If yes, information on this last use of the satellite should be provided to the Bureau

Source: [34] Report of the first meeting of the Working Party of the Special Committee on Regulatory/Procedural Matters

Space Industry in 2015

$ 335.3 Billion

Source: SSIR 2016 Tauri Group

Key ITU documents *free* on-line

- **The ITU Constitution:**
  http://www.itu.int/pub/S-CONF-PLEN-2011

- **ITU Radio Regulations @ 2012:**
  http://www.itu.int/pub/R-REG-RR-2012

- **ITU-R Recommendations:**
  http://www.itu.int/publ/R-REC/en

- **WRC-15:**
  http://www.itu.int/en/ITU-R/conferences/wrc/2015

Questions?

Chuen Chern Loo

chuen-chern.loo@itu.int

Space Publication and Registration Division (SPR)

ITU Radiocommunication Bureau

Harmful Interference to Space Services

Space Policy & Law Course, 2016

Chuen Chern Loo

ITU Radiocommunication Bureau

11 October 2016, London

LONDON INSTITUTE OF SPACE POLICY AND LAW

Topics

1 ITU-R in brief

2 International Regulatory Framework and Procedures applicable to cases of Harmful Interference (HI) to Space Services

3 The Current Situation, Statistics, Typical Cases

4 ITU actions to combat Harmful Interference to Space Services

5 Summary and Key Messages

Radiocommunication Sector (ITU-R)

Strategic Goals:

- ✓ Rights of access to the spectrum
- ✓ Efficient use of spectrum
- ✓ Operation free from interference
- ✓ Economies of scale
- ✓ Interoperability and roaming
- ✓ Global harmonization
- ✓ Guidelines for national & regional regulations

→ GOOD QUALITY AND LESS COSTLY EQUIPMENT

→ MORE FAVORABLE INVESTMENT ENVIRONMENT (CLEAR & STABLE)

In other words:

Interference Free operation → **Maximize Quality of Service**

→ **Prevents loss of investment, customers and revenue by minimizing unusable satellite capacity due to interference**

ITU Constitution (CS)

"The Union shall effect allocation of bands of the radio-frequency spectrum, the allotment of radio frequencies and the registration of radio frequency assignments and, for space services, of any associated orbital position in the geostationary-satellite orbit or any associated characteristics of satellite in other orbits, in order to avoid harmful interference between radio stations of different countries."

(Article 1, par.11)

Radio Regulations

- Intergovernmental Treaty governing the use of spectrum/orbit resources by administrations
- Define the rights and obligations of Member States in respect of the use of these resources
- Recording of a frequency assignment in the Master Register (MIFR) provides international recognition
- Update every 3-4 years by a WRC

Definition of interference in RR

- **1.166** *interference:* The effect of unwanted energy due to one or a combination of *emissions*, *radiations*, or inductions upon reception in a *radiocommunication* system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.
- **1.167** *permissible interference:* Observed or predicted *interference* which complies with quantitative *interference* and sharing criteria contained in these Regulations or in ITU-R Recommendations or in special agreements as provided for in these Regulations.
- **1.168** *accepted interference: Interference* at a higher level than that defined as *permissible interference* and which has been agreed upon between two or more *administrations* without prejudice to other *administrations*.
- **1.169** *harmful interference: Interference* which endangers the functioning of a *radionavigation service* or of other *safety services* or seriously degrades, obstructs, or repeatedly interrupts a *radiocommunication service* operating in accordance with Radio Regulations (CS).

WRC-12 & Article 15 - Interferences

- WRC-12 reaffirmed that recent and repeated cases of intended harmful interference represent infringements and that Member States under the jurisdiction of which the signals causing this harmful interference are transmitted have the *obligation to take the necessary actions*

Section I – Interference from Radio Stations

No. 15.1 § 1 All stations are forbidden to carry out unnecessary transmissions, or the transmission of superfluous signals, or the transmission of false or misleading signals, or the transmission of signals without identification (except as provided for in Article 19).

Section V − Reports of Infringements

WRC-12 MOD

No.15.21 §13 If an administration has information of an infringement of the Constitution, the Convention or the Radio Regulations (in particular Article 45 of the Constitution and No. 15.1 of the Radio Regulations) *committed by a station* ~~*over which it may exercise authority,*~~ *under its jurisdiction*, the administration shall ascertain the facts, ~~fix the responsibility~~ and take the necessary actions.

WRC-12 updates related to HI

❑ Some Related Modifications to Radio Regulations:

- ✓ **11.42** Upon receiving the harmful interference report, the administration responsible for the station using the frequency assignment recorded under No. 11.41 shall immediately eliminate the harmful interference.

- ✓ **11.42.1** Use the format prescribed in Appendix 10 of the Radio Regulations.

- ✓ **11.42A:**
  - ➢ Administrations involved shall cooperate in the elimination of harmful interference
  - ➢ may request the assistance of the Bureau,
  - ➢ shall exchange relevant technical and operational information required to resolve the issue
  - ➢ If HI not resolved, BR report, RRB decide (including possible cancellation of assignment)

Infringement of the ITU CS, CV or RR

CS - ARTICLE 45 - Harmful Interference

1. **CS 197-** *All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other Member States or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service, and which operate in accordance with the provisions of the Radio Regulations.*
2. **CS 198 -** *Each Member State undertakes to require the operating agencies which it recognizes and the other operating agencies duly authorized for this purpose to observe the provisions of No. 197 above.*
3. **CS 199 -** *Further, the Member States recognize the necessity of taking all practicable steps to prevent the operation of electrical apparatus and installations of all kinds from causing harmful interference to the radio services or communications mentioned in No. 197 above.*

Infringement of the ITU CS, CV or RR

- Not necessarily harmful interference;
- Representations relating to infringement committed by a station shall be made to the administration of the country having jurisdiction over the station by the administrations which detect it.(No. 15.20 of the RR)
- If an administration has information of an infringement of the CS, the CV or the RR (*in particular Article 45 of the Constitution and No. 15.1 of the RR*) committed by a station under its jurisdiction, the administration shall ascertain the facts and take the necessary actions (No. 15.21 – REV. WRC-12)

Report of an infringement (AP9 to RR)

15.19 § 11 Infringements of the Constitution, Convention or Radio Regulations shall be reported to their respective administrations by the control organization, stations or inspectors detecting them. For this purpose they shall use forms similar to the specimen given in Appendix **9**.

APPENDIX 9

Report of an irregularity or infringement

(See Article **15**, Section V)

Particulars concerning the station infringing the Radio Regulations:

1 Name[1] if known (in BLOCK letters) .....

2 Call sign or other identification (in BLOCK letters) .....

3 Nationality, if known .....

4 Frequency used (kHz, MHz, GHz or THz) .....

5 Class of emission[2] .....

6 Class of station and nature of service, if known .....

7 Location[3, 4, 5] .....

Particulars concerning the station, the centralizing office or inspection service reporting the irregularity or infringement:

8 Name (in BLOCK letters) .....

9 Call sign or other identification (in BLOCK letters) .....

10 Nationality .....

11 Location[3, 4] .....

Particulars of the irregularity or infringement:

12 Name[6] of the station (in BLOCK letters) in communication with the station committing the irregularity or infringement .....

13 Call sign or other identification (in BLOCK letters) of the station in communication with the station committing the irregularity or infringement .....

14 Date and time[7] .....

15 Nature of the irregularity or infringement[8] .....

16 Extracts from ship log or other information supporting the report .....

Particulars concerning the transmitting station interfered with[9]:

17 Name of the station (in BLOCK letters) .....

18 Call sign or other identification (in BLOCK letters) .....

19 Frequency assigned (kHz, MHz, GHz or THz) .....

20 Frequency measured at the time of the interference .....

21 Class of emission[2] and bandwidth (indicate whether measured or estimated, or indicate the necessary bandwidth notified to the Radiocommunication Bureau) .....

22 Receiving location[3, 4] (in BLOCK letters) where the interference was experienced .....

23 Certificate:

I certify that the foregoing report represents, to the best of my knowledge, a complete and accurate account of what took place. .....

Signatures[10] ..... Date: .....

....

Harmful Interference in the Radio Regulations

RR 1.169 Harmful Interference:

"Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with Radio Regulations (CS1003)."

- **No Distinction between Deliberate/Intentional and Unintended Interference**
- **No specific level to define from Permissible Interference (RR1.167) to Accepted Interference (RR1.168) and then Harmful Interference**
- **No real Enforcement Mechanism apart from Art.56 CS** *(Settlement of Disputes)* **and Optional Protocol**

Harmful Interference in the Radio Regulations

- ✓ **Mechanism to ensure free-interference operation**
- ✓ **Prevents loss of investment, customers & revenue by minimizing unusable capacity due to interference**
- ✓ **Some key provisions:**

  - *Art. 5: Table of Frequency Allocations*
  - *Art. 9: Coordination Procedure of satellite networks*
  - *Art. 11: Notification Procedure of satellite networks*
  - *AP 30, AP30A, AP30B: BSS and FSS plans*
  - *Art.21: Sharing Scenario between Space and Terrestrial systems (limits on PFD , eirp, minimum elevation angle, etc)*
  - *Art.22: Sharing scenario between GSO, NGSO (limits on epfd , station keeping, pointing accuracy, off-axis eirp density on Earth Stations)*
  - *Art. 15: Procedure in case of Harmful Interference*
  - *Art. 13.2: Request for assistance in case of Harmful Interference (HI)*
  - *Art. 13.6: BR request Adms clarifications about recorded assignments*
  - *Art. 16: International Monitoring*
  - *Art. 18: Licensing - Identification of Stations*
  - *AP 10 and Report ITU-R SM.2181 (submission of information)*
  - *…*

RR Mechanisms to control HI

Control of Interference

ALLOCATION

Frequency separation
of stations
of different services

POWER LIMITS

PFD to protect TERR services
EIRP to protect SPACE services
EPFD to protect GSO from N-GSO
(EPFD = aggregate equivalent power flux-density)

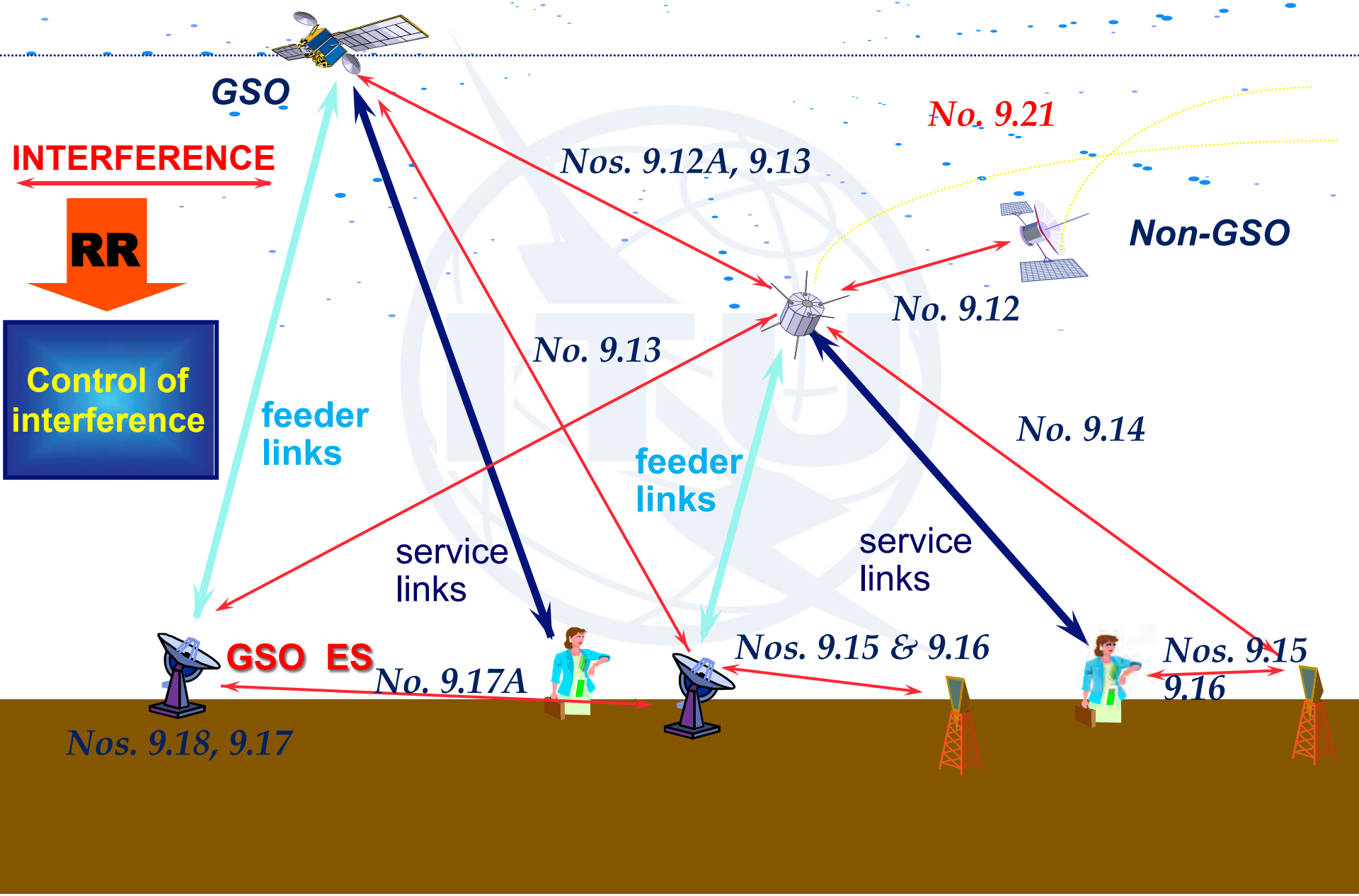
REGULATORY PROTECTION

e.g. No. **22.2**: Non-GSO to
protect GSO (FSS and BSS)

COORDINATION

between Administrations to
ensure interference-free
operations conditions

Article 9 Coordination provisions



Measures against HI (1/4)

- **No. 4.3** Any new assignment or any change of frequency or other basic characteristic of an existing assignment *shall be made in such a way as to avoid causing harmful interference to assignments recorded in the MIFR* in accordance with the Table of Frequency Allocations (ART 5) and the other provisions of the RR;

- **No. 4.4** Administrations *shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations (ART 5) or the other provisions of the RR*, *except on the express condition that such a station 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 the Radio Regulations

Measures against HI (2/4)

Primary and secondary services (Nos. 5.23 – 5.31)

- **Primary service;**
- ***Secondary service***
  - shall cause no harmful interference to, nor claim protection from, the primary service;
  - can claim protection from harmful interference from stations of the same or other secondary services.

Measures against HI (3/4)

- **Right to international recognition (No. 8.3)**

- *Any frequency assignment recorded in the Master Register (MIFR) with a favourable finding* with respect to the Table of Frequency Allocations and other provisions of the RR shall have the right to ***international recognition and protection***

- *This right means that other administrations shall take it into account when making their own assignments, in order to avoid harmful interference*

Measures against HI (4/4)

- **Non-conforming assignment (Nos. 8.4 & 8.5)**

- A frequency assignment shall be known as a non-conforming assignment when it is not in accordance with the Table of Frequency Allocations or the other provisions of the RR

- Recorded in the MIFR for information purposes only if the administration states that it shall be operated under the conditions that:
  - it shall cause no harmful interference to, nor claim protection from, other stations operating in accordance with the Table of Frequency Allocations or the other provisions of the RR;
  - it shall eliminate harmful interference if caused to a station operating in accordance with the Table of Frequency Allocations and other provisions of the RR.

ITU-R General Measures against HI

- **Preventive:**
  - ITU-R Recommendations:
    - ***Access Procedures for FSS GSO Occasional Use***
    - ***Carrier ID***
  - Application of various provisions of the Radio Regulations, including the coordination and notification procedures for satellite networks and earth stations
    - *Provides International Recognition and Protection*
- **Corrective:**
  - Article 15 and Appendix 10 to RR + ITU-R SM. 2181:
    → To report a case of Harmful Interference to the Bureau
    Radio Regulations Board's Decisions

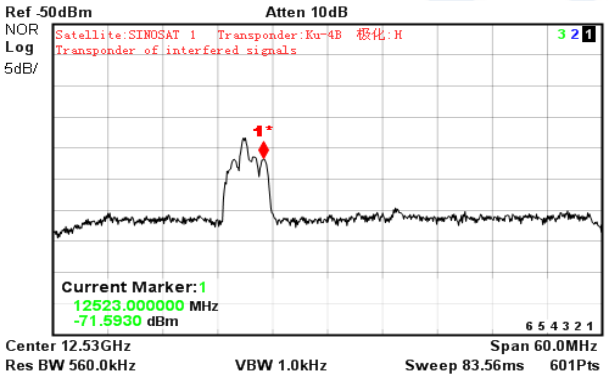
How to Report a Case of Harmful Interference to ITU ?

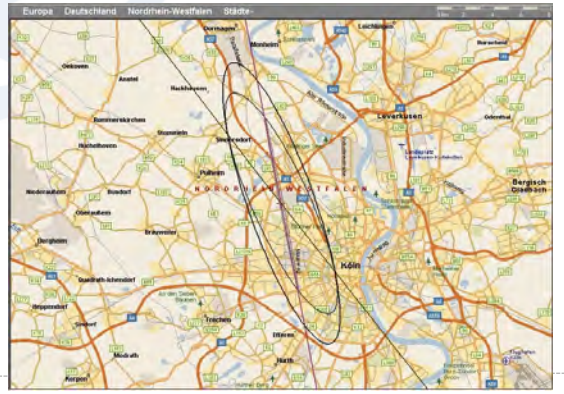
To submit Letter to BR :

- For BR Information, or
- For BR Action, requesting Assistance under **No 13.2**

In both cases the information to be submitted is described in:

- Appendix 10 to RR
- ITU-R Report 2181
- If possible, Geolocation Information and Scan Plots could be very useful





Report of HI (AP10 to RR)

No. **15.27** § 19 Full particulars relating to harmful interference shall, whenever possible, be given in the form indicated in Appendix **10**.

APPENDIX 10 (Rev.WRC-07)

Report of harmful interference

(See Article **15**, Section VI)

Particulars concerning the station causing the interference:

a Name, call sign or other means of identification .....

b Frequency measured .....

Date: .....

Time (UTC): .....

c Class of emission[1] .....

d Bandwidth (indicate whether measured or estimated) .....

e Measured field strength or power flux-density[2] .....

Date: .....

Time (UTC): .....

f Observed polarization .....

g Class of station and nature of service .....

h Location/position/area/bearing (QTE[3]) (WRC-07) .....

i Location of the facility which made the above measurements .....

Particulars concerning the transmitting station interfered with:

j Name, call sign or other means of identification .....

k Frequency assigned .....

[1] The class of emission shall contain the basic characteristics listed in Appendix **1**. If any characteristic cannot be determined, indicate the unknown symbol with a dash. However, if a station is not able to identify unambiguously whether the modulation is frequency or phase modulation, indicate frequency modulation (F).

[2] When measurements are not available, signal strengths according to the QSA scale should be provided.

[3] See the most recent version of Recommendation ITU-R M.1172. (WRC-07)

l Frequency measured .....

Date: .....

Time (UTC): .....

m Class of emission[4] .....

n Bandwidth (indicate whether measured or estimated, or indicate the necessary bandwidth notified to the Radiocommunication Bureau) .....

o Location/position/area .....

p Location of the facility which made the above measurements .....

Particulars furnished by the receiving station experiencing the interference:

q Name of station .....

r Location/position/area .....

s Dates and times (UTC) of occurrence of harmful interference .....

t Bearings (QTE[5]) or other particulars (WRC-07) .....

u Nature of interference .....

v Field strength or power flux-density of the wanted emission at the receiving station experiencing the interference[6] .....

Date: .....

Time (UTC): .....

w Polarization of the receiving antenna or observed polarization .....

x Action requested .....

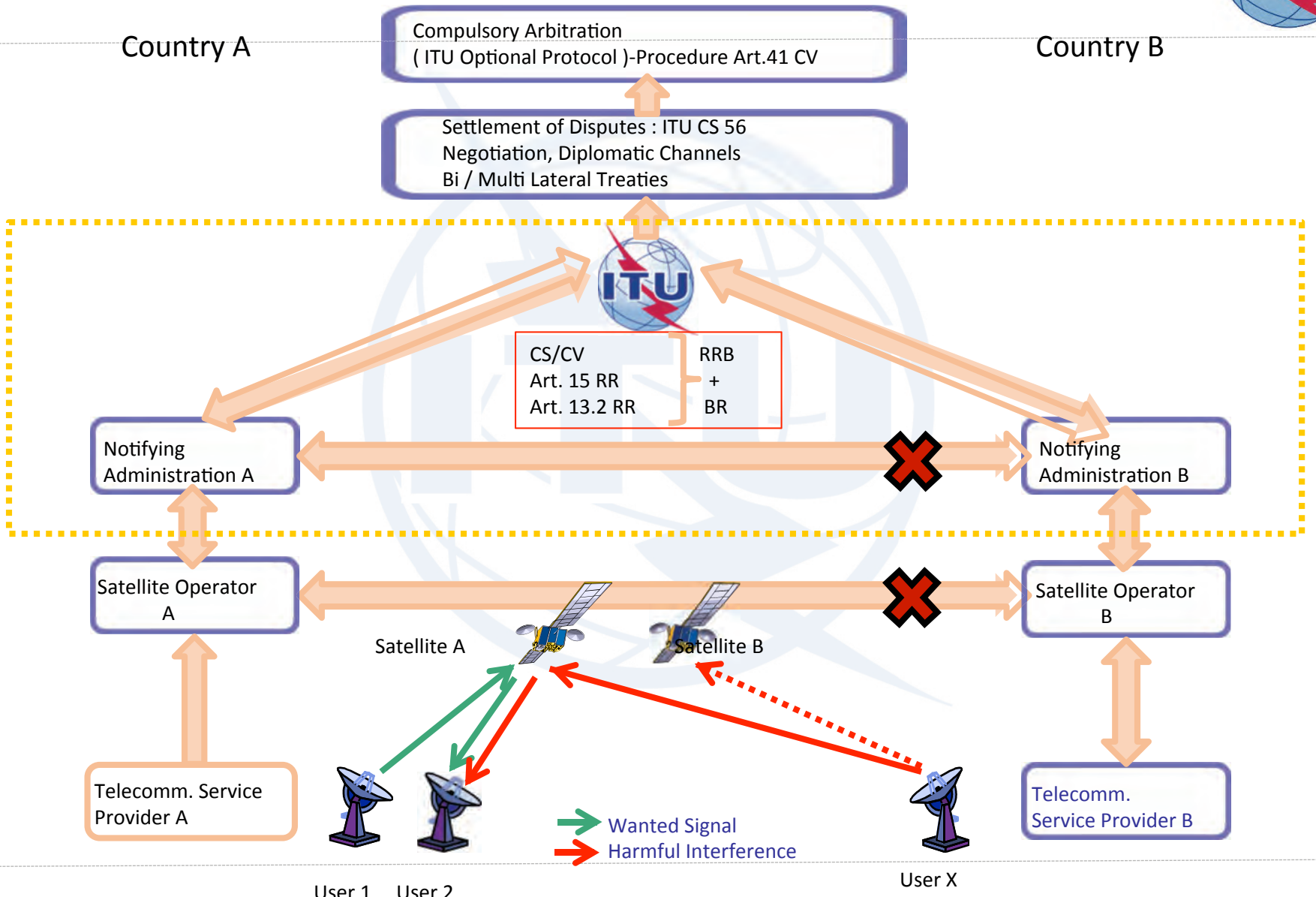
NOTE – For convenience and brevity, telegraphic reports shall be in the format above, using the letters in the order listed in lieu of the explanatory titles, but only those letters for which information is provided should be used. However, sufficient information shall be provided to the administration receiving the report, so that an appropriate investigation can be conducted.

[4] See footnote 1.

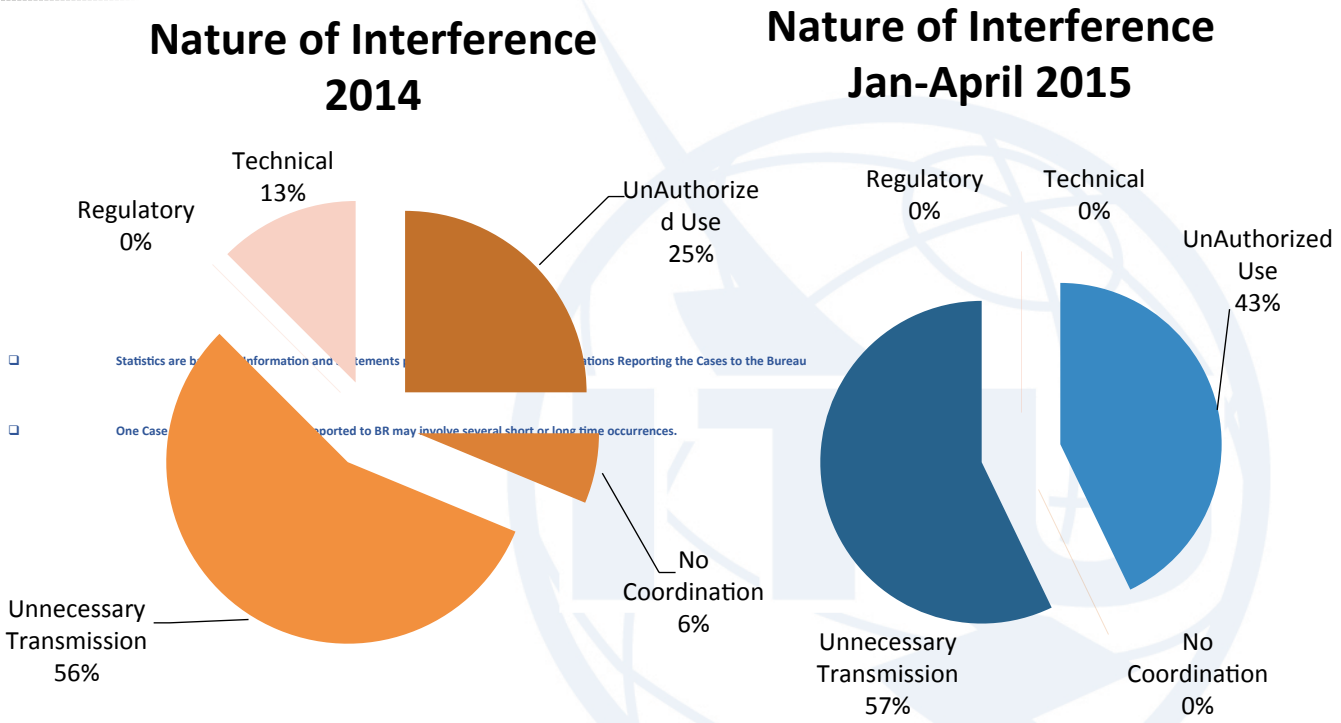
[5] See footnote 3.

[6] See footnote 2.

Schema of Actions in case of Harmful Interference



Statistics on HI



- Statistics are b… information and …tements p… …ations Reporting the Cases to the Bureau
- One Case … …ported to BR may involve several short or long time occurrences.

Affected Services:

FSS, BSS, MSS, EESS, RNSS, ASS

Affected Freq. Ranges:

437	MHz
1.2	GHz
1.5 / 1.6	GHz
2.2	GHz
3/4, 5/6	GHz
10-14	GHz
17/18	GHz

HI definitions used for Statistics Purposes

Nature of Interference:

1. **No coordination :**

It concerns all the cases of harmful interference caused by the operation of non-coordinated frequency assignments

2. **Unauthorized use:**

Accessing transponders without having the required authorization either deliberately or by mistake

3. **Unnecessary transmission:**

Cases of harmful interference as described in RR15.1:

"All stations are forbidden to carry out unnecessary transmissions, or the

transmission of superfluous signals, or the transmission of false or misleading signals…"

In case of space services, typically, it refers to harmful interference caused by a high power CW carrier.

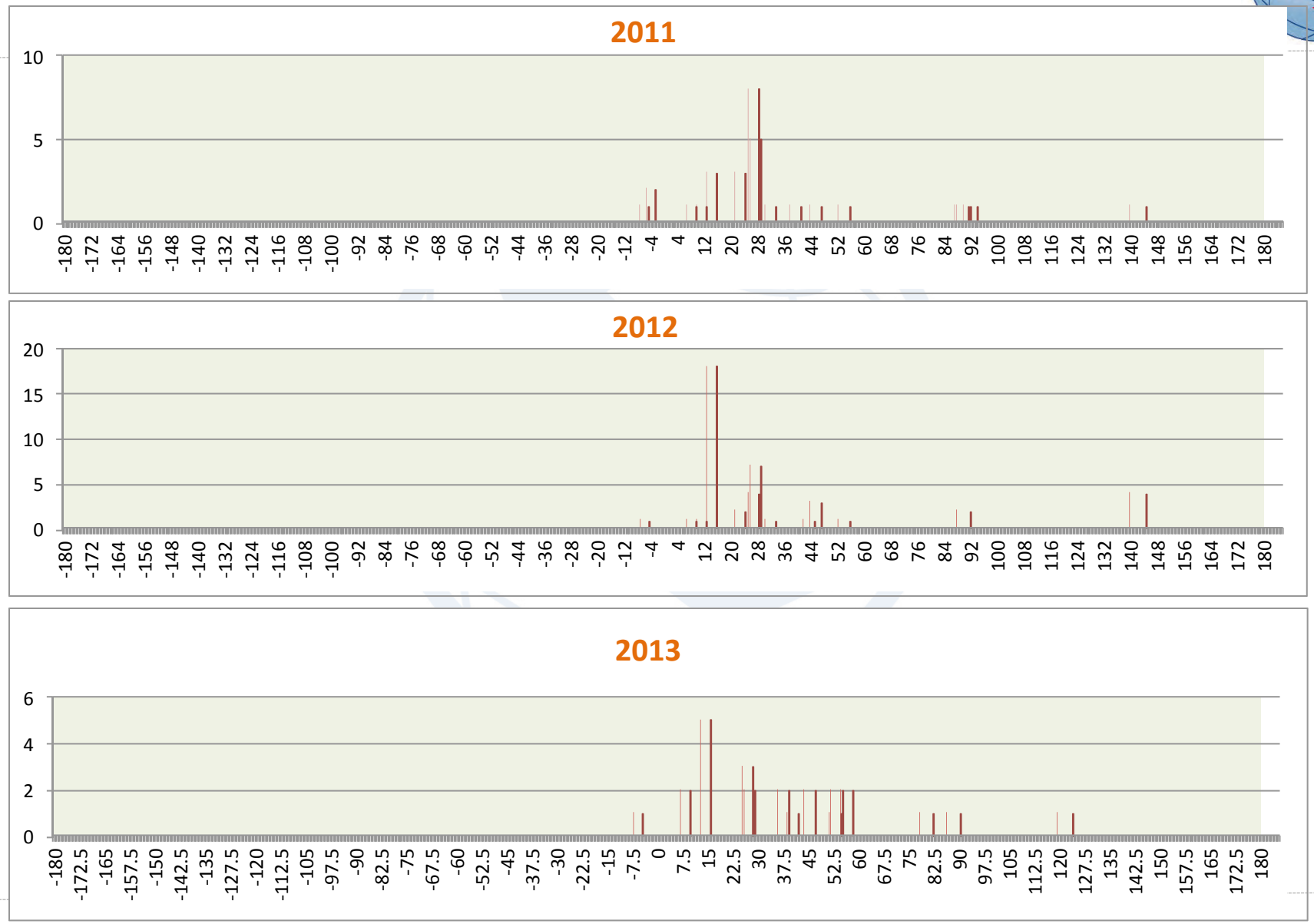
4. **Technical:**

Spurious emissions, excessive transmitting power, transmitting stations that are not in conformity with frequency tolerances, miss-pointing of antennas associated to earth stations, cross-polarization interference, transponder saturation, etc.

5. **Regulatory:**

Out-of-band operations

Distribution and Evolution of Cases of HI along GSO



Actions being taken by ITU

- **Extension of the International Monitoring System**
- Promoting the exchange of experience, cooperation, co-organization and participation in related Fora
- **Providing Assistance to ITU Members**
- Development of New REC ITU-R S.2049 on Access Procedures for FSS Occasional Use, Transmissions to GSO Space Stations in 4/6 GHz and 11-12/13/14 GHz FSS Bands
- Development of New REC ITU-R S.2062 on Carrier ID
- ***Development of an International Registry of Interference to Space Services (IRISS)***

REC ITU-R S.2049

Access Procedures for FSS Occasional Use, Transmissions to GSO Space Stations in 4/6 GHz and 11-12/13/14 GHz FSS Bands.

This Recommendation is intended to provide some easy-to-follow practices to enable OU operators to transmit to geostationary space stations without interfering with other users on the target satellite or with users on any other nearby satellites.

Free Download:

http://www.itu.int/rec/R-REC-S.2049-0-201312-I/en

REC ITU-R S.2049

Some Key Verifications:

- Equipment Selection and verification of its conditions.
- Primary parameters correctly configured:
  - ✓ ES antenna alignment and Polarization
  - ✓ Frequency, Modulation, BW
  - ✓ Time of TX
  - ✓ Power Level

III. Transmit with Permission Only (Authorization/License)

IV. Follow instructions from your Satellite Operator

V. Special Case of Satellites in Inclined Orbit

VI. Avoiding Retransmission of Nearby RF Signals

VII. Additional Considerations for Auto-Deploy ES

VIII. Full detailed Step by Step process given in REC.

Carrier ID - REC ITU-R S.2062

- **Carrier identification system for digital-modulation transmissions of fixed-satellite service occasional use carrier earth station transmissions using geostationary-satellite networks in the 4/6 GHz and 11-12/13/14 GHz FSS bands**

- **Objective: To facilitate rapid identification of an interference source and reduce the time required to clear the interference that occurs unintentionally.**

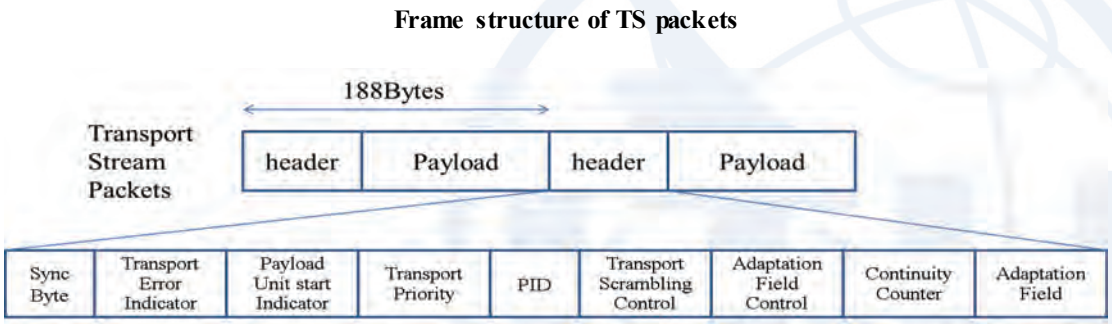
- **Two Methods:**
  a) Network Information Table (NIT) CID
  b) Spread Spectrum CID

Free Download:

http://www.itu.int/rec/R-REC-S.2062/en

Network Information Table (NIT) CID

To insert the Carrier-ID as a Network Information Table (NIT) frame in the original Transport Stream (TS) packets of the MPEG Stream



Content Information

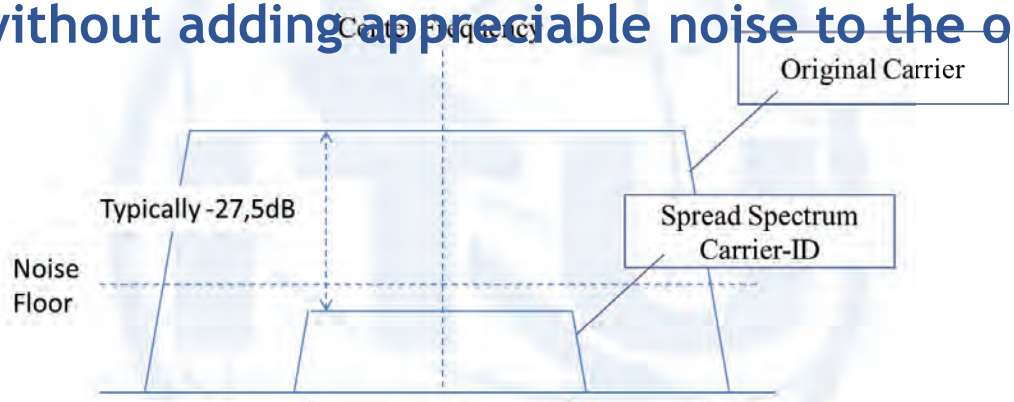
Encoder manufacturer
Encoder serial number
Carrier identifier
Telephone number
Longitude
Latitude
User information

-NIT does not need special equipment, just update Software in modulator or encoder

-Carrier ID not recoverable if TS packets containing NIT are suffering from severe interference or encrypted

Spread Spectrum CID

Carrier-ID with specific carrier information is embedded within the low rate spread spectrum carrier, and then will be sent overlaying the original carrier without adding appreciable noise to the original carrier



- Carrier ID can be recovered even though original carrier is suffering from severe interference

- Requires Modulator to be DVB-CID Compliant, or firmware update or additional equipment.

International Registry of HI to Space Services (IRISS)

Recent ITU Plenipotentiary Conference Resolution 186 (Busan, 2014) instructs the Director BR:

"2 to continue taking action to maintain a database on cases of harmful interference, reported in accordance with relevant provisions of the Radio Regulations and in consultation with Member States concerned; "

- **Main characteristics of this project:**

- ✓ *Web Based Application*
- ✓ To Facilitate communication between parts involved in a case of HI with the aim to resolve the case, and with capability to contact not only **45** Administrations responsible for Satellite Networks recorded in the MIFR but also 193 Member States operating Earth Stations under their jurisdiction.
- ✓ *Remote access from Fix or Mobile Devices*
- ✓ Facility to be Alerted when a Case of Harmful Interference is Reported

International Registry of HI to Space Services (IRISS)

- ✓ **Reading Access Restricted to ITU Members**
- ✓ *Submission of Events facilitated and granted to Administrations through a secure connection*
- ✓ **List of Parameters extracted from Report ITU-R SM.2181 and APP10 to RR.**
- ✓ *Additional Parameters or Information can be considered to be included (WRC-15 may indicate)*
- ✓ **Scan Plots, Geolocation Plots, Uplink-Downlink footprints and other Documents in pdf Format**
- ✓ *Information to be displayed can be configured at different levels depending on its sensitivity*
- ✓ *Facility to Export/Download Data for Analysis, Statistics, Reports*

International Registry of HI to Space Services (IRISS)

- ✓ **List of Parameters extracted from Report ITU-R SM.2181 and APP10 to RR**
- ✓ *Additional Parameters or Information can be considered to be included*
- ✓ **Scan Plots, Geolocation Plots, Uplink-Downlink footprints and other Documents in .pdf Format**
- ✓ *Information to be displayed can be configured at different levels*

Project to be reported to WRC-15

Input documents and comments from Administrations are expected.

Space Services Department

Report of Harmful Interference (APP 10)

Particulars concerning the station causing the interference:

Name, call sign or other means of identification	Unknown
Frequency measured [MHz]	14025.30
Date:	06.05.2014
Time (UTC):	12:40
Class of emission	3M60G7W
Bandwidth [MHz]	3.60
Measured field strength or power flux-density	
Date:	
Time (UTC):	
Observed polarization	V
Class of station and nature of service	
Location/position/area	AFG
Location of the facility which made the above measurements	

Particulars concerning the transmitting station interfered with:

Name, call sign or other means of identification	
Frequency assigned [MHz]	
Frequency measured [MHZ]	
Date:	
Time (UTC):	
Class of emission	
Bandwidth [MHz]	
Location/position/area	
Location of the facility which made the above measurements	

Particulars furnished by the receiving station experiencing the interference:

Name of station	EUTELSAT 13E
Location/position/area	13E
Dates and times (UTC) of occurrence of harmful interference	05.05.2014 - Today
Bearings (QTE) or other particulars	
Nature of interference	TV DIG.MODULATED CARRIER (FSS)
Field strength or power flux-density of the wanted emission at the receiving station experiencing the interference	
Date:	
Time (UTC):	
Polarization of the receiving antenna or observed polarization	V
Action requested	To eliminate Harmful Interference

Logged-In Administration: F (France)

Letter from Affected Adminstration -> Upload File

Interfering Signal Geolocation Plot -> Upload File

Interfered and Interfering Signals Scan Plots -> Upload File

Additional Information -> Upload File

Remarks:

Re-Occurrence. See past incidents No. 143, 168.

Action Requested to BR:

To Record it for Information ☐

Assistance under RR. No.13.2 ☐

Report to be treated Confidentially by BR ? ☐

Submit Report to BR

Summary and Key Messages

- **ITU plays a key role to ensure *interference-free* operations of space services**
- **ITU constitution, Radio Regulations etc. contain all the procedures to ensure interference free operations.**
- **Member States' goodwill, cooperation and exchange of information among parties is essential**
- **Only continuous synergistic actions by all sectors of satellite community can guarantee a minimum level of interference is kept**

Questions?

Chuen Chern Loo

Chuen-chern.loo@itu.int

Space Publication and Registration Division (SPR)

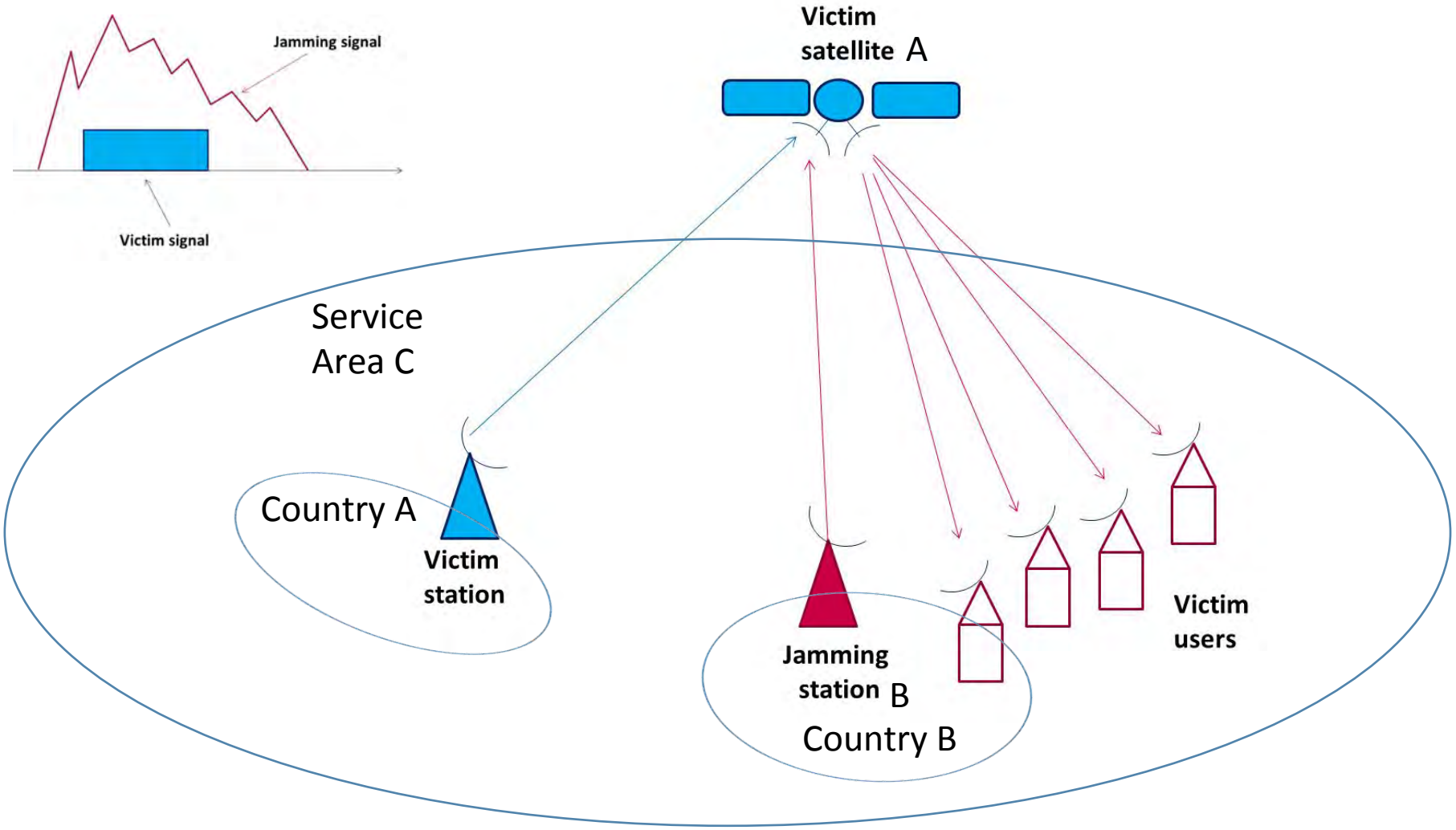
ITU Radiocommunication Bureau

Case Study
on
Harmful Interference to Space Services

Case Study - Scenario

- *Station A* is a Space Station of Country A, located at a given orbital location of the GSO arc.
- *Station B* is located within Country B.
- Station A carries broadcasting programmes to a service area C that also includes Country B.
- Station B transmits a jamming signal, either continuously or intermittently, that causes harmful interference to Station A that severely disrupts the signals carrying the programmes into the whole of the service area C. Hence the users in the service Area C and also Country B may not be able to receive the intended information.
- The interfering signal may also cause other issues: such as technical damages to the satellite receiver of Station A; revenue losses to the client of the operator of Station A, and revenue losses to the satellite operator of Station A who might lose his clients.

Case study - Scenario



Case study - questions

- What law and jurisdiction apply?
- What recourses are available to Country A or to the Operator of the Station A?
- Does operator A of country A have agreement in the countries of area C, including country B, to transmit broadcasting signals receivable in area C?
- Does it require a licence from countries in area C?

Case study – procedure under RR

- Country A: apply procedures of RR Article 15
  - Submit particulars of the harmful interference using the form in Appendix 10 (Rec ITU-R SM.2181)
  - Request the Bureau for assistance under Article 13
- Assistance under RR Article 13.2
  - Bureau will help in identifying the source of the interference and seek the cooperation of the responsible administration in order to resolve the matter, and prepare a report for consideration by the Board, including draft recommendations to the administrations concerned.
- If interfering assignment is not recorded in the MIFR and its location is unknown, these provisions may be ineffective
- Depends on all Member States to exercise the utmost goodwill and mutual assistance in the application of the provisions of Article 45 of the Constitution and of this Section to the settlement of problems of harmful interference

Case study - discussion

- The ITU Constitution (CS Article 6), Convention and the Administrative Regulations apply to member states and their operating agencies, all telecommunication offices and stations established or operated by them (except for military radio installations (CS Article 48)) that are capable of causing harmful interference to radio services of other countries.
- CS Article 45 obliges member states to ensure that all their authorised stations (RR Article 18), whatever their purpose, do not cause harmful interference to the radio services or communications of other member states or recognized operating agencies.
- Country B has a responsibility under the ITU Constitution to prevent the operator of Station B making any transmissions that cause the jamming of Station A.
- Country B may have already objected for its territory to be in the service area of Station A (No.23.13C), but station A is not able to reduce the signal over country B since it lies within the service area C.
- Country B may invoke GA Resolution 110(II) condemning propaganda

Dispute Resolution/Arbitration

- **ITU**
  - CS Article 41: Arbitration Procedure
  - Optional Protocol on the Compulsory Settlement of Disputes
- **International Court**
  - International Court of Justice
  - Permanent Court of Arbitration
    - *OPTIONAL RULES FOR ARBITRATION OF DISPUTES RELATING TO OUTER SPACE ACTIVITIES*
- **National Court**

Internet Governance

Space Policy & Law Course, 2016

Chuen Chern Loo

ITU Radiocommunication Bureau

11 October 2016, London

LONDON INSTITUTE OF SPACE POLICY AND LAW

Internet Governance - Background

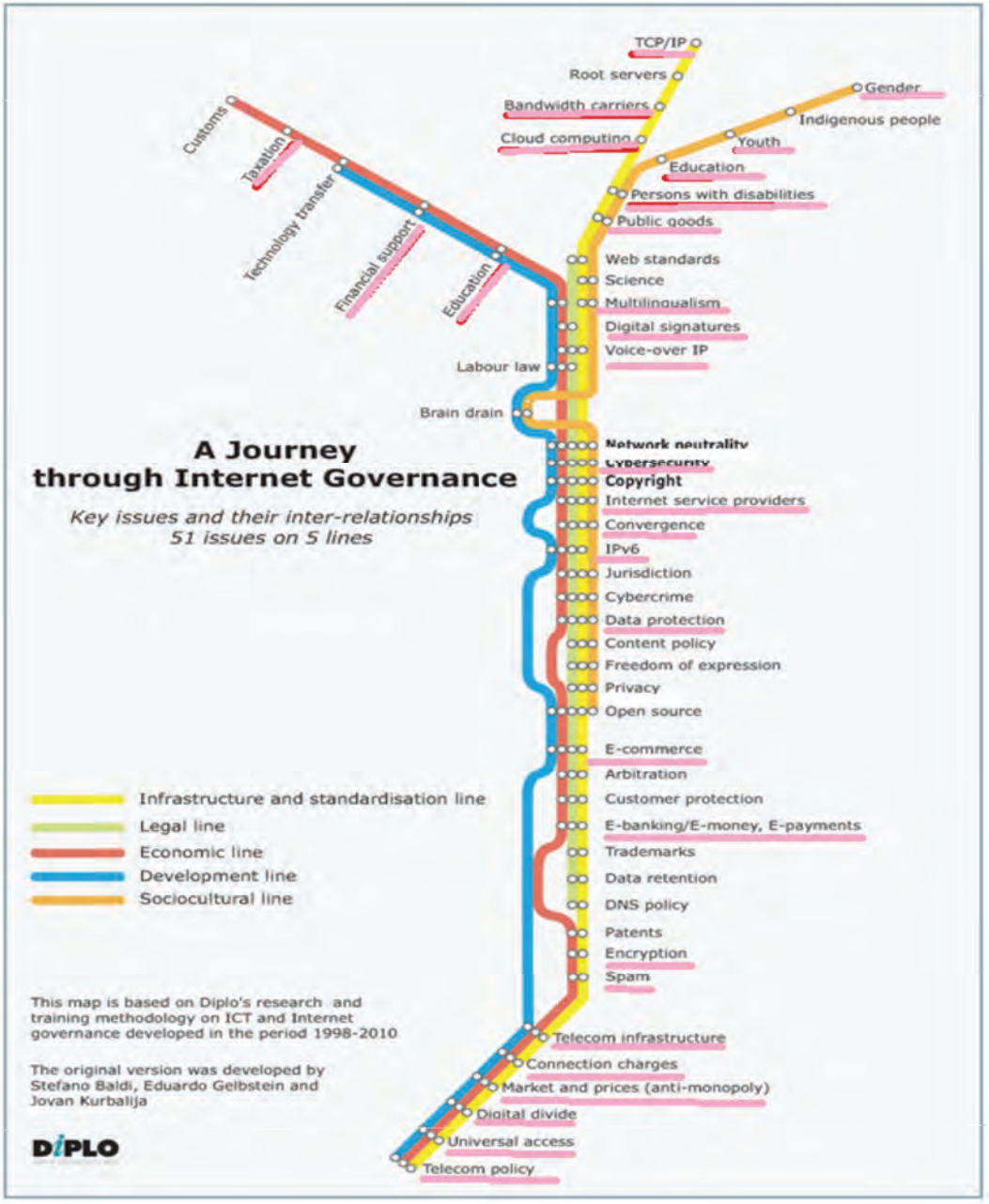
- Definition/Scope of Internet Governance

  - Internet governance includes more than Internet naming and addressing. It also includes other significant public policy issues such as, inter alia, critical Internet resources, the security and safety of the Internet, and developmental aspects and issues pertaining to the use of the Internet.
    (Para. 58, Tunis Agenda, WSIS)

  - Internet governance includes social, economic and technical issues including affordability, reliability and quality of service.
    (Para. 59, Tunis Agenda, WSIS)

http://www.itu.int/wsis/docs2/tunis/off/6rev1.html

Internet Governance



WCIT-12

World Conference on International Telecommunications 2012 (WCIT-12) Dubai, UAE

http://www.itu.int/en/wcit-12

- **treaty-level conference**
- **address International Telecommunications Regulations (ITR)**
- **international rules for telecommunications**
- **international telecommunication tariffs**

International Telecommunications Regulations (ITR)

- **ITR before WCIT-12**

regulatory structure was based on voice telecommunications, telex and service data

telecommunication operated under regulated monopolies in most countries

- **ITR after WCIT-12**

Telecommunications networks structure changes to *electronic data communication*

http://www.itu.int/en/wcit-12/Documents/final-acts-wcit-12.pdf

ITR update after WCIT-12

ARTICLE 5A

Security and robustness of networks

41B Member States shall individually and collectively endeavour to ensure the security and robustness of international telecommunication networks in order to achieve effective use there of and avoidance of technical harm thereto, as well as the harmonious development of international telecommunication services offered to the public.

ARTICLE 5B

Unsolicited bulk electronic communications

41C Member States should endeavour to take necessary measures to prevent the propagation of unsolicited bulk electronic communications and minimize its impact on international telecommunication services.

Member States are encouraged to cooperate in that sense.

Internet Governance @ ITU

http://www.itu.int/en/council/cwg-internet

ITU's mandate

- ITU's role on Internet Governance comprises of those decisions by ITU Membership (e.g., Decisions and Resolutions) which are also in the Union's strategic plan

CWG-Internet

- The CWG-Internet was established by Council 2011 Res.1366 to identify, study and develop matters related to international Internet-related public policy issues, and including those issues identified in Council Resolution 1305 (2009).

WSIS 2015

- The **World Summit on the Information Society** Forum 2015 represents the world's largest annual gathering of the 'ICT for development' community. The WSIS Forum, co-organized by ITU, UNESCO, UNDP and UNCTAD, in close collaboration with all WSIS Action Line Facilitators/Co-Facilitators, has proven to be an efficient mechanism for coordination of multi stakeholder implementation activities, information exchange, creation of knowledge, sharing of best practices and continues to provide assistance in developing multi stakeholder and public/private partnerships to advance development goals - http://www.itu.int/wsis

Other ITU Forums

- Various Study Groups within the Radiocommunication, Standardization and Development Sectors where ITU membership discuss and agree on Recommendations on a variety of topics related to Internet governance

Key Internet-related ITU PP Resolutions

- Plenipotentiary Resolution 101, Busan, 2014
  Internet Protocol-based networks

- Plenipotentiary Resolution 102, Busan, 2014
  ITU's role with regard to international public policy issues pertaining to the Internet and the management of Internet resources, including domain names and addresses

- Plenipotentiary Resolution 130, Busan, 2014
  Strengthening the role of ITU in building confidence and security in the use of information and communication technologies

- Plenipotentiary Resolution 133, Busan, 2014
  Role of administrations of Member States in the management of internationalized (multilingual) domain names

- Plenipotentiary Resolution 140, Busan, 2014
  ITU's role in implementing the outcomes of the World Summit on the Information Society and in the overall review by United Nations General Assembly of their implementation

- Plenipotentiary Resolution 174, Busan, 2014
  ITU's role with regard to international public policy issues relating to the risk of illicit use of information and communication technologies

- Plenipotentiary Resolution 178, Guadalajara, 2010
  ITU role in organizing the work on technical aspects of telecommunication networks to support the Internet