



***Communications for all in East Africa***

# **A GUIDE TO SATELLITE FILLINGS AND COORDINATION**

**Prepared by EACO**

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## Acronyms

<b>App 30</b>	Appendix 30 of the Radio Regulations containing Broadcasting-Satellite Service Plan
<b>App 30A:</b>	Appendix 30A of the Radio Regulations containing Plan for feeder link for Broadcasting-Satellite Service referred to in Appendix 30.
<b>App 30B:</b>	Appendix 30B of the Radio Regulations containing Fixed-Satellite Service Plan
<b>APM:</b>	African Preparatory Meetings for WRC
<b>BR IFIC:</b>	BR International Frequency Information Circular
<b>GPS:</b>	Global Positioning System
<b>GSO:</b>	geostationary satellite orbits
<b>LEO:</b>	Low Earth Orbits
<b>MEO:</b>	Medium Earth Orbits
<b>NGSO:</b>	non-geostationary satellite orbits
<b>RRB:</b>	The Radio Regulations Board
<b>WP4A:</b>	Working Party 4A under Study Group 4 of the ITU-R
<b>WRC:</b>	World Radiocommunication Conference

## **a) Executive Summary**

In line with the core objectives of EACO on harmonizing ICT Policy and regulatory frameworks in the East African Region and on devising ways and means to achieve fast, reliable, secure, affordable and efficient communication services within the EAC, working Group 5 established in its terms of reference the task of developing a satellite coordination framework for the member states.

This is intended to enable the member states to acquire and maintain satellite frequencies and related orbital slots for the future implementation of their national or possible regional satellite projects. The document provides a general background on satellite technologies highlighting key guidelines on ITU satellite filling and coordination procedures. Some of the aspects on satellite technologies that are covered include but not limited to the following;

- i. General introduction including the scope and objectives, ITU's Management of Satellite orbital slots and frequencies as well as types of satellite networks and interference in satellite networks.
- ii. Institutional and administrative arrangements such as policy making, satellite resource management and operating agencies
- iii. Satellite network filing and submission procedures detailing the steps for planned and un-planned bands
- iv. Satellite coordination procedures as well as cancellation and deletion of satellite fillings.
- v. Also highlighted in the document are some recommendations for EACO administrations and for the region as a block on how to optimize the potential of satellite technologies for the benefit of the member states and the region.

As the document is aimed at providing general backgrounds to ITU satellite filling and coordination process, procedures and requirements, it hence fully relied on ITU-R resources to provide the guidelines contained here. Considerable information has also been adopted from the African Telecommunication Union framework on satellite fillings and coordination. All the ITU and ATU resources have been referenced for the benefit of EACO administrations to access further information on satellite issues.

## **b) General Introductions**

### **a. Background**

Successful launch and operation of any satellite system requires two important but scarce resources namely; the radio frequency spectrum and Orbital slot in case of GSO satellite or orbit in case of NGSO satellite constellations.

Satellite Filing and Coordination are two essential processes required to access and maintain these satellite orbital slots or orbits and related frequency resources that are necessary for the successful implementation of a satellite project. It is very key to integrate these two process into an overall satellite project plan in order to achieve a successful outcome. These orbital slots and related frequencies are valuable and limited resources that need to be planned early enough and diligently managed against degradation as well as to avoid harmful interference between satellite networks.

Most Countries in EACO already have allotments in the Appendix 30B plan with the exception of South Sudan which however has already filled for one. All EACO administrations were also beneficiaries from Resolution 559 of ITU's WRC-19 which gave an opportunity to a number of developing countries in Region 1 and 3 to restore their unusable BSS allotments in the Appendix 30/30A plan. EACO member states can as well take advantage of resources in the unplanned bands which could be utilized for services such as Earth Observation satellites especially using the Q and V bands.

Successful filing, coordination, acquisition and retention of these satellite resources however requires each EACO administration to have dedicated personnel who will need to be adequately trained and equipped in these processes.

This document provides the key guidelines to ITU satellite filling with some basics on types of satellite networks, satellite interference, institutional and administrative arrangements to manage satellite issues such as policy, management and utilization including the skills for personnel as well as coordination procedures for planned and unplanned bands. It also contains some recommendations for EACO administrations and for the region as a block on how to optimize the potential of satellite technologies for the benefit of the member states and the region.

## **b. Key definitions**

**Administration:** Any governmental department or service responsible for discharging the obligations undertaken in the Constitution of the International Telecommunication Union, in the Convention of the International Telecommunication Union and in the Administrative Regulations (CS 1002).

**Space Radiocommunication Service:** Any radiocommunication involving the use of one or more space stations or the use of one or more reflecting satellites or other objects in space.

**Satellite Services:** The use of artificial satellites to provide communication links between various points on Earth and in space.

**Satellite system/Network:** A communication system or a part there of, consisting of one or more satellites communication with Earth stations and or space stations.

**Satellite Constellation:** A satellite constellation is a group of satellites working together in a network to provide wider, near-global or global coverage such that at any time everywhere on Earth at least one satellite is visible.

**Geostationary Orbit (GSO):** also referred to as a geosynchronous equatorial orbit (GEO), is a circular geosynchronous orbit 35,786 kilometres (22,236 miles) in altitude above Earth's equator (42,164 kilometers in radius from Earth's center) and following the direction of Earth's rotation.

**Non Geostationary Orbit (N-GSO):** A range of orbital positions above the earth do not maintain a stationary position, but instead move relative to the Earth's surface. Low Earth Orbit (LEO) located between 700km-1,500km above the Earth, Medium Earth Orbit (MEO) located at 10,000km above the Earth, and Highly Elliptical Orbit (HLO) at .....above the earth surface.

**Satellite filling:**

A process of compiling simulating, analyzing and determining optimum satellite orbital slots and frequency channels for a given satellite project which together with the technical and operational parameters of the satellite are notified to the BR for final analysis and publication in the BRIFIC to other member states and subjected to coordination.

**Satellite Coordination:** a technical and regulatory process undertaken by the satellite notifying administration with the other administrations which have been identified as affected by the ITU-BR. This is intended to mitigate possible frequency interference between the notified satellite networks and operational satellite networks as well as those still in the list.

**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.

### c. Scope

The scope of the guidelines covers ITU Satellite filling and coordination procedures for planned bands (Appendix 30/30A BSS and Appendix 30B FSS) and unplanned bands. IT also includes some general introductions on satellite services and recommendations on institutional and administrative arrangements that member states need to have in place including personnel to ensure effective handling of satellite related issues.

### d. Objectives

These guidelines aim to:

- i. Enlighten EACO administrations on the potential of satellite technologies emphasizing the need to harness such technologies for the benefit of the region

- ii. Guide EACO administrations on the procedures for ITU Satellite fillings and coordination for the planned (App 30/30A and 30B) and unplanned bands/services
- iii. Encourage corporation and a closely coordinated approach between EACO administrations in managing satellite related issues
- iv. Promote the need for capacity building on satellite technologies and services within the region.

#### **e. ITU's management of satellite orbital slots and frequencies**

The International Telecommunications Union (ITU) as a United Nations (UN) Specialized Agency for Information and Communication Technologies (ICTs) is responsible for managing, coordinating and facilitating access to satellite orbital slots and related frequencies.

The ITU has three sectors namely: Radiocommunications Sector, Telecommunication Development Sector and Standardisation Sector. The ITU through these sectors hosts Study groups whose works are considered and adopted at ITU Conferences by member states. These avenues, enables the ITU to develop regulatory, technical and operational recommendations for managing satellite orbital slots and related frequencies as well as facilitating satellite frequency coordination and mitigating interference cases.

The ITU constitution and related regulations gives right to every member state to have access to at least one satellite orbital slot in the geostationary orbit and related frequency resources to cover its national territory. As such, filling and coordination of satellite orbital slots and related frequency resources can only be undertaken by a member state. ITU Constitution and the Radio Regulations establish a broad framework for satellite filling and notification by member states, processing and publication by the BR, coordination and approval process for entering the assignments into the MIFR and authorization to launch and transmit from and to satellites. It is only after successfully undertaking these processes that a country can obtain international recognition and protection against interference for its satellite orbital slot and related frequencies as registered in the MIFR.

To achieve their national satellite goals and aspirations, EACO member states need to adopt specific measures at the national and regional level to implement ITU's requirements for satellite filling and coordination. The key principles that can guide administrations when developing their policy framework on satellite spectrum and orbits use are as follows:

- i. Consistency in applying the ITU Radio Regulations;
- ii. Strengthening national processes towards managing international satellite coordination and consistently evaluating and responding to all coordination requests.
- iii. Protection of existing services in a given country in regard to the use of the same spectrum for satellite services.
- iv. Seeking for more satellite orbital and frequency resources in both the GSO and the N-GSO arcs to satisfy future needs and support the implementation of a national/regional space programs.

The ITU Radiocommunication Bureau (ITU-BR) has developed extensive material to help administrations to understand and implement the procedures defined in the Radio regulations applicable to space services. However, some of the procedures, requirements and conditions laid out in the Radio Regulations may be difficult for administrations to diligently follow through due to many factors such as limited human resource capacity.

This document summarises the key principles, procedures and approaches for satellite filing and coordination. This does not seek in any way to substitute ITU resources on this subject but is simply aimed at providing EACO administrations a closer look at the Radio Regulations as far as Satellite fillings and coordination is concerned. It also stresses the importance of proper satellite filing and efficient coordination in achieving a successful satellite project implementation. Contained here also are references to some important and relevant ITU resources that member states can take advantage of.

#### **f. Types of Satellite Networks/Systems**

Satellite systems may be categorized into two types, namely, Geostationary Satellite Orbit (GSO) and non-geostationary satellite orbit (N-GSO).

The orbital slot occupied by a satellite will determine the coverage area on Earth and the characteristics of the satellite operation. Satellites operating in the GSO, which is at an altitude of approximately 35,800 km in the plane of the equator, have an orbital period equal to the Earth's rotation period (one sidereal day). Thus, the satellites appear to be at a fixed position in the sky relative to ground observers. Communications satellites and weather satellites are often given GSO slots, so that the antennas on ground that communicate with them do not have to move to track them, but can be pointed permanently at the same position in the sky where they stay.

The N-GSO satellite's position relative to the Earth is not fixed. There are different types of N-GSOs such as Highly Elliptic Orbit (HEO), Medium Earth Orbit (MEO) and Low Earth Orbit (LEO). The N-GSO satellite networks use a wide variety of earth stations to support different kinds of services and uses.

GSO satellites have been the exclusive means of providing commercial space-based communications. With advances in technology, N-GSO satellites are now being used to fulfil a wide range of mobile and fixed service communication needs as well. The regulatory structure governing satellite communications is designed to fit GSO and N-GSO characteristics.

#### **g. Interference in Satellite Networks/Systems**

The provisions of RR deal precisely with all cases of interference in order to allow the deployment of satellite services without the risk of harmful interference. There are various modes of interference between satellite space stations and terrestrial services:

**Interference mode between space service and terrestrial service:**

- i. A-1 The transmission of a terrestrial station may interfere with reception at an earth station;
- ii. A-2 The transmission of an earth station may interfere with the reception of a terrestrial station;
- iii. C-1 Transmission from a space station may interfere with reception at a terrestrial station;
- iv. C-2 Transmission from an earth station may interfere with reception in a space station.

**Interference mode between stations belonging to different space systems, operated in part of the spectrum where separate bands are allocated to Earth-to-space paths and space-to-Earth paths:**

- i. B-1 The transmission of a space station of one space system may interfere with reception at an earth station belonging to another space system;
- ii. B-2 Transmission from an earth station in one space system may interfere with reception at a space station belonging to another space system;

**Interference mode between stations belonging to different space systems, operated in a frequency band allocated for bidirectional use:**

- i. B-1 The transmission of a space station of one space system may interfere with reception at an earth station belonging to another space system;
- ii. B-2 Transmission from an earth station in one space system may interfere with reception at a space station belonging to another space system;
- iii. E- The emission of a space station of a space system can interfere with the reception in a space station belonging to another space system;
- iv. F- The transmission of an earth station in one space system may interfere with reception at an earth station belonging to another space system.

Interference types A2, C1, C2 have been regulated by imposing appropriate limits on the radiated power, particularly in the critical direction.

A1 and A2 type interference is subject to a coordination procedure which must be applied by the Administrations concerned when the "coordination zone" surrounding an earth station (transmitting or receiving) extends over the territory from another country.

For type B1 and B2 interference, an assessment is made of the apparent rise in the equivalent noise temperature of the satellite link, produced by another satellite link.

#### **h. National Satellite Filings and Coordination**

As indicated in Recommendation ITU-R S.1254, one of the best practices to facilitate the coordination process of satellite networks relies on exchanging accurate and up-to-date satellite and service parameters on a regular and timely basis during the process.

- i. In order to be able to do so, it is necessary to commence the satellite coordination with a prior knowledge of the intended satellite service parameters, which is only

possible if the satellite project has gone through the first phase of design where the main applications intended to be provided by the satellite have been defined, the initial technical parameters of the satellite determined (orbital location and slot, frequency bands, earth stations types) and link budgets for each of these identified applications computed taking into account potential interference from other systems.

- ii. When these steps have been completed, a first round of regulatory checks can be performed on these parameters, notably to determine if the allocated frequency bands that were chosen are in practice usable within the intended service area (difference between international allocations in Article 5 of the Radio Regulations and national allocations contained in each country's national table of frequency allocations) and to assess if the computed radio parameters are within the various power limits set forth in the Radio Regulations.
- iii. The result of these checks should then be entered into the technical assessments and link budgets in order to modify them to be compliant with the international and national regulatory frameworks. It may happen at this stage that several options of equal value emerge: for example, in the case of a geostationary-satellite network, several orbital positions can be considered as equally interesting or feasible.
- iv. For the reason in "iii" above, there are often multiple filings submitted to ITU in order to cover one satellite project (approximately 4 to 5 geostationary filings for 1 geostationary satellite brought into use). Only the detailed coordination process and the negotiations with other administrations will determine which of these filings is the most appropriate to operate the satellite in a manner commensurate with the performance objectives.
- v. This iterative process between the technical design of the satellite, its operational implementation and the satellite coordination should be maintained during the entire lifetime of the project, including after its bringing into use this is to ensure that the satellite coordination process supports the operations of the actual in-orbit satellite.

### **c) Institutional and Administrative Arrangements**

#### **a. Background**

The acquisition, retention and use of satellite resources can only be possible if a country has the right Institutional and governance tools to ensure maximum social-economic impact. These Institutions are generally classified into three main roles namely Policy Making, Satellite resources management and satellite resources utilisation institutions.

#### **b. Policy Making Institutions and their tools**

The policy for Space sector is usually handled by a Ministry. Depending on the country, this role can be handled in a Ministry responsible for ICT and /or Digital matters or it can be handled by a Ministry responsible for Sciences and Research. The main mandate of such Ministry is to establish a policy that governs the Space Sector of the country. Such policy provides a country vision on Space and establishes a high-level framework or

guidance for necessary institutions and stakeholders in the Space Sector and their specific roles. The main tool used for achieving that is a “National Space Policy”.

### **c. Satellite resources management institutions and their tools**

The management of satellite resources namely orbital slots and frequency spectrum are generally handled by Regulatory Authorities either as Independent Institutions or under the relevant Ministries depending on a given country’s Laws. These tasks usually requires some legal and regulatory tools that include but not limited to the following:

- a) National Frequency Allocation Table,
- b) Regulations governing frequency management and coordination,
- c) Licensing framework for satellite services.

Such an institution usually deals with the following tasks:

- i. Filling for and submitting satellite orbital slots and frequency notices to the ITU to secure such resources for national satellite operators.
- ii. Protecting national satellite resources by conducting necessary coordination as required by the ITU Radio Regulations and Rules of Procedures;
- iii. Defending national interests in terms of satellite resources by representing the country in all international fora such as ITU’s World Radiocommunication Conference and relevant ITU working groups that discuss and pass international satellite regulations;
- iv. Ensuring long term plan for national satellite resources;
- v. Contributing to global endeavour for ensuring equitable access to satellite resources and their efficient utilisation.

### **d. Satellite Resources Utilisation Institutions and their Tools**

Acquiring and protecting satellite resources with no strategy for their actual utilisation renders such resources a waste for the country and the entire Space Industry. Thus, the establishment National Space Agencies is a very critical step for any member state intending to make the best use of their satellite resources.

The main role of a Space Agency is developing a National Space Strategy in line with the National Space Policy and facilitating their implementation to ensure that space resources are efficiently utilised for providing maximum impact on socio-economic development. The following are the main tools required for a National Space Agency:

- a) National Space Policy,
- b) Space Law.
- c) National Space Strategy

### **e. A national Multi-stakeholder Advisory Body on Space Resources Management and Utilisation**

The three main bodies described above need to be coordinated to ensure that all endeavours in space sector are channelled via priority areas of the country for sustainable development. This role of coordinating and identifying priority areas is handled by a National Space Advisory Body comprising of representatives from main concerned

Government Institutions and from key players in private sector. Such a body is usually initiated by the relevant ministry and facilitated by the regulatory agency and subsequently the Space Agency. They can sit on quarterly basis and develop and propose policies that can be adopted by the relevant ministries and resolutions and or recommendations to be implemented by the Space Agency and or the Regulatory Authority.

**Note:** See the African Space Strategy for some details (e.g. typical mandate) of the above elements.

#### **f. Personnel Recommendations for EACO Administrations**

The following are recommended approaches for the EACO administrations to consider in adopting personnel structure to handle satellite related issues in their respective countries

##### **i. Focal Point of Administration Responsible for Satellite Issues**

In order to facilitate communications with the Radiocommunications Bureau and other administrations on matters related to satellite filings and coordination procedures, administrations may designate a National Focal Point. The Focal Point is a person or persons nominated by the competent authority. This nomination may be a working arrangement to allow for the information exchange and flow between BR and the administration. In Circular Letters CR/450 (e-Communications) and CR/427 (e-Submission of satellite filing networks), BR requested administrations to designate administrations managers in order to get access to the online application.

This Administration Manager may be considered as the Focal Point of Administration for satellite issues. The designated Administration Manager will authorize access to the system for other Administration users, Operator Manager and Operator users. Any change of the Focal Point must be communicated as soon as possible to the Bureau.

Amongst the key tasks of the Focal Point are the following:

- a) Facilitation of information sharing between BR and the various satellite operators;
- b) Coordination of the satellite filings and submission to BR;
- c) Ensuring that deadlines for comments and any regulatory procedures are met;
- d) Participation at BR seminars/training related to satellite issues;
- e) Regular updating of the table 12A/12B of the Preface to the BR IFIC;
- f) Being a point of contact between national administrations with other administrations in the case of harmful interference.

##### **ii. Core knowledge and skills of Satellite personnel**

Satellite Network Coordination is a complex process with meticulous procedures. Specialized teams should be trained and equipped with all necessary tools and software to enable them handle the coordination and bi-lateral negotiations and mitigate harmful interferences scenarios to protect national satellite networks and avoid interferences to other networks.

The following knowledge and skills may be required for Satellite personnel:

- a) Knowledge of the ITU Radio Regulations, Rules of Procedure, relevant ITU-R Recommendations, and its application to space radiocommunication services;
- b) Advanced university degree in telecommunications, electrical/electronic engineering;

- c) Ability to communicate well;
- d) Ability to use computer application in particular BR software;
- e) Experience in the test field measurements as well as the skills in installation of the Earth stations or other communication equipment's, may be useful;
- f) Knowledge of how Administrations/satellite networks are identified by the Bureau as potentially affected including the criteria applied by the Bureau;
- g) Knowledge of acceptable levels of interference to be used in negotiation;
- h) Ability to find a solution/compromise;
- i) Have the right to take decisions in negotiation;
- j) Ability to make a link between satellite communications and the Radio Regulations;
- k) Ability to work with other staff in a coordination team;
- l) Ability to extract necessary information from the Bureau's databases for coordination.

### **iii. EACO Regional Satellite Task Group**

It is recommended that EACO creates a task group on Satellite Network Filing and Coordination with a clear Terms of Reference (ToR) which will enhance knowledge and information sharing among the member states and capacity building.

#### **d) Satellite Networks Filings Submission Procedures**

- i. A satellite network filing can only be submitted to the ITU by an administration of an ITU Member State in accordance with the provisions of the Radio Regulations and Rules of procedures.
- ii. These include compliance with the provisions of Radio Regulations Article 5 (Table of Frequency Allocations), Article 9 (Procedures for effecting coordination with or obtaining agreement of other administrations) and Article 11 (Notification and recording of frequency assignments), as well as obligations under Article 44 of the Constitution.
- iii. After an administration decides to initiate a filing process based on its needs as an administration or request by one of its licensee, it proceeds to file the satellite network submission to the ITU.
- iv. The notifying administration is responsible for ensuring that the satellite networks under its responsibility comply with the provisions of the ITU Radio Regulations.

**The generic steps involved in bringing a country satellite network into use are as follows:**

- i. The administration files the Advanced Publication Information (**API**) with ITU as provided by the operator for satellite systems not subject to coordination;
- ii. ITU publishes the API in the Space Radiocommunication Bureau (**BR**) International Frequency Information Circular (**IFIC**);
- iii. Arising from the ITU's publication of the API in the Space BR IFIC, other administrations may advise the notifying administration of existing services that they believe may be affected by the published satellite network;
- iv. The administration files a Coordination Request (**CR**) with ITU as provided by the operator for satellite systems subject to coordination;
- v. ITU publishes the CR filing in the Special Section CR/C of the Space BR IFIC;
- vi. Arising from ITU's publication of the CR filing in the Special Section CR/C of the Space BR IFIC, other administrations may advise the notifying administration of existing services that they believe may be affected by the published satellite network;
- vii. In the event that coordination is required, the administration will assist the satellite operator to co-ordinate the published satellite network with those existing networks of other administrations that may be affected by its operation; and
- viii. When coordination is completed, the administration files a Notification Request with ITU and seeks inclusion of the satellite network in the MIFR.
- ix. All satellite filings received by an administration from the operators need to be evaluated against the existing systems with the aim of protecting these systems.



Figure 2: Interaction between national operators and notifying administration

Operators may make a request to administration for the submission of a new Satellite Network filing, consisting of planned and non-planned services.

#### **a. Planned services and relevant provisions**

The Radio Regulations contain three Appendices dealing with the satellite Plans (Broadcasting Satellite Service and Fixed Satellite Service) and associated regulatory procedures and technical annexes for these Plans as follows:

- a) **Appendix 30**, setting out the provisions for all services and associated plan and list for the broadcasting-satellite service (BSS) in the range 11.7-12.5 GHz;
- b) **Appendix 30A**, setting out the provisions and associated plan and list for feeder links for the BSS in the range 17.3-18.1 GHz; and 14.5 -14.8 GHz (outside of Europe).

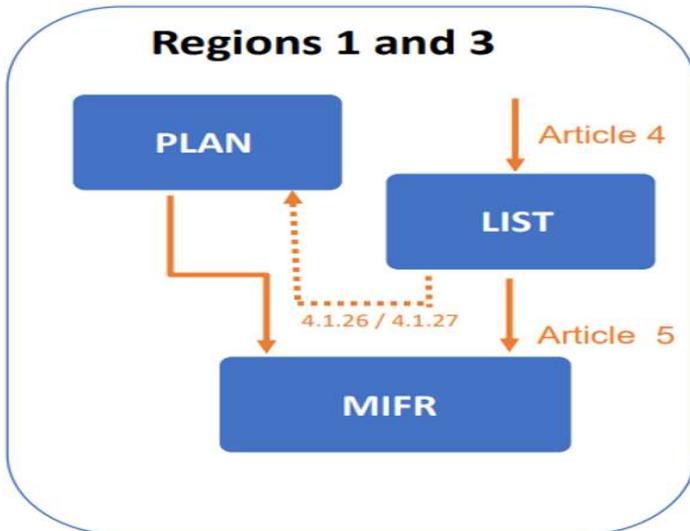


Figure 4: AP30/30A regulatory procedures

- c) **Appendix 30B**, setting out the provisions and associated plan for the fixed-satellite service (FSS) in the frequency ranges 4500-4800 MHz (space-to-Earth), 6725-7025 MHz (Earth-to-space), 10.7-10.95 GHz (space-to-Earth), 11.2-11.45 GHz (space-to-Earth) and 12.75-13.25 GHz (Earth-to-space).



Article 6 of AP30B

Article 8 of AP30B

Figure 5: AP30B regulatory procedures (Articles 6 and 8)

### b. Non-Planned services

Under the provisions of Articles 9 and 11 of the ITU Radio Regulations (where an Assignment results from an application by an operator to the administration for an

Assignment in certain bands with a specific coverage and orbital position or orbit constellation and where the applications will be filed by notifying administration on a first-come-first-served basis); The steps in the coordination procedures for satellite networks in non-planned services include Advance Publication Information and Notification for satellite systems not subject to coordination, and Request for coordination and Notification for systems subject to coordination.

### Procedures for Registration of satellite

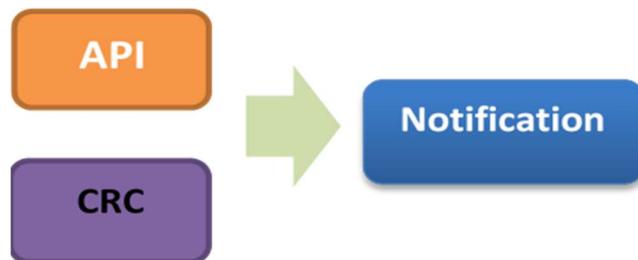


Figure 3: Registration procedures

#### **Registration procedures of Non-Planned services:**

- i. Advanced Publication Information - API (With respect to Satellite Networks not subject to the coordination procedure set out in the ITU RR),
  - e) The first stage is the submission of the API to ITU by the notifying administration.
  - f) The date of receipt by the ITU of the API from notifying administration marks the start of the 7-year regulatory period.
  - g) This kind of Satellite Networks are required to be notified and brought into use, before the end of the 7-year regulatory period.
- ii. Coordination Request – CRC or CR (With respect to Satellite Networks in the non-planned services subject to the coordination procedure set out in the ITU RR),
  - a) The first stage is the submission of the CR (compliant with the ITU RR) to ITU by the notifying administration, in accordance with the ITU procedures.
  - b) The date of receipt by the ITU of the CR from notifying administration marks the start of the 7-year regulatory period.
  - c) This kind of Satellite Networks are required to be notified and brought into use, before the end of the 7-year regulatory period.
  - d) Notification of frequency assignments (With respect to Satellite Networks Subject /not subject to the coordination procedure)
- iii. The notification of a frequency assignment to the ITU-BR in accordance with Article 11 of the Radio Regulations is the final regulatory step leading to the recording of the frequency assignments in the Master Register.

- iv. The provisions relating to notification of frequency assignments stated in Article 11 of the Radio Regulations with respect to the Notification of an Assignment of a Satellite network in accordance with the ITU RR shall be submitted by notifying administration.
- v. On the notification, the operator must provide type of service to be provided by means of the Satellite Network, report summarizing the status of coordination and Satellite procurement contracts and launch services contracts.
- vi. Based on impact assessment in relation to existing national Satellite Networks and proposals to avoid causing Harmful Interference, provide information on any mitigation measures to avoid Harmful Interference to such existing national Satellite Networks.

#### a. Processing of Appendix 30B submissions

In accordance with § 8.5 of Article 8 as well as §§ 6.5, 6.21 and 6.22 of Article 6, complete notices are examined by the order of the date of their receipt, except for the following two special types of submission:

- i. Requests for new allotments received in accordance with Article 7
- ii. Submissions received in accordance with Resolution **170** (WRC-19).

In such cases, they will be treated by the Bureau ahead of submissions for which the examination under § 6.5 has not yet started.

For Article 7 request, the Bureau will carry out the following examinations:

- i. Identification of suitable orbital positions
- ii. The requesting administration to select the final orbital position.
- iii. Examination of the proposed allotment using the final orbital position ahead of submissions for which the examination under § 6.5 has not yet started:
  - a) With respect to the Table of Frequency Allocation, hard limits contained in Annex 3 to Appendix **30B** and hard limits contained in RR Article 21 and Article 22 as listed in the associated Rule of Procedure on § 6.3 of Article 6.
  - b) Identification of any administration together with its allotment/assignments which are considered as being affected.
- iv. If the Bureau reaches favourable finding, the proposed new allotment will be entered in the FSS Plan; otherwise the proposed allotment of the Member State shall be treated as a submission under § 6.1 and shall be treated by the Bureau ahead of any other submissions received under Article 6, except for submissions which were already under examination under § 6.5 by the Bureau at the time of completion of the examination of the request of the new Member State under § 7.5.
- v. Under the above-cited Appendices, the ITU Member States have a pre-assigned GSO orbital position and related frequency assignments / allotments and technical

characteristics.

- vi. In accordance with Appendices 30 and 30A, an administration in Regions 1 and 3 can ask for additional uses through the application of the procedure of Section 4.1 of Article 4. In addition, an administration may request a WRC to include a new assignment or modify an existing assignment in the BSS and associated BSS feeder-link Plans by applying provision 4.1.26 or 4.1.27, as appropriate.
- vii. The Appendix 30B, as prescribed in its Article 6, contains relevant procedures for the conversion (with or without modification) of an allotment into an assignment and for the introduction of an additional system. Also, it contains a procedure for the addition of a new allotment to the Plan for a new Member State of the Union (Article 7 of Appendix 30B). Modification of the FSS Plan, if any, is the subject of a WRC based on the relevant request of concerned administration.
- viii. The notification of the planned frequency assignments shall be done in accordance with Article 5 (Appendices 30 and 30A) and Article 8 (Appendix 30B), respectively.

## **h) Satellite Coordination Procedures**

### **a. Definition and approaches for frequency coordination**

The procedures in Chapter III, the Radio Regulations define how an administration can employ a particular allocation of the spectrum and assign a frequency to one of its users.

- i. Theoretically, an administration checks the allocation to see if the frequency fits a predefined category. If so, it follows the procedure for informing the BR and other administrations whose radio communication services could be interfered with by the operation of the proposed radio station or stations. The affected administration may agree or disagree to the use of that frequency or band.
- ii. Any disagreement must be resolved through the process of frequency coordination, which involves bilateral negotiations between the applicant and incumbent and multilateral procedures that might include a special conference. The ITU-BR will provide assistance to either administration to help resolve a disagreement as to the rules and criteria for interference.
- iii. Space-based radio transmitters are more of a concern because of their greater potential to radiate into the territory of more countries. If the transmission could cause interference, then the administration must follow the convoluted process of frequency coordination, which is defined in the Radio Regulations.
- iv. The frequency coordination procedure gives the other administrations a chance to decide if they want to allow this particular station to go on the air. A successfully coordinated frequency assignment can be recorded in the Master International

Frequency Register (the Master Register) of the ITU and thereby gain international status.

- v. The principle of a priori planning was established as a way to guarantee entry for countries that were late to construct their own satellite systems. For instance, the WARC-77 produced two worldwide Ku-band BSS plans that assigned at least one slot to every member of the ITU for the purpose of satellite broadcasting.
- vi. In line with this principle, segments of C-band and Ku-band were allocated to the FSS and preassigned to administrations through the Allotment Plan. An allotment is made of a particular frequency or band segment to a particular country or area. This gives each administration an orbit position and access to the spectrum for a variety of purposes. Under this arrangement, the need for coordination is reduced but not eliminated.

#### **b. General Steps in the International Frequency Coordination Process**

The process of international frequency coordination is required because the spectrum and orbit space are limited resources and must be shared by all nations and users. Because this process is technically complex and often political, cooperation with the ITU-R is always highly required.

- i. Beginning at the top, the ITU develops the frequency allocations and rules for coordination; next, the administration participates in the ITU activities at the WRC and oversees the assignment and user of frequencies within its domestic borders; and finally, the user applies for and obtains frequency assignments and the authority to operate from the administration.
- ii. A planned user of the orbit and spectrum, such as a company proposing to launch a GEO satellite, must therefore apply to the national regulatory body, which acts as the administration for the particular country. The user will usually be required to prepare the actual applications that are forwarded to the BR by the administration.
- iii. There are basically two types of frequency coordination: terrestrial coordination, for land-based microwave transmitters; and space coordination, for radio transmitters and receivers on satellites.
- iv. In order to gain the right to use any radio frequency to provide satellite communication services, administrations are required by the Radio Regulations, which is the international treaty text governing the use of the finite radio frequency resource, to comply with technical and regulatory requirements and procedures laid out in the RR.
- v. One of the important regulatory requirements and a very effective mechanism in managing harmful interference between space radiocommunication services is to carry out coordination of the radio frequency assignments with other administrations before using them.

The regulatory text for this coordination requirement is contained in the Radio Regulation.

- a) Article 9 for non-planned services.
- b) AP30, AP30A and AP30B for the modified uses in the planned services, it is the initiative of the administration wishing to implement a new satellite network to start the coordination procedure.
- c) After the submission of the API, CRC and AP30/30A/30B filling, as appropriate, the BR will publish the list of administration and satellite networks that may have a potential for interference from the new satellite network.

The BR identifies potential affected network based on the following mechanisms:

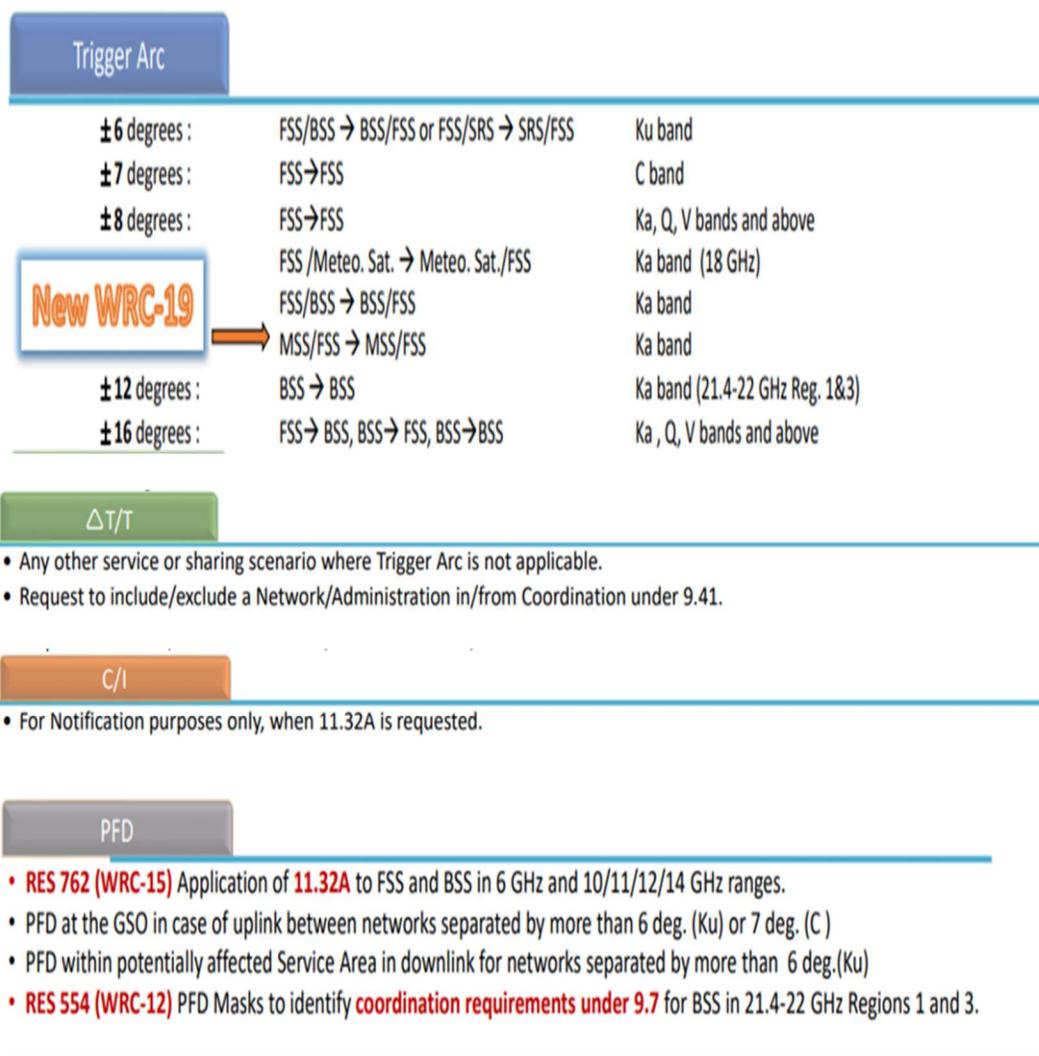


Figure 7: Mechanisms of identification of the affected networks

Administrations need to ensure the following:

- i. That before submission of notification data for the subject satellite network to the ITU-BR the coordination has been completed with other affected networks with higher regulatory precedence. In such cases, the operator must submit copies of the completed coordination agreements to administration.
- ii. In some cases, where it is satisfied that adequate efforts have been made to achieve coordination, administration can submit notification data under No. 11.41 for a satellite network to the ITU-BR where coordination is still in progress with other affected networks with higher regulatory precedence. In such cases, the operator must notify administration that coordination for such satellite network is not completed with other affected networks and provide the relevant information on the status of the coordination.
- iii. Any operation of a network notified under these circumstances can only be on a non-interference and non-protection basis with respect to any senior network with which coordination was not completed.
- iv. Should the network recorded under No. 11.41 cause harmful interference to any existing network with which coordination was not completed, the operator responsible for that network shall immediately eliminate such interference, as per No. 11.42.
- v. Administrations may conduct meetings as a way of coordinating their Assignments.
- vi. Coordination enables parties interested in providing satellite services to exchange information, analyse interference scenario and work out solutions that will allow their existing and planned satellite networks to operate without causing harmful interference to one another.
- vii. Coordination is a continuing or ongoing effort. It should continue as long as the use of the radio frequency is required for the satellite service as it is essential in maintaining the quality and reliability of the satellite service.
- viii. Coordination outcomes can affect viability of projects, business decisions and marketing plans.

### **c. Satellite Frequency and Orbit Coordination**

- i. The Advance Publication of Information (API) is required for satellite networks or systems that are not subject to the coordination procedure under Section II of Article 9. API should be provided to the ITU in the first step no earlier than 7 years and not later than 2 years before the start of operation in a general description of the proposed satellite network to allow other administrations to assess the potential impact on their existing or planned satellite networks.

- ii. After review by the BR for compliance with the Radio Regulations, the information is published in the BR IFIC, which is a special publication containing these applications as well as requests for coordination and notices of frequency assignment. The required information is specified in Appendix 4.
- iii. The API step is a prerequisite allowing any administration to submit comments on how the new satellite network could interfere with the operation of their own existing or planned satellite networks. If this is the case, they are to respond with their comments within 4 months of publication to the filing administration.
- iv. The filing administration is supposed to try to resolve any difficulties raised in these comments by altering the orbit position and/or transmission characteristics of the proposed satellite. This could involve a change in the coverage pattern, power levels, or specific frequency bands.
- v. The Radio Regulations require that the filing administration try to bring this to resolution. However, if the administration making the comments does not remove its complaint, the rules do not explicitly obligate the filing administration to do much else.
- vi. At the end of the 4-month period of the comments, the BR consolidates the comments received and publishes the list of administrations which have sent comments in an API/B special section of a BR IFIC. In any case, the filing administration may move on to the notification phase when 4 months have passed after the publication of the API in the BR IFIC.
- vii. Some services commonly used in NGSO satellite networks not subject to coordination are Earth exploration-satellite service, meteorological satellite service, space research service, amateur-satellite service, space operation service, etc. Small satellites, including nano-satellites and pico-satellites, are frequently designed to use frequency bands that are not subject to coordination.
- viii. For satellite networks subject to coordination procedure under Section II of Article **9**, the notifying administration must submit filing information as a request for initiating the coordination process for the satellite and Earth stations in the network. Coordination is the most critical phase as it determines the priority that the new network will have over new applicants who come later.
- ix. The information to be supplied for coordination is contained in Appendix 4. It is very much like the API, except that specific frequency assignments are requested. This can be accommodated by filling in the characteristics of the transponders (center frequencies and bandwidths) along with the basic specifications of typical Earth stations and services.
- x. The rules place the burden of determining which administrations could be affected by the new assignments upon the BR itself. The determination of the affected administration uses the calculation of the percentage increase in equivalent link

noise temperature ( $\Delta T/T$ ), defined in Appendix 29. The threshold for coordination is set at 6%.

- xi. The analysis technique is very conservative in that it will indicate that unacceptable interference could occur even when it would not be the case in practice. The idea is to assure the priority given by the Radio Regulations to any other administration that has a system that meets one of the two conditions cited above.
- xii. The requested administration must evaluate the data in the coordination filing to see if the calculated interference levels would be acceptable. Specifically, it must:
  - a. Acknowledge receipt of the data;
  - b. Examine the data to determine if interference would be caused to its lawful frequency assignments;
  - c. Within 4 months of receipt, inform the requesting administration of its agreement that the interference is acceptable or its disagreement, giving also the technical details upon which, its disagreement is based, including relevant characteristics about its system not previously notified and its suggestions with a view to a satisfactory solution to the problem.
- xiii. An affected administration will evaluate the technical characteristics of the proposed satellite network and inform the filing administration if it agrees to its operation.
- xiv. An administration with which coordination is sought must issue its opinion within 30 days of the final request from the BR; otherwise, it is presumed to agree that no harmful interference would occur.
- xv. On the other hand, an administration believing it should have been included in the coordination process can demand of the BR that it be allowed to provide its review as well.
- xvi. Coordination of satellite networks is a bilateral activity where the newcomer must approach the incumbent and obtain their agreement regarding the potential for interference between systems. Such discussions and negotiations will take a year or more, particularly in difficult or acrimonious situations.
- xvii. Following a successful coordination, a filing administration submits its frequency assignments to the BR for recording purposes. The BR examines the assignment to make sure that it fits the Table of Frequency Allocations and that the coordination procedures have been followed. In particular, the new assignment should not cause unacceptable interference to an existing assignment that has already entered or completed the review and coordination.
- xviii. Although it has not been given policing authority, the BR does have power over administrations because of the status given to frequencies that have been recorded in the Master Register. When a frequency assignment is in coordination

between two administrations, the BR can assist by performing calculations of the expected level of interference and can make recommendations to the parties on how the interference could be prevented.

- xix. In the event of a deadlock, and provided the BR has already been asked to assist in resolving the conflict, the filing administration can proceed directly to the notification phase. This particular provision is a means to overcome the kind of obstacle that has been used in the past to attempt to block a competitor. Therefore, the BR would examine these notices with respect to standard technical criteria that assure that appropriate frequencies were chosen and that harmful interference will not occur.
- xx. A positive conclusion will result in recording of the assignments in the Master Register, indicating the names of administrations with which coordination was successfully completed and those that were not but where the technical finding by the BR was favourable. This provision happily provides the means to obtain protection where an uncooperative administration would attempt to block the new entrant.
- xxi. Most of the time, coordination and recording are accomplished in a straightforward manner, taking anywhere from 6 months to 3 years, depending on the number of administrations involved and the complexity of the technical analysis of potential interference.
- xxii. Notification of frequency assignments as the last step in the regulatory process, should be accomplished before the service is initiated. This is done by submitting the same data items with the characteristics of the satellite network after the completion of coordination. The BR will verify that the entire coordination process is complete with all of the appropriate administrations. If so, they will record the assignments in the Master Register and the new operator is free to begin using them to provide service.

#### **d. Terrestrial Coordination of Earth Stations**

Terrestrial coordination involves any terrestrial radio transmitter that can potentially radiate signal power across a border into a neighbouring country. In particular, the Radio Regulations and Recommendations provide technical analysis procedures to compute the coordination contour, which is a graphical depiction of the expected and worst-case power levels from a transmitting earth station after propagating through the atmosphere.

A neighbouring administration analyses the coordination contour to determine whether or not this level of power could interfere with the operation of domestic radio receivers that employ the same frequency band. If so, then the two administrations would, on a bilateral basis, make an agreement as to which frequencies would be used or how the transmit radiation pattern of the offending Earth station should be altered. After coordination is complete, the administration can register the new frequency assignment with the BR. Some of the key elements of terrestrial coordination includes the following;

- a) Terrestrial coordination is intended to protect terrestrial microwave stations in other countries from transmissions by new earth stations that operate in a shared frequency band. The bands where this is required are those where the FSS and the fixed service are co-primary. The aim is to try to control interference along path where the Earth station interferes with the terrestrial station, and path where the inverse situation can exist.
- b) An applicant for a new earth station starts with data that describes the radiation pattern around the full 360° of azimuth along the horizon. This is used to compute the amount of RF energy that could propagate from the earth station location to locations in a neighbouring country where terrestrial receivers could be located. Additional shielding is provided by the existing terrain and buildings around the earth station site.
- c) The mechanism used to perform this assessment is the coordination distance, which is the calculated distance over which interference could potentially result.
- d) This distance is calculated with formulas in Appendix 7 to the Regulations and considers attenuation produced by propagation over the surface of the Earth along the great circle path, which introduces greater path loss than simple line of sight. The techniques are complicated and are best carried out with computer software available for download from the ITU Web site.
- e) Unlike satellite coordination, it is up to the requesting administration (and not the BR) to determine which administrations need to be included—a relatively simple process once the coordination diagram for the new earth station is complete.
- f) An administration that receives the request for coordination, including the coordination contour along with the other information in Appendix 4, must determine if interference could result from the operation of the new Earth station. Receipt of this data must be acknowledged within 30 days of receipt. The examination would consider:
  - i. Interference to terrestrial stations existing or to be operating before the earth station enters service or within 3 years, whichever is longer;
  - ii. Interference to the earth station by such terrestrial stations.
- g) Each affected administration notifies the requesting administration within 4 months of one of the following:
  - i. Its agreement to the proposed earth station with a copy to the BR;
  - ii. Its desire to include specified terrestrial stations in the coordination;
  - iii. Its disagreement.
- h) In the last two cases, the notification should include a diagram showing the location of existing or planned terrestrial stations within the coordination area (which is the area inside the coordination contour) and suggestions for solving the interference problem. A copy should also be provided to the BR.

- i) In cases where it is difficult to get agreement, the BR can be counted on to provide assistance. They have even been in the position of acting as a disinterested party and honest broker in finding the needed solution to the problem.

**i) Cancellation and deletion of satellite filings**

- i. In the event that the operator of any satellite network causes harmful interference to other satellite networks, administration can instruct the satellite operator to cease transmission immediately and not to resume operation until the cause of the interference is remedied. If the operator is unable to remedy the interference within a defined period, administration may suspend the filing in accordance with No. 11.49 of the Radio Regulations.
- ii. If within the period of suspension administration is satisfied that the interference has been remedied, administration can permit transmissions to be recommenced and will notify the ITU-BR that the assignment has been brought back into regular use. Otherwise, if at the end of the suspension period the interference has not been remedied and the filing brought back into regular use the filing will be cancelled by the ITU-BR.
- iii. Cancellation of satellite filings may happen in the event that it is established by administration that a satellite network is operating outside either:
  - a) its characteristics as recorded in the Master Register; or
  - b) in the case where the ITU-BR has not completed the processing of the notice in accordance with Article 11 of the Radio Regulations, the notified characteristics of the satellite network.
- iv. Cancellation of satellite filings may also occur in the event that a satellite either:
  - a) suffers an anomaly and as a result is no longer able to operate all, or part of, the assignments notified to the ITU as having been brought into use, or recorded in the MIFR; or
  - b) is relocated from the relevant orbital location.

**j) Satellite Coordination with ATU member Countries for the implementation of Resolution 559 (WRC-19)**

- i. The ITU Constitution guarantees an equitable access for all countries to the orbital and frequency resources of the geostationary arc. This fundamental principal has led to the development of Frequency Plans AP30, 30A for BSS and AP30B for FSS in the C and Ku Band for the developing countries of the Region 1 where Africa is included.
- ii. However, for various reasons, a good number of countries in Africa have seen their assignments/allotments in the Plans degraded mostly due to lack of commenting to new systems for additional use filed in terms of Article 4 of Appendices 30 and 30A for BSS plan and Article 6 in Appendix 30B for the FSS plan.
- iii. On the other hand, during the last WRC-19 that took place in Egypt, the Resolution 559 was adopted whereby all the affected African countries have been given the opportunity to submit new fillings for their BSS Plan to replace the degraded assignments.
- iv. With this opportunity came new challenges regarding coordination with the systems in the List and assignments in the Plan since after the new assignment were published in Part A of the BRIFIC, the notifying countries are obliged by the ITU Radio Regulation to coordinate with all the countries that have been identified by the ITU-R Bureau as affected before they can submit the Part B of their assignments.
- v. To overcome this challenge, all the ATU member countries are urged, in the spirit of cooperation and collaboration, to consider the following recommendations in order to facilitate the progress on the coordination of the Res. 559 fillings:
- vi. Administrations with affected assignments in the Regions 1 and 3 Plans (identification under § 4.1.1a):
  - a) When an affected administration is a neighbouring country, that affected administration should give its agreement to the notifying administration of affecting Res.559 filing as the new level of EPM values of the assignment in the Plan, after having accepted interference from the affecting Res.559 filing, would still be acceptable.

- b) When an affected administration is not a neighbouring country but a member of ATU, the beam of the affecting administration should be shaped to avoid affecting assignments in the Regions 1 and 3 Plans.
- vii. Administrations with affected assignments of Res.559 filings (identification under §4.1.1b):
  - a) When an affected administration is a neighbouring country, that affected administration should give its agreement to the notifying administration of affecting Res.559 filing as the new level of EPM values of the assignment of Res.559 filing, after having accepted interference from the affecting Res.559 filing, would still be acceptable.
  - b) When an affected administration is not a neighbouring country but a member of ATU, the beam of the affecting administration should be shaped to avoid affecting assignments of other Res.559 filings.
  - c) A new level of EPM values is considered as acceptable when the affected administration would still be able to provide services and at the same time continue to be protected from an incoming network.
- viii. Administrations with affected Assignments of Regions 1 and 3 List or for which complete Appendix 4 information has been received by the Radiocommunication Bureau in accordance with the provisions of § 4.1.3 (identification under §4.1.1 b):
- ix. ATU Res.559 Administrations should engage in the coordination, trying to obtain as many agreements as possible. However, for cases, where EPM of assignments in the List is degraded a lot, countries can apply § 4.1.18. The use of § 23.13 to request the exclusion of ATU from the service area of assignments in the List is not advisable. But this 23.13 could be used to negotiate and obtain an agreement for Resolution 559 filings.

## References

- i. ITU Constitution and Convention: <https://www.itu.int/en/history/Pages/ConstitutionAndConvention.aspx>
- ii. ITU Radio Regulations: <https://www.itu.int/en/publications/ITU-R/Pages/publications.aspx?lang=en&media=paper&parent=R-REG-RR-2020>
- iii. ITU Space Plans: <https://www.itu.int/ITU-R/go/space-plans/en>
- iv. Learning Materials: <https://www.itu.int/en/ITU-R/space/elearning/Pages/default.aspx>
- v. ITU-R Seminar Materials: <https://www.itu.int/en/ITU-R/seminars/Pages/default.aspx>
- vi. Installation of the BR Space software from BR web site: <https://www.itu.int/ITU-R/go/space-software/en> or from the BR IFIC (Space) DVD: <https://www.itu.int/en/ITU-R/space/Pages/brificMain.aspx>
- vii. Registration to e-submissions of satellite networks filing: <https://www.itu.int/ITU-R/go/space-submission>