
Interference Management Procedures

Relevant to

International Coordination

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Introduction:

Due to frequency spectrum is a limited natural resource it is often that two or more radiocommunication services have to use the same frequency band, in which case the concerned allocations are called “shared frequency bands”. The principle of sharing is applied to enable efficient and effective operation of all radiocommunication services bearing in mind the radio frequency bands so they have to be used rationally, efficiently and economically.

Satellite systems are key communication tools that are increasingly in demand from a large and growing number of requirements, such as fixed, mobile, broadcasting, amateur, space research, emergency telecommunications, meteorology, global positioning systems, environmental monitoring and a host of other communication services.

In recent years, an increasing number of cases of harmful interference have emerged, including deliberate ones with the intention of disturbing or preventing the reception of signals, which particularly affect telecommunication satellites.

A primary objective of International Telecommunication Union (ITU) is to ensure interference-free operations of radio communication systems. This has been emphasized at World Radio Communication Conferences, as citizens of every country around the world depend on terrestrial and space Radiocommunication systems for the provision of reliable telecommunication and broadcast services.

Therefore, 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 Members or of recognized operating agencies, or of other duly authorized operating agencies which carry on a radio service. (No. 197 of the Constitution) However, there are many possible causes for interference beyond our control, such as natural atmospheric conditions.

NTRA is committed with the following mandates according to law no. 10 of 2003:

- Guaranteeing the optimum usage of the frequency spectrum and increasing its returns according to the provisions of this Law.
- Guaranteeing the compliance of the effective international agreements and resolutions issued by the international and regional organizations related to telecommunication, which are approved by the State.

- Monitoring the realization of the technical and economic efficiency programs for different Telecommunication Services.

Interference categories in the RR:

According to radio regulations (RR 1.166 to RR 1.169), there are different types of interference, which are defined as follows:

- **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.

- **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.

- **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.

- **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.

Generally, Interference to radio-communication services is considered harmful if:

- It creates danger, or risks of danger, in relation to the functioning of any service provided by means of radiocommunication for the purposes of navigation or otherwise for safety purposes

- It degrades, obstructs or repeatedly interrupts anything which is being broadcast or otherwise transmitted by means of radiocommunication and in accordance with a license, or a grant of recognized spectrum access or otherwise lawfully from NTRA.

Interference mitigation mechanisms:

There are five Mechanisms to control interference and ensure equitable access for the satellite system in accordance with Radio Regulations as follow:

1. Allocation:

It reveals to Frequency separation of stations of different services to avoid the interference between the different frequency bands. (ARTICLE -5).

Services are listed either in the Table of Frequency Allocations of Article 5 of the RR or in one of the footnotes to Article 5. The allocated services can have either primary or secondary category of service. Depending on the geographical area, allocations could be divided into three different categories: worldwide, regional or sub-regional allocations.

- **Worldwide primary service:**

In the case of worldwide primary service allocations, they can be used in designated frequency bands throughout the whole world subjected to the relevant conditions applicable to sharing with other services.

- **Regional allocations:**

In the case of regional allocations, services used only in one of the Regions indicated in the Table of Frequencies of Article 5, as for example in the band 2 010 MHz to 2 025 MHz; in this case only the terrestrial services from Region 2 are subjected to the relevant conditions applicable to sharing with space services

- **Sub-regional allocations**

Sub regional allocations are usually allocated to services by means of the footnote of Article 5 of the RR. In cases like this, services can be used only in the geographical area indicated in the relevant footnote. In addition, if these allocations are shared with the other services, the services are also subjected to the relevant conditions applicable to sharing with space services.

In addition, there are also several terrestrial allocations with a lower (secondary) category of service, such as the one defined in footnote No. 5.514 for the frequency band from 17.3 GHz to 17.7 GHz. In this case, terrestrial services shall neither cause harmful interference to, nor claim protection from space services, and in addition, they are subjected to power limits intended to ensure the required protection to the space services.

2. Power limits:

The power limits are an effective technique to avoid the harmful interference between the different services via limitation the power transmitted from any station. Therefore, the radio regulations state some of power limitations to avoid the harmful interference scenarios between different stations as follow:

I. Power flux density (PFD) limit:

It is considered the amount of power flow through a unit area within a unit bandwidth. The units of power flux density are those of power spectral density per unit area, namely watts per hertz per square meter. These units are generally expressed in decibel form as dB (W/Hz/m²), dB (W/m²) in a 4 kHz band, or dB (W/m²) in a 1 MHz band. Moreover, it is necessary limit to protect the terrestrial services from space services (Article-21).

II. Effective Isotropic Radiated Power (EIRP) limit:

It is considered the measured radiated power of an antenna in a specific direction. It is also called Equivalent Isotropic Radiated Power. It is the output power when a signal is concentrated into a smaller area by the Antenna. The EIRP (in dB) can take into account the transmitted power, the losses in transmission line, connectors and includes the gain of the antenna. Moreover, it is necessary limit to protect the space services from terrestrial services (Article-21 / Article-22).

III. Equivalent Power Flux Density (EPFD) limit:

EPFD stands for the Equivalent Power Flux Density and is defined in Article 22.5C.1 of the Radio Regulations. Whereas Non-GSO satellite networks wishing to operate in parts of C, Ku and Ka band must meet interference thresholds in the Radio Regulations defined using the Equivalent Power Flux Density (EPFD) metric. Moreover, it is necessary limit to protect the GSO satellites from NGSO systems (Article-22).

3. Coordination:

One of the main purposes of the international radio regulatory procedures is to enable implementation of new radiocommunication systems while avoiding harmful interference with the other existing and planned users. The coordination process is the most important stage to allow for the notified administration to record the satellite network, and it include negotiation between the notified administration and the affected administration to avoid any interference during the operation from the incoming network with operated networks. (ARTICLE -9).

For this reason, the procedure for coordinating the use of frequencies in the non-planned bands represents the basic element of the international radio regulatory arrangement. To facilitate the coordination process, both the RR and ITU-R Recommendations provide additional help and guidance to administrations.

- **Special Agreements**

To achieve shared use of the spectrum, administrations need to coordinate among themselves the frequency assignments with the aim of avoiding interference with other both existing and planned services.

The provisions of Article 6 of the RR stipulate, among other things, that if two or more Member States coordinate the use of individual frequencies in the frequency bands covered by Article 5 before notifying the frequency assignments concerned, they shall in all appropriate cases inform the Bureau of such coordination.

- **Terms and provisions for coordination in RR**

I. Special terms

With respect to coordination with terrestrial stations in frequency bands shared with space services there is some important terms such as:

- **RR 1.171 Coordination area:** When determining the need for coordination, the area surrounding an earth station sharing the same frequency band with terrestrial stations or surrounding a transmitting earth station sharing the same bi-directionally allocated frequency band with receiving earth stations, beyond which the level of permissible interference will not be exceeded and coordination is therefore not required.

- **RR 1.172 Coordination contour:** The line enclosing the coordination area.
- **RR 1.173 Coordination distance:** When determining the need for coordination, the distance on a given azimuth from an earth station sharing the same frequency band with terrestrial stations, or from a transmitting earth station sharing the same bi-directionally allocated frequency band with receiving earth stations, beyond which the level of permissible interference will not be exceeded and coordination is therefore not required.

The term permissible interference, that is used in the coordination of frequency assignments between administrations, refers to the observed or predicted interference which complies with quantitative interference and sharing criteria contained in the RR or in ITU-R Recommendations or in special agreements (See No. 1.167 of the RR).

II. Particular RR provisions in shared frequency bands

Article 9: provides in its Section II the procedure for effecting coordination. Coordination of terrestrial services in the shared frequency bands shall be effected with other administrations for the cases described in the following provisions:

- **No. 9.16:** for a transmitting station of a terrestrial service for which the requirement to coordinate is included in a footnote to the Table of Frequency Allocations referring to **No. 9.11A** and which is located within the coordination area of an earth station in a non-geostationary-satellite network.
- **No. 9.18:** For any transmitting station of a terrestrial service in frequency bands above 100 MHz allocated with equal rights to space and terrestrial services within the coordination area of an earth station, in respect of this earth station, with the exception of the coordination under **Nos. 9.16** and **9.19**.
- **No. 9.19:** For any transmitting station of a terrestrial service or any transmitting earth station in the fixed-satellite service (Earth-to-space) in a frequency band shared on an equal primary basis with the broadcasting-satellite service, with respect to typical earth stations included in the service area of a space station in the broadcasting-satellite service.
- **No. 9.21:** For any station of a service for which the requirement to seek the agreement of other administrations is included in a footnote to the Table of Frequency Allocations referring to this provision (such as footnotes **Nos. 5.410** and **5.447**).

Furthermore, the Rules of Procedure define how the provisions Nos. 9.18, 9.19 and 9.21 shall be applied.

The coordination procedure of **No. 9.18** is to be applied only in frequency bands allocated to a space service in the direction space-to-Earth, i.e., when transmitting terrestrial stations are inside the coordination area of a receiving earth station for which coordination under **No. 9.17** has already been initiated and, in the case, where both services have the same category of allocation. The coordination between receiving terrestrial stations and transmitting earth stations is done only when the transmitting earth station is coordinated in application of **No. 9.17**. Once that coordination is initiated an administration wishing to operate terrestrial stations within the coordination area of the transmitting earth station can evaluate the level of interference that its station may receive and decide by itself whether to proceed or not with the implementation of its terrestrial stations.

The provision **No. 9.19** relates to the requirements of coordination between transmitting terrestrial stations and transmitting earth stations in the FSS (Earth-to-space) with respect to typical BSS earth stations. For terrestrial assignments in the frequency bands shared with planned BSS, all necessary criteria and procedures are defined in **Appendices 30 and 30A**.

To date, there is no ITU-R Recommendation defining the power flux-density level produced by the terrestrial stations at the edge of the service area of non-planned BSS to be used for triggering the coordination. Until such time that, a calculation method and technical criteria are included in the relevant ITU-R Recommendations, in applying this provision, for the identification of the affected administration.

In addition to the frequency overlap examination, the Bureau also uses, the distance from the location of the terrestrial station to the national border of any country included in the service area of the BSS assignment less than 1 200 km (see **Rule of Procedure (RoP) Part A1** with respect to **provision No 9.19**).

It is necessary to state that coordination referred in **Nos. 9.16, 9.18 and 9.19** is to be used in direct coordination between administrations. After completion of coordination, the administration can notify the Bureau of the terrestrial station, with indication of administrations with which the coordination has been effected.

The frequency assignments to be taken into account in effecting coordination are identified using the principles of **Appendix 5** to the **RR**.

4. Recording

The frequency assignments, which have succeeded coordination have been recorded in MIFR in ITU and these assignments gain the required international recognition. These assignments are protected from the incoming new frequency assignments. There are two types of examinations applicable to an assignment notified in shared frequency bands between space services and terrestrial services:

- **Regulatory examination:**

Complete notices of frequency assignments to terrestrial stations in the shared frequency bands are examined, by the Bureau, with respect to their conformity with the Table of Frequency Allocations including the successful application of No. **9.21**, when necessary, and with the other provisions of the RR which are identified and included in the Rules of Procedure (Provision No. **11.31** of the RR);

- **Coordination examination:**

The notices are also examined with respect to their conformity with the procedures relating to coordination with other administrations applicable to the radiocommunication service and the frequency band concerned (Provision No. **11.32** of the RR).

NOTE 1: When both examinations result in a favorable finding, the assignment is recorded in the Master Register indicating the administrations with which the coordination procedure has been completed.

NOTE2: When one of the findings is unfavorable, the notice is returned to the notifying administration, with an indication of the appropriate action (Provision No. 11.37 of the RR).

5. Monitoring:

The purpose of spectrum monitoring is to support the spectrum management process, in general, including frequency assignment and spectrum planning activities. Monitoring is closely associated with inspection and compliance in that it enables to:

- a. Assist in the resolution of electromagnetic spectrum interference, whether on a local, regional or global scale
- b. Detect and identify illegal transmitters
- c. Verify the proper technical and operational characteristics of emissions
- d. Assist in ensuring an acceptable quality of radio-communication services, especially for security services
- e. Provide valuable monitoring data to an administration's electromagnetic spectrum management process concerning:
 - The actual use of frequencies and bands (e.g., channel occupancy and band congestion)
 - The effectiveness of spectrum management policies
- f. Provide valuable monitoring information for programs organized by the Bureau by participating in the International Monitoring System (IMS)

Interference Management Procedures

- A Licensee making a complaint of interference (“the Complainant”) is required to provide details of the interference as detailed above. Localizing the source of interference is a challenging task. NTRA Will use all possible means to localize the source of interference. However, for certain types of emissions and moving sources of interference, the interference localization can take longer monitoring sessions involving more than one monitoring station.
- The Complainant will assist NTRA where possible to complete this task. NTRA will specify the extent of support required depending on the requirement. In certain cases, such support may be limited to access to the Complainant’s network or system.
- The Complainant is required to provide details of the periodicity and levels of interference. This information is required for allocation of the monitoring resources and conduct monitoring session.
- In some cases, cooperation agreement between ITU and administrations having monitoring facilities part of the international monitoring system (IMS) will be needed. This would allow measurements to be performed in relation to cases of harmful interference for which an administration is seeking the assistance of ITU under Article 15, No. 13.2 of the Radio Regulations, and in cases of reported interference arising from coordination issues (No. 11.41).
- To detect the source of interference to satellite services NTRA could perform radio frequency monitoring to identify and localize the source of interference. This could require an inspection on the facilities of the licensee.

Case A: Source of interference within the Egyptian territory:

Case B: Source of interference outside the Egyptian territory.

Case A: Source of interference within the Egyptian territory:

1. NTRA may carry out the inspection of sites reasonably suspected as a source of interference.
2. Interfering license will be required to provide a written explanation for such case within three (3) calendar days from date of detection.
3. NTRA shall determine if the Interfering User's violation was willful or whether it occurred due to reasons beyond the control of the Interfering User.
4. In the event of willful violations by an Interfering User, the NTRA will initiate action against the Interfering User according to national telecommunication law and granted license/Approval to user.

Case B: Source of interference outside the Egyptian territory.

1. The Complainant are required to provide NTRA with information indicated in **Annex (1)** where possible to complete this task.
2. NTRA will send to the administration responsible for the station causing the harmful interference (Administration B) full particulars relating to the harmful interference in the form indicated in Appendix 10 (RR15.27).
3. Administration B shall investigate the matter and take action in order to eliminate the harmful interference if it is confirmed that the interfering station is located on its territory.
4. Immediate reaction of Administration B (in terms of investigation, remedial action and response to the administration responsible of the station affected) is required when one of its stations is causing harmful interference to a safety service (RR11.37/RR.15.28).
5. If the cooperation between NTRA and other administration has not produced satisfactory results, NTRA may forward details of the case to the BR for its information (RR15.41).

6. In such a case, a request of assistance may also be sent to the BR with all the technical and operational details and copies of the correspondence (RR15.42).
7. The BR studies all details related to the interference case.
8. If necessary, the BR may also request the cooperation of stations on the International Monitoring List that may be able to help in identifying the source of harmful interference.
9. The Bureau will forward to the two administrations its findings and recommendations for the solution of the problem.
10. If the harmful interference persists, the Bureau prepares a report for consideration by the Radio Regulations Board.
11. The Bureau transmits the decisions of the Board to the administrations concerned.

Annex (1)

Data required for informing any interference scenario

Stations Causing Interference	
Station type	
Associated ITU Satellite Name(s)	
Orbital Longitude (in case of space station)	
Class of Station	
Location ((in case of earth station)	
Polarization	
Administration(s) having jurisdiction	
Measured frequencies	
Class of Emission	
Bandwidth	
Field Strength or Power Flux Density of Interfering Carrier	
Date of interference	
Type of carrier	
Source	
Interfering station (Affected station)	
Station type	
Direction	
Name	
Orbital Longitude (in case of space station)	
Location ((in case of earth station)	
Administration	
Associated ITU name	
Associated Polarization	
Class of emission	
Affected Frequency Assignments	
Assigned frequency	
Bandwidth	
Polarization	
Service	
Class of emission	
Field Strength or Power Flux Density of Wanted carrier	
Facility which made the above measurements	