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Orbit/Spectrum International Regulatory Framework

Challenges in the 21st century

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During the last 50 years, from the Administrative Radio Conference in 1963 and up to and including the last World Radiocommunication Conference, in 2012 (WRC-12), many ITU conferences have addressed the regulation of spectrum/orbit usage by stations of the space radiocommunication services. The ITU Member States have established a legal regime which is codified through the Constitution/Convention, including the Radio Regulations. These instruments contain the main principles and lay down the specific regulations governing the following major elements:

- frequency spectrum allocations to different categories of radiocommunication services;
- rights and obligations of Member administrations in obtaining access to the spectrum/orbit resources;
- international recognition of these rights by recording frequency assignments and, as appropriate, orbital positions used or intended to be used in the Master International Frequency Register (MIFR) or by their conformity, where appropriate, with a plan.

The above regulations are based on the main principles of efficient use of and equitable access to the spectrum/orbit resources laid down in No. 196 of the ITU Constitution (Article 44).

Specific procedures have been established to ensure international recognition of the frequencies used and to safeguard the rights of administrations when they comply with those procedures.

The ITU Constitution and Convention (<http://www.itu.int/pub/S-CONF-PLN-2011>) and the Radio Regulations (RR) (<http://www.itu.int/pub/R-REG-RR-2012>) that complement them are *intergovernmental treaties ratified by governments* meaning that those governments undertake:

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- to apply the provisions included in the above instruments in their countries; and
- to adopt adequate national legislation that includes, as the basic minimum, the essential provisions of this international treaty.

1. Major Principles

In the process of establishing the ITU's space-related regulations, emphasis was laid from the outset on **efficient, rational and cost-effective utilization** of the orbit and spectrum resources. This concept was implemented through a "first come, first served" procedure. This procedure ("coordination before use") is based on the principle that the right to operate frequencies for a satellite at the geostationary-satellite orbit (GSO) or other orbits is acquired through negotiations with the *administrations concerned* by actual usage of the same portion of the frequencies and orbital segment. If applied correctly (i.e. to cover genuine requirements), the procedure offers a means of achieving efficient spectrum/orbit management. On the basis of the RR, and in the frequency bands where this concept is applied, Member administrations designate the volume of orbit/spectrum resources that is required to satisfy their *actual requirements*. It then falls to the national administrations to assign frequencies and orbital positions, to apply the appropriate procedures (international coordination and recording) for the space segment and earth stations of their (governmental, scientific, commercial or non-commercial, public and private) networks, and to assume continuing responsibility for the networks. The progressive exploitation of the orbit/frequency resources and the resulting likelihood of congestion of the GSO prompted ITU Member countries to consider more and more seriously the question of **equitable access** in respect of the orbit/spectrum resources. This resulted in the establishment (and introduction into the ITU regulatory regime) of frequency/orbital position plans in which a certain amount of frequency spectrum is set aside *for future use by all countries*, particularly those which are not in a position, at present, to make use of these resources. These plans, in which each country has a predetermined orbital position associated with the free use, at any time, of a certain amount of frequency spectrum, together with the associated procedures, guarantee for each country equitable access to the spectrum/orbit resources, thereby safeguarding their basic rights. Such plans govern a part of the frequency bands available for the space communication services.

2. Regulations applying to the use of frequencies and orbits by satellite networks

The specific procedures setting out the rights and obligations of the administrations in the domain of orbit/spectrum management and providing means to achieve interference-free (...or controlled) radiocommunications have been laid down by successive WRCs on the basis of the two main principles referred to above: efficient use and equitable access. In order to put these

principles into effect, two major mechanisms for the sharing of orbit and spectrum resources have been developed and implemented:

- A *a priori* planning procedures (guaranteeing *equitable access* to orbit/spectrum resources for *future use*), which include:
 - the Allotment Plan for the fixed-satellite service using part of the 4/6 and 10 - 11/ 12 - 13 GHz frequency bands contained in Appendix 30B;
 - the Plan for the broadcasting-satellite service in the frequency band 11.7 - 12.7 GHz (Appendix 30) and the associated Plan for feeder links in the 14 GHz and 17 GHz frequency bands (Appendix 30A).
- Coordination procedures (with the aim of *efficiency* of orbit/spectrum use and interference-free operation satisfying *actual requirements*), which include:
 - geostationary-satellite networks (in all services and frequency bands) and non-geostationary-satellite networks in certain frequency bands governed by No. 9.11A procedure, which are subject to advance publication and coordination procedures;
 - other non-geostationary-satellite networks (all pertinent services and certain frequency bands), for which only the advance publication procedure is required before notification.

3. Coordination procedures applying to non-planned services

Coordination procedures are contained in Article 9 of the RR “Procedure for effecting coordination with or obtaining agreement of other administrations”. This article contains all elements of the procedures as well as refers to the provisions of Article 7 of Appendix 30 for the coordination of the fixed-satellite service (FSS) and the broadcasting-satellite service (BSS) in the 11.7 - 12.7 GHz band and the application of Article 7 of Appendix 30A for the coordination of the fixed-satellite service (space-to-Earth and Earth-to-space) and broadcasting-satellite service with frequency assignments to feeder links for broadcasting-satellite stations. Associated with the Article 9 are also Appendix 4, which specifies the various data that must be furnished in any advance publication or coordination request and Appendix 5, that contains criteria for identification of administrations with which coordination is to be effected or agreement sought. The coordination procedure is based on the principle of “first come - first served”. Successful coordination of space networks or earth stations gives an international recognition to the use of frequencies by these networks/stations. The relevant provisions involve three basic steps:

- advance publication (Section I, Article 9);
- coordination (Section II, Article 9);

- notification (Article 11).

4. Notification and recording (Article 11 of the RR)

The procedure for notification and recording of space network frequency assignments in the Master International Frequency Register (MIFR) is described in Article 11 of the Radio Regulations. The MIFR represents one of the pillars of the international radio regulatory set-up as it contains *all frequency usage notified to ITU*. It should be consulted before selecting a frequency for any new user. For these reasons, *notification of frequency assignments to the Bureau, with a view to their recording in the MIFR, represents an important obligation for administrations, especially in respect to those frequency assignments that have international implications.*

5. The BSS and associated feeder-link plans and lists procedures (Appendices 30 and 30A)

Appendices 30 and 30A to the Radio Regulations contain Plans for the broadcasting-satellite service (BSS) in the 12 GHz band and the associated feeder-link Plans in the fixed-satellite service (FSS) in the 14 and 17 GHz bands. These Plans are occasionally referred to as the “BSS and the associated feeder-link Plans” and were established with a view to facilitating equitable access to the geostationary-satellite orbit (GSO) for all countries. In Regions 1 and 3 there are also the Lists of additional uses, which are separated from the Plans and annexed to the Master International Frequency Register (MIFR).

6. The FSS plan and its associated procedures (Appendix 30B)

Appendix 30B of the Radio Regulations contains the Plan for the fixed-satellite service (FSS) in the 6/4 GHz frequency bands and in the 13/10-11 GHz frequency bands. This Plan is also referred to as the “FSS Plan” and was established with a view to facilitating equitable access to the geostationary-satellite orbit (GSO) for all countries.

The FSS Plan covers the following frequency bands:

- 4 500-4 800 MHz (space-to-Earth);
- 6 725-7 025 MHz (Earth-to-space);
- 10.70-10.95 GHz (space-to-Earth);
- 11.20-11.45 GHz (space-to-Earth);
- 12.75-13.25 GHz (Earth-to-space),

resulting in a total bandwidth of 800 MHz in each direction.

7. Administrative due diligence (Resolution 49 (WRC-12) and resolution 552 (WRC-12))

7.1 Following one of the recommendations in the report by the Director of the BR on Resolution 18 (Kyoto, 1994), WRC-97 adopted Resolution 49,

which has been modified by subsequent WRCs, on the administrative due diligence applicable to some satellite communication services as a means of addressing the problem of reservation of orbit and spectrum capacity without actual use. This resolution will apply to any satellite network of the fixed-satellite service, mobile-satellite service or broadcasting-satellite (except in the 21.4-22 GHz band) service in frequency bands subject to coordination under Section II of Article 9, as well as modifications of the Appendices 30 and 30A Plans and additional uses in the Appendix 30B planned services.

7.2 Resolution 552 (WRC-12) contains due diligence procedure for BSS in the band 21.4-22 GHz. The Resolution is entitled “Long term access to and development in the band 21.4-22 GHz in Region 1 and 3”. The content of this resolution is similar to Resolution 49 with however new data elements required to be submitted by administration listed in Annex 2 to the resolution. Under this resolution administrations have to submit due diligence information not only when the space station is brought into use for the first time but also submit information about any further change, like deorbiting of the satellite or moving of the satellite to another orbital location. Further, this Resolution requires ITU to provide an ITU-ID for each of physical satellite network brought into use in this band and this satellite ID remains same for the life time of the satellite irrespective of the orbital location of the satellite or its responsible administration till it is deorbited.

8. Cost Recovery

In accordance with **Resolution 88 (rev Marrakech, 2002)** of the Plenipotentiary Conference and Council **Decision 482**, cost recovery is to apply to satellite network filings received by the Bureau after 7 November 1998. Additionally the WRC-03 and WRC-07 adopted provisions referring to **Decision 482**, as amended, under which a satellite network filing is cancelled if payment is not received in accordance with the provisions of this decision.

The cost recovery for satellite network filings is consistent with the general principles for cost recovery adopted in **Resolution 91 (Minneapolis, 1998)**, in particular *resolves* 4 and the need to ensure that no more than the actual costs of providing products and services are recovered: <http://www.itu.int/ITU-R/go/space-cost-recovery/en>

9. Pico, Nano and small Satellites

There is no regulatory definition for small satellites. The ITU Radio Regulations recognize only geostationary and non-GSO satellites. During WRC-12, the conference considered that nanosatellites and picosatellites might require regulatory procedures which take account of the short development cycle, the short lifetimes and the typical missions of such satellites. Through Resolution 757 (WRC-2012) “Regulatory aspects for nanosatellites and picosatellites”, the

conference requested the ITU-R to examine the procedures for notifying space networks and consider possible modifications to enable the deployment and operation of nanosatellites and picosatellites, taking into account the short development time, short mission time and unique orbital characteristics.

Small satellites are commonly described as:

- ranging in mass from 0.1 to 10 kg and measuring less than 0.5 m in any linear dimension, with physical characteristics that differ from those of larger satellites;
- typically a short (1-2 years) development time and low cost, often using off-the-shelf components;
- an operational lifetime ranging from several weeks up to a few (< 5) years depending on their mission;
- being used for a wide variety of missions and applications, including remote sensing, space weather research, upper atmosphere research, astronomy, communications, technology demonstration and education, as well as commercial applications, and therefore may operate under various radiocommunication services;
- typically launched as secondary payloads;
- for some missions requiring simultaneous launches and operation of several such satellites in formation or as a constellation;

Currently, many nanosatellites and picosatellites use spectrum allocated to the amateur satellite service and the MetSat service in the frequency range 30-3 000 MHz and have limited orbit control capabilities.

Small satellites challenge matrix

Source	Effect	Concern
Launch as piggyback	Orbital elements are not known until late in the satellite system design	More specific orbital elements may be needed for frequency coordination
No thrusters	Uncontrolled orbital changes during satellite operation, inability to hold exact orbital position	Movement of radiation pattern with time (most of satellite uses omnidirectional antennas)
Short development process	Specific spectral parameters desirable at the beginning of design process that could be difficult to change later on	Too lengthy coordination

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Source	Effect	Concern
Low onboard power	Low RF transmission power	Still has potential for interference due to narrow bandwidth and resulting power spectral density
No or ineffective attitude control	Omni-directional antennas commonly used	Potential interference to other satellites in orbit and terrestrial systems

The ITU Radiocommunication Bureau recently organized a global Symposium to addresses regulatory requirements for small satellite communication systems with aim to ensure sustainable deployment of new generation of small satellites in outer space. For more information see: <http://www.itu.int/GO/ITU-R/Prague-2015>

10. Space Protocol

The **Space Protocol** is part of a family of international treaties beginning with the Convention on International Interests in Mobile Equipment and the Protocol on Matters specific to Aircraft Equipment, both opened to signature in Cape Town on 16 November 2001. The Space Protocol is an instrument designed to facilitate asset-based financing for the acquisition and use of space assets, such as satellites and transponders that move beyond frontiers.

Under an international legal framework of **asset-based financing**, a creditor could enforce its rights against the equipment in the event of default by the debtor. Under the current legal regime, it is the law governing the location of the equipment that will normally decide questions regarding the validity, priority ranking and enforcement of security and leasing rights in such equipment. However, there is currently no applicable law governing the location of equipment in space. From the viewpoint of a lender, this situation makes the risks of asset-based financing less acceptable.

The Space Protocol is establishing the legal foundation for the creation, priority ranking and enforcement of security and leasing rights in space-based equipment. One of the key features of the Space Protocol is the creation of an **international registry for space assets** in which those rights may be registered. The Registry would determine priority among rights on the basis of the first-come, first-served principle to give lenders a degree of legal certainty relating to asset-based financing. The Registry would be operated and administered by the Registrar on a twenty-four hour /seven days a week basis.

The Supervisory Authority would oversee the operation of the Registry by the Registrar. In particular, it would nominate and dismiss the Registrar, monitor its activities, establish regulations in relation to the functioning of the Registry after approval by Contracting States and would be assisted by a commission of experts nominated by Signatory and Contracting States. It would determine and periodically review the structure of fees for the Registry's services.

The Space Protocol: progress and outcomes

Pursuant to Resolution 1 of the diplomatic Conference for the adoption of the draft Protocol to the Convention on International Interests in Mobile Equipment on Matters specific to Space Assets (Berlin, 27 February - 9 March 2012), a Preparatory Commission (1st Session, UNIDROIT Rome, 6-7 May 2013, 2nd Session, UNIDROIT Rome, 27-28 January 2014, 3rd Session, UNIDROIT Rome, 11-12 September 2014) was set up to act as Provisional Supervisory Authority for the establishment of the International Registry for Space Assets under the guidance of the UNIDROIT General Assembly: <http://www.unidroit.org/work-in-progress-studies/current-studies/space-prepcom>

➤ Draft implementation schedule:

- **2015-2016:** Completion of the Regulations for the International Registry for Space Assets/ Selection of the Registrar;
- **2016:** Determination of the fees for use of the Registry facilities, establishment of a Commission of experts to assist the Commission in the discharge of its function;
- **2017:** Preparatory Commission would act with full authority as Provisional Supervisory Authority for the establishment of the International Registry for Space Assets, pending the entry into force of the Protocol and the definite choice of the Supervisory Authority.
- **2017:** Formal request to ITU to become the Supervisory Authority of the International Registration System for Space Assets.

ITU's role as Supervisory Authority of the future international registration system for Space Assets under the Space Protocol has been discussed since 2011 within the organization. In that regard, the **2014 session of the ITU Plenipotentiary Conference** agreed that “[the ITU] Council continue to monitor any further development on this matter, and that the Secretariat continue to express interest in ITU becoming the Supervisory Authority and respond to any questions raised by the Member States between now and the next Plenipotentiary Conference.” noting that the matter of whether or not ITU could become the Supervisory Authority should not be prejudged at the current stage <http://www.itu.int/en/ITU-R/space/Pages/spaceAssets.aspx>

11. Conclusion

“With a concerted effort, we can reduce, and to the extent possible remove, all obstacles impeding the development and bringing into operation of new satellite networks. I would invite everybody to think carefully about how we can continue to use and improve satellite access to help connect the unconnected, and make the world a better and a fairer place for all”

