



The International Amateur Radio Union

Since 1925, the Federation of National Amateur Radio Societies
Representing the Interests of Two-Way Amateur Radio Communication

AMATEUR RADIO SATELLITES

*INFORMATION FOR DEVELOPERS OF SATELLITES
PLANNING TO USE FREQUENCY BANDS
ALLOCATED TO
THE AMATEUR-SATELLITE SERVICE*

I. INTRODUCTION: SUCCESSFUL SATELLITE PROJECTS.

[Radio frequency](#) (RF) planning at the beginning of your project means:

- fewer design changes,
- lower project costs, and
- **a greater chance of your project succeeding!**

Careful and detailed mission planning — particularly [Radio](#) frequency planning — gives satellite projects the best chances of success. Working out [space station](#) and [Earth station](#) operating frequencies and link operating parameters at the very beginning of the design process means:

- Communication links will work because the link budget is planned to be adequate for the mission;
- Antenna gain, physical size(s), placement(s), and pointing accuracy (if needed) will be adequate for the mission;
- Transmitter power requirements, emission, and coding types will be selected for efficiency and performance;
- Receiver design will be selected for sensitivity, bandwidth, and susceptibility to interference so that it will perform adequately for the mission; and
- Space station power generation and storage will be adequate for the mission.

To help you throughout this document, click on [highlighted terms](#) to see the definition or reference. Citations indicated in square brackets “[]” are explained in [Annex II](#).

This document shows explanations and definitions of important frequency management issues to help you through the beginning of RF planning. Important topics include:

- Treaty basis for worldwide radio regulation
- Special frequency management terms and definitions
- Frequency coordination process
 - Amateur service and amateur-satellite service station coordination
 - Starting the frequency coordination process
 - IARU frequency coordination assistance
 - International frequency planning requirements
- Operational guidelines
 - Positive transmitter control
 - Purposes of amateur satellites
 - Station control
 - Multi-service satellites
 - Permissible communication
 - Open access
 - Broadcasting (not permitted!)
- Review of mission plans and service options

No doubt, radio frequency planning seems involved and full of details.

But, keep in mind that Earth stations and space stations must take into account other users of the radio spectrum and the laws of physics.

When you plan accordingly, your project likely will work!

II. PARTICIPATING AMATEUR ORGANISATIONS

Radio frequency planning information in this document comes from the [International Amateur Radio Union \(IARU\)](#) supported by amateur satellite organisations worldwide. National amateur radio societies established the IARU as their worldwide federation in 1925. For more information about the IARU, see: <http://www.iaru.org/>.



The Radio Amateur Satellite Corporation (AMSAT®) is a non-profit scientific and educational corporation chartered in the District of Columbia (USA) in 1969. (Both the name "AMSAT" and its familiar globe and arrow symbol are trademarks of the Radio Amateur Satellite Corporation registered with the US Patent & Trademark Office.) For more information about AMSAT, see: <http://www.amsat.org>. Often, the original AMSAT organisation is known as **AMSAT-NA**, with NA standing for "North America."



Since the formation of AMSAT in the United States of America, many amateur radio satellite organisations have been formed in other countries. See: <http://www.amsat.org/amsat/others/menu.html> for a listing of amateur satellite organisations and contacts worldwide.

Designing and building spacecraft to operate in the amateur-satellite service is a major activity of amateur satellite organisations. Projects are carried out by amateur resources, often with industry support, or in cooperation with other organisations with similar aims. Radio amateurs throughout the world and educators and students everywhere value these products of amateur radio operators.

IARU works closely with amateur satellite organisations throughout the world in many ways. Among these are the IARU International Satellite Forum and the [IARU Satellite Advisor](#).

III. TREATY BASIS FOR RADIO REGULATION



Member States [countries] of the [International Telecommunication Union \(ITU\)](#) obligate themselves to maximise the use of the radio frequency spectrum and to minimise interference through a treaty called the International Telecommunication Convention. Annexed to the Convention are administrative regulations, known as the [Radio Regulations](#), which have the same treaty status as the Convention itself.

The Convention and the [Radio Regulations](#) form the international legal basis used by [administrations](#) to regulate the [amateur service](#), the [amateur-satellite service](#), and all other [radiocommunication services](#).

Each [administration](#) implements its treaty obligations using its domestic laws, rules, and regulations.

For more about the ITU, see: <http://www.itu.int>.

Many of the Radio Regulations and other important documents relating to radio frequency management are on-line. See the web site provided by the International Amateur Radio Club (4U1ITU) in Geneva. See: [Annex II](#).

IV. TERMS AND DEFINITIONS

Many words used here may seem familiar. However, *in the context of frequency management, these same words have very specific meanings established by Treaty*. They are honoured by administrations and operating agencies worldwide.

Always use the Treaty terms as defined, to avoid confusion. Do NOT assume the definition of a word or make up a new definition!

Always cite frequencies by the numbers, to avoid confusion. Do NOT use letter band designations. They are neither recognized by Treaty nor defined by world standards organisations.

Here are two very important definitions used frequently throughout this paper.

"Amateur Service: A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest." [RR 1.56]

"Amateur-Satellite Service: A radiocommunication service using space stations on Earth satellites for the same purposes as those of the amateur service." [RR 1.57]

Many more important frequency management terms and definitions are in [Annex I](#) and in specific parts of the [Radio Regulations: Article 1 - Terms and definitions](#), [Article 2 - Nomenclature](#), and [Appendix S1 - Designation of emissions](#).

V. INTERNATIONAL FREQUENCY COORDINATION

A. Frequency coordination among amateur stations and amateur-satellite stations.

Coordination is the process of communicating with other [radio](#) users to minimise the chances of causing [interference](#) to or receiving [interference](#) from other [amateur stations](#) and [amateur-satellite stations](#).

In practice, many different and, often, incompatible operations are conducted in frequency bands [allocated](#) to the [amateur service](#) and [amateur-satellite service](#). **Nevertheless, amateurs are expected to coordinate uses of frequencies among themselves.**

Radio signals from satellites necessarily propagate into many countries, making world-wide frequency coordination necessary for a successful project.

Guiding the coordination process are [band plans](#) drawn up by cooperating amateur radio organisations. Band plans, as agreed to by the [national amateur radio societies](#), are recommended by IARU.

Coordinating frequencies for amateur-satellite stations works best when using (1) your [national amateur satellite organization](#), (2) your [national amateur radio society](#), and (3) the [IARU Satellite Advisor](#).

B. Starting the frequency coordination process

Start the frequency coordination process as soon as possible!

Knowing the frequencies to use *from the beginning* means stable designs for receivers, transmitters, and antennas. Knowing frequencies *before* committing to finished designs saves time, money, and improves the chances of a project working the way you want.

Begin by contacting your [national amateur satellite organisation](#). If none is available, then, contact the [IARU Satellite Advisor](#) directly. You should also contact your [national amateur radio society](#).

C. IARU Frequency Coordination Assistance



The [IARU Satellite Advisor](#) assists in planning [space telemetry](#), [space telecommand](#), and operating frequencies for best results. Other amateur radio satellites and terrestrial operations around the world are taken into account.

The IARU Satellite Advisor works closely with an Advisory Panel, a small committee of experienced amateur radio operators drawn from every [Region](#) of the world.

D. International Requirements

Frequency bands [allocated](#) to the [amateur-satellite service](#) are listed in [Annex III](#). Many bands are shared with other services or have other limitations. Amateur band plans exist for many frequency allocations and should be observed. For more information on band plans, contact your [national amateur radio society](#) or the [IARU Satellite Advisor](#).

[Administrations](#) are required to notify the [ITU Radiocommunication Bureau \(ITU-R\)](#) about amateur-satellite

service [space stations](#) and plans for adequate [space telecommand](#) of satellite operation. See [RR 25.11](#) included in [Annex V](#).



Radiocommunication

If amateurs from more than one country are involved in a project, one country of license must be agreed upon so that only one [administration](#) communicates with the [Radiocommunication Bureau](#).

VI. OPERATIONAL GUIDELINES

Operational guidelines are based on [IARU](#) interpretations of the Radio Regulations and good amateur practice. They are intended to help in planning the missions, management, and control of satellites developed to operate in the amateur-satellite service.

A. Positive Transmitter Control

YOU MUST BE ABLE TO TURN OFF THE SPACE STATION TRANSMITTER IMMEDIATELY IN CASE OF INTERFERENCE. [See [RR 25.11](#) and [RR 22.1](#).] This requirement applies to all transmitters on Earth as well as in space.

In practice, the meaning of “immediate” probably varies a little, depending on the situation. If [interference](#) is caused to a [safety service](#), immediately means **NOW**: no more than minutes or a few tens of minutes. [Interference](#) to other services should be terminated in no more than a few hours.

We share the radio spectrum and must be good neighbours.

Positive transmitter turn-off signals should use an independent telecommand receiver on the space station. [Telecommand](#) on a user input frequency means that another transmitter can [interfere](#) easily with your [telecommand](#) signals so as to obstruct control.

An adequate network of well placed earth stations capable of sending control signals to the satellite reduces the time required to issue the turn-off command. Other mechanisms might be (1) a transmitter time-out timer which is completely independent of the normal housekeeping or control computer; or (2) limiting the space station's power budget so that it will run out of energy and stop operating in a reasonably short time.

Remember, we share the radio spectrum and should be good neighbours.

B. Purposes of an amateur satellite

The purposes of an amateur satellite should be to:

- (1) Provide communication resources for the general amateur radio community and/or
- (2) Self training and technical investigations relating to radio technique.
[See [RR 1.56](#), [1.57](#), and [25.2](#).]

"Radio technique" means having a reasonable possibility of application to radio communication systems. Examples relating to radio technique include, but are not limited to:

- communication protocols
- attitude determination methods
- command and control procedures
- receivers, transmitters, and transponders
- antennas
- sensors to study spacecraft performance
- telemetry protocols
- power controls and supplies for use in space
- spacecraft computers, memory, operating systems, programs, and related items
- radiation effects on electronic components
- radio wave propagation
- meteor trail reflection
- measurements of the orbital environment

An [administration](#) can reject whatever it decides is inappropriate use of the [amateur-satellite service](#) and questions may be raised by other [administrations](#) about the operation of a particular [station](#).

C. Station Control — who may operate a transmitter

All [stations](#) operating in the [amateur service](#) and the [amateur-satellite service](#), including [space stations](#) and [Earth stations](#), must be controlled by "duly authorised persons," that is, individual licensed amateur radio operators who must be acting "solely with a personal aim and without pecuniary interest." [See [RR 1.56](#) and [1.57](#)]

Even with these limitations, organisations and amateurs have common interests and work together for their mutual benefit. (For this discussion, an organisation can be a

university, research institute, for-profit or not-for-profit corporation, association, club, or other similar entity.)

AMSAT-NA, for example, is an organisation that owns and builds space stations to operate in the amateur-satellite service. However, because it is an organisation and not an individually licensed radio amateur, it may not control an [amateur station](#). Licenses under which AMSAT-NA owned amateur stations are operated may be issued in the name of an individually licensed amateur radio operator. They may also be issued in the name of an amateur radio club (in this case, AMSAT-NA itself) where a licensed amateur radio operator is named on the license as trustee (the person responsible) for the club station.

In every case, one individual, a licensed amateur radio operator who is neither employed nor paid by AMSAT-NA, is legally responsible for the operation of each [amateur station](#) or [amateur-satellite station](#).

Commonly, the licensee is an unpaid member of the organisation owning the amateur station equipment or is a volunteer acting in close association with it. In these cases, the owner's interest and the licensee's "personal interest" are usually the same.

Of course, it is theoretically possible (although to the best of our knowledge, it has never occurred in practice) that the licensee or trustee of an [amateur station](#) or [amateur-satellite station](#) may determine that something he or she is requested to do is not in accordance with the rules and regulations of the licensing [administration](#). If this happens, the licensee will inform the organisation and, if possible, they will work out a solution together that satisfies and protects both.

Thus, the individual responsibility of each licensed amateur radio operator, imposed by the Radio Regulations, works as a legal safety check for the organisation and the amateur to protect both of their interests and those of the [amateur-satellite service](#) as well.

This arrangement has worked successfully and effectively for AMSAT-NA and its predecessor organization since the first amateur satellite ([OSCAR I](#)) in 1961.

D. Multi-service Satellites

A "multi-service satellite" is a [space station](#) operating in frequency bands allocated to the [amateur-satellite service](#) and one or more additional satellite services. [See: [Annex IV](#).] Even though the [space station](#) is part of a shared platform, all operation on frequencies allocated to the [amateur-satellite service](#) must meet the requirements of the [amateur-satellite service](#).

Transmissions to a multi-service satellite in frequency bands allocated to the [amateur-satellite service](#) should not be used for routine [space telecommand](#), [space telemetry](#), or

other operation involving the portion of the [space station](#) operating in another service. [See: [RR 1.56 and RR 1.57](#).]

E. Permissible communication

The [amateur-satellite service](#), by its nature, involves [stations](#) of more than one country. Transmissions between amateur stations of different countries must be limited to communication consistent with the purposes of the [amateur service](#) [see: [RR 1.56](#)] and to remarks of a personal character [see: [RR 25.2](#)].

Transmissions between [amateur stations](#) in different countries may not be obscured. [See: [RR 25.2A](#)] This means that (1) technical descriptions of all emissions, codes, and formats must be publicly and widely available; and, that (2) technical descriptions must be sufficient to enable any technically competent licensed amateur radio operator to use the system. You may do nothing intended to conceal the meaning of a transmission, except in the case of [space telecommand](#) transmissions for critical spacecraft functions. [See: [RR 25.2A](#).]

Whenever possible, publish prior to launch or as soon as possible thereafter.

Publication can be in a variety of ways.

Use the amateur radio press: The AMSAT Journal published by [AMSAT-NA](#), OSCAR News from [AMSAT-UK \(United Kingdom\)](#), or AMSAT-DL News from [AMSAT-DL \(Germany\)](#); or, use general circulation periodicals such as QST, CQ, and *Radio Communication*.

Use electronic publications: [AMSAT-BB](#) is an e-mail remailer reaching amateur-satellite operators around the world quickly and cheaply. The [amsat.org World Wide Web site](#) is accessible everywhere on the INTERNET. Clickable links to your web site may be arranged.

For more information about electronic publishing, see [Annex IX](#).

F. Open Access

All telecommunication facilities, except [space telecommand](#), operating in [amateur-satellite service allocations](#) should be open for use by amateur radio operators worldwide. All experiments utilising frequencies allocated to the [amateur-satellite service](#) should be freely available for use by radio amateurs worldwide and, incidentally, for reception by students and educators.

G. Broadcasting

[Broadcasting](#) is "a [radiocommunication service](#) in which the transmissions are intended for direct reception by the general public." [See [RR 1.38](#) and CS/An. 1010.] [Broadcasting](#) in the [amateur service](#) or the [amateur-satellite service](#) is normally considered to be inconsistent with the purposes of the amateur services. [See: [RR 1.56](#).] However, transmission of bulletins and data directed to licensed amateurs is not considered [broadcasting](#), even though the transmissions may also be received by non-amateurs.

VII. PUBLIC RELATIONS FOR AMATEUR RADIO SATELLITES

Public announcements, press releases, and other public relations items concerning stations in the [amateur-satellite service](#) are valuable tools for maintaining frequency [allocations](#) to the [amateur service](#) and [amateur-satellite service](#) and stimulating interest in amateur radio.

[Frequency allocations](#) are highly contested. [Administrations](#) voting at World Radiocommunication Conferences must be kept aware of benefits to the people of their countries from the [amateur-satellite service](#). Direct contact with [administration](#) officials is very important, should be sought, well planned, and well maintained.

Good public relations help amateur radio grow better. Greater exposure of the [amateur service](#) and [amateur-satellite service](#) will attract more people to amateur radio. Everyone benefits from the influx of new members into the amateur radio community.

VIII. REVIEW MISSION PLANS

A. Compare to service requirements

Compare your mission plans to the definitions and requirements for the [amateur-satellite service](#) explained in this document.

If mission plans are consistent with the [amateur-satellite service](#), then, continue project frequency planning together with your [national amateur satellite organisation](#), [national amateur radio society](#), and the [IARU Satellite Advisor](#).

If mission plans are *not* consistent with the [amateur-satellite service](#), then licensing and operation should be in a service better suited to the mission. Advantages of services other than amateur for your mission may be:

- no restrictions on organisations (schools and corporations may be licensed)
- no restrictions on financial interests or payments to participants for their work

- no permissible communication limitations (specialised emissions and/or ciphered transmissions may be permitted)
- no open access requirements (system may be reserved for your use)
- no special operator licensing examinations

B. Alternatives to the amateur-satellite service

Alternatives to the [amateur-satellite service](#) exist in the many satellite services for which [allocations](#) are provided in the Radio Regulations. See [Annex IV](#) for a complete list of services, including satellite services, to which frequencies are allocated.

For missions not fitting into one of the existing services, particularly for short term research or school projects, [experimental stations](#) may be licensed by administrations. See: [Article 27 of the Radio Regulations](#). [Experimental stations](#) may be [assigned](#) on any frequency on a [secondary](#) basis.

NOTE: Experimental stations authorized by one administration are not normally permitted to communicate with experimental stations authorized by another. Special international arrangements are required. [See: [RR 27.1](#).]

If experimental licensing is proposed using frequencies in an [amateur-satellite service](#) allocation, then the [IARU Satellite Advisor](#) may be able to help guide your frequency planning so as to minimise the probability of interference to and from licensed [amateur-satellite service stations](#). [Administrations](#) normally consider [experimental stations](#) as [secondary](#) to all other licensed [stations](#). So, **frequency coordination is particularly important for assuring mission success.**

NOTE: When ready to ask for IARU frequency coordination, please, be sure to use the latest frequency coordination request form! The form changes from time to time.

See: <http://www.iaru.org/satellite>.

IX. SUMMARY CHECKLIST

Communication links involve a great deal of thought and care which can be planned in a step-by-step process. [Annex X](#) contains a checklist of steps to help in frequency planning.

X. CONCLUSION

The frequency planning process represents time and effort well spent because it provides an inexpensive measure of insurance. You will account for:

- (1) stations which might cause harmful interference to your project as well as
- (2) other stations which would receive interference from your satellite, and
- (3) the underlying laws of physics.

In the end: **SUCCESS!**

For more information, contact your [national amateur satellite organisation](#), [national amateur radio society](#), and the [IARU Satellite Advisor](#).

— end —

LIST of ANNEXES

<u>ANNEX I.</u>	TERMS COMMONLY USED IN FREQUENCY MANAGEMENT
<u>ANNEX II.</u>	CITATIONS AND FINDING USEFUL INTERNATIONAL DOCUMENTS
<u>ANNEX III.</u>	FREQUENCY BANDS ALLOCATED TO THE AMATEUR-SATELLITE SERVICE
<u>ANNEX IV.</u>	LIST OF RADIO SERVICES
<u>ANNEX V.</u>	EXTRACT FROM ARTICLE 22 OF THE RADIO REGULATIONS – SPACE SERVICES
<u>ANNEX VI.</u>	ARTICLE 25 OF THE RADIO REGULATIONS – AMATEUR SERVICES
<u>ANNEX VII.</u>	ARTICLE 27 OF THE RADIO REGULATIONS – EXPERIMENTAL STATIONS
<u>ANNEX VIII.</u>	IARU CONTACTS
<u>ANNEX IX.</u>	ELECTRONIC PUBLICATION
<u>ANNEX X.</u>	SUMMARY CHECKLIST
<u>ANNEX XI.</u>	DOCUMENT HISTORY

ANNEX I. TERMS COMMONLY USED IN FREQUENCY MANAGEMENT.

These definitions are from the Constitution (CS) of the International Telecommunication Union (ITU), Geneva, 1994; and the Radio Regulations (RR), Geneva, 1990, as amended by the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (WARC-92), Geneva, 1992, and the World Radiocommunication Conferences of 1995 (WRC-95) and 1997 (WRC-97). (Edition of 2001)

"Members of the Union shall have the rights and shall be subject to the obligations provided for in this Constitution and the Convention." [CS 24]

"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/An. 1002]

"Allocation (of a frequency band): Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned." [RR 1.16]

"Allotment (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions." [RR 1.17]

"Assignment (of a radio frequency or radio frequency channel): Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions." [RR 1.18]

5.1 In all documents of the Union where the terms *allocation*, *allotment* and *assignment* are to be used, they shall have the meaning given them in Nos. **1.16** to **1.18**, the terms used in the three working languages being as follows:

Frequency distribution to:	French	English	Spanish
Services	Attribution (attribuer)	Allocation (to allocate)	Atribución (atribuir)
Areas or countries	Allotissement (allotir)	Allotment (to allot)	Adjudicación (adjudicar)
Stations	Assignment (assigner)	Assignment (to assign)	Asignación (asignar)

Secondary service: “Stations of a secondary service:

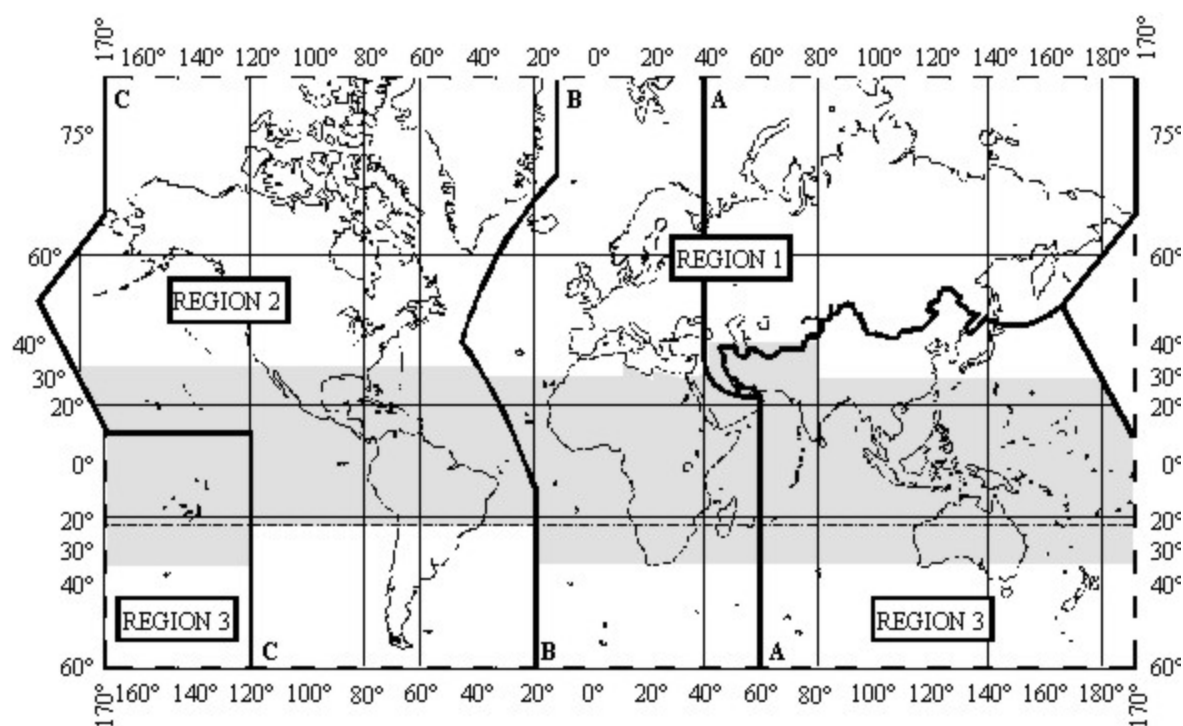
“a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date [RR 5.29];

“b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date [RR 5.30];

“c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date [RR5.31].”

Regions and areas

5.2 For the allocation of frequencies the world has been divided into three Regions¹ as shown on the following map and described in Nos. 5.3 to 5.9:



The shaded part represents the Tropical Zones as defined in Nos. S5.16 to S5.20 and S5.21.

S5-01

5.3 Region 1: Region 1 includes the area limited on the east by line A (lines A, B and C are defined below) and on the west by line B, excluding any of the territory of the Islamic Republic of Iran which lies between these limits. It also includes the whole of the territory of Armenia, Azerbaijan, Russian Federation, Georgia, Kazakstan, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey and Ukraine and the area to the north of Russian Federation which lies between lines A and C.

5.4 Region 2: Region 2 includes the area limited on the east by line B and on the west by line C.

¹ **5.2.1** It should be noted that where the words “regions” or “regional” are without a capital “R” in these Regulations, they do not relate to the three Regions here defined for purposes of frequency allocation.

5.5 Region 3: Region 3 includes the area limited on the east by line C and on the west by line A, except any of the territory of Armenia, Azerbaijan, Russian Federation, Georgia, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, Turkey and Ukraine and the area to the north of Russian Federation. It also includes that part of the territory of the Islamic Republic of Iran lying outside of those limits.

5.6 The lines A, B and C are defined as follows:

5.7 Line A: Line A extends from the North Pole along meridian 40° East of Greenwich to parallel 40° North; thence by great circle arc to the intersection of meridian 60° East and the Tropic of Cancer; thence along the meridian 60° East to the South Pole.

5.8 Line B: Line B extends from the North Pole along meridian 10° West of Greenwich to its intersection with parallel 72° North; thence by great circle arc to the intersection of meridian 50° West and parallel 40° North; thence by great circle arc to the intersection of meridian 20° West and parallel 10° South; thence along meridian 20° West to the South Pole.

5.9 Line C: Line C extends from the North Pole by great circle arc to the intersection of parallel 65° 30' North with the international boundary in Bering Strait; thence by great circle arc to the intersection of meridian 165° East of Greenwich and parallel 50° North; thence by great circle arc to the intersection of meridian 170° West and parallel 10° North; thence along parallel 10° North to its intersection with meridian 120° West; thence along meridian 120° West to the South Pole.

Radio: A general term applied to the use of *radio waves*. [RR 1.4]

Radio waves or hertzian waves: Electromagnetic waves of frequencies arbitrarily lower than 3 000 GHz, propagated in space without artificial guide. [RR 1.5]

Radiocommunication: *Telecommunication* by means of *radio waves*. [RR 1.6, CS, CV]

Terrestrial radiocommunication: Any *radiocommunication* other than *space radiocommunication* or *radio astronomy*. [RR 1.7]

Space radiocommunication: 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. [RR 1.8]

"Radiocommunication Service: A service as defined in this Section [of the Radio Regulations] involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes. [RR 1.19]

"Amateur Service: A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest." [RR 1.56]

"Amateur-Satellite Service: A radiocommunication service using space stations on Earth satellites for the same purposes as those of the amateur service." [RR 1.57]

"Station: One or more transmitters and receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service. Each station shall be classified by the service in which it operates permanently or temporarily." [RR 1.143]

"*Earth Station*: A station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication:

- with one or more space stations; or
- with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space." [RR 1.162]

"*Space Station*: A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere." [RR 1.64]

"*Telemetry*: The use of telecommunication for automatically indicating or recording measurements at a distance from the measuring instrument." [RR 1.131]

"*Space Telemetry*: The use of telemetry for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft." [RR 1.133]

"*Telecommand*: The use of telecommunication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance." [RR 1.134]

"*Space Telecommand*: The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of equipment on an associated space object, including the space station." [RR 1.135]

"*Safety service*: Any *radiocommunication service* used permanently or temporarily for the safeguarding of human life and property. [RR 1.59]

"*Experimental station*: A station utilizing *radio waves* in experiments with a view to the development of science or technique.

This definition does not include *amateur stations*. [RR 1.98]

"*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. [RR 1.166]

ANNEX II. CITATIONS AND FINDING USEFUL INTERNATIONAL DOCUMENTS

Citations explained:

CS Constitution of the International Telecommunication Union (ITU), Geneva, 1992. Specific provisions are cited as "CS" followed by the provision number from the left hand margin of the document. The latest version of both the Constitution and Convention of the International Telecommunication Union, including Optional Protocol, Resolutions, and Recommendations, are in the Final Acts of the Additional Plenipotentiary Conference, Geneva, 1992.

RR Radio Regulations, Geneva, 1990, as amended by the World Administrative Radio Conference for Dealing with Frequency Allocations in Certain Parts of the Spectrum (WARC-92), Geneva, 1992, and the World Radiocommunication Conferences of 1995 (WRC-95) and 1997 (WRC-97). (Edition of 2001) Specific provisions are cited as "RR" followed by the provision number from the left hand margin of the document.

Finding useful international documents:

The [International Radio Club, 4U1ITU](http://life.itu.int/radioclub/arslook.htm), operates an excellent amateur radio resource look up at:



<http://life.itu.int/radioclub/arslook.htm>

Use it for locating portions of the Radio Regulations relevant to the amateur service and amateur-satellite service, and many other very useful documents and resources.

ITU distributes copies of the International Telecommunication Convention, the ITU Constitution, Radio Regulations, and other documents, to administrations of Members States and recognised operating agencies. Often, national amateur radio societies will have a copy. Most ITU publications can be obtained through the [ITU Electronic Bookshop](http://www.itu.int/publications/sector.aspx?lang=e§or=1). See also the on line listing of ITU-R publications: <http://www.itu.int/publications/sector.aspx?lang=e§or=1>.

Annex III. Frequency bands allocated to the amateur-satellite service

Frequency band	Status Area Direction	Footnotes
7.0 – 7.1 MHz	PRIMARY World-wide	<p>5.140 <i>Additional allocation:</i> in Angola, Iraq, Rwanda, Somalia and Togo, the band 7 000-7 050 kHz is also allocated to the fixed service on a primary basis.</p> <p>5.141 <i>Alternative allocation:</i> in Egypt, Eritrea, Ethiopia, Guinea, Libya and Madagascar, the band 7 000-7 050 kHz is allocated to the fixed service on a primary basis. (WRC-97)</p>
14.0 – 14.25 MHz	PRIMARY World-wide	
18.068 – 18.168 MHz	PRIMARY World-wide	<p>5.154 <i>Additional allocation:</i> in Armenia, Azerbaijan, Georgia, Kazakstan, Moldova, Uzbekistan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Ukraine, the band 18 068-18 168 kHz is also allocated to the fixed service on a primary basis for use within their boundaries, with a peak envelope power not exceeding 1 kW. (WRC-97)</p>
21.0 – 21.45 MHz	PRIMARY World-wide	
24.89 – 24.99 MHz	PRIMARY World-wide	
28.0 - 29.7 MHz	PRIMARY World-wide	
144 – 146 MHz	PRIMARY World-wide	<p>5.216 <i>Additional allocation:</i> in China, the band 144-146 MHz is also allocated to the aeronautical mobile (OR) service on a secondary basis.</p>

Frequency band	Status Area Direction	Footnotes
435 – 438 MHz	Non-interference basis World-wide	<p>5.271 <i>Additional allocation:</i> in Azerbaijan, Belarus, China, Estonia, India, Latvia, Lithuania, Kyrgyzstan, Turkmenistan and Ukraine, the band 420-460 MHz is also allocated to the aeronautical radionavigation service (radio altimeters) on a secondary basis. (WRC-97)</p> <p>5.277 <i>Additional allocation:</i> in Angola, Armenia, Azerbaijan, Belarus, Cameroon, the Congo, Djibouti, Gabon, Georgia, Hungary, Kazakstan, Latvia, Mali, Moldova, Mongolia, Uzbekistan, Pakistan, Poland, Kyrgyzstan, Slovakia, the Czech Republic, Romania, Russian Federation, Rwanda, Tajikistan, Chad, Turkmenistan and Ukraine, the band 430-440 MHz is also allocated to the fixed service on a primary basis. (WRC-97)</p> <p>5.278 <i>Different category of service:</i> in Argentina, Colombia, Costa Rica, Cuba, Guyana, Honduras, Panama and Venezuela, the allocation of the band 430-440 MHz to the amateur service is on a primary basis (see No. S5.33).</p> <p>5.284 <i>Additional allocation:</i> in Canada, the band 440-450 MHz is also allocated to the amateur service on a secondary basis.</p> <p>5.285 <i>Different category of service:</i> in Canada, the allocation of the band 440-450 MHz to the radiolocation service is on a primary basis (see No. 5.33).</p> <p>5.282 In the bands 435-438 MHz, 1 260-1 270 MHz, 2 400-2 450 MHz, 3 400-3 410 MHz (in Regions 2 and 3 only) and 5 650-5 670 MHz, the amateur-satellite service may operate subject to not causing harmful interference to other services operating in accordance with the Table (see No. 5.43). Administrations authorizing such use shall ensure that any harmful interference caused by emissions from a station in the amateur-satellite service is immediately eliminated in accordance with the provisions of No. 25.11. The use of the bands 1 260-1 270 MHz and 5 650-5 670 MHz by the amateur-satellite service is limited to the Earth-to-space direction.</p>

Frequency band	Status Area Direction	Footnotes														
1260 – 1270 MHz	Non-interference basis World-wide Earth-to-space	<p>See 5.282.</p> <p>5.330 <i>Additional allocation:</i> in Angola, Saudi Arabia, Bahrain, Bangladesh, Cameroon, China, the United Arab Emirates, Eritrea, Ethiopia, Guyana, India, Indonesia, the Islamic Republic of Iran, Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Libya, Morocco, Mozambique, Nepal, Nigeria, Pakistan, the Philippines, Qatar, Syria, Somalia, Sudan, Sri Lanka, Chad, Togo and Yemen, the band 1 215-1 300 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-97)</p> <p>5.331 <i>Additional allocation:</i> in Algeria, Germany, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Burundi, Cameroon, China, Croatia, Denmark, the United Arab Emirates, France, Greece, India, the Islamic Republic of Iran, Iraq, Kenya, The Former Yugoslav Republic of Macedonia, Liechtenstein, Luxembourg, Mali, Mauritania, Norway, Oman, Pakistan, the Netherlands, Portugal, Qatar, Senegal, Slovenia, Somalia, Sudan, Sri Lanka, Sweden, Switzerland, Turkey and Yugoslavia, the band 1 215-1 300 MHz is also allocated to the radionavigation service on a primary basis.</p> <p>5.332 In the band 1 215-1 300 MHz, active spaceborne sensors in the earth exploration-satellite and space research services shall not cause harmful interference to, claim protection from, or otherwise impose constraints on operation or development of the radiolocation service, the radionavigation-satellite service and other services allocated on a primary basis. (WRC-97)</p> <p>5.334 <i>Additional allocation:</i> in Canada and the United States, the bands 1 240-1 300 MHz and 1 350-1 370 MHz are also allocated to the aeronautical radionavigation service on a primary basis.</p> <p>5.335 In Canada and the United States in the band 1 240-1 300 MHz, active spaceborne sensors in the earth exploration-satellite and space research services shall not cause interference to, claim protection from, or otherwise impose constraints on operation or development of the aeronautical radionavigation service. (WRC-97)</p>														
2400 – 2450 MHz	Secondary World-wide	<p>5.150 The following bands:</p> <table><tr><td>13 553-13 567 kHz</td><td>(centre frequency 13 560 kHz),</td></tr><tr><td>26 957-27 283 kHz</td><td>(centre frequency 27 120 kHz),</td></tr><tr><td>40.66-40.70 MHz</td><td>(centre frequency 40.68 MHz),</td></tr><tr><td>902-928 MHz</td><td>in Region 2 (centre frequency 915 MHz),</td></tr><tr><td>2 400-2 500 MHz</td><td>(centre frequency 2 450 MHz),</td></tr><tr><td>5 725-5 875 MHz</td><td>(centre frequency 5 800 MHz), and</td></tr><tr><td>24-24.25 GHz</td><td>(centre frequency 24.125 GHz)</td></tr></table> <p>are also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of No. 15.13.</p>	13 553-13 567 kHz	(centre frequency 13 560 kHz),	26 957-27 283 kHz	(centre frequency 27 120 kHz),	40.66-40.70 MHz	(centre frequency 40.68 MHz),	902-928 MHz	in Region 2 (centre frequency 915 MHz),	2 400-2 500 MHz	(centre frequency 2 450 MHz),	5 725-5 875 MHz	(centre frequency 5 800 MHz), and	24-24.25 GHz	(centre frequency 24.125 GHz)
13 553-13 567 kHz	(centre frequency 13 560 kHz),															
26 957-27 283 kHz	(centre frequency 27 120 kHz),															
40.66-40.70 MHz	(centre frequency 40.68 MHz),															
902-928 MHz	in Region 2 (centre frequency 915 MHz),															
2 400-2 500 MHz	(centre frequency 2 450 MHz),															
5 725-5 875 MHz	(centre frequency 5 800 MHz), and															
24-24.25 GHz	(centre frequency 24.125 GHz)															

Frequency band	Status Area Direction	Footnotes
3400 – 3410 MHz	Non-interference basis Region 2 Region 3	<p>See 5.282.</p> <p>5.431 <i>Additional allocation:</i> in Germany, Israel, Nigeria and the United Kingdom, the band 3 400-3 475 MHz is also allocated to the amateur service on a secondary basis.</p> <p>5.432 <i>Different category of service:</i> in the Republic of Korea, Indonesia, Japan and Pakistan, the allocation of the band 3 400-3 500 MHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. S5.33). (WRC-97)</p> <p>5.433 In Regions 2 and 3, in the band 3 400-3 600 MHz the radiolocation service is allocated on a primary basis. However, all administrations operating radiolocation systems in this band are urged to cease operations by 1985. Thereafter, administrations shall take all practicable steps to protect the fixed-satellite service and coordination requirements shall not be imposed on the fixed-satellite service.</p>
5650 – 5670 MHz	Non-interference basis World-wide Earth-to-space	<p>See 5.282.</p> <p>5.451 <i>Additional allocation:</i> in the United Kingdom, the band 5 470-5 850 MHz is also allocated to the land mobile service on a secondary basis. The power limits specified in Nos. 21.2, 21.3, 21.4 and 21.5 shall apply in the band 5 725-5 850 MHz.</p> <p>5.453 <i>Additional allocation:</i> in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, the Central African Republic, China, the Congo, the Republic of Korea, Egypt, the United Arab Emirates, Gabon, Guinea, India, Indonesia, the Islamic Republic of Iran, Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Libya, Madagascar, Malaysia, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syria, Democratic People's Republic of Korea, Singapore, Swaziland, Tanzania, Chad, and Yemen, the band 5 650-5 850 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-97)</p>
5830 – 5850 MHz	Secondary space-to-Earth	<p>See 5.150.</p> <p>See 5.451.</p> <p>See 5.453.</p>
10.45 – 10.5 GHz	Secondary World-wide	<p>5.481 <i>Additional allocation:</i> in Germany, Angola, China, Ecuador, Spain, Japan, Morocco, Nigeria, Oman, Democratic People's Republic of Korea, Sweden, Tanzania and Thailand, the band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis.</p>
24.0 – 24.05 GHz	PRIMARY World-wide	<p>See 5.150.</p>
47.0 – 47.2 GHz	PRIMARY World-wide	
75.5 – 76.0 GHz	PRIMARY World-wide	

Frequency band	Status Area Direction	Footnotes	
76 – 81 GHz	Secondary World-wide		
142 – 144 GHz	PRIMARY World-wide		
144 – 149 GHz	Secondary World-wide	<p>5.149 In making assignments to stations of other services to which the bands:</p> <p>13 360-13 410 kHz, 25 550-25 670 kHz, 37.5-38.25 MHz, 73-74.6 MHz in Regions 1 and 3, 150.05-153 MHz in Region 1, 322-328.6 MHz*, 406.1-410 MHz, 608-614 MHz in Regions 1 and 3, 1 330-1 400 MHz*, 1 610.6-1 613.8 MHz*, 1 660-1 670 MHz, 1 718.8-1 722.2 MHz*, 2 655-2 690 MHz, 3 260-3 267 MHz*, 3 332-3 339 MHz*, 3 345.8-3 352.5 MHz*, 4 825-4 835 MHz*, 4 950-4 990 MHz, 4 990-5 000 MHz, 6 650-6 675.2 MHz*, 10.6-10.68 GHz, 14.47-14.5 GHz*, 22.01-22.21 GHz*, 22.21-22.5 GHz, 22.81-22.86 GHz*, 23.07-23.12 GHz*, 31.2-31.3 GHz, 31.5-31.8 GHz in Regions 1 and 3,</p>	<p>36.43-36.5 GHz*, 42.5-43.5 GHz, 42.77-42.87 GHz*, 43.07-43.17 GHz*, 43.37-43.47 GHz*, 48.94-49.04 GHz*, 72.77-72.91 GHz*, 93.07-93.27 GHz*, 97.88-98.08 GHz*, 140.69-140.98 GHz*, 144.68-144.98 GHz*, 145.45-145.75 GHz*, 146.82-147.12 GHz*, 150-151 GHz*, 174.42-175.02 GHz*, 177-177.4 GHz*, 178.2-178.6 GHz*, 181-181.46 GHz*, 186.2-186.6 GHz*, 250-251 GHz*, 257.5-258 GHz*, 261-265 GHz, 262.24-262.76 GHz*, 265-275 GHz, 265.64-266.16 GHz*, 267.34-267.86 GHz*, 271.74-272.26 GHz*</p> <p>are allocated (* indicates radio astronomy use for spectral line observations), administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. S4.5 and S4.6 and Article S29). (WRC-97)</p>

Frequency band	Status Area Direction	Footnotes
241 – 248 GHz	Secondary World-wide	<p>5.138 The following bands:</p> <p>6 765-6 795 kHz (centre frequency 6 780 kHz),</p> <p>433.05-434.79 MHz (centre frequency 433.92 MHz) in Region 1 except in the countries mentioned in No. 5.280,</p> <p>61-61.5 GHz (centre frequency 61.25 GHz),</p> <p>122-123 GHz (centre frequency 122.5 GHz), and</p> <p>244-246 GHz (centre frequency 245 GHz)</p> <p>are designated for industrial, scientific and medical (ISM) applications. The use of these frequency bands for ISM applications shall be subject to special authorization by the administration concerned, in agreement with other administrations whose radiocommunication services might be affected. In applying this provision, administrations shall have due regard to the latest relevant ITU-R Recommendations.</p>
248 – 250 GHz	PRIMARY World-wide	
275 – 400 GHz	Not allocated	<p>5.565 The frequency band 275-400 GHz may be used by administrations for experimentation with, and development of, various active and passive services. In this band a need has been identified for the following spectral line measurements for passive services:</p> <ul style="list-style-type: none"> – radio astronomy service: 278-280 GHz and 343-348 GHz; – Earth exploration-satellite service (passive) and space research service (passive): 275-277 GHz, 300-302 GHz, 324-326 GHz, 345-347 GHz, 363-365 GHz and 379-381 GHz. <p>Future research in this largely unexplored spectral region may yield additional spectral lines and continuum bands of interest to the passive services. Administrations are urged to take all practicable steps to protect these passive services from harmful interference until the next competent world radiocommunication conference.</p>

Related provisions:

5.33 Where a band is indicated in a footnote of the Table as allocated to a service “on a primary basis”, in an area smaller than a Region, or in a particular country, this is a primary service only in that area or country.

5.43 Where it is indicated in these Regulations that a service or stations in a service may operate in a specific frequency band subject to not causing harmful interference to another service or to another station in the same service, this means also that the service which is subject to not causing harmful interference cannot claim protection from harmful interference caused by the other service or other station in the same service.

5.150 The following bands:

13 553-13 567 kHz	(centre frequency 13 560 kHz),
26 957-27 283 kHz	(centre frequency 27 120 kHz),
40.66-40.70 MHz	(centre frequency 40.68 MHz),
902-928 MHz in Region 2	(centre frequency 915 MHz),
2 400-2 500 MHz	(centre frequency 2 450 MHz),
5 725-5 875 MHz	(centre frequency 5 800 MHz), and
24-24.25 GHz	(centre frequency 24.125 GHz)

are also designated for industrial, scientific and medical (ISM) applications. Radiocommunication services operating within these bands must accept harmful interference which may be caused by these applications. ISM equipment operating in these bands is subject to the provisions of [No. 15.13](#).

5.280 In Germany, Austria, Bosnia and Herzegovina, Croatia, The Former Yugoslav Republic of Macedonia, Liechtenstein, Portugal, Serbia and Montenegro, Slovenia and Switzerland, the band 433.05-434.79 MHz (centre frequency 433.92 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services of these countries operating within this band must accept harmful interference which may be caused by these applications. ISM equipment operating in this band is subject to the provisions of [No. 15.13](#).

5.451 *Additional allocation:* in the United Kingdom, the band 5 470-5 850 MHz is also allocated to the land mobile service on a secondary basis. The power limits specified in Nos. [21.2](#), [21.3](#), [21.4](#) and [21.5](#) shall apply in the band 5 725-5 850 MHz.

5.453 *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Egypt, the United Arab Emirates, Gabon, Guinea, Equatorial Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, the Libyan Arab Jamahiriya, Japan, Jordan, Kenya, Kuwait, Lebanon, Madagascar, Malaysia, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Sri Lanka, Swaziland, Tanzania, Chad, Thailand, Togo, Viet Nam and Yemen, the band 5 650-5 850 MHz is also allocated to the fixed and mobile services on a primary basis. In this case, the provisions of Resolution **229 (WRC-03)** do not apply. (WRC-03)

15.13 Administrations shall take all practicable and necessary steps to ensure that radiation from equipment used for industrial, scientific and medical applications is minimal and that, outside the bands designated for use by this equipment, radiation from such equipment is at a level that does not cause harmful interference to a radiocommunication service and, in particular, to a radionavigation or any other safety service operating in accordance with the provisions of these Regulations¹.

¹ **15.12.1** and **15.13.1** In this matter, administrations should be guided by the latest relevant ITU-R Recommendations.

15.33 When cases of harmful interference occur as a result of emissions from space stations, the administrations having jurisdiction over these interfering stations shall, upon request from the administration having jurisdiction over the station experiencing the interference, furnish current ephemeral data necessary to allow determination of the positions of the space stations when not otherwise known.

ANNEX IV. LIST OF RADIO SERVICES

1.19 *radiocommunication service*: A service as defined in this Section involving the transmission, *emission* and/or reception of *radio waves* for specific *telecommunication* purposes.

In these Regulations, unless otherwise stated, any radiocommunication service relates to *terrestrial radiocommunication*.

1.20 *fixed service*: A *radiocommunication service* between specified fixed points.

1.21 *fixed-satellite service*: A *radiocommunication service* between *earth stations* at given positions, when one or more *satellites* are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the *inter-satellite service*; the fixed-satellite service may also include *feeder links* for other *space radiocommunication services*.

1.22 *inter-satellite service*: A *radiocommunication service* providing links between artificial *satellites*.

1.23 *space operation service*: A *radiocommunication service* concerned exclusively with the operation of *spacecraft*, in particular *space tracking*, *space telemetry* and *space telecommand*.

These functions will normally be provided within the service in which the *space station* is operating.

1.24 *mobile service*: A *radiocommunication service* between *mobile* and *land stations*, or between *mobile stations* (CV).

1.25 *mobile-satellite service*: A *radiocommunication service*:

- between *mobile earth stations* and one or more *space stations*, or between *space stations* used by this service; or
- between *mobile earth stations* by means of one or more *space stations*.

This service may also include *feeder links* necessary for its operation.

1.26 *land mobile service*: A *mobile service* between *base stations* and *land mobile stations*, or between *land mobile stations*.

1.27 *land mobile-satellite Service*: A *mobile-satellite service* in which *mobile earth stations* are located on land.

1.28 *maritime mobile service*: A *mobile service* between *coast stations* and *ship stations*, or between *ship stations*, or between associated *on-board communication stations*; *survival craft stations* and *emergency position-indicating radiobeacon stations* may also participate in this service.

1.29 *maritime mobile-satellite service*: A *mobile-satellite service* in which *mobile earth stations* are located on board ships; *survival craft stations* and *emergency position-indicating radiobeacon stations* may also participate in this service.

1.30 *port operations service*: A *maritime mobile service* in or near a port, between *coast stations* and *ship stations*, or between *ship stations*, in which messages are restricted to those relating to the operational handling, the movement and the safety of ships and, in emergency, to the safety of persons.

Messages which are of a *public correspondence* nature shall be excluded from this service.

1.31 *ship movement service*: A *safety service* in the *maritime mobile service* other than a *port operations service*, between *coast stations* and *ship stations*, or between *ship stations*, in which messages are restricted to those relating to the movement of ships.

Messages which are of a *public correspondence* nature shall be excluded from this service.

1.32 *aeronautical mobile service*: A *mobile service* between *aeronautical stations* and *aircraft stations*, or between *aircraft stations*, in which *survival craft stations* may participate; *emergency position-indicating radiobeacon stations* may also participate in this service on designated distress and emergency frequencies.

1.33 *aeronautical mobile (R)* service*: An *aeronautical mobile service* reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes.

1.34 *aeronautical mobile (OR)** service*: An *aeronautical mobile service* intended for communications, including those relating to flight coordination, primarily outside national or international civil air routes.

1.35 *aeronautical mobile-satellite service*: A *mobile-satellite service* in which *mobile earth stations* are located on board aircraft; *survival craft stations* and *emergency position-indicating radiobeacon stations* may also participate in this service.

1.36 *aeronautical mobile-satellite (R)* service*: An *aeronautical mobile-satellite service* reserved for communications relating to safety and regularity of flights, primarily along national or international civil air routes.

1.37 *aeronautical mobile-satellite (OR)** service*: An *aeronautical mobile-satellite service* intended for communications, including those relating to flight coordination, primarily outside national and international civil air routes.

1.38 *broadcasting service*: A *radiocommunication service* in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, *television* transmissions or other types of transmission (CS).

1.39 *broadcasting-satellite service*: A *radiocommunication service* in which signals transmitted or retransmitted by *space stations* are intended for direct reception by the general public.

In the broadcasting-satellite service, the term “direct reception” shall encompass both *individual reception* and *community reception*.

1.40 *radiodetermination service*: A *radiocommunication service* for the purpose of *radiodetermination*.

1.41 *radiodetermination-satellite service*: A *radiocommunication service* for the purpose of *radiodetermination* involving the use of one or more *space stations*.

This service may also include *feeder links* necessary for its own operation.

1.42 *radionavigation service*: A *radiodetermination service* for the purpose of *radionavigation*.

1.43 *radionavigation-satellite service*: A *radiodetermination-satellite service* used for the purpose of *radionavigation*.

This service may also include *feeder links* necessary for its operation.

1.44 *maritime radionavigation service*: A *radionavigation service* intended for the benefit and for the safe operation of ships.

*(R): route.

** (OR): off-route

1.45 *maritime radionavigation-satellite service*: A *radionavigation-satellite service* in which *earth stations* are located on board ships.

1.46 *aeronautical radionavigation service*: A *radionavigation service* intended for the benefit and for the safe operation of aircraft.

1.47 *aeronautical radionavigation-satellite service*: A *radionavigation-satellite service* in which *earth stations* are located on board aircraft.

1.48 *radiolocation service*: A *radiodetermination service* for the purpose of *radiolocation*.

1.49 *radiolocation-satellite service*: A *radiodetermination-satellite service* used for the purpose of *radiolocation*.

This service may also include the *feeder links* necessary for its operation.

1.50 *meteorological aids service*: A *radiocommunication service* used for meteorological, including hydrological, observations and exploration.

1.51 *earth exploration-satellite service*: A *radiocommunication service* between *earth stations* and one or more *space stations*, which may include links between *space stations*, in which:

- information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from active sensors or passive sensors on Earth satellites;
- similar information is collected from airborne or Earth-based platforms;
- such information may be distributed to earth stations within the system concerned;
- platform interrogation may be included.

This service may also include *feeder links* necessary for its operation.

1.52 *meteorological-satellite service*: An *earth exploration-satellite service* for meteorological purposes.

1.53 *standard frequency and time signal service*: A *radiocommunication service* for scientific, technical and other purposes, providing the transmission of specified frequencies, time signals, or both, of stated high precision, intended for general reception.

1.54 *standard frequency and time signal-satellite service*: A *radiocommunication service* using *space stations* on earth *satellites* for the same purposes as those of the *standard frequency and time signal service*.

This service may also include *feeder links* necessary for its operation.

1.55 *space research service*: A *radiocommunication service* in which *spacecraft* or other objects in space are used for scientific or technological research purposes.

1.56 *amateur service*: A *radiocommunication service* for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

1.57 *amateur-satellite service*: A *radiocommunication service* using *space stations* on earth *satellites* for the same purposes as those of the *amateur service*.

1.58 *radio astronomy service*: A service involving the use of *radio astronomy*.

1.59 *safety service*: Any *radiocommunication service* used permanently or temporarily for the safeguarding of human life and property.

1.60 *special service*: A *radiocommunication service*, not otherwise defined in this Section, carried on exclusively for specific needs of general utility, and not open to *public correspondence*.

ANNEX V. EXTRACT FROM ARTICLE 22 OF THE RADIO REGULATIONS – SPACE STATIONS

Section I – Cessation of emissions

22.1 § 1 Space stations shall be fitted with devices to ensure immediate cessation of their radio emissions by telecommand, whenever such cessation is required under the provisions of these Regulations.

ANNEX VI. ARTICLE 25 OF THE RADIO REGULATIONS

ARTICLE 25

Amateur services

Section I – Amateur service

25.1 § 1 Radiocommunications between amateur stations of different countries shall be permitted unless the administration of one of the countries concerned has notified that it objects to such radiocommunications.

25.2 § 2 1) Transmissions between amateur stations of different countries shall be limited to communications incidental to the purposes of the amateur service, as defined in No. 1.56 and to remarks of a personal character.

25.2A 1 bis) Transmissions between amateur stations of different countries shall not be encoded for the purposes of obscuring their meaning, except for control signals exchanged between Earth command stations and space stations in the amateur-satellite service.

25.3 2) Amateur stations may be used for transmitting international communications on behalf of third parties only in case of emergencies or disaster relief. An administration may determine the applicability of this provision to amateur stations under its jurisdiction.

25.4 SUP

25.5 § 3 1) Administrations shall determine whether or not a person seeking a license to operate an amateur station shall demonstrate the ability to send and receive texts in Morse code signals.

25.6 2) Administrations shall verify the operational and technical qualifications of any person wishing to operate an amateur station. Guidance for standards of competence may be found in the most recent version of Recommendation ITU-R M.1544.

25.7 § 4 The maximum power of amateur stations shall be fixed by the administrations concerned.

25.8 § 5 1) All pertinent articles and provisions of the Constitution, the Convention and of these Regulations shall apply to amateur stations.

25.9 2) During the course of their transmissions, amateur stations shall transmit their call sign at short intervals.

25.9A Administrations are encouraged to take the necessary steps to allow amateur stations to prepare for and meet communication needs in support of disaster relief.

25.9B An administration may determine whether or not to permit a person who has been granted a license to operate an amateur station by another administration, to operate an amateur station while that person is temporarily in its territory, subject to such conditions or restrictions as it may impose.

Section II – Amateur-satellite service

25.10§ 6 The provisions of Section I of this Article shall apply equally, as appropriate, to the amateur-satellite service.

25.11§ 7 Administrations authorising space stations in the amateur-satellite service shall ensure that sufficient Earth command stations are established before launch to insure that any harmful interference caused by emissions from a station in the amateur-satellite service can be terminated immediately. (See No. [22.1](#)).

ANNEX VII. ARTICLE 27 OF THE RADIO REGULATIONS

ARTICLE 27

Experimental stations

27.1 § 1 1) An experimental station may enter into communication with an experimental station of another country only after it has been authorized to do so by its administration. Each administration shall notify other administrations concerned when such authorizations are issued.

27.2 2) The administrations concerned determine by special arrangement the conditions under which communications may be established.

27.3 § 2 Administrations shall take such measures as they judge necessary to verify the operational and technical qualifications of any person wishing to operate the apparatus of an experimental station.

27.4 § 3 The administrations concerned shall fix the maximum power of experimental stations, having regard to the purpose for which their establishment has been authorized and the conditions under which they are to operate.

27.5 § 4 1) All the general rules of the Constitution, the Convention and of these Regulations shall apply to experimental stations. In particular, experimental stations shall comply with the technical conditions imposed upon transmitters operating in the same frequency bands, except where the technical principles of the experiments prevent this. In such a case, the administration which authorizes the operation of these stations may grant a dispensation in an appropriate form.

27.6 2) During the course of their transmissions, experimental stations shall transmit, at short intervals, their call sign or any other recognized form of identification (see Article **S19**).

27.7 § 5 Where there is no risk of an experimental station causing harmful interference to a service of another country, the administration concerned may, if considered desirable, adopt different provisions from those contained in this Article.

ANNEX VIII. IARU CONTACTS

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Web site with Satellite Frequencies: <http://www.iaru.org/satellite>

ANNEX IX. ELECTRONIC PUBLICATION

AMSAT publishes information through its World Wide Web server [<http://www.amsat.org/>] and its FTP site [<http://ftp.amsat.org/>].

More information is available from Paul Williamson, KB5MU, AMSAT Vice President for Electronic Publications, electronic mail address: kb5mu@amsat.org.

ANNEX X. SUMMARY CHECKLIST

Determine mission objectives

Determine communication requirements to support the mission

- voice

- data (data rate(s), bit error rate, number of channels, etc.)

- video

- other

- command station locations to assure adequate world wide control

Review frequency bands available [Table of Frequency Allocations](#) to identify technically suitable bands

Plan the link power budget for every link to determine:

- space station

 - transmitter power (peak and RMS) and spurious emission limits

 - transmission line and connector losses

 - antenna type, placement, pattern, gain, pointing accuracy

 - signal strength and pattern on the Earth

 - emission type(s)

 - coding (and processing gain, if any)

 - receiver noise temperature, bandwidth, selectivity,

 - susceptibility to interference

 - Earth noise temperature

 - data rate(s) and acceptable E_b/N_0 for desired bit error rate

 - link margin

 - power generation and storage

- Earth station

 - transmitter power (peak and RMS) and spurious

 - emission limits

 - transmission line and connector losses

 - antenna type, placement, gain, pattern, pointing accuracy,

 - local horizon

 - emission type(s)

 - coding (and processing gain, if any)

 - receiver sensitivity, bandwidth, selectivity, susceptibility to

 - interference

 - sky temperature

 - data rate(s) and acceptable E_b/N_0 for desired bit error rate

 - link margin

 - power supply and battery

NOTE 1: Telecommand and ordinary operating stations may have different link power budgets.

NOTE 2: Be sure to use treaty nomenclature to describe all parameters. Some helpful parts of the Radio Regulations are: [Article 1 - Terms and definitions](#), [Article 2 - Nomenclature](#), and [Appendix S1 - Designation of emissions](#).

Begin frequency coordination

List all technical parameters for every link
space-to-Earth direction (downlink)
Earth-to-space direction (uplink)

For amateur-satellite service coordination,
see [B. Starting the frequency coordination process](#).

For experimental stations, contact your administration or frequency coordination agency. If the experimental station is planned to share an amateur allocation, start the amateur-satellite service coordination process as well to find if there is a reasonable frequency sharing opportunity.

Work out specific
frequency plans (amateur) or
frequency assignments (non-amateur)

ANNEX XI. DOCUMENT HISTORY

Originally prepared by AMSAT-NA in 1995 for use in North America, this document was adapted for international use and approved by the IARU International Satellite Forums in 1997 and 1998, by the IARU Administrative Council; and updated in 2000, 2001, 2002, 2003, 2004, and 2006.

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