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I.C.T.P., P.O. BOX 586, 34100 TRIESTE, ITALY, CABLE: CENTRATOM TRIESTE

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Radio Spectrum Management for System Planning

R.G. Struzak
International Telecommunications Union (ITU)
Geneva, Switzerland

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RADIO SPECTRUM MANAGEMENT FOR SYSTEM PLANNING

R. G. Struzak
Radio Regulation Board, International Telecommunication Union

Summary. This text reviews basic concepts of frequency spectrum management for planning of radio system. The spectrum is treated as a natural resource, and spectrum management as a concept embracing all activities involved in its allocation, use, and control. Models of sharing the spectrum are discussed. Global and national aspects of spectrum management are described. Frequency bands allocated to various radiocommunication services are given in the annex.

1. INTRODUCTION

What is the radio frequency spectrum? There are more than one answer to this simple question. To some, it is an abstract mathematical concept introduced by Jean-Baptiste Fourier (1768 - 1830). It interesting that the Fourier's concept of integral transforms and frequency-domain was considered as a strange curiosity of doubtful value and was strongly criticized. Only after resolving the doubts by Peter Dirichlet (1805 - 1859) and Georg Riemann (1826 - 1866), the idea received a wide acceptance in many branches of science. To others, the spectrum is a real, measurable physical quantity, as spectrum analyzers are basic tools in microwave laboratories. Still others see the spectrum as a mixture of *"technology, industry, money, culture, and power"* (Bedin, after: *The new spectrum...*, 1992).

In this text, we consider the radio frequency spectrum a resource. Consequently, we understand spectrum management as a concept embracing all the activities and agents involved in the planning, apportioning, evaluation, use, and control of that resource. By nature, spectrum engineering is its inseparable ingredient. We do not distinguish designer from manager because decisions taken by one affect the other. On the one hand, planning decisions determine how the system will operate. On the other hand, the spectrum manager becomes designer when setting boundaries on the system, establishing goals, allocating resources, and deciding about the system configuration.

The origins of the spectrum management discipline extend back to the Second World War and classified military projects. Since then, spectrum conservation and management become also a major civilian issue (*Spectrum...*, 1952). Military aspects, however, did not loose their importance. For instance, the US army alone disburses nearly $40 million each year in frequency compatibility investigations (*The new spectrum...*, 1992).

It is impossible to cover all aspects of spectrum management in the limited space of this paper. We will offer only a review. Readers interested in more details are referred to the texts listed at the end of the paper, especially to the books by Matos (1985), Rotkiewicz (1982), and Withers (1991).

In the following text, we review the uses made of the spectrum and factors influencing its scarcity. Sections 2 and 3 deal with sharing issues, competition and cooperation. International spectrum management is discussed in Section 4, and the next section is devoted to national spectrum management. Spectrum engineering issues are treated in Sections 6. The key role of information exchange is outlined in Section 7. The following section discusses trends, and the last section lists publications for further reading. Annex offers the international frequency allocation table extracted from the ITU Radio Regulations.

1.1. SPECTRUM RESOURCE

The ability to carry energy and messages at a distance at the speed of light, made the spectrum of radio waves a valuable resource from which everyone can profit. Free access to it, from any place and at any time, added to its attractiveness. Later, another abstract concept, the geostationary-

satellite orbit, has been integrated with the original concept of the spectrum resource.

A great array of radio services has grown to be vital to the society. Defense and navigation are examples. Radio and television have become the main source of everyday information for most people of the world. The Winter Olympic Games 1994, for instance, were watched by two billion people, or so. There are more TV sets than telephones, and radios are even more abundant. Radiowaves are irreplaceable to communicate in move, or with remote and rural areas. They play a principal role in meeting information needs of illiterate people unable to read, and of developing countries, about two-thirds of the world population. All these applications depend on the electromagnetic spectrum.

It is widely accepted that the spectrum will be the engine of economic growth and improvement of the standard of living in the next decades. The traditional uses such as broadcasting, point-to-point fixed links, maritime and aeronautical communications, etc., are developing at a growing pace. At the same time, technological innovations create new services and applications. One of them is the Global Positioning System (GPS), a space-based navigation, positioning and time-transfer system. The GPS offers unsurpassed accuracy and availability for the cost of thousand million US dollars or so. Some predictions suggest that GPS receivers may become as ubiquitous as watches, and GPS coordinates may eventually replace a street address to define the location of home or business.

Another booming application is the satellite mobile service. Several constellations of satellites are expected to be launched before the end of this decade to provide personal communications worldwide, at any time and any place. The project has so far absorbed about eight billion US dollars. In 1994, another project was announced to build a global system of 840 low-Earth-orbit satellites. This would be an orbiting packet-switched data network to interconnect computers and hand-held terminals around the world. It would employ 40 satellites in each of 21 polar orbits some 700 km above the earth at the 30 GHz frequency band and would cost $9 billion or so (Microsoft, 1994)

A decade or so ago, another project, known as the Satellite Power System, was developed, to satisfy the increasing energy demand. A constellation of 60 or so satellites would collect energy from solar radiation above the earth atmosphere, beam it to the Earth, and inject into the existing power distribution system. Each satellite would carry a solar array, 10 km long and 5 km wide, klystron generators, and 1 km diameter phased array microwave antenna. Radio waves would transport the energy from the geostationary-satellite orbit to a terrestrial receiving antenna array of about 10 km in diameter. The system would cover about 50% of the USA energy consumption and cost few thousand million US dollars.

The spectrum resource becomes crucial for national and world economy. The use of the radio spectrum for communication and other applications (industrial, medical, scientific and domestic) means business. In spite of the economic crisis, the telecommunication sector is booming, with more than $500 billion revenues and 8% growth rate (1992). In 1990, in the USA only, shipments of radiocommunication equipment were estimated to be over $55 billion (U.S. Spectrum..., 1991, p.1). One of the UK cellular operators alone made a yearly profit of about £350 million (Goddard, 1994).

There are various functions vital to the society, ranging from public safety to air traffic control and weather forecasting, for which radio frequency spectrum is essential. Of equal importance is the catalytic role radio plays in the development of nations. Various services, such as mobile radio, make substantial contributions to the economy also indirectly, by increasing the productivity in other sectors. The access to the spectrum resource means access to science, technology, business, politics and power.

The importance of the discipline has been evidenced by the number and caliber of intergovernmental organizations involved. Among them, there are specialized UN Agencies such as the International Telecommunication Union (ITU), International Civil Aviation Organization (ICAO), International Maritime Organization (IMO), World Meteorological Organization (WMO), and the World Bank. In Europe, involved in spectrum management are: the European Commission (EC), Conference of European Posts and Telecommunications Administrations (CEPT), European Radiocommunications Committee (ERC), and European Radiocommunications Office (ERO), among other organizations.

Due to its importance, the uses made of the spectrum resource is regulated by international treaties. The most significant is the ITU Constitution and Convention. One article of the Constitution reads:

"... *radio frequencies and geostationary-satellite orbit are limited natural resources ... they must*

be used rationally, efficiently and economically ... so that countries ... may have equitable access to both..." (Constitution, 1992, Art. 44)

1.2. SPECTRUM SCARCITY?

Radio is entering a new era. The converging computer and communication technologies improve the old services and generate new ones. With the renaissance of wireless technology, the radio frequency spectrum is becoming a scarce resource. The number of radio stations, terrestrial and satellite, is growing and the frequency demand increases without precedence. The ITU has recorded more frequency assignments in the last few years than during the whole previous history of radio.

Deregulation trends encourage newcomers to apply for new broadcasting and wireless communication licenses. However, the most suitable frequencies have already been occupied, and the demand for new frequencies often exceeds what can be accommodated. In some regions, there is no place for a new radio service due to the spectrum congestion. Some analysts suggest that congestion is inevitable in VHF/UHF frequency bands in areas where population density and GNP exceed, respectively, 200 people/km^2 and \$10.000 per capita p.a.. The scarcity of spectrum hampers further development of radio applications. Redistribution and better use of frequencies is felt necessary by many analysts. The issue is critical for the future of all radio-dependent businesses local, national, and international, and deserves serious consideration.

As a consequence of the spectrum scarcity, conflicts arise between those who have access to the spectrum resources and those who have not. Conflicts arise also between the proponents of competing uses of the spectrum and between those who manage the spectrum and those who want to use it (Huang, 1993). These conflicts may be of various natures: commercial, social, political, or physical.

The society is composed of various groups, each with its own interests, goals, and views on how to use and manage the spectrum resources. For established service providers, whose needs have already been satisfied, spectrum management should assure a continuation of the existing order. Any modification would be a threat to their privileged position. The *status quo* is, however, unacceptable to those who have no access to the resource. For them, the principal aim of spectrum management is to change the way the spectrum is apportioned, and to eliminate obstacles that prevent competition operating smoothly. What is the best for one group is not necessarily good for another. The spectrum management policy tends to reflect the relative balance of powers of the competing groups.

The growing disproportion we observe between what is demanded and what is apportioned depends strongly on how the spectrum resource is managed. Some analysts believe that the scarcity is, in great part, a combined effect of inadequate approach to the spectrum, simplistic management rules, primitive tools, and oversimplified engineering models. An analysis indicated that inadequate management arrangements caused economic losses evaluated for many tens of millions of pounds per year in the United Kingdom only (*The future management...*, 1994).

2. SHARING THE SPECTRUM

This section deals with the basic issues of the usage of common spectrum resources by many users. For that purpose, spectrum sharing models are introduced.

2.1. FREE-PASTURE MODEL

Common resources such as the radio frequencies and geostationary-satellite orbit have one disadvantage which can be best explained on a model of free pasture. Because the pasture is open to all and free of charge, it is to be expected that everybody keeps his herd on it, and that each herdsman tries to maintain as many cattle as possible. Such an arrangement works well until the number of beast reaches the carrying capacity of the pasture. At this point, the scenario develops following the inherent logic of the commons.

"*As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks 'What is the utility to me of adding one more animal to my herd?' This utility has one negative and one positive component:*

1) The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.

2) The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all herdsmen, the negative utility

for any particular decision-making herdsman is only a fraction of -1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another... But this is the conclusion reached by each and every rational herdsman sharing a commons.

Therein is a tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons." (Hardin, 1968)

Is that model applicable to the radio frequencies and the geostationary- satellite orbit? The pasture and the spectrum are quite different objects, but there are some analogies. Indeed, the spectrum resource cannot be fenced and is available for countries free of charge at the international market. It has a limited carrying capacity, the limits resulting from the laws of physics, the available technology, and the management system. A portion of spectrum resource used by one system is denied to other systems.

If, therefore, one replaces the word *animal* in Hardin's text by *radio station* and *herdsman* by *Administration*, one obtains a global model of unrestricted use of the spectrum resource. The conclusion is that the concept of free use of the spectrum resources may work satisfactorily only if the number of users is negligible. As that number increases, competition develops and the concept has to be abandoned.

2.2. OTHER MODELS

Our past confirms that the approach to our resources changes, as does our understanding of their value and social role. We have discovered that many common resources, considered long time as being inexhaustible, have become scarce. Firstly, the commons in food gathering were abandoned. Farmland has been enclosed, and there is no free farmland now. Later, open pastures and free hunting and fishing areas have been restricted. Then, using the commons as a place for waste disposal has been abandoned and restrictions on the disposal of sewage are now widely accepted throughout the world. A concept of environmental protection was developed, and restrictions were also imposed on the pollution of land, water and air. Not so long ago, the radio frequencies and geostationary satellite orbit were added to the list of critical resources.

The issue of rational use, sharing, conservation, and protection of limited common resources has become an essential element, on national and world-wide scales. When discussing their future, several possible approaches can be indicated:

"We might sell them off as private property. We might keep them as public property, but allocate the right to enter them. The allocation might be on the basis of wealth, by the use of an auction system. It might be on the basis of merit, as defined by some agreed-upon standards. It might be by lottery. Or it might be on a first-come, first-served basis... " (Hardin, op.cit.).

Any of these options implies an organizational framework necessary for consultations, coordination and negotiations among the parties interested. For common benefit, these parties have to agree common rules and restrictions to be observed, and mechanisms to settle unavoidable conflicts.

2.3. PREFERENCES

Which of the approaches listed above is the best one? Each of them can be questionable, dependent on the criteria applied. The final answer results from human preferences of goals and hierarchies of values. In practice, it is often impossible to separate technical aspects of resource sharing from their economical, social and political contexts, and from the interests affected by them. However, discussion of non-technical issues is beyond the scope of this text.

The problem of sharing scarce resources cannot be solved by technical means, without involving systems of human values and ideas. Tradition and past experience play a significant role here:

"Every adoptable set of resource process will be one which is valued by some population in terms of that population's own system of activities. ... Where a resource process involves beliefs and techniques that are incongruous with a people's system of activities, it will not be adopted by that people, however superior it may be by other criteria." (Firey, 1977)

However, in a pluralistic society the goals and hierarchies of values are often inconsistent and conflicting:

"...The hierarchies of values and preferences of each individual are inconsistent among themselves, and different individuals and ... groups have different hierarchies of preferences which are partially in conflict with those of other groups and individuals. Furthermore, the

capacities of different groups to implement their preferences ... are widely different" (Brooks, 1972).

Inconsistency means here that progress toward realization of one value or goal is destructive of another value or goal held by the same individual or group, and the lack of consistency may be not obvious to the individual or group concerned. *Conflicting* goals or values mean such goals or values of two groups that cannot be served by the same policies: what enhances one will degrade the other.

The way in which the spectrum resource is used and managed follows the technological, economic political and social changes in the world. Our experience from the past shows that countries follow the example of a leading or dominating nation and accept voluntarily its "mode of life" and hierarchy of values.

3. COMPETITION AND COOPERATION

This section discusses two opposite trends ruling the use of spectrum resource and shows how they complement each other. These are competition and cooperation.

3.1. EARLY YEARS OF RADIO

The first uses of radio waves were military, to communicate with warships on the sea. Soon, however, military secrets were abandoned under the pressure of private business rushing to exploit the "nobody land" of civilian radio. It was at the turnout of the century that competition in radio communication started. In a liberal environment, without any control, regulation, and negotiations, mutual interference paralyze the operation of systems. Two opposite tendencies become visible, one diverging and another converging. The diverging one was the competition among the service suppliers and among the equipment producers. It was leading to separate communication networks and incompatible equipment. The converging force came from the market. The users of radio wanted to communicate freely one with another, independently of the service or equipment supplier. That tendency forced them to cooperate.

Finally, all parties came to a conclusion that coordination of their activities is necessary. Such coordination activities started on a national scale, with strong governmental involvement. A global nature of the problem required, however, an international cooperation. Only two years after the first transatlantic wireless communication had astonished the world, the first international conference was called to coordinate the spectrum resource use. It was the preliminary conference held in Berlin, in 1903. That conference marked the end of the first period of liberalism and uncontrolled rivalry in radiocommunications.

3.2. FIRST AGREEMENTS

The first radio conference held three years later, also in Berlin, agreed upon the principles of radio spectrum management. Like at all intergovernmental conferences, the private sector interests were represented indirectly, through governmental delegations. One of major steps at the conference was the establishment of the International Bureau in Bern to register the operating frequencies of radio stations to avoid mutual interference. It was the first attempt to manage the radio frequency spectrum, worldwide. The register of the occupied frequencies was named later "The Bern List".

International treaties are all part of a worldwide game nations agree to play following certain rules. Agreement is an inevitable ingredient here, and there is nothing to force nations to abide by these rules. If competitive forces are stronger than cooperative ones, no progress could be made. In Berlin it was not possible, due to conflict of interests, to reach consensus on issues related to inter-communication. There were several separate maritime radio communication networks in operation, but no communication was possible between the networks of different operators. Soon, a test of life showed in full light its tragic consequences. It was the well-known disaster of Titanic in April 1912. Only three months later, and not without the influence of public opinion shocked by the disaster, the second radio conference was held in London. It finally settled the problem of inter-communication between ships on the sea.

The World War I interrupted international cooperation for few years. Radio science and technology, harnessed to military applications, got an enormous impetus. When the war finished, all the scientific progress, technical developments and operational experience gained during the war time could be used again in peaceful service for the humanity. In new circumstances, the old international agreements regulating the use of radio waves were not appropriate.

Consequently, the next international radio conference was called to Washington in

1927. The problem of frequency demand exceeding the available spectrum resource appeared sharply there, and the unending battle of frequencies had started. At that time, spark-type transmitters were in use. They occupied wide frequency bands, much wider than needed to transmit the information. The demand for a complete outlawing of spark-type transmitters was pressed strongly, but not passed because of conflict interests.

The spectrum shortage problem was settled in Washington by two actions. On the one hand, more stringent technical standards were imposed, to limit the radiation out-of the band necessary for transmission of information. On the other hand, the spectrum resource limits defined in old radio regulations were moved to embrace additional portions of spectrum, not yet regulated. That approach has been copied at all later radio conferences.

The drawing up of the first Frequency Allocation Table, regulating the use of the spectrum, was considered as one of the most important results of the Washington conference. Another one was to set up the International Radio Consultative Committee, CCIR. Its aim was to study technical ad operational issues relevant to radiocommunications and to issue recommendations on them.

Under the pressure of service and equipment suppliers, administrations allowed the non-governmental sector to participate directly in the work of the ITU-CCIR. In the following years, the involvement of that sector increased. In 1992 one-third of entities participating in the CCIR work were non-governmental.

4. INTERNATIONAL SPECTRUM MANAGEMENT

This section introduces the word-wide spectrum management. The system of the International Telecommunication Union is described.

4.1. THE ITU

The use of the radio frequency spectrum is now coordinated through the International Telecommunication Union (ITU). The ITU, a Specialized Agency of the United Nations since 1947, is the oldest of all existing intergovernmental agencies, with a line-age dating back to 1865. It performs legislative, management, and executive functions, within budget limits set to about $100 million, a tiny fraction of the market value of radio services and equipment. In maintaining the ITU, the Member countries have the object of

"*... facilitating peaceful relations, international cooperation among peoples and economic and social development...*" This activity must, however, not interfere with the principle of sovereignty, and " *...the sovereign rights of each country to regulate its telecommunications*" (Constitution, 1992, Preamble) are fully recognized. The ITU Members, totaling now more than 160 countries, agreed that the Union shall, in particular:

"*a) effect allocation of bands of the radio-frequency spectrum, the allotment of radio-frequencies and registration of radio-frequency assignments and any associated orbital positions in the geostationary-satellite orbit in order to avoid harmful interference between radio stations of different countries;*

b) coordinate efforts to eliminate harmful interference between radio stations of different countries and to improve the use made of the radio-frequency spectrum and of the geostationary satellite orbit for radio-communication services;..." (Constitution, 1992, Art. 1) The agreed general rule of rational use of the resource is "*... to limit the number of frequencies and the spectrum used to the minimum essential to provide in a satisfactory manner the necessary services. To that end, they shall endeavour to apply the latest technical advances as soon as possible.*" (Constitution, 1992, Art. 44).

Changes in the world require the policies and structure of ITU to be reviewed time to time. In this connection, the Members of the Union meet, at regular intervals, at a Plenipotentiary Conference. This is the supreme authority which lays down the general policy and structure of the ITU, reviews the Union's work and revises the Convention itself, if it considers this necessary. It also establishes the calendar of all ITU conferences, and sets a limit on expenditure until the next Plenipotentiary Conference. The last such a conference was held in Kyoto in 1994.

The Plenipotentiary Conferences of 1992 and 1994 have introduced major changes in functioning of the union, marking the end of one era in the history of the ITU. The "new" ITU will follow closer the trend of liberalization and privatization seen around the world. Its functions have been separated in the three Sectors:

- Telecommunication Development Sector,
- Telecommunication Standardization Sector and

- Radiocommunication Sector.

The Plenipotentiary Conference continues as the supreme organ of the Union, the former Administrative Council changes the name to "Council" and the General Secretariat remains without change.

4.2. RADIOCOMMUNICATION SECTOR

To keep pace with technological, economic, and political changes, the ITU periodically reviews the spectrum management rules. Fig. 1 illustrates the process of global spectrum management in the ITU, in force since 1993. It forms a closed-loop system built around consensus-seeking studies and negotiations.

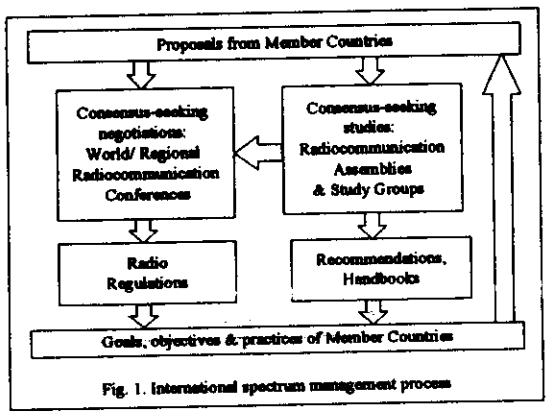

Fig. 1. International spectrum management process

Since 1993, the ITU Radiocommunication Sector forms the supporting organizational framework for international spectrum management. Its mission is, inter alia, to ensure rational, equitable, and economical use of the radio-frequency spectrum by all radiocommunication services, including those using the geostationary-satellite orbit, to solve international conflicts, and to carry out studies on radiocommunication matters.

The mission of the Sector is accomplished by

- ensuring meeting the specific needs of Members through Radiocommunication Conferences and Radio Regulations
- coordinating efforts to eliminate harmful interference between radio stations of different countries
- making recommendations on technical and operational radiocommunication matters through Radiocommunication Assemblies and Study Groups.

The Sector consists of the following organs:

- World and Regional Radiocommunication Conferences
- Radio Regulation Board
- Radiocommunication Assemblies & Study Groups
- Radiocommunication Advisory Group
- Radiocommunication Bureau.

4.3. RADIOCOMMUNICATION CONFERENCES

Three objectives shape any spectrum management system: conveying policy goals, apportioning scarcity, and solving conflicts. To solve the conflicts, coordination and negotiating among the conflicting parties are employed. As the radiowaves do not stop on political borders, international aspects have been involved since the very beginning. In the early years of radio, an administration was generally required to co-ordinate with one administration only. Later, the spectrum scarcity resulted in a necessity to co-ordinate among three and more Administrations. The negotiations with one may lead to modifying the characteristics of the network. This, in turn, often makes necessary re-negotiations with the other, and even the involvement of a third party, new in the processing. Such an iterative co-ordination and search-for-agreement process became absorbing much effort and time and lead to multilateral radio conferences.

Spectrum sharing principles

The first Radio Conferences established general principles maintained until the present time, with minor changes only. These are:

- the radio frequency spectrum resource (including the geostationary satellite orbit added at later conferences) is a public resource;
- each country has equitable and free access to that resource;
- the use of the spectrum resource is based on regulations and administrative allocation of frequency bands and positions in the geostationary satellite orbit;
- the principles of electromagnetic compatibility (EMC) have to be followed by all parties (this term was introduced later).
- the regulations and frequency allocations are set through the mechanisms of consultations, negotiations, and consensus.

Following the tradition originated in Berlin, London, and Washington, the use of the radio frequency spectrum continues to be based on negotiations and consensus among

all Members of ITU at radio Conferences. The Conferences review and negotiate the usage of radio frequencies. They may establish and revise the frequency allocations, operational rules, standards, and procedures relevant to the spectrum resource sharing. A collection of legal, administrative, operational and technical arrangements agreed by all parties at the Conferences are included into the ITU Radio Regulations. These Regulations are binding on all parties, and only the Conferences have the authority to change them.

The participants in the Conferences are official governmental delegations of the ITU Member Countries. Each has one voice, independently of its size or economic significance. The Conferences are also open to the United Nations, international organizations, regional telecommunication organizations, intergovernmental organizations operating satellite systems, the specialized agencies of the United Nations, and the International atomic Energy Agency. The national delegations represent interests of all domestic groups, but there is a growing pressure to allow non-governmental entities a more direct involvement. Since 1993, non-governmental entities authorized by their countries to participate in the work of the Radiocommunication Sector are admitted also to radio conferences.

The Radiocommunication Conferences may be world-wide or regional, general or specialized. Since 1947, when the ITU joined the United Nations System, there were three general World Administrative Radio Conferences, WARCs (in 1959, 1979 and 1992) and several specialized and/or regional conferences. The general WARCs were authorized to deal with virtually all aspects of spectrum use. The specialized WARCs dealt with particular services and/or particular portions of the spectrum. The regional conferences were held to solve specific spectrum use problems within particular geographic regions. The first World Conference in the new system was held in Geneva in 1993. The next ones are to be held on a regular basis every two years in 1995, 1997, etc.

4.3.1. Planning Conferences

Some Radiocommunication Conferences are convened to negotiate and agree international frequency plans for certain application, geographical regions, and frequency bands which are subject to *a priori* planning. A frequency plan is a table, or more generally, a function that assigns appropriate characteristics to each of the radio stations at hand. It may be one, a few, or all characteristics by which radiocommunications can be distinguished one from another. Examples are: the operating frequency, power radiated, antenna location, height and radiation-pattern, polarization, service area, etc. Initially, in the early days of radio, only the frequency was assigned, and this explains the traditional name "frequency planning".

In *a priori* frequency plans, specific frequency bands (and geographic areas) are reserved for particular applications well in advance of their real use. Individual regions may have various allotment plans for specific services (e.g., broadcasting), within their respective areas. *A priori plans* make a one-time distribution of the spectrum resource on the basis of the expected or declared needs of all parties interested. That approach has been used, for instance, for the sound and television broadcasting in Europe and in Africa, and for some satellite services. The techniques used for that purpose are discussed in the following sections.

Critics of the *a priori* planning indicate that it freezes technological progress. Indeed, technological progress is very fast, and implementation of the plan may require several years. Technology known at the time of creation of the frequency plan may be obsolete at the time of its implementation.

Another difficulty is the impossibility to predict future requirements with a needed degree of accuracy. Plans based on unrealistic data have no value at all.

In addition, as the radio spectrum is available at no cost at international conferences, there is no mechanism to limit the requirements. Although the ITU Convention calls for minimizing the use of the spectrum resource, " *...each country has an incentive to overstate its requirements, and there are few accepted or objective criteria for evaluating each country's stated need. In fact, the individual country itself may have only the dimmest perception of its needs over the time period for which the plan is to be constructed ... Under these circumstances, it is easy to make a case that allotment plans are not only difficult to construct, but when constructed will lead to a waste of resources as frequencies and orbit positions are 'warehoused' to meet future, indeterminate needs...*" (Robinson, 1980)

4.4. ITU Radio Regulations

For system planning, the most important are the ITU Radio Regulations. It is the

summary of agreements reached at the Radiocommunication Conferences, the framework and backbone of the overall spectrum management. These Regulations have the status of international treaty, binding on all members of ITU.

Simplification of Radio Regulations. After a series of Conferences, the Regulations became complex and difficult to understand and to follow in practice. Consequently, the ITU Members decided to simplify them and created a Voluntary Group of Experts (VGE) for that purpose. The Group concluded its work in 1994, and the 1995 Conference will consider the results. No substantial changes in technical or operational requirements are expected, but some provisions will be transferred to ITU Recommendations or Rules of procedures. The future Radio Regulations will contain only provisions essential from the viewpoint of international treaty and will refer to those texts.

Regions & Service Categories. The Radio Regulations differentiate between geographical regions and radio applications called *services*. There are three regions: Region 1 which consists of Europe, Africa and part of Asia (USSR and Mongolia), Region 2, containing both Americas, and Region 3, consisting of Australia, Oceania, and the remainder of Asia.

The radiocommunication services are grouped in three main categories: mobile, fixed and broadcasting. In addition, one differentiates between the primary, permitted, and secondary services. Primary and permitted services have equal rights, except when planning, stations of a primary service have priority in choice of frequencies. Stations of a secondary service should neither cause interference to, nor claim protection against interference from, stations of primary and permitted services.

Frequency Allocation Table. The use of the radio frequency spectrum has been based on frequency allocation principles, as given in the Table of Frequency Allocations, that defines the specific uses of specific frequency bands. *Allocation* means the distribution of a frequency band to a service, *allotment* - to a country or area, and *assignment* - to an individual radio station. Some allocations are world-wide, that is identical throughout the world. In other cases, allocations are regional, that is uniform throughout a particular region. The International Frequency Allocation Table is annexed to this text.

Footnotes. In some cases there are allocations specific for a single country, or a group of countries, in addition to, or different from, allocations approved by a majority of ITU Members. These are so-called *footnotes* to the Table of Frequency Allocations. Frequencies allocated to a service are available for use by any country, subject only to the limitations contained in the ITU Radio Regulations. The Frequency Allocation Table covers the frequency range extending from below 9 kHz to 400 GHz and has fundamental significance in system planning.

Frequency plans. The Radio Regulations contain also frequency plans agreed at the Radiocommunication Conferences. For services subject to such a planning procedure, a frequency assignment according to the plan receives protection from any other assignment.

Other issues. In addition to frequency allocations, the Radio Regulations contain many rules for the use of frequencies, and specify operating procedures for stations and for the coordination of frequencies. One of the basic requirement is that no transmitting station may operate without a license issued by the Government of the country to which the station in question is subject. The license must be in conformity with the Radio Regulations.

4.5. RADIO REGULATION BOARD

The new part-time Radio Regulation Board consists of nine elected Members serving "as custodians of public trust" and not as representatives of their respective Member States or Regions. The Board approves the Rules of procedure and technical criteria which are used in the application of the Radio Regulations to register frequency assignments. It considers any matter which cannot be resolved through the application of the Rules of procedure and performs any duties related to the assignment and utilization of frequencies and to the equitable utilization of the geostationary-satellite orbit.

Moreover, the Board considers reports on investigations of cases of harmful interference and formulates recommendations for their resolution. Such investigations are made at the request of one or more ITU Members.

4.6. ASSEMBLY AND STUDY GROUPS

The Radiocommunication Assembly and Study Groups continue the tasks of the former International Radio Consultative Committee (CCIR) and its Study Groups. They provide the technical bases for the

work of Radiocommunication Conferences and for the rational use of the frequencies and geostationary satellite orbit.

These are groups of experts in which administrations and public/private sector entities participate on a voluntary basis. In 1994, 120 companies and 50 international and organizations were taking part along with the representatives of Administrations. They study technical questions relating to radiocommunication issues and draft recommendations to be approved by the Administrations at the Assembly or by correspondence. Even approved, the Recommendations are voluntary (unless they are referred to in the Radio Regulations).

The focus of study is on the rational use of the spectrum resource and performance standards and criteria for radio systems in terrestrial and space radiocommunication. Subjects covered include:

- Spectrum utilization and monitoring
- Inter-service sharing and compatibility
- Science services
- Radio wave propagation
- Fixed-satellite service
- Fixed service
- Mobile services
- Sound broadcasting
- Television broadcasting.

Throughout a year, hundreds of experts meet at the ITU Headquarters in Geneva to develop recommendations, and thousands of others contribute by correspondence. A single meeting may be attended by over 200 specialists to study over 1000 pages of proposals, producing about 100 Recommendations a year. This represents a gigantic intellectual and logistic effort. The first Assembly was held in Geneva in 1993. The next ones are to be held in conjunction with the Radiocommunication Conferences in 1995, 1997, etc.

4.7. ADVISORY GROUP

The Director of the Radiocommunication Bureau is assisted by a group advising on strategic issues. The role of the Advisory Group is to:

- review priorities and strategies in the Sector activities as well as the progress on the implementation of the work program;
- provide guidelines for the work of the Study Groups
- recommend measures to foster cooperation and coordination with other organizations and within the various constituencies of the ITU.

The advisory group is open to representatives of administrations and other entities authorized to participate in the work of the Union, including non-governmental ones.

4.8. RADIOCOMMUNICATION BUREAU

The Radiocommunication Bureau (BR) supports activities of the other organs of the Sector and performs all duties previously dealt with in the Secretariats of the former International Frequency Registration Board (IFRB) and CCIR.

The duties of the Bureau include:

- the processing of frequency assignment notices, including information about orbital locations of geostationary satellites, received from administrations for recording in the Master International Frequency Register (MIFR), a central database on the spectrum resource use. This includes also the maintenance, review and updating of the MIFR and periodic compilation of frequency lists reflecting the data recorded in the MIFR
- the processing of information received in application of the procedures of the Radio Regulations (advance publication, coordination, publication of weekly circulars on new applications and on the results of their examinations, etc.);
- the processing and coordination of seasonal HF broadcasting schedules;
- the investigation of cases of harmful interference on the request of one or more administrations;
- the provision of assistance to administrations in the field of the spectrum utilization including the training of staff;
- the collection of the results of monitoring observations coordinated internationally;
- the development of Rules of procedure and technical criteria for internal use after approval by the Radio regulation Board;
- the provision of technical and administrative support to Radiocommunication Conferences, Assemblies and Study Group activities;
- publication of revised Radio Regulations, Recommendations, and

Handbooks on radio system characteristics and spectrum utilization.

5. NATIONAL SPECTRUM MANAGEMENT

This section discusses major issues in national spectrum management. Emphasis is given to new trends and models that are being under consideration in several countries.

5.1. GENERAL

Profits drawn from the use of spectrum resource are limited by physical proprieties of the resource, by technology, and by management capabilities. To exploit all potential benefits, each country must thus develop both, the technological and management capabilities. Otherwise it would be unable to coordinate uses made of the resource, to solve conflicts within the country, to represent the country's interests at international fora. It would be also unable to verify that all regulations and obligations are respected which is a necessary element to assure the rational use of the resource and to prevent interference.

National spectrum management is in many aspects similar to the international management discussed in the previous section. In all countries-members of ITU, no frequency can be used without the prior authorization made by, or on behalf of, the Government. This makes a significant difference from the international approach that is voluntary. A fee is collected for such authorization, which is another significant difference. In almost every country, there exist a national spectrum manger - a governmental agency or service responsible for spectrum management issues. In Germany, for instance, about 2500 civilian personnel is involves in such a service. In the USA, the Federal Communication Commission employs over 1000 staff and spends about $100 million yearly (1990).

National spectrum mangement bases on international agreements discussed earlier, and on National Radiocommunication Laws and Directives. All technical and operational requirements are usually detailed in the National Radio Regulations, Frequency Allocation Tables, National Frequency Plans, and in technical standards compatible with the international treaties, regulations, and standards.

5.2. ATTRIBUTION OF FREQUENCIES

Planning of any radiocommunication system involves, among others, assigning of operating frequency. The assignment can concern an individual station, or a network of several stations requiring a set of frequencies. In any case, each assignment has to be in conformity with the radio regulations, standards and agreements in force. Moreover, detailed compatibility examinations are necessary to determine if the proposed assignment could cause interference to, or suffer interference from, other systems that already exist or have been planned earlier. The same applies to the position on the geostationary-satellite orbit. If any potential incompatibility is discovered, the system parameters must be changed to eliminate the source of the incompatibility. Alternatively, negotiations with the parties involved in the conflict are necessary to solve the conflict. Some technical details involved are discussed in the following sections. More details can be found in the literature listed at the end of the paper.

If the potential interference involves system or systems from outside the country's territory, the assignment has to be notified to the ITU. The notification is also required if the station is intended for international communication, or if the assigning country seeks an international recognition for the assignment. The ITU staff examine the submitted notification according to the International Radio Regulations and Rules of procedure. If the result of the examination is favourable, the proposed assignment is registered, otherwise it is returned for modification. The final step in that process is the issue of an authorization, license, or concession that allow for legal use of the assigned frequency or frequencies.

5.3. SELLING THE SPECTRUM?

The disproportion between the demand for radio frequencies and orbital positions on one hand, and the available resource capacity on the other hand, call for reconsideration of the existing order in the spectrum resource use and management. The current practices, based on the administrative allotment and *service separation* philosophy was elaborated at the times of the first radio conferences. In the meantime, the world has changed. Digital signal processing, microelectronics, and computer technology opened new horizons for *integration* of services and techniques. New ideas such as packed-switched and spread-spectrum technologies have

revolutionized the concept of frequency channel use.

The role of non-governmental international financial and technological giants became increasingly important. The US Motorola's Iridium example proved not only the innovative capabilities of such organizations, but also their international power. At the World Administrative Radio Conference 1992, the Iridium project was supported not only by the USA but also by almost 20 developing countries. This was possible by convincing them that Iridium is a way out of their frustrated development efforts in the past.

To follow these changes, in some countries, and in some frequency bands, the existing administrative regulation system has been replaced by a competitive market economy mechanism. In other countries that mechanism is being proposed. *Deregulation* is urged as a means of allowing market forces to distribute the spectrum resource to the market sectors where demand is greatest. Advocates of this idea indicate that it automatically matches the demand to the available resource capacity and is inexpensive in implementation. Moreover, opinion area expressed that relying upon administrative decision-making is inferior to relying on market forces because decisions are arbitrary and often mistaken in determining what is the best interest of users [Webbing, 1977, Deregulation, 1987].

With market economy rules, the concept of radio frequency spectrum as a free common resource of the humanity has to be abandoned. It will rather become a renewable and reusable commodity or a sellable, auctionable, rentable thing like a piece of real estate. Regardless of the mechanism, there is growing support for putting price tags on the spectrum [Dougan, 1992].

The idea is presented in various fora and in various forms. An example is "Bogota Declaration" in which some equatorial countries claim their sovereign rights over the geostationary orbit above their territories. Any satellite located above these countries would be under their jurisdiction. Behind the legal issues, hidden are financial benefits such as fees and taxes. The Bogota Declaration was an attempt to extend the concept of national waters and air space over the spectrum resource. That idea, however, has been rejected by all non-equatorial countries.

One expected that the recent World Administrative Radio Conferences would be a major vehicle for debating a new order of the spectrum/orbit use. In reality they did not establish any new principles, and were"..*rather to adjust existing regulations governing spectrum allocations and use to accommodate new and future requirements. The debate on general principles was left essentially untouched...*" (Robinson 1980).

5.4. ATTRIBUTION MODELS

When the set of free frequencies is insufficient to satisfy the demand, the spectrum manager has to decide how the scarce resource is to be attributed. Several approaches have been used for that purpose, and some are described below.

"First come, first served" or ***"Ad-hoc"***.The name of that approach defines its principle. From the economic standpoint, it corresponds to rationing through time, where the price is the time spent "queuing" before being able to access the resource. That approach favours the candidates who have the most ready access to information, or who are the most "patient".

Partisans of that approach underline its naturalness, simplicity and low cost of implementation. In the USA, for instance, a frequency for AM sound broadcasting can be assigned on demand, if the applicant is able to prove there will be no interference to other users. One of the main advantages of the *ad hoc* spectrum distribution is that it eliminates the "warehousing" problem.

Critics of the *ad hoc* approach indicate that it is not fair because it transfers all the burden to "latecomers". They alone must accommodate their requirements of the existing uses of the resource. The method also excludes application of some "feed-back" optimizations that would require modifications in the existing uses of the spectrum resource. Replacement of *ad hoc* methods by systematic plans would allow for fair sharing and better use of the resource, they say.

"Beauty contest". The "beauty contest", or selection on merit, involves an evaluation and ranking of qualities of each applicant to select according to merit between competitors for the same portion of the resource at the same time. Some qualification standards are required for that purpose. In France, for example, TV licenses were attributed according to a criterion of the "culturally highest bidder". In the USA, they were given to the "best user" after a "comparative hearing" procedure, according to a criterion of "social benefit".

The approach was questioned by many as based on insufficiently precise criteria and prone to a risk of corruption.

A variant of that procedure, involving more precise criterion, was used in France in 1987. The authorities defined the specifications, and called for tender. The contract was awarded to the bidder who minimized costs and prices within the constraints laid down in the specifications. (The specification required a mobile network in operation by March 1989, with the coverage of 85% of the national territory to be reached in 1991 and a capacity for 30.000 subscribers in the Paris region and 100.000 for the whole country).

Lotteries. When the rights to use frequencies are attributed by a lottery procedure, the spectrum manager identifies the lots, defines the concession clauses and organizes and conducts the draw. In the USA, following the complaints concerning the prohibitive costs of "comparative hearings", the lottery procedure was used for the attribution of cellular radio licenses during the period of 1984-1989. Any American citizen capable of proving his capacity to put into operation a cellular network within a given time period (18 months) could apply.

The application of lottery process is the only method permitting an equitable distribution of a limited resource. It is, however, questioned because of the many dummy applications lodged and the speculation that accompanies subsequent resale of licenses.

Auctions. The sale by auction of concession to use the radio spectrum resource maximizes the State revenue. It is advantageous to those who are able and willing to pay the most.

In the traditional auctions bids are oral. The auctioner starts with a low price and increases it until the good is finally obtained by the highest bidder. In some such auctions the bids are submitted in writing, with the good going to the highest bidder at the price he has stated. In Vickery, or second-bid auctions, bids are in writing. Each bidder states his price and the good goes to the highest bidder, but he pays the price stated by the second highest bid. Dutch auctions are oral auctions where the auctioner starts with a high price and then reduces it until a bidder accepts to pay the price announced.

The auction approach was applied in New Zealand in 1990 or so, to sell certain portions of the spectrum. The concessions sold were of two types: management rights and license rights. The management rights concern a specified frequency band over the whole country and involve specific restrictions aimed at avoiding interference. These rights, granted for 20 years, may be divided, aggregated, and transferred. The license rights concern the use of a given frequency band over a given geographic area. They contain specific restrictions and a guarantee against interference. The license rights are transferable and are granted for a limited period of time.

Partisans of that approach underline its rapidity, low cost of implementation, and flexibility. Opponents stress that, in practice, it does not promote competition, putting "the big users" in a privileged position. Many consider that selection according to financial criteria is an ultra-liberal solution that only few political parties can support.

Mutual agreement. There are cases when the authorization to use a frequency band is transferred from one user to another as a result of mutual agreement. An example is the release to civil uses of frequency bands originally allocated to governmental/military applications in the USA and Europe. The transferability of the rights to use frequencies is subject prior authorization by the spectrum manager.

6. SPECTRUM ENGINEERING

This section deals with some general aspects of spectrum engineering. Elementary concepts of environment and spectrum use, and basic approaches to frequency planning are discussed.

6.1. ENGINEERING PROBLEMS

There are many millions of transmitting and receiving stations around the world, mutually interacting with the environment and among themselves. Radio waves they radiate spread out up to the limits of the Universe. It is the most complex and the largest system ever created by human civilization both in terms of spatial dimensions and in terms of the number of elements. Their radio signals would dissolve into chaos without proper coordination. The coordination process has to fit in with budget, technology and other constraints.

Our problem is a special case of a general problem: given a collection of consumers who place demands upon a set of resources, find an assignment of consumers to resources that satisfies various constraints and that minimizes (or maximizes) a given objective function (Hale, 1980). However, in attempts to solve this problem, serious difficulties have come across. Not only a proper objective function has to be

determined, but also all relevant constraints have to be identified, which is not an obvious task. Finally, a solution has to be found. Often, the exhaustive inspection of all possibilities is the only exact method available.

One of the peculiarity of the problem is a large number of possible frequency plans to be inter-compared. Let take into account a simplistic example of a network of N_T transmitters, each to be assigned an operating frequency and power. The operating frequency and power are to be selected from given catalogues of available frequencies and powers. The number of different plans possible, N, is

$$N = \left(N_F \times N_P\right)^{N_T}$$

where N_F, and N_P are the numbers of frequencies and powers in the transmitter catalogue, and N_T is the number of transmitters in the network.

With the network degenerated in a single transmitter, and the catalogue containing a single power and N_F different frequencies, N_F different plans are possible, as each frequency can be assigned to the transmitter. If the catalogue allows for N_P different values of the power, the number of different plans becomes N_P times greater, $\left(N_F \times N_P\right)$. Each transmitter added to the network increases that number. (Note that two frequency plans are identical if they contain the same transmitters and each transmitter has the same frequency and power.) For a modest network of $N_T = 10$ transmitters and catalogues containing as little as $N_F = 20$ frequencies and $N_P = 5$ powers, the number of different frequency plans possible reaches

$$N = \left(20 \times 5\right)^{10} = 100^{10} = 10^{20}.$$

Many of these plans may be unacceptable for various reasons.

Usual questions in such problems are: How much work is required to find the solution? Is the model and input data correct? Due to complex interactions and an enormous amount of required data, any attempt to apply rigorous formal methods to real-life situations leads to *ntrinsically difficult* or *intractable* mathematical problems which, unfortunately, cannot be solved in practice (Stockmeyer and Chandra, 1979).

As no exact solution method realizable is known, attempts have been made to apply various informal, approximate, and heuristic methods (Hale, 1980, Struzak, 1982). Despite all efforts, frequency management is still not yet based on stringent scientific and technical criteria (Sviridenko, 1977). Even if there would be such "ideal" criteria and allocation system, it is not sure that they would be accepted by business and policy makers. With no objective criteria and methods applicable, a "practical" approach based on past experience and negotiations has to be arranged.

6.2. AN ISOLATED SYSTEM

Spectrum management relies strongly on engineering models. One such model is shown in Fig. 2. The figure represents a simple single-link radiocommunication system TR. Transmitting station T produces a signal that carries input messages. The signal is radiated as radiowaves that are captured at the receiving station R. There, the message is to be reconstructed.

Due to various disturbances, the received and the emitted signals usually differ one from another. As a consequence, the recovered message may differ from the original message. The disturbances may be multiplicative, such as fading, additive, such as thermal noise, or combined.

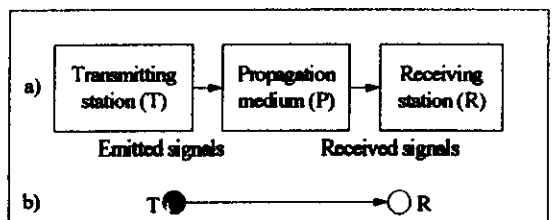

Fig. 2. An isolated single-link radiocommunication system a) simplified block-diagram b) graph representation

The task of the system is to keep the difference between the recovered and original messages within the limits of an acceptable error, according to a given criterion. The criterion is application-specific. In television, for instance, the error may be defined in terms of signal-to-noise power ratio, and should be not less than, for example, 10.000:1 (+40 dB). In other applications, that ratio may be as low as 1:10.000 (-40 dB), as in some spread-spectrum systems. There may be also additional requirements dealing, for instance, with the cost or weight of equipment.

A general problem can be formulated as follows. Given are class of messages, class of noise, and propagation transformations. What is sought, is the optimum ensemble of signals and transforms that the two stations should perform to satisfy the requirements. Involved may be various signals (continuous, digital, deterministic, random),

various operations (encoding, decoding, modulation, demodulation, spreading, despreading, filtering), etc. To reach practical solutions, the problem is usually broken into more specific tasks with restricted number of variables.

6.3. ENVIRONMENTAL EFFECTS

The system shown in Fig. 2 is isolated. Although models that assume isolated systems are standard in Communication Theory and classic Radio Engineering, they are often inadequate in spectrum management. Radiocommunications rely on free propagation of radiowaves and, consequently, all radio systems are potentially interconnected either by design, or through parasitic or spurious links.

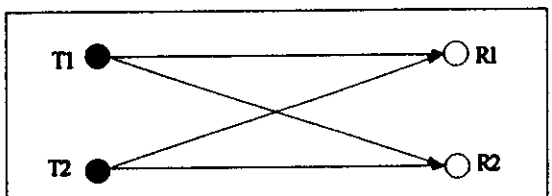

Fig. 3. Graph representing two single-link radiocommunication systems (T1R1, T2R2) with parasitic links (T1R2, T2R1).

The issue is illustrated in Fig. 3. The figure shows a system T1R1 in an ideal environment containing another system, T2R2. Along with the two designed or wanted links T1-R1 and T2-R2, two additional links T1-R2 and T2-R1 are shown. It is up to the designer, or spectrum manager, to decide what elements of the actual environment should be taken into account. In an extreme case, the modeled environment may degenerate to a transmitting (e.g., jamming), or to a receiving (e.g., radioastronomy) station only.

Fig. 3 may also serve as a model of a system consisting of two sub-systems. In any case, the links T1-R2 and T2-R1 are unintended, parasitic, or spurious. Such unwanted links decide whether the two systems T1R1 and T2R2 are compatible or not. It should be noted that signals and transforms optimal for an isolated system do not necessarily are optimal when environmental interactions are taken into account.

From the point of view of coordination aimed at reaching compatibility, the environmental systems can be classified into hostile or jamming, cooperative or allied, and neutral (neither cooperative nor hostile). The good thing is that, normally, all systems are cooperative, and only a small fraction of potential parasitic links among them is significant. The bad thing is that, in the real world, there is much more unwanted links than wanted ones and we do not know *a priori* which links are significant and which can be disregarded. In frequency planning and in inter- and intra-system compatibility studies, special techniques are being developed to cope with the multitude of wanted and unwanted links.

6.4. SPECTRUM USE CONCEPT

System planning and spectrum management are based on a concept of spectrum (orbit) use. A *used* or *occupied* portion of the spectrum resource means "denied to others". One distinguish between the actual, or physical, denial and administrative denials (Berry, 1977).

The space is physically denied if it is filled with sufficient power to interfere with other systems. It is administratively denied when its assignment would be against the spectrum mangement rules and frequency assignment criteria in force. The physically denied space depends on numerous processes and parameters which can be only roughly estimated, and is difficult to define with a precision. To simplify system planning, usually the administrative denial is used in organizational and management processing as a practical approximation to physical denial. Consequently, the space may be denied by administrative spectrum management rules even if it is really not physically denied.

The spectrum resource is used by transmitters and receivers in a complementary way. Traditionally, radio transmitters have been considered the users of the spectrum resource. They radiate power so that receivers of other system cannot operate in certain locations, times, and frequencies because of unacceptable interference. Note that the transmitter denies the space to receivers only.

On the other hand, receivers use the spectrum resource because they deny it to the transmitters. Spectrum mangers have to deny licenses to transmitters in certain locations, times, and frequencies, to guarantee interference-free reception. The protection may require minimum separation to be observed in space (coordination distance), frequency (guard band), etc. This denial constitutes "use" of the resource by the receiver. The radio astronomy bands are a familiar example of the recognition of receiver use of the spectrum resource.

Components, or "dimensions", of the spectrum resource involve the radio-frequency bandwidth (ΔB), physical

(geographical) space (ΔV), and time (ΔT). Note that that concept implies a multi-dimensional space of five variables: "classic" X, Y, Z (for ΔV), ΔB, and ΔT. Consequently, system planning and spectrum management often deal with the product

$$(\Delta B) \times (\Delta V) \times (\Delta T) \qquad (1)$$

that is denied to other users. In some cases, in dealing with the space ΔV, one differentiate between the coverage area and the interference area. The first one is the volume associated with the radio station at hand within which conditions for the normal service are fulfilled. The interference area is a similar volume within which the station is likely to interfere with other stations. Derived from these concepts are two distances: the coverage range and the interference range of station.

Note, however that formula (1) is only a rough, approximation. Indeed, other quantities, such as polarization, modulation coding-decoding and spreading-despreading schemes, can be treated as additional dimensions. The argument is that systems using "orthogonal" values of these parameters do not interfere with each other. For example, horizontally polarized antennas do not respond well to vertically polarized radio waves. Another weakness of this measure is that it concerns an isolated system. The formula (ΔB×ΔV×ΔT) ignores effects of system nonlinearities such as intermodulation and imperfections such as out-of-band radiation. It makes no difference when an isolated system is considered, but is essential if more systems are interacting one with other. These deficiencies can be omitted by introduction of more elaborated definition of ΔB. A better approximation of administrative denials to physical ones and more precise estimations for physical denials means, therefore, improved system planning and use of the spectrum resource.

6.5. FREQUENCY PLANNING

A general approach to frequency planning is illustrated in Figure 4. Three abstract spaces are distinguished: (1) the transmitter space, (2) the signal space and (3) the performance space (Struzak, 1982). Each transmitter under consideration is represented by a point in the transmitter space and each signal at the input of receiver is represented by a point in the signal space. The same is true for the performance space. Each point of the transmitter space is mapped first in the signal space and then in the performance space. The mapping process involves various transformations and many factors. Same factors (e.g. noise) are uncontrollable and/or contain random elements. This introduces some uncertainty in the mapping process.

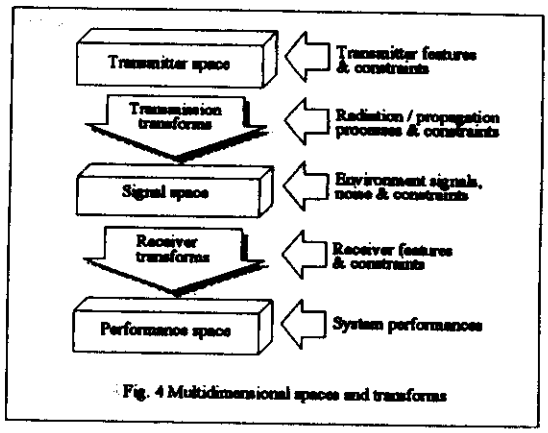

Fig. 4 Multidimensional spaces and transforms

Many factors of a physical, technical, economic, social and even political nature must be given due consideration when planning transmitter networks. There is no realistic way to include explicitly all of them into mathematical models. Their effects are thus evaluated by handling them as constraints. The constraints cut out allowable regions in each of the spaces. The transmitetr space may be interpreted as some kind of "transmitter catalogue".

The frequency planning in this approach consists, first, of mapping back the allowable points (region) in the performance and signal spaces into the transmitter catalogue (space) and, second, of finding an appropriate transmitter parameters. The simplest approach is the application of frequency-distance restrictions, or so-called "FD rules". They specify the minimum geographic distance between two radio stations in function of their frequency separation. These requirements are derived from the two requirements that are most essential in practice in system planning and spectrum management:

- the wanted signal power should be greater that a given threshold (to overcome background noise);
- the protection ratio (wanted-signal to interference ratio) should be greater that a given threshold (to overcome interfering signals).

The derivation of FD rules involves the protection ratios and propagation models. The rules are usually presented as matrix. FD rules were used for the first time in the USA in 1950s as a simple but efficient rule to harmonize the use of available frequency channels.

When the FD rules concern two transmitting stations, each transmitter is to be considered twice: first as the wanted transmitter and then as interfering. In both cases the distance between them must be not less than the sum of the coverage range of the wanted transmitter and the interference range of the other transmitter treated as interfering. Otherwise the coverage area of one transmitter coincides with the interfering area of another. The minimum distance between them is the greater of the two values determined in the two cases.

Table 1. Minimum distance separation between a radionavigation station and a sound broadcasting transmitting station beyond which the aeronautical service is unlikely to be affected, in function of the power and frequency of the broadcasting station

	Frequency of broadcasting station (MHz)						
Power of broadcasting station ↓	100	102	104	105	106	107	107.9
ERP (kW)	Distance (km)						
300	125	210	400	500	500	500	500
100	75	120	230	340	500	500	500
30	40	65	125	190	310	500	500
10	25	40	70	105	180	380	500
3	20	20	40	60	95	210	500
1	20	20	25	35	55	120	370
0.30	20	20	20	20	30	65	200
0.10	20	20	20	20	20	40	115
0.03	20	20	20	20	20	20	65

ERP: Effective Radiated Power
Source: ITU Handbook on National Spectrum Management, p. 63 (draft 1994)

An example is shown in Table 1. The table shows the minimum acceptable distances between an FM sound broadcasting transmitter and an aeronautical radionavigation station. The distances are shown in function of two parameters: (1) the frequency of the broadcasting station and (2) its power. The radionavigation station was tacitly assumed to operate on the lowest frequency of the band allocated to the radionavigation service. The probability of interference to the radionavigation system decreases with the distance between the two stations and with the power of the FM station. When the distance is greater than indicated in the table, the probability of interference is very low. Similar rules and tables can be created for other services and/or service combinations.

The FD concept is still used in some countries, especially in the North and South Americas. It also served as a basis for planning during the Regional Administrative MF Broadcasting Conference (Region 2), Rio de Janeiro, 1981.

The FD rules assume ideal propagation conditions. At higher frequencies (e.g. VHF/UHF), in some applications, terrain shadowing is essential and more realistic propagation models (e.g. involving the propagation path profile) must be applied. As the actual terrain relief is irregular, required distance separations are direction-dependent and cannot be represented by a simple matrix.

A systematic application of FD rules to a radiocommunication network over a large and uniform territory lead to a frequency planning method known as "Regular Lattice Method", introduced in Europe some 40 years ago (Eden, 1986; EBU, 1988).

That approach is based on the following assumptions:

- all transmitters are identical, having the same power, omnidirectional antennas at the same height as well as the same polarization,
- all transmitters are situated on an infinitely extended plane area exactly at nodes of a boundless regular lattice, with all nodes occupied and no other locations allowed, and with natural and administrative boundaries ignored,
- radio wave propagation is isotropic, uniform throughout the whole area and does not depend on terrain,
- one set of frequency channels is regularly reused throughout the whole lattice (other frequency assignments are ignored) following a linear distribution scheme.

That frequency planning based on geometrically regular lattices is still used in some countries, especially in Europe and Africa. The lattice planning method was applied, among others, at the European VHF/UHF Broadcasting Conference, Stockholm 1961 (for UHF television) and the African VHF/UHF Broadcasting Conference, Geneva, 1963 (for television and FM sound).

Simplifications inherent to the regular lattice method make it difficult to take into account terrain shadowing, actual station locations and antenna radiation patterns, non-continuous coverage area, effects of other services sharing the same or adjacent frequency bands, etc. To release from these difficulties, more elaborated methods and models, e.g. digital terrain model, are required (e.g. Struzak, 1982, 1992, 1993). Many of these methods are based on a graph-theoretical approach that facilitates identification of "critical" elements.

Fig. 5 gives an example. It represents seven interacting transmitters. For simplicity, the environment is disregarded and only co-channel interference mechanism is assumed. The small circles represent the transmitters. The lines represent potential incompatibilities between the transmitters.

The number of lines associated with a transmitter (the degree of vertex) is the number of adjacent transmitters with which a frequency coordination is required. As no adjacent transmitters may use the same frequency, it is the number of frequencies denied to them. On the other hand, it is also the number of frequency restrictions imposed by the adjacent transmitters.

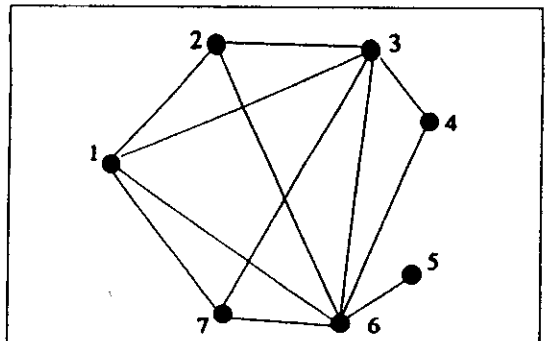

Fig. 5. Graph representing a network of seven transmitters

The degree of vertex can, therefore, be used as a simple indicator of the difficulties in frequency assignment process. The "critical" transmitter is associated with the greatest number of lines. In Fig. 5, transmitter #6 is "critical". It requires a coordination with as many as 6 neighbours. Then go transmitters #3 with 5, #1 with 4, #7 and #2 with 3, #4 with 2 neighbours, and #5 with a single adjacent transmitter. Several planning methods are based on that approach (e.g., Struzak, 1982).

7. KEY ELEMENT: INFORMATION

This section discusses issues related to spectrum management and radio interference prevention that require exchange of information among spectrum users within and across the state borders.

7.1. EARLY YEARS

It has already been recognized that information *per se* is an economic resource on a par with other resources such as labor, materials, instruments, or capital. Rational use of any shared resource is impossible without knowing how it is used by each shareholder. Otherwise no coordination is possible. That information *per se* never exists in an integrated form. It is dispersed among various separate bits of data, often incomplete and contradictory, about the individual systems, service providers, equipment manufacturers, etc. The need for an integrated information bank on the spectrum resource uses has been realized

since the early years of radio and led to the Bern List, mentioned earlier.

Later, that list has been replaced by the ITU databases, but the idea has been the same. All parties agree to register their uses made of the spectrum resources in a database, accessible to all. If somebody wants to use a frequency and check if that use would cause or would suffer interference, it is sufficient to consult the database. If a conflict is expected, the database helps to identify its cause. Then, the coordination, modification, and negotiation process can start.

7.2. DATA NEEDED

Access to information on the spectrum usage is essential in system planning. It is necessary not only for spectrum managers but also for service providers and equipment manufacturers. Relevant are legal, administrative, technical, and operational documents, rules, regulations, recommendation and data on the current and planned uses of the spectrum, on acceptable interference criteria and interference prevention procedures.

Of equal importance is information about the local environment, population, traffic density, terrain coverage and elevation, etc. Planners, service providers and equipment manufacturers need to know details of required procedures of equipment-type approval, and licensing. Access to international agreements, final acts of radio conferences, frequency plans, standards and Recommendations in force is also essential. So is access to equipment data, and models, tools, and data for frequency sharing. These include propagation models and, in some applications, digital terrain model.

7.3. DATA RELIABILITY

A serious problem in system planning and spectrum management is the reliability of information. First, the original source data may be erroneous. False data are even worse that complete lack of data, as they create an unintended "virtual reality". Often, there is no simple way to distinguish between entries that actually represent the real world and those that do not. False data create a false feeling of confidence, and lead to faulty frequency plans, wrong investment decisions and irrational use of the spectrum resource.

The implementation of reliable database has been difficult for several reasons. One reason results from the fact that spurious interactions are usually ignored during the system planning, and precise data on them do not exist. Another reason is the consequence of the intrinsic logic of the system. On the one hand, if the registration costs nothing, as it is the case in the ITU system, there is a tendency to register more frequencies than really used. The surplus is kept as a "reserve" for some undefined future needs. On the other hand, if the registration (licensing) involves costs, as it is in national systems, there is a tendency to use frequencies without any registration, that is illegally. In both cases, the database records are unreliable as they do not represent correctly the reality.

There is growing concern about cases of satellites launched before the coordination process is properly concluded, or even initiated. Also some satellites have been repositioned without re-coordination. No sanctions are presently envisaged in the ITU Radio Regulations. On the other hand, the time-frame of the regular coordination process may be too long and inadequate for current needs. Should penalties be considered? Established by whom? Paid to whom?

The problem of un-reliable data is additionally complicated by the fact that the national and ITU frequency registers have been kept separately since the very beginning. After several years of such separation, the two data sets, one used for domestic purposes and another one for international use, are not identical. That separation might be maintained for security reasons, or to achieve extra "gain" in the negotiation "game" with competing partners. Because of such a logic, and without any experimental validation, the records do not represent correctly the true usage of the spectrum resource. Consequently, they are inadequate for spectrum management based on sound technical criteria.

7.4. "PAPER SATELLITES"

Currently, one of major problems in the satellite coordination, is the existence of systems under consideration which do not represent real communication requirements. These are so called "paper satellites". Some administrations tend to initiate the coordination procedure for more orbital positions, or more spectrum, then needed, expecting that some of these positions will not survive by the end of the coordination process. These overfillings can also be

attributed to orbit "slot reservations" for potential future applications. In some cases, these slot are to be used for commercial arrangements.

The "overfilling" results in a multiplication of the networks with which coordination is required. This, in turn, increases the administrative and technical burden of the administrations involved in more complex coordination negotiations. The reliability of the data base of space networks in coordination is deteriorating and the assessment of the level of actual congestion of the spectrum orbit becomes increasingly difficult.

In this connection several questions arise: How to eliminate "paper satellites"? How can the reliability of the space data base be safeguarded? Would an international fee system help to limit overfilling practices? At present, the Radio Regulations do not contain any obligation or incentive to prove real commitment to take up and implement "filed" positions or frequencies. Should an international control mechanism be introduced (due diligence) be introduced to monitor progress in conception and implementation, in realistic time-frames, of satellite projects? Should refundable financial deposits associated with the initiation of a new coordination request be considered? When should the filling of a satellite network start?

7.5. COMPUTER IMPACT

System planning and spectrum management rely on the data processing, and computers have dramatically changed the way of doing it. Tasks, that only a few years ago were considered almost impossible, can now be done with easy. Technology is developing fast: the microprocessor speed and memory capacity double every 18 months, or so. Mainframes are giving way to networks of personal computers, and workstation clusters are substituting for super computers. Multi-user and multi-tasking environment is increasingly popular, offering user-friendly and time-saving tools that improve productivity.

The Internet, a worldwide *network of computer networks* that store, exchange, and process information, overtook the telex in terms of users in 1990, videotex in 1992, and fax terminals in 1994 or 1995. It interconnects 25 to 35 million users grouped around about 35000 networks. The number of users increases with a rate reaching nearly 750.000 new users per month (1994). Internet supports some 10 terabytes of data in the USA alone and over 500 gigabytes of data on the main European networks. Numerous universities, libraries, insurance companies, banks, travel agencies, and other entities enjoy benefits of Internet and other similar networks.

Decreasing prices contribute to further proliferation of computer networking. Some analysts predict that 75% of all personal computers in Europe will be interconnected by the year 2000. This trend is influencing the system planning process and spectrum management. The computerization is increasing rapidly, but not at the same rate in all countries, and the technology gap increases between the rich countries and the poor ones.

8. CONCLUDING REMARKS

This section discusses the current problems and trends, and the role of science.

8.1. PROBLEMS AND TRENDS

We are witnessing many conflicts of various natures: racial, religious, military, economic. The congestion of radio spectrum is only one of many problems we area facing. There exists a great imbalance between the poor and the rich, the developed and the developing. In spite of great hopes and efforts of previous decades, the gap between rich and poor has not disappeared. 15% of the nations have 90% of TV receivers; 4% of countries account for 85% of the world expenditure for research and development and employ 70% of all research scientists and engineers.

Major problems in developed countries are: recession and unemployment; environment pollution; shortage of energy and natural resources, including the spectrum. The developing countries suffer from overpopulation; shortage of food and/or water; shortage of capital resources; "brain-drain"(trained/educated people emigrate to rich countries); shortage of "know-how" and "know-why".

In such a scenario, the use of spectrum resource will be undergoing radical changes triggered by advancements in technology, liberalization of economies, and political transformations. It will be influenced by the following major factors:

- increasing application of digital techniques

- further development and convergence of information and telecommunication technologies into "intelligent" multimedia communications with integration of forms (voice, video, text, image, data) and differentiation of functions (creating, displaying, storing, processing, distributing).
- continuing pressure for better quality of life at home and at work, and associated social changes and migration of people of different cultures;
- trend toward regional integration of economies and global competition;
- trend towards liberalization, deregulation, privatization, increasing markets, and competition throughout the world,
- multinational businesses, characterized by open markets and transnational alliances.

The competition for the access to the spectrum resource will be intensified. It will follow the social, economic, technological and political changes and growing competition between "wired" and "wireless" communications. The increasing demand for radio frequencies and orbital positions (for different: systems, services, service providers, and countries) and growing recognition of the economic value of radio frequencies and orbital positions will lead to new approaches to spectrum management issues.

How radio communication activities are developed to the advantage of nations, raises global implications. Although the necessity of international management of the spectrum resource is generally declared, it is not always clear whether it is desired in order to achieve certain common, collectively agreed objectives, or in order to resolve conflicts where parties adhere to their own individual objectives.

8.2. THE ROLE OF SCIENCE

Spectrum/orbit sharing, world-wide, requires every nation to study the best ways of the use of these resources, and to study the nations' needs to elaborate an adequate position and effective interface for negotiations in the international framework. The scientific and technical elements of that process remain very important and deserving the most competent attention.

Many of our current problems are symptoms of inadequacies in our knowledge.

One hopes that further scientific efforts will ultimately offer practical solutions. However, scientists and engineers have only limited influence on the policy- and business-makers. The specific role of science has been best described by Gvishiani:

"...By its very nature, science is well equipped for internationally coordinated efforts directed to the solution of common problems. Science is universal, independent of nationality, ideological convictions or political orientation, which makes joint efforts much easier than in any other field..." (Gvishiani, 1982).

As the time between scientific discovery and its application becomes shorter and shorter, it is increasingly difficult to separate the pure and applied aspects of disciplines, and the research from production and business. All this indicates that close collaboration between scientist, engineers, businessmen and policy makers becomes essential more than ever.

* * *

Note: The views expressed herein are those of the author and do not necessarily reflect those of ITU or any other organization.

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CHAPTER I

Terminology

ARTICLE 1

Terms and Definitions

Introduction

2 For the purposes of these Regulations, the following terms shall have the meanings defined below. These terms and definitions do not, however, necessarily apply for other purposes. Definitions identical to those contained in the International Telecommunication Convention (Malaga-Torremolinos, 1973) are marked "(CONV.)". *

Note: If, in the text of a definition below, a term is printed in italics, this means that the term itself is defined in this Article.

Section I. General Terms

3 1.1 *Administration:* Any governmental department or service responsible for discharging the obligations undertaken in the Convention of the International Telecommunication Union and the Regulations (CONV.).

4 1.2 *Telecommunication:* Any transmission, *emission* or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, *radio*, optical or other electromagnetic systems (CONV.).

5 1.3 *Radio:* A general term applied to the use of *radio waves* (CONV.).

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* *Note by the General Secretariat:* The following provisions: **4**, **26**, **36**, **110**, **112** and **163** contain definitions identical to those in the International Telecommunication Convention (Nairobi, 1982).

6 1.4 *Radio Waves* or *Hertzian Waves:* Electromagnetic waves of frequencies arbitrarily lower than 3 000 GHz, propagated in space without artificial guide.

7 1.5 *Radiocommunication: Telecommunication* by means of *radio waves* (CONV.).

8 1.6 *Terrestrial Radiocommunication:* Any *radiocommunication* other than *space radiocommunication* or *radio astronomy.*

9 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.

10 1.8 *Radiodetermination:* The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of *radio waves.*

11 1.9 *Radionavigation: Radiodetermination* used for the purposes of navigation, including obstruction warning.

12 1.10 *Radiolocation: Radiodetermination* used for purposes other than those of *radionavigation.*

13 1.11 *Radio Direction-Finding: Radiodetermination* using the reception of *radio waves* for the purpose of determining the direction of a *station* or object.

14 1.12 *Radio Astronomy:* Astronomy based on the reception of *radio waves* of cosmic origin.

15 1.13 *Coordinated Universal Time (UTC):* Time scale, based on the second (SI), as defined and recommended by the CCIR [1], and maintained by the International Time Bureau (BIH).

For most practical purposes associated with the Radio Regulations, UTC is equivalent to mean solar time at the prime meridian (0° longitude), formerly expressed in GMT.

15.1 [1] The full definition is contained in CCIR Recommendation 460-2.

16 1.14 *Industrial, Scientific and Medical (ISM) Applications* (of radio frequency energy): Operation of equipment or appliances designed to generate and use locally radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of *telecommunications.*

Section II. Specific Terms Related to Frequency Management

17 2.1 *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.

18 2.2 *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.

19 2.3 *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.

Section III. Radio Services

20 3.1 *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.*

21 3.2 *Fixed Service:* A *radiocommunication service* between specified fixed points.

22 Orb-88 3.3 *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.*

23 3.4 *Aeronautical Fixed Service:* A *radiocommunication service* between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air transport.

24 3.5 *Inter-Satellite Service:* A *radiocommunication service* providing links between artificial earth *satellites.*

25 3.6 *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.

26 3.7 *Mobile Service:* A *radiocommunication service* between *mobile* and *land stations*, or between *mobile stations* (CONV.).

27 3.8 *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.

8 3.9 *Land Mobile Service:* A *mobile service* between *base stations* and *land mobile stations*, or between *land mobile stations.*

29 3.10 *Land Mobile-Satellite Service:* A *mobile-satellite service* in which *mobile earth stations* are located on land.

30 3.11 *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.

31 3.12 *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.

32 3.13 *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.

33 3.14 *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.

34 3.15 *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.

34A Mob-87 3.15A *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.

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* (R): route.

34B Mob-87 3.15B *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.

35 3.16 *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.

35A Mob-87 3.16A *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.

35B Mob-87 3.16B *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.

36 3.17 *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 (CONV.).

37 3.18 *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.*

38 3.19 *Radiodetermination Service:* A *radiocommunication service* for the purpose of *radiodetermination.*

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* (OR): off-route.

** (R): route.

39 Mob-87 3.20 *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.

40 3.21 *Radionavigation Service:* A *radiodetermination service* for the purpose of *radionavigation.*

41 3.22 *Radionavigation-Satellite Service:* A *radiodetermination-satellite service* used for the purpose of *radionavigation.*

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

42 3.23 *Maritime Radionavigation Service:* A *radionavigation service* intended for the benefit and for the safe operation of ships.

43 3.24 *Maritime Radionavigation-Satellite Service:* A *radionavigation-satellite service* in which *earth stations* are located on board ships.

44 3.25 *Aeronautical Radionavigation Service:* A *radionavigation service* intended for the benefit and for the safe operation of aircraft.

45 3.26 *Aeronautical Radionavigation-Satellite Service:* A *radionavigation-satellite service* in which *earth stations* are located on board aircraft.

46 3.27 *Radiolocation Service:* A *radiodetermination service* for the purpose of *radiolocation.*

47 3.28 *Meteorological Aids Service:* A *radiocommunication service* used for meteorological, including hydrological, observations and exploration.

48 3.29 *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 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.

49 3.30 *Meteorological-Satellite Service:* An *earth exploration-satellite service* for meteorological purposes.

50 3.31 *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.

51 3.32 *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.

52 3.33 *Space Research Service:* A *radiocommunication service* in which *spacecraft* or other objects in space are used for scientific or technological research purposes.

53 3.34 *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.

54 3.35 *Amateur-Satellite Service:* A *radiocommunication service* using *space stations* on earth *satellites* for the same purposes as those of the *amateur service.*

55 3.36 *Radio Astronomy Service:* A service involving the use of *radio astronomy.*

56 3.37 *Safety Service:* Any *radiocommunication service* used permanently or temporarily for the safeguarding of human life and property (CONV.).

57 3.38 *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.*

Section IV. Radio Stations and Systems

58 4.1 *Station:* One or more transmitters or 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.

59 4.2 *Terrestrial Station:* A *station* effecting *terrestrial radiocommunication.*

In these Regulations, unless otherwise stated, any *station* is a terrestrial station.

60 4.3 *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.

61 4.4 *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.

62 4.5 *Survival Craft Station:* A *mobile station* in the *maritime mobile service* or the *aeronautical mobile service* intended solely for survival purposes and located on any lifeboat, life-raft or other survival equipment.

63 4.6 *Fixed Station:* A *station* in the *fixed service.*

64 4.7 *Aeronautical Fixed Station:* A *station* in the *aeronautical fixed service.*

65 4.8 *Mobile Station:* A *station* in the *mobile service* intended to be used while in motion or during halts at unspecified points.

66 4.9 *Mobile Earth Station:* An *earth station* in the *mobile-satellite service* intended to be used while in motion or during halts at unspecified points.

67 4.10 *Land Station:* A *station* in the *mobile service* not intended to be used while in motion.

67A Mob-87 4.10A *Land Earth Station:* An *earth station* in the *fixed-satellite service* or, in some cases, in the *mobile-satellite service,* located at a specified fixed point or within a specified area on land to provide a *feeder link* for the *mobile-satellite service.*

68 4.11 *Base Station:* A *land station* in the *land mobile service.*

68A Mob-87 4.11A *Base Earth Station:* An *earth station* in the *fixed-satellite service* or, in some cases, in the *land mobile-satellite service,* located at a specified fixed point or within a specified area on land to provide a *feeder link* for the *land mobile-satellite service.*

69 4.12 *Land Mobile Station:* A *mobile station* in the *land mobile service* capable of surface movement within the geographical limits of a country or continent.

69A Mob-87 4.12A *Land Mobile Earth Station:* A *mobile earth station* in the *land mobile-satellite service* capable of surface movement within the geographical limits of a country or continent.

70 4.13 *Coast Station:* A *land station* in the *maritime mobile service.*

71 4.14 *Coast Earth Station:* An *earth station* in the *fixed-satellite service* or, in some cases, in the *maritime mobile-satellite service,* located at a specified fixed point on land to provide a *feeder link* for the *maritime mobile-satellite service.*

72 4.15 *Ship Station:* A *mobile station* in the *maritime mobile service* located on board a vessel which is not permanently moored, other than a *survival craft station.*

73 4.16 *Ship Earth Station:* A *mobile earth station* in the *maritime mobile-satellite service* located on board ship.

74 4.17 *On-Board Communication Station:* A low-powered *mobile station* in the *maritime mobile service* intended for use for internal communications on board a ship, or between a ship and its lifeboats and life-rafts during lifeboat drills or operations, or for communication within a group of vessels being towed or pushed, as well as for line handling and mooring instructions.

75 4.18 *Port Station:* A *coast station* in the *port operations service.*

76 4.19 *Aeronautical Station:* A *land station* in the *aeronautical mobile service.*

In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea.

77 4.20 *Aeronautical Earth Station:* An *earth station* in the *fixed-satellite service,* or, in some cases, in the *aeronautical mobile-satellite service,* located at a specified fixed point on land to provide a *feeder link* for the *aeronautical mobile-satellite service.*

78 4.21 *Aircraft Station:* A *mobile station* in the *aeronautical mobile service,* other than a *survival craft station,* located on board an aircraft.

79 4.22 *Aircraft Earth Station:* A *mobile earth station* in the *aeronautical mobile-satellite service* located on board an aircraft.

80 4.23 *Broadcasting Station:* A *station* in the *broadcasting service.*

81 4.24 *Radiodetermination Station:* A *station* in the *radiodetermination service.*

82 4.25 *Radionavigation Mobile Station:* A *station* in the *radionavigation service* intended to be used while in motion or during halts at unspecified points.

83 4.26 *Radionavigation Land Station:* A *station* in the *radionavigation service* not intended to be used while in motion.

84 4.27 *Radiolocation Mobile Station:* A *station* in the *radiolocation service* intended to be used while in motion or during halts at unspecified points.

85 4.28 *Radiolocation Land Station:* A *station* in the *radiolocation service* not intended to be used while in motion.

86 4.29 *Radio Direction-Finding Station:* A *radiodetermination station* using *radio direction-finding.*

87 4.30 *Radiobeacon Station:* A *station* in the *radionavigation service* the *emissions* of which are intended to enable a *mobile station* to determine its bearing or direction in relation to the radiobeacon station.

88 4.31 *Emergency Position-Indicating Radiobeacon Station:* A *station* in the *mobile service* the *emissions* of which are intended to facilitate search and rescue operations.

88A Mob-83 4.31A *Satellite Emergency Position-Indicating Radiobeacon:* An *earth station* in the *mobile-satellite service* the *emissions* of which are intended to facilitate search and rescue operations.

89 4.32 *Standard Frequency and Time Signal Station:* A *station* in the *standard frequency and time signal service.*

90 4.33 *Amateur Station:* A *station* in the *amateur service.*

91 4.34 *Radio Astronomy Station:* A *station* in the *radio astronomy service.*

92 4.35 *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.*

93 4.36 *Ship's Emergency Transmitter:* A ship's transmitter to be used exclusively on a distress frequency for distress, urgency or safety purposes.

94 4.37 *Radar:* A *radiodetermination* system based on the comparison of reference signals with radio signals reflected, or retransmitted, from the position to be determined.

95 4.38 *Primary Radar:* A *radiodetermination* system based on the comparison of reference signals with radio signals reflected from the position to be determined.

96 4.39 *Secondary Radar:* A *radiodetermination* system based on the comparison of reference signals with radio signals retransmitted from the position to be determined.

97 4.40 *Radar Beacon (racon):* A transmitter-receiver associated with a fixed navigational mark which, when triggered by a *radar,* automatically returns a distinctive signal which can appear on the display of the triggering *radar,* providing range, bearing and identification information.

98 4.41 *Instrument Landing System (ILS):* A *radionavigation* system which provides aircraft with horizontal and vertical guidance just before and during landing and, at certain fixed points, indicates the distance to the reference point of landing.

99 4.42 *Instrument Landing System Localizer:* A system of horizontal guidance embodied in the *instrument landing system* which indicates the horizontal deviation of the aircraft from its optimum path of descent along the axis of the runway.

100 4.43 *Instrument Landing System Glide Path:* A system of vertical guidance embodied in the *instrument landing system* which indicates the vertical deviation of the aircraft from its optimum path of descent.

101 4.44 *Marker Beacon:* A transmitter in the *aeronautical radionavigation service* which radiates vertically a distinctive pattern for providing position information to aircraft.

102 4.45 *Radio Altimeter: Radionavigation* equipment, on board an aircraft or *spacecraft,* used to determine the height of the aircraft or the *spacecraft* above the Earth's surface or another surface.

103 4.46 *Radiosonde:* An automatic radio transmitter in the *meteorological aids service* usually carried on an aircraft, free balloon, kite or parachute, and which transmits meteorological data.

104 4.47 *Space System:* Any group of cooperating *earth stations* and/or *space stations* employing *space radiocommunication* for specific purposes.

105 4.48 *Satellite System:* A *space system* using one or more artificial earth *satellites.*

106 4.49 *Satellite Network:* A *satellite system* or a part of a *satellite system,* consisting of only one *satellite* and the cooperating *earth stations.*

107 4.50 *Satellite Link:* A radio link between a transmitting *earth station* and a receiving *earth station* through one *satellite.*

A satellite link comprises one up-link and one down-link.

108 4.51 *Multi-Satellite Link:* A radio link between a transmitting *earth station* and a receiving *earth station* through two or more *satellites,* without any intermediate *earth station.*

A multi-satellite link comprises one up-link, one or more satellite-to-satellite links and one down-link.

109 Orb-88 4.52 *Feeder Link:* A radio link from an *earth station* at a given location to a *space station,* or vice versa, conveying information for a *space radiocommunication service* other than for the *fixed-satellite service.* The given location may be at a specified fixed point, or at any fixed point within specified areas.

Section V. Operational Terms

110 5.1 *Public Correspondence:* Any *telecommunication* which the offices and *stations* must, by reason of their being at the disposal of the public, accept for transmission (CONV.).

111 5.2 *Telegraphy**: A form of *telecommunication* which is concerned in any process providing transmission and reproduction at a distance of documentary matter, such as written or printed matter or fixed images, or the reproduction at a distance of any kind of information in such a form. For the purposes of the Radio Regulations, unless otherwise specified therein, telegraphy shall mean a form of *telecommunication* for the transmission of written matter by the use of a signal code.

112 5.3 *Telegram* : Written matter intended to be transmitted by *telegraphy* for delivery to the addressee. This term also includes *radiotelegrams* unless otherwise specified (CONV.).

In this definition the term *telegraphy* has the same general meaning as defined in the Convention.

113 5.4 *Radiotelegram:* A *telegram,* originating in or intended for a *mobile station* or a *mobile earth station* transmitted on all or part of its route over the *radiocommunication* channels of the *mobile service* or of the *mobile-satellite service.*

114 5.5 *Radiotelex Call:* A telex call, originating in or intended for a *mobile station* or a *mobile earth station,* transmitted on all or part of its route over the *radiocommunication* channels of the *mobile service* or the *mobile-satellite service.*

115 5.6 *Frequency-Shift Telegraphy: Telegraphy* by frequency modulation in which the telegraph signal shifts the frequency of the carrier between predetermined values.

116 5.7 *Facsimile:* A form of *telegraphy* for the transmission of fixed images, with or without half-tones, with a view to their reproduction in a permanent form.

In this definition the term *telegraphy* has the same general meaning as defined in the Convention.

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* *Note by the General Secretariat:* This definition is not in alignment with Annex 2 to the Convention. The corresponding definition in that Annex shall prevail to the extent that there are differences between them (see also Resolution **68**).

117 5.8 *Telephony* *: A form of *telecommunication* set up for the transmission of speech or, in some cases, other sounds.

118 5.9 *Radiotelephone Call:* A telephone call, originating in or intended for a *mobile station* or a *mobile earth station*, transmitted on all or part of its route over the *radiocommunication* channels of the *mobile service* or of the *mobile-satellite service*.

119 5.10 *Simplex Operation:* Operating method in which transmission is made possible alternately in each direction of a *telecommunication* channel, for example, by means of manual control [1].

120 5.11 *Duplex Operation:* Operating method in which transmission is possible simultaneously in both directions of a *telecommunication* channel [1].

121 5.12 *Semi-Duplex Operation:* A method which is *simplex operation* at one end of the circuit and *duplex operation* at the other [1].

122 5.13 *Television:* A form of *telecommunication* for the transmission of transient images of fixed or moving objects.

123 5.14 *Individual Reception* (in the broadcasting-satellite service): The reception of *emissions* from a *space station* in the *broadcasting-satellite service* by simple domestic installations and in particular those possessing small antennae.

119.1 120.1 121.1 [1] In general, *duplex operation* and *semi-duplex operation* require two frequencies in *radiocommunication*; *simplex operation* may use either one or two.

* *Note by the General Secretariat:* This definition is not in alignment with Annex 2 to the Convention. The corresponding definition in that Annex shall prevail to the extent that there are differences between them (see also Resolution **68**).

124 5.15 *Community Reception* (in the broadcasting-satellite service): The reception of *emissions* from a *space station* in the *broadcasting-satellite service* by receiving equipment, which in some cases may be complex and have antennae larger than those used for *individual reception*, and intended for use:

- by a group of the general public at one location; or
- through a distribution system covering a limited area.

125 5.16 *Telemetry:* The use of *telecommunication* for automatically indicating or recording measurements at a distance from the measuring instrument.

126 5.17 *Radiotelemetry: Telemetry* by means of *radio waves*.

127 5.18 *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*.

128 5.19 *Telecommand:* The use of *telecommunication* for the transmission of signals to initiate, modify or terminate functions of equipment at a distance.

129 5.20 *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*.

130 5.21 *Space Tracking:* Determination of the *orbit*, velocity or instantaneous position of an object in space by means of *radiodetermination*, excluding *primary radar*, for the purpose of following the movement of the object.

Section VI. Characteristics of Emissions and Radio Equipment

131 6.1 *Radiation:* The outward flow of energy from any source in the form of *radio waves.*

132 6.2 *Emission: Radiation* produced, or the production of *radiation,* by a radio transmitting *station.*

For example, the energy radiated by the local oscillator of a radio receiver would not be an emission but a *radiation.*

133 6.3 *Class of Emission:* The set of characteristics of an *emission,* designated by standard symbols, e.g. type of modulation of the main carrier, modulating signal, type of information to be transmitted, and also, if appropriate, any additional signal characteristics.

134 6.4 *Single-Sideband Emission:* An amplitude modulated *emission* with one sideband only.

135 6.5 *Full Carrier Single-Sideband Emission:* A *single-sideband emission* without reduction of the carrier.

136 6.6 *Reduced Carrier Single-Sideband Emission:* A *single-sideband emission* in which the degree of carrier suppression enables the carrier to be reconstituted and to be used for demodulation.

137 6.7 *Suppressed Carrier Single-Sideband Emission:* A *single-sideband emission* in which the carrier is virtually suppressed and not intended to be used for demodulation.

138 6.8 *Out-of-band Emission*: Emission* on a frequency or frequencies immediately outside the *necessary bandwidth* which results from the modulation process, but excluding *spurious emissions.*

139 6.9 *Spurious Emission*: Emission* on a frequency or frequencies which are outside the *necessary bandwidth* and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic *emissions,* parasitic *emissions,* intermodulation products and frequency conversion products, but exclude *out-of-band emissions.*

140 6.10 *Unwanted Emissions*:* Consist of *spurious emissions* and *out-of-band emissions.*

141 6.11 *Assigned Frequency Band:* The frequency band within which the *emission* of a *station* is authorized; the width of the band equals the *necessary bandwidth* plus twice the absolute value of the *frequency tolerance.* Where *space stations* are concerned, the assigned frequency band includes twice the maximum Doppler shift that may occur in relation to any point of the Earth's surface.

142 6.12 *Assigned Frequency:* The centre of the frequency band assigned to a *station.*

143 6.13 *Characteristic Frequency:* A frequency which can be easily identified and measured in a given *emission.*

A carrier frequency may, for example, be designated as the characteristic frequency.

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* The terms associated with the definitions given by Nos. **138**, **139** and **140** shall be expressed in the working languages as follows:

Numbers	In French	In English	In Spanish
138(6.8)	Emission hors bande	Out-of-band emission	Emisión fuera de banda
139(6.9)	Rayonnement non essentiel	Spurious emission	Emisión no esencial
140(6.10)	Rayonnements non désirés	Unwanted emissions	Emisiones no deseadas

144 6.14 *Reference Frequency:* A frequency having a fixed and specified position with respect to the *assigned frequency*. The displacement of this frequency with respect to the *assigned frequency* has the same absolute value and sign that the displacement of the *characteristic frequency* has with respect to the centre of the frequency band occupied by the *emission*.

145 6.15 *Frequency Tolerance:* The maximum permissible departure by the centre frequency of the frequency band occupied by an *emission* from the *assigned frequency* or, by the *characteristic frequency* of an *emission* from the *reference frequency*.

The frequency tolerance is expressed in parts in 10^6 or in hertz.

146 6.16 *Necessary Bandwidth:* For a given *class of emission*, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions.

147 6.17 *Occupied Bandwidth:* The width of a frequency band such that, below the lower and above the upper frequency limits, the *mean powers* emitted are each equal to a specified percentage $\beta/2$ of the total *mean power* of a given *emission*.

Unless otherwise specified by the CCIR for the appropriate *class of emission*, the value of $\beta/2$ should be taken as 0.5%.

148 6.18 *Right-Hand* (clockwise) *Polarized Wave:* An elliptically- or circularly-polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a right-hand or clockwise direction.

149 6.19 *Left-Hand* (anticlockwise) *Polarized Wave:* An elliptically- or circularly-polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a left-hand or anticlockwise direction.

150 6.20 *Power:* Whenever the power of a radio transmitter, etc. is referred to it shall be expressed in one of the following forms, according to the *class of emission*, using the arbitrary symbols indicated:

- *peak envelope power* (PX or pX);
- *mean power* (PY or pY);
- *carrier power* (PZ or pZ).

For different *classes of emission*, the relationships between *peak envelope power*, *mean power* and *carrier power*, under the conditions of normal operation and of no modulation, are contained in CCIR Recommendations which may be used as a guide.

For use in formulae, the symbol p denotes power expressed in watts and the symbol P denotes power expressed in decibels relative to a reference level.

151 6.21 *Peak Envelope Power* (of a radio transmitter): The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle at the crest of the modulation envelope taken under normal operating conditions.

152 6.22 *Mean Power* (of a radio transmitter): The average power supplied to the antenna transmission line by a transmitter during an interval of time sufficiently long compared with the lowest frequency encountered in the modulation taken under normal operating conditions.

153 6.23 *Carrier Power* (of a radio transmitter): The average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle taken under the condition of no modulation.

154 6.24 *Gain of an Antenna:* The ratio, usually expressed in decibels, of the power required at the input of a loss-free reference antenna to the power supplied to the input of the given antenna to produce, in a given direction, the same field strength or the same

power flux-density at the same distance. When not specified otherwise, the gain refers to the direction of maximum *radiation.* The gain may be considered for a specified polarization.

Depending on the choice of the reference antenna a distinction is made between:

a) *absolute or isotropic gain* (G_i), when the reference antenna is an isotropic antenna isolated in space;

b) *gain relative to a half-wave dipole* (G_d), when the reference antenna is a half-wave dipole isolated in space whose equatorial plane contains the given direction;

c) *gain relative to a short vertical antenna* (G_v), when the reference antenna is a linear conductor, much shorter than one quarter of the wavelength, normal to the surface of a perfectly conducting plane which contains the given direction.

155 6.25 *Equivalent Isotropically Radiated Power (e.i.r.p.):* The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna *(absolute or isotropic gain).*

156 6.26 *Effective Radiated Power (e.r.p.)* (in a given direction): The product of the power supplied to the antenna and its *gain relative to a half-wave dipole* in a given direction.

157 6.27 *Effective Monopole Radiated Power (e.m.r.p.)* (in a given direction): The product of the power supplied to the antenna and its *gain relative to a short vertical antenna* in a given direction.

158 6.28 *Tropospheric Scatter:* The propagation of *radio waves* by scattering as a result of irregularities or discontinuities in the physical properties of the troposphere.

159 6.29 *Ionospheric Scatter:* The propagation of *radio waves* by scattering as a result of irregularities or discontinuities in the ionization of the ionosphere.

Section VII. Frequency Sharing

160 7.1 *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.

161 7.2 *Permissible Interference*[1] : Observed or predicted *interference* which complies with quantitative *interference* and sharing criteria contained in these Regulations or in CCIR Recommendations or in special agreements as provided for in these Regulations.

162 7.3 *Accepted Interference*[1] : *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.

163 7.4 *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 these Regulations.

164 7.5 *Protection Ratio* (R.F.): The minimum value of the wanted-to-unwanted signal ratio, usually expressed in decibels, at the receiver input, determined under specified conditions such that a specified reception quality of the wanted signal is achieved at the receiver output.

165 7.6 *Coordination Area:* The area associated with an *earth station* outside of which a *terrestrial station* sharing the same frequency band neither causes nor is subject to interfering *emissions* greater than a permissible level.

161.1
162.1 [1] The terms "permissible interference" and "accepted interference" are used in the coordination of frequency assignments between administrations.

166 7.7 *Coordination Contour:* The line enclosing the *coordination area.*

167 7.8 *Coordination Distance:* Distance on a given azimuth from an *earth station* beyond which a *terrestrial station* sharing the same frequency band neither causes nor is subject to interfering *emissions* greater than a permissible level.

168 7.9 *Equivalent Satellite Link Noise Temperature:* The noise temperature referred to the output of the receiving antenna of the *earth station* corresponding to the radio frequency noise power which produces the total observed noise at the output of the *satellite link* excluding noise due to *interference* coming from *satellite links* using other *satellites* and from terrestrial systems.

168A Orb-88 7.10 *Effective Boresight Area* (of a steerable satellite beam): An area on the surface of the Earth within which the boresight of a *steerable satellite beam* is intended to be pointed.

There may be more than one unconnected effective boresight area to which a single *steerable satellite beam* is intended to be pointed.

168B Orb-88 7.11 *Effective Antenna Gain Contour* (of a steerable satellite beam): An envelope of antenna gain contours resulting from moving the boresight of a *steerable satellite beam* along the limits of the *effective boresight area.*

Section VIII. Technical Terms Relating to Space

169 Orb-88 8.1 *Deep Space:* Space at distances from the Earth equal to, or greater than, 2×10^6 kilometres.

170 8.2 *Spacecraft:* A man-made vehicle which is intended to go beyond the major portion of the Earth's atmosphere.

171 8.3 *Satellite:* A body which revolves around another body of preponderant mass and which has a motion primarily and permanently determined by the force of attraction of that other body.

172 8.4 *Active Satellite:* A *satellite* carrying a *station* intended to transmit or retransmit radiocommunication signals.

173 8.5 *Reflecting Satellite:* A *satellite* intended to reflect radiocommunication signals.

174 8.6 *Active Sensor:* A measuring instrument in the *earth exploration-satellite service* or in the *space research service* by means of which information is obtained by transmission and reception of *radio waves.*

175 8.7 *Passive Sensor:* A measuring instrument in the *earth exploration-satellite service* or in the *space research service* by means of which information is obtained by reception of *radio waves* of natural origin.

176 8.8 *Orbit:* The path, relative to a specified frame of reference, described by the centre of mass of a *satellite* or other object in space subjected primarily to natural forces, mainly the force of gravity.

177 8.9 *Inclination of an Orbit* (of an earth satellite): The angle determined by the plane containing the *orbit* and the plane of the Earth's equator.

178 8.10 *Period* (of a satellite): The time elapsing between two consecutive passages of a *satellite* through a characteristic point on its *orbit.*

179 8.11 *Altitude of the Apogee* or *of the Perigee:* The altitude of the apogee or perigee above a specified reference surface serving to represent the surface of the Earth.

180 8.12 *Geosynchronous Satellite:* An earth *satellite* whose period of revolution is equal to the period of rotation of the Earth about its axis.

181 8.13 *Geostationary Satellite:* A *geosynchronous satellite* whose circular and direct *orbit* lies in the plane of the Earth's equator and which thus remains fixed relative to the Earth; by extension, a *satellite* which remains approximately fixed relative to the Earth.

182 8.14 *Geostationary-satellite orbit:* The *orbit* in which a *satellite* must be placed to be a *geostationary satellite.*

183 **Orb-88** 8.15 *Steerable Satellite Beam:* A *satellite* antenna beam that can be re-pointed.

184 to **207** NOT allocated.

ARTICLE 2

Nomenclature of the Frequency and Wavelength Bands Used in Radiocommunication

208 § 1. The radio spectrum shall be subdivided into nine frequency bands, which shall be designated by progressive whole numbers in accordance with the following table. As the unit of frequency is the hertz (Hz), frequencies shall be expressed:

- in kilohertz (kHz), up to and including 3 000 kHz;
- in megahertz (MHz), above 3 MHz, up to and including 3 000 MHz;
- in gigahertz (GHz), above 3 GHz, up to and including 3 000 GHz.

For bands above 3 000 GHz, i.e. centimillimetric waves, micrometric waves and decimicrometric waves, it would be appropriate to use terahertz (THz).

However, where adherence to these provisions would introduce serious difficulties, for example in connection with the notification and registration of frequencies, the lists of frequencies and related matters, reasonable departures may be made.

Band Number	Symbols	Frequency Range (lower limit exclusive, upper limit inclusive)	Corresponding Metric Subdivision	Metric Abbreviations for the Bands
4	VLF	3 to 30 kHz	Myriametric waves	B.Mam
5	LF	30 to 300 kHz	Kilometric waves	B.km
6	MF	300 to 3 000 kHz	Hectometric waves	B.hm
7	HF	3 to 30 MHz	Decametric waves	B.dam
8	VHF	30 to 300 MHz	Metric waves	B.m
9	UHF	300 to 3 000 MHz	Decimetric waves	B.dm
10	SHF	3 to 30 GHz	Centimetric waves	B.cm
11	EHF	30 to 300 GHz	Millimetric waves	B.mm
12		300 to 3 000 GHz	Decimillimetric waves	

Note 1: "Band Number N" (N = band number) extends from 0.3×10^N Hz to 3×10^N Hz.

Note 2: Prefix: k = kilo (10^3), M = mega (10^6), G = giga (10^9), T = tera (10^{12}).

209 § 2. In communications between administrations and the ITU, no names, symbols or abbreviations should be used for the various frequency bands other than those specified in No. **208**.

210 to 234 NOT allocated.

ARTICLE 3

Nomenclature of Dates and Times Used in Radiocommunication

235 § 1. Any date used in relation to radiocommunication shall be according to the Gregorian Calendar.

236 § 2. If in a date the month is not indicated either in full or in an abbreviated form, it shall be expressed in an all-numeric form with the fixed sequence of figures, two of each representing the day, month and year.

237 § 3. Whenever a date is used in connection with Coordinated Universal Time (UTC), this date shall be that of the prime meridian at the appropriate time, the prime meridian corresponding to zero degrees geographical longitude.

238 § 4. Whenever a specified time is used in international radiocommunication activities, UTC shall be applied, unless otherwise indicated, and it shall be presented as a four-digit group (0000-2359). The abbreviation UTC shall be used in all languages.

239 to 263 NOT allocated.

ARTICLE 4

Designation of Emissions

264 § 1. (1) Emissions shall be designated according to their necessary bandwidth and their classification.

265 (2) Examples of emissions designated in accordance with this Article are given in Appendix **6**, Part B. Further examples may appear in the latest CCIR Recommendations. These examples may also be published in the Preface to the International Frequency List.

Section I. Necessary Bandwidth

266 § 2. (1) The necessary bandwidth, as defined in No. **146** and determined in accordance with Appendix **6**, Part B, shall be expressed by three numerals and one letter. The letter occupies the position of the decimal point and represents the unit of bandwidth. The first character shall be neither zero nor K, M or G.

267 (2) Necessary bandwidths [1]:

between 0.001 and 999 Hz shall be expressed in Hz (letter H);
between 1.00 and 999 kHz shall be expressed in kHz (letter K);
between 1.00 and 999 MHz shall be expressed in MHz (letter M);
between 1.00 and 999 GHz shall be expressed in GHz (letter G).

Section II. Classification

268 § 3. The class of emission is a set of characteristics conforming to No. **269**.

267.1 [1] Examples:

0.002	Hz	= H002	6	kHz	= 6K00	1.25	MHz	= 1M25
0.1	Hz	= H100	12.5	kHz	= 12K5	2	MHz	= 2M00
25.3	Hz	= 25H3	180.4	kHz	= 180K	10	MHz	= 10M0
400	Hz	= 400H	180.5	kHz	= 181K	202	MHz	= 202M
2.4	kHz	= 2K40	180.7	kHz	= 181K	5.65	GHz	= 5G65

269 § 4. Emissions shall be classified and symbolized according to their basic characteristics as given in No. **270** and any optional additional characteristics as provided for in Appendix 6, Part A.

270 § 5. The basic characteristics (see Nos. **271, 272, 273**) are:

(1) first symbol – type of modulation of the main carrier;

(2) second symbol – nature of signal(s) modulating the main carrier;

(3) third symbol – type of information to be transmitted.

Modulation used only for short periods and for incidental purposes (such as, in many cases, for identification or calling) may be ignored provided that the necessary bandwidth as indicated is not thereby increased.

271 § 6. (1) First symbol – type of modulation of the main carrier

(1.1)	Emission of an unmodulated carrier	N
(1.2)	Emission in which the main carrier is amplitude-modulated (including cases where subcarriers are angle-modulated)	
(1.2.1)	Double-sideband	A
(1.2.2)	Single-sideband, full carrier	H
(1.2.3)	Single-sideband, reduced or variable level carrier	R
(1.2.4)	Single-sideband, suppressed carrier	J
(1.2.5)	Independent sidebands	B
(1.2.6)	Vestigial sideband	C

(1.3)	Emission in which the main carrier is angle-modulated	
(1.3.1)	Frequency modulation	F
(1.3.2)	Phase modulation	G
(1.4)	Emission in which the main carrier is amplitude- and angle-modulated either simultaneously or in a pre-established sequence	D
(1.5)	Emission of pulses [1]	
(1.5.1)	Sequence of unmodulated pulses	P
(1.5.2)	A sequence of pulses	
(1.5.2.1)	modulated in amplitude	K
(1.5.2.2)	modulated in width/duration	L
(1.5.2.3)	modulated in position/phase	M
(1.5.2.4)	in which the carrier is angle-modulated during the period of the pulse	Q
(1.5.2.5)	which is a combination of the foregoing or is produced by other means	V
(1.6)	Cases not covered above, in which an emission consists of the main carrier modulated, either simultaneously or in a pre-established sequence, in a combination of two or more of the following modes: amplitude, angle, pulse	W
(1.7)	Cases not otherwise covered	X

271.1 [1] Emissions where the main carrier is directly modulated by a signal which has been coded into quantized form (e.g. pulse code modulation) should be designated under (1.2) or (1.3).

272 (2) Second symbol – nature of signal(s) modulating the main carrier

(2.1)	No modulating signal	0
(2.2)	A single channel containing quantized or digital information without the use of a modulating sub-carrier [1]	1
(2.3)	A single channel containing quantized or digital information with the use of a modulating sub-carrier [1]	2
(2.4)	A single channel containing analogue information	3
(2.5)	Two or more channels containing quantized or digital information	7
(2.6)	Two or more channels containing analogue information	8
(2.7)	Composite system with one or more channels containing quantized or digital information, together with one or more channels containing analogue information	9
(2.8)	Cases not otherwise covered	X

273 (3) Third symbol – type of information to be transmitted [2]

(3.1)	No information transmitted	N
(3.2)	Telegraphy – for aural reception	A
(3.3)	Telegraphy – for automatic reception	B
(3.4)	Facsimile	C
(3.5)	Data transmission, telemetry, telecommand	D

272.1 [1] This excludes time-division multiplex.

273.1 [2] In this context the word "information" does not include information of a constant, unvarying nature such as is provided by standard frequency emissions, continuous wave and pulse radars, etc.

(3.6)	Telephony (including sound broadcasting)	E
(3.7)	Television (video)	F
(3.8)	Combination of the above	W
(3.9)	Cases not otherwise covered	X

274 to 298 NOT allocated.

CHAPTER II

ARTICLE 5

Technical Characteristics of Stations

299 § 1. (1) The choice and performance of equipment to be used in a station and any emissions therefrom shall satisfy the provisions of these Regulations.

300 (2) Also, as far as is compatible with practical considerations, the choice of transmitting, receiving and measuring equipment shall be based on the most recent advances in the technique as indicated, *inter alia*, in CCIR Recommendations.

301 § 2. Transmitting and receiving equipment intended to be used in a given part of the frequency spectrum should be designed to take into account the technical characteristics of transmitting and receiving equipment likely to be employed in neighbouring and other parts of the spectrum, provided that all technically and economically justifiable measures have been taken to reduce the level of unwanted emissions from the latter transmitting equipment and to reduce the susceptibility to interference of the latter receiving equipment.

302 § 3. To the maximum extent possible, equipment to be used in a station should apply signal processing methods which enable the most efficient use of the frequency spectrum in accordance with the relevant CCIR Recommendations. These methods include, *inter alia*, certain bandwidth expansion techniques, and in particular, in amplitude-modulation systems, the use of the single-sideband technique.

303 § 4. (1) Transmitting stations shall conform to the frequency tolerances specified in Appendix 7.

304 (2) Transmitting stations shall conform to the maximum permitted spurious emission power levels specified in Appendix 8.

305 (3) Transmitting stations shall conform to the maximum permitted power levels for out-of-band emissions specified for certain services and classes of emission in the present Regulations, e.g. Appendices **17** and **27 Aer2** *. In the absence of such specified maximum permitted power levels transmitting stations shall, to the maximum extent possible, satisfy the requirements relating to the limitation of the out-of-band emissions specified in the most recent CCIR Recommendations.

306 (4) Moreover, every effort should be made to keep frequency tolerances and levels of unwanted emissions at the lowest values which the state of the technique and the nature of the service permit.

307 § 5. (1) The bandwidths of emissions also shall be such as to ensure the most efficient utilization of the spectrum; in general this requires that bandwidths be kept at the lowest values which the state of the technique and the nature of the service permit. Appendix **6** is provided as a guide for the determination of the necessary bandwidth.

308 (2) Where bandwidth-expansion techniques are used, the minimum spectral power density consistent with efficient spectrum utilization shall be employed.

309 § 6. (1) Wherever necessary for efficient spectrum use, the receivers used by any service should comply as far as possible with the frequency tolerances of the transmitters of that service, due regard being paid to the Doppler effect where appropriate.

310 (2) Receiving stations should use equipment with technical characteristics appropriate for the class of emission concerned; in particular, selectivity should be appropriate having regard to No. **307** on the bandwidths of emissions.

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* *Note by the General Secretariat:* See No. **5189** and Resolution **400**.

311 (3) The performance characteristics of receivers should be adequate to ensure that they do not suffer from interference due to transmitters situated at a reasonable distance and which operate in accordance with these Regulations.

312 § 7. To ensure compliance with these Regulations, administrations shall arrange for frequent checks to be made of the emissions of stations under their jurisdiction. For this purpose, they shall use the means indicated in Article **20**, if required. The technique of measurements and the intervals of measurements to be employed shall be, as far as is practicable, in accordance with the most recent CCIR Recommendations.

313 § 8. The use of damped wave emissions is forbidden in all stations.

314 to 338 NOT allocated.

CHAPTER III

Frequencies

ARTICLE 6

General Rules for the Assignment and Use of Frequencies

339 § 1. Members shall endeavour to limit the number of frequencies and the spectrum space used to the minimum essential to provide in a satisfactory manner the necessary services. To that end they shall endeavour to apply the latest technical advances as soon as possible [1].

340 § 2. Members undertake that in assigning frequencies to stations which are capable of causing harmful interference to the services rendered by the stations of another country, such assignments are to be made in accordance with the Table of Frequency Allocations and other provisions of these Regulations.

341 § 3. Any new assignment or any change of frequency or other basic characteristic of an existing assignment (see Appendix 1 or Appendix 3) shall be made in such a way as to avoid causing harmful interference to services rendered by stations using frequencies assigned in accordance with the Table of Frequency Allocations in this Chapter and the other provisions of these Regulations, the characteristics of which assignments are recorded in the Master International Frequency Register.

342 § 4. Administrations of the Members shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations given in this Chapter or the other provisions of these Regulations, except on the express condition that harmful interference shall not be caused to services carried on by stations operating in accordance with the provisions of the Convention and of these Regulations.

339.1 [1] No. 130 of the International Telecommunication Convention (Malaga-Torremolinos, 1973).

343 § 5. The frequency assigned to a station of a given service shall be separated from the limits of the band allocated to this service in such a way that, taking account of the frequency band assigned to a station, no harmful interference is caused to services to which frequency bands immediately adjoining are allocated.

344 § 6. For the purpose of resolving cases of harmful interference, the radio astronomy service shall be treated as a radiocommunication service. However, protection from services in other bands shall be afforded the radio astronomy service only to the extent that such services are afforded protection from each other.

345 § 7. For the purpose of resolving cases of harmful interference, the space research (passive) service and the earth exploration-satellite (passive) service shall be afforded protection from different services in other bands only to the extent that these different services are protected from each other.

346 § 8. Where, in adjacent Regions or sub-Regions, a band of frequencies is allocated to different services of the same category (see Sections I and II of Article 8), the basic principle is the equality of right to operate. Accordingly, the stations of each service in one Region or sub-Region must operate so as not to cause harmful interference to services in the other Regions or sub-Regions.

347 § 9. No provision of these Regulations prevents the use by a station in distress of any means of radiocommunication at its disposal to attract attention, make known its condition and location, and obtain assistance.

348 § 10. No provision of these Regulations prevents the use by a station, in the exceptional circumstances described in No. 347, of any means of radiocommunication at its disposal to assist a station in distress.

349 to 373 NOT allocated.

ARTICLE 7

Special Agreements

374 § 1. Two or more Members may, under the provisions for special arrangements in Article 31 of the Convention, conclude special agreements regarding the sub-allocation of bands of frequencies to the appropriate services of the participating countries.

375 § 2. Two or more Members may, under the provisions for special arrangements in Article 31 of the Convention, conclude special agreements, as a result of a conference to which all those Members concerned have been invited, regarding the assignment of frequencies to those of their stations which participate in one or more specific services within the frequency bands allocated to these services by Article 8, either below 5 060 kHz or above 27 500 kHz, but not between those limits.

376 § 3. Members may, under the provisions for special arrangements in Article 31 of the Convention, conclude, on a worldwide basis, and as a result of a conference to which all Members have been invited, special agreements concerning the assignment of frequencies to those of their stations participating in a specific service, on condition that such assignments are within the frequency bands allocated exclusively to that service in Article 8.

377 § 4. Special agreements concluded in accordance with the provisions of Nos. 374 to 376 shall not be in conflict with any of the provisions of these Regulations.

378 § 5. The Secretary-General shall be informed, in advance, of any conference to be convened to conclude such an agreement; he shall also be informed of the terms of the agreement when concluded; and he shall inform the Members of the existence of such agreements.

379 § 6. In accordance with the provisions of Article **10**, the International Frequency Registration Board may be invited to send representatives to participate in an advisory capacity in the preparation of these agreements and in the proceedings of the conferences, it being recognized that in the majority of cases such participation is desirable.

380 § 7. If, besides the action they may take in accordance with No. **375**, two or more Members coordinate the use of individual frequencies in any of the frequency bands covered by Article **8** before notifying the frequency assignments concerned, they shall in all appropriate cases inform the Board of such coordination.

381 to 390 NOT allocated.

ARTICLE 8

Frequency Allocations

Introduction

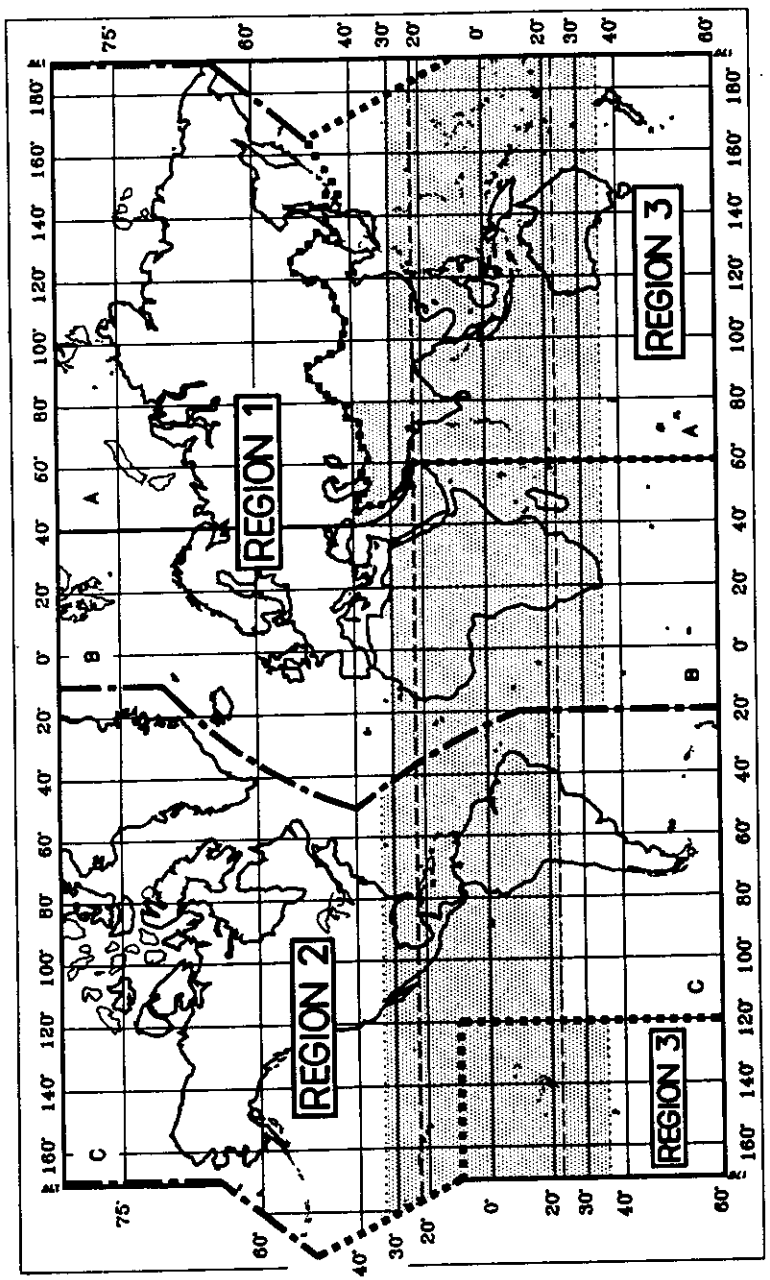
391 § 1. In all documents of the Union where the terms *allocation, allotment* and *assignment* are to be used, they shall have the meaning given them in Nos. **17** to **19**, the terms used in the three working languages being as follows:

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	Assignation (assigner)	Assignment (to assign)	Asignación (asignar)

Section I. Regions and Areas

392 § 2. For the allocation of frequencies the world has been divided into three Regions[1] as shown on the following map and described in Nos. **393** to **399**:

392.1 [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.



The shaded part represents the Tropical Zone as defined in Nos. 406 to 410 and 411.

393 *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 Iran which lies between these limits. It also includes that part of the territory of Turkey and the Union of Soviet Socialist Republics lying outside of these limits, the territory of the Mongolian People's Republic, and the area to the north of the U.S.S.R. which lies between lines A and C.

394 *Region 2:*

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

395 *Region 3:*

Region 3 includes the area limited on the east by line C and on the west by line A, except the territories of the Mongolian People's Republic, Turkey, the territory of the U.S.S.R. and the area to the north of the U.S.S.R. It also includes that part of the territory of Iran lying outside of those limits.

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

397 *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.

398 *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.

399 *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.

400 § 3. For the purposes of these Regulations, the term "African Broadcasting Area" means:

401 *a)* African countries, parts of countries, territories and groups of territories situated between the parallels 40° South and 30° North;

402 *b)* islands in the Indian Ocean west of meridian 60° East of Greenwich, situated between the parallel 40° South and the great circle arc joining the points 45° East, 11° 30′ North and 60° East, 15° North;

403 *c)* islands in the Atlantic Ocean east of line B defined in No. **398** of these Regulations, situated between the parallels 40° South and 30° North.

404 § 4. The "European Broadcasting Area" is bounded on the west by the western boundary of Region 1, on the east by the meridian 40° East of Greenwich and on the south by the parallel 30° North so as to include the western part of the U.S.S.R., the northern part of Saudi Arabia and that part of those countries bordering the Mediterranean within these limits. In addition, Iraq and Jordan are included in the European Broadcasting Area.

405 **Mob-87** § 5. The "European Maritime Area" is bounded to the north by a line extending along parallel 72° North from its intersection with meridian 55° East of Greenwich to its intersection with meridian 5° West, then along meridian 5° West to its intersection with parallel 67° North, thence along parallel 67° North to its intersection with meridian 32° West; to the west by a line

extending along meridian 32° West to its intersection with parallel 30° North; to the south by a line extending along parallel 30° North to its intersection with meridian 43° East; to the east by a line extending along meridian 43° East to its intersection with parallel 60° North, thence along parallel 60° North to its intersection with meridian 55° East and thence along meridian 55° East to its intersection with parallel 72° North.

406 § 6. (1) The "Tropical Zone" (see map in No. **392**) is defined as:

407 *a)* the whole of that area in Region 2 between the Tropics of Cancer and Capricorn;

408 *b)* the whole of that area in Regions 1 and 3 contained between the parallels 30° North and 35° South with the addition of:

409 1) The area contained between the meridians 40° East and 80° East of Greenwich and the parallels 30° North and 40° North;

410 2) that part of Libya north of parallel 30° North.

411 (2) In Region 2, the Tropical Zone may be extended to parallel 33° North, subject to special agreements between the countries concerned in that Region (see Article 7).

412 § 7. A sub-Region is an area consisting of two or more countries in the same Region.

Section II. Categories of Services and Allocations

413 *Primary, Permitted and Secondary Services*

414 § 8. (1) Where, in a box of the Table in Section IV of this Article, a band is indicated as allocated to more than one service, either on a worldwide or Regional basis, such services are listed in the following order:

415 *a)* services the names of which are printed in "capitals" (example: FIXED); these are called "primary" services;

416 *b)* services the names of which are printed in "capitals between oblique strokes" (example: /RADIOLOCATION/); these are called "permitted" services (see No. **419**);

417 *c)* services the names of which are printed in "normal characters" (example: Mobile); these are called "secondary" services (see Nos. **420** to **423**).

418 (2) Additional remarks shall be printed in normal characters (example: MOBILE except aeronautical mobile).

419 (3) Permitted and primary services have equal rights, except that, in the preparation of frequency plans, the primary service, as compared with the permitted service, shall have prior choice of frequencies.

420 (4) Stations of a secondary service:

421 *a)* shall not cause harmful interference to stations of primary or permitted services to which frequencies are already assigned or to which frequencies may be assigned at a later date;

422 *b)* cannot claim protection from harmful interference from stations of a primary or permitted service to which frequencies are already assigned or may be assigned at a later date;

423 *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.

424 (5) Where a band is indicated in a footnote of the Table as allocated to a service "on a secondary basis" in an area smaller than a Region, or in a particular country, this is a secondary service (see Nos. **420** to **423**).

425 (6) Where a band is indicated in a footnote of the Table as allocated to a service "on a primary basis", or "on a permitted basis" in an area smaller than a Region, or in a particular country, this is a primary service or a permitted service only in that area or country (see No. **419**).

426 *Additional Allocations*

427 § 9. (1) Where a band is indicated in a footnote of the Table as "also allocated" to a service in an area smaller than a Region, or in a particular country, this is an "additional" allocation, i.e. an allocation which is added in this area or in this country to the service or services which are indicated in the Table (see No. **428**).

428 (2) If the footnote does not include any restriction on the service or services concerned apart from the restriction to operate only in a particular area or country, stations of this service or these services shall have equality of right to operate with stations of the other primary service or services indicated in the Table.

429 (3) If restrictions are imposed on an additional allocation in addition to the restriction to operate only in a particular area or country, this is indicated in the footnote of the Table.

430 *Alternative Allocations*

431 § 10. (1) Where a band is indicated in a footnote of the Table as "allocated" to one or more services in an area smaller than a Region, or in a particular country, this is an "alternative" allocation, i.e. an allocation which replaces, in this area or in this country, the allocation indicated in the Table (see No. **432**).

432 (2) If the footnote does not include any restriction on stations of the service or services concerned, apart from the restriction to operate only in a particular area or country, these stations of such a service or services shall have an equality of right to operate with stations of the primary service or services, indicated in the Table, to which the band is allocated in other areas or countries.

433 (3) If restrictions are imposed on stations of a service to which an alternative allocation is made, in addition to the restriction to operate only in a particular country or area, this is indicated in the footnote.

434 *Miscellaneous Provisions*

435 § 11. (1) Where it is indicated in these Regulations that a service may operate in a specific frequency band subject to not causing harmful interference, this means also that this service cannot claim protection from harmful interference caused by other services to which the band is allocated under Chapter **III** of these Regulations.

436 (2) Except if otherwise specified in a footnote, the term "fixed service", where appearing in Section IV of this Article, does not include systems using ionospheric scatter propagation.

Section III. Description of the Table of Frequency Allocations

437 § 12. (1) The heading of the Table in Section IV of this Article includes three columns, each of which corresponds to one of the Regions (see No. **392**). Where an allocation occupies the whole of the width of the Table or only one or two of the three columns, this is a worldwide allocation or a Regional allocation, respectively.

438 (2) The frequency band referred to in each allocation is indicated in the left-hand top corner of the part of the Table concerned.

439 (3) Within each of the categories specified in Nos. **415** to **417**, services are listed in alphabetical order according to the French language. The order of listing does not indicate relative priority within each category.

440 (4) In the case where there is a parenthetical addition to an allocation in the Table, that service allocation is restricted to the type of operation so indicated.

441 (5) The footnote references which appear in the Table below the allocated service or services apply to the whole of the allocation concerned.

442 (6) The footnote references which appear to the right of the name of a service are applicable only to that particular service.

443 (7) In certain cases, the names of countries appearing in the footnotes have been simplified in order to shorten the text.

Section IV. Table of Frequency Allocations

(See No. 208)

kHz

9 – 70

Allocation to Services		
Region 1	Region 2	Region 3
Below 9	(not allocated) 444 445	
9 – 14	RADIONAVIGATION	
14 – 19.95	FIXED MARITIME MOBILE 448 446 447	
19.95 – 20.05	STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)	
20.05 – 70	FIXED MARITIME MOBILE 448 447 449	

444 Administrations authorizing the use of frequencies below 9 kHz shall ensure that no harmful interference is caused thereby to the services to which the bands above 9 kHz are allocated (see No. **1816**).

445 Administrations conducting scientific research using frequencies below 9 kHz are urged to advise other administrations that may be concerned in order that such research may be afforded all practicable protection from harmful interference.

446 *Additional allocation:* In Bulgaria, Hungary, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the band 14 - 17 kHz is also allocated to the radionavigation service on a permitted basis.

447 The stations of services to which the bands 14 - 19.95 kHz and 20.05 - 70 kHz and in Region 1 also the bands 72 - 84 kHz and 86 - 90 kHz are allocated may transmit standard frequency and time signals. Such stations shall be afforded protection from harmful interference. In Bulgaria, Hungary, Mongolia, Poland, Czechoslovakia and the U.S.S.R., the frequencies 25 kHz and 50 kHz will be used for this purpose under the same conditions.

448 Mob-87 The use of the bands 14 - 19.95 kHz, 20.05 - 70 kHz and 70 - 90 kHz (72 - 84 kHz and 86 - 90 kHz in Region 1) by the maritime mobile service is limited to coast radiotelegraph stations (A1A and F1B only). Exceptionally, the use of class J2B or J7B emissions is authorized subject to the necessary bandwidth not exceeding that normally used for class A1A or F1B emissions in the band concerned.

449 *Additional allocation:* In Bulgaria, Hungary, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the band 67 - 70 kHz is also allocated to the radionavigation service on a permitted basis.

kHz
70 – 110

Allocation to Services		
Region 1	Region 2	Region 3
70 – 72 RADIONAVIGATION 451	**70 – 90** FIXED MARITIME MOBILE 448 MARITIME RADIO-NAVIGATION 451 Radiolocation	**70 – 72** RADIONAVIGATION 451 Fixed Maritime Mobile 448 450
72 – 84 FIXED MARITIME MOBILE 448 RADIONAVIGATION 451 447		**72 – 84** FIXED MARITIME MOBILE 448 RADIONAVIGATION 451
84 – 86 RADIONAVIGATION 451		**84 – 86** RADIONAVIGATION 451 Fixed Maritime Mobile 448 450
86 – 90 FIXED MARITIME MOBILE 448 RADIONAVIGATION 447	452	**86 – 90** FIXED MARITIME MOBILE 448 RADIONAVIGATION 451
90 – 110	RADIONAVIGATION 453 Fixed 453A 454	

450 *Different category of service:* In Bangladesh, Iran and Pakistan, the allocation of the bands 70 - 72 kHz and 84 - 86 kHz to the fixed and maritime mobile service is on a primary basis (see No. **425**).

451 Mob-87 In the bands 70 - 90 kHz (70 - 86 kHz in Region 1) and 110 - 130 kHz (112 - 130 kHz in Region 1), pulsed radionavigation systems may be used on condition that they do not cause harmful interference to other services to which these bands are allocated.

452 In Region 2, the establishment and operation of stations in the maritime radionavigation service in the bands 70 - 90 kHz and 110 - 130 kHz shall be subject to agreement obtained under the procedure set forth in Article **14** with administrations whose services, operating in accordance with the Table, may be affected. However, stations of the fixed, maritime mobile and radiolocation services shall not cause harmful interference to stations in the maritime radionavigation service established under such agreements.

453 Administrations which operate stations in the radionavigation service in the band 90 - 110 kHz are urged to coordinate technical and operating characteristics in such a way as to avoid harmful interference to the services provided by these stations.

453A Mob-87 In the band 90 - 110 kHz, the United Kingdom may continue to use its coast radiotelegraph stations in operation on 14 September 1987, on a secondary basis.

454 Only classes A1A or F1B, A2C, A3C, F1C or F3C emissions are authorized for stations of the fixed service in the bands allocated to this service between 90 kHz and 160 kHz (148.5 kHz in Region 1) and for stations of the maritime mobile service in the bands allocated to this service between 110 kHz and 160 kHz (148.5 kHz in Region 1). Exceptionally, class J2B or J7B emissions are also authorized in the bands between 110 kHz and 160 kHz (148.5 kHz in Region 1) for stations of the maritime mobile service.

kHz
110 – 130

Allocation to Services		
Region 1	Region 2	Region 3
110 – 112 FIXED MARITIME MOBILE RADIONAVIGATION 454	**110 – 130** FIXED MARITIME MOBILE MARITIME RADIO-NAVIGATION 451 Radiolocation	**110 – 112** FIXED MARITIME MOBILE RADIONAVIGATION 451 454
112 – 115 RADIONAVIGATION 451		**112 – 117.6** RADIONAVIGATION 451 Fixed Maritime Mobile 454 455
115 – 117.6 RADIONAVIGATION 451 Fixed Maritime Mobile 454 456		
117.6 – 126 FIXED MARITIME MOBILE RADIONAVIGATION 451 454		**117.6 – 126** FIXED MARITIME MOBILE RADIONAVIGATION 451 454
126 – 129 RADIONAVIGATION 451		**126 – 129** RADIONAVIGATION 451 Fixed Maritime Mobile 454 455
129 – 130 FIXED MARITIME MOBILE RADIONAVIGATION 451 454	452 454	**129 – 130** FIXED MARITIME MOBILE RADIONAVIGATION 451 454

455 *Different category of service:* in Bangladesh, Iran and Pakistan, the allocation of the bands 112 - 117.6 kHz and 126 - 129 kHz to the fixed and maritime mobile services is on a primary basis (see No. **425**).

456 *Different category of service:* in the Federal Republic of Germany, the allocation of the band 115 - 117.6 kHz to the fixed and maritime mobile services is on a primary basis (see No. **425**) and to the radionavigation service on a secondary basis (see No. **424**).

kHz
130 – 315

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>130 – 148.5
MARITIME MOBILE
/FIXED/

454 457</td><td rowspan="2">130 – 160
FIXED
MARITIME MOBILE

454</td><td>130 – 160
FIXED
MARITIME MOBILE
RADIONAVIGATION

454</td></tr>
<tr><td rowspan="2">148.5 – 255
BROADCASTING

460 461 462</td><td>160 – 190
FIXED

459</td><td>160 – 190
FIXED
Aeronautical Radionavigation</td></tr>
<tr><td colspan="2">190 – 200
AERONAUTICAL RADIONAVIGATION</td></tr>
<tr><td rowspan="2">255 – 283.5
BROADCASTING
/AERONAUTICAL RADIONAVIGATION/ 463

462 464 464A</td><td>200 – 275
AERONAUTICAL RADIONAVIGATION
Aeronautical Mobile</td><td rowspan="2">200 – 285
RADIONAVIGATION AÉRONAUTIQUE
Aeronautical Mobile</td></tr>
<tr><td>275 – 285
AERONAUTICAL RADIONAVIGATION
Aeronautical Mobile
Maritime radionavigation (radiobeacons)</td></tr>
<tr><td>283.5 – 315
MARITIME RADIONAVIGATION (radiobeacons) 466
/AERONAUTICAL RADIONAVIGATION/

464A 465 466A</td><td colspan="2">285 – 315
MARTITIME RADIONAVIGATION (radiobeacons) 466
/AERONAUTICAL RADIONAVIGATION/</td></tr>
</table>

457 *Additional allocation:* in Bulgaria, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 130 - 148.5 kHz is also allocated to the radionavigation service on a secondary basis. Within and between these countries this service shall have an equal right to operate.

458 SUP*
Mob-87

459 In the Region 2 polar areas (north of 60° N and south 60° S), which are subject to auroral disturbances, the aeronautical fixed service is the primary service in the band 160 - 190 kHz.

460 *Alternative allocation:* in Angola, Botswana, Burundi, the Congo, Malawi, Rwanda, South Africa and Zaire, the bande 160 - 200 kHz is allocated to the fixed service on a primary basis.

461 *Additional allocation:* In Somalia, the band 200 - 255 kHz is also allocated to the aeronautical radionavigation service on a primary basis.

462 *Alternative allocation:* in Angola, Botswana, Burundi, Cameroon, the Central African Republic, the Congo, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Nigeria, Oman, Rwanda, South Africa, Swaziland, Tanzania, Chad, Zaire, Zambia and Zimbabwe, the band 200 - 283.5 kHz is allocated to the aeronautical radionavigation service on a primary basis.

463 *Different category of service:* in Sudan and Yemen (P.D.R. of), the allocation of the band 255 - 283.5 kHz to the aeronautical radionavigation service is on a primary basis (see No. **425**).

464 *Alternative allocation:* In Tunisia, the band 255 - 283.5 kHz is allocated to the broadcasting service on a primary basis.

464A In Region 1, the change of the band limit from 285 kHz to 283.5 kHz shall
Mob-87 take place on 1 February 1990 (see Resolution **500**).

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* *Note by the General Secretariat:* This note has been renumbered **464A**, to preserve the chronological order.

465 Norwegian stations of the fixed service situated in northern areas (north of 60° N) subject to auroral disturbances are allowed to continue operation on four frequencies in the bands 283.5 - 490 kHz and 510 - 526.5 kHz.

466 In the band 285 - 325 kHz (283.5 - 325 kHz in Region 1), in the maritime radionavigation service, radiobeacon stations may also transmit supplementary navigational information using narrow-band techniques, on condition that the prime function of the beacon is not significantly degraded.

466A ~~Mob-87~~ *Additional Allocation:* in Region 1, the frequency band 285.3 - 285.7 kHz is also allocated to the maritime radionavigation service (other than radiobeacons) on a permitted basis.

kHz

315 – 505

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>315 – 325
AERONAUTICAL RADIONAVIGATION
Maritime Radionavigation (radiobeacons) 466

465 467</td><td>315 – 325
MARITIME RADIONAVIGATION (radiobeacons) 466
Aeronautical Radionavigation</td><td>315 – 325
AERONAUTICAL RADIONAVIGATION
MARITIME RADIONAVIGATION (radiobeacons) 466</td></tr>
<tr><td rowspan="2">325 – 405
AERONAUTICAL RADIONAVIGATION

465</td><td>325 – 335
AERONAUTICAL RADIONAVIGATION
Aeronautical Mobile
Maritime Radionavigation (radiobeacons)</td><td rowspan="2">325 – 405
AERONAUTICAL RADIONAVIGATION
Aeronautical Mobile</td></tr>
<tr><td>335 – 405
AERONAUTICAL RADIONAVIGATION
Aeronautical Mobile</td></tr>
<tr><td>405 – 415
RADIONAVIGATION 468

465</td><td colspan="2">405 – 415
RADIONAVIGATION 468
Aeronautical Mobile</td></tr>
<tr><td>415 – 435
AERONAUTICAL RADIONAVIGATION
/MARITIME MOBILE/ 470

465</td><td colspan="2" rowspan="2">415 – 495
MARITIME MOBILE 470

Aeronautical Radionavigation 470A

469 469A 471 472A</td></tr>
<tr><td>435 – 495
MARITIME MOBILE 470
Aeronautical Radionavigation

465 471 472A</td></tr>
<tr><td>495 – 505</td><td colspan="2">MOBILE (distress and calling)

472</td></tr>
</table>

467 *Different category of service:* in the U.S.S.R. and the Black Sea areas of Bulgaria, Roumania and Turkey, the allocation of the band 315 - 325 kHz to the maritime radionavigation service is on a primary basis (see No. **425**) under the following conditions:

a) in the Black Sea and White Sea areas, the maritime radionavigation service is the primary service and the aeronautical radionavigation service is the permitted service;

b) in the Baltic Sea area, the assignment of frequencies in this band to new stations in the maritime or aeronautical radionavigation services shall be subject to prior consultation between the administrations concerned.

468 The frequency 410 kHz is designated for radio direction-finding in the maritime radionavigation service. The other radionavigation services to which the band 405 - 415 kHz is allocated shall not cause harmful interference to radio direction-finding in the band 406.5 - 413.5 kHz.

469 Mob-87 *Different category of service:* in Afghanistan, Australia, China, the French Overseas Territories of Region 3, India, Indonesia, the Islamic Republic of Iran, Japan, Pakistan, Papua New Guinea and Sri Lanka, the allocation of the band 415 - 495 kHz to the aeronautical radionavigation service is on a permitted basis. Administrations in these countries shall take all practical steps necessary to ensure that aeronautical radionavigation stations in the band 435 - 495 kHz do not cause interference to reception by coast stations of ship stations transmitting on frequencies designated for ship stations on a world-wide basis (see No. **4237**).

469A Mob-87 *Different category of service:* in Cuba, the United States of America, and Mexico the allocation of the band 415 - 435 kHz to the aeronautical radionavigation service is on a primary basis.

470 The use of the bands 415 - 495 kHz and 505 - 526.5 kHz (505 - 510 kHz in Region 2) by the maritime mobile service is limited to radiotelegraphy.

470A Mob-87 In Region 2, the use of the band 435 - 495 kHz by the aeronautical radionavigation service is limited to non-directional beacons not employing voice transmission.

471 Mob-87 The bands 490 - 495 kHz and 505 - 510 kHz shall be subject to the provisions of No. **3018** until the entry into force of the reduced guardband in accordance with Resolution **210 (Mob-87)**.

472 Mob-87 The frequency 500 kHz is an international distress and calling frequency for Morse radiotelegraphy. The conditions for its use are prescribed in Articles **37**, **38**, **N 38** and **60**.

472A Mob-87 In the maritime mobile service, the frequency 490 kHz is, from the date of full implementation of the GMDSS (see Resolution **331 (Mob-87)**), to be used exclusively for the transmission by coast stations of navigational and meteorological warnings and urgent information to ships, by means of narrow-band direct-printing telegraphy. The conditions for use of the frequency 490 kHz are prescribed in Articles **N 38** and **60**, and Resolution **329 (Mob-87)**. In using the band 415 - 495 kHz for the aeronautical radionavigation service, administrations are requested to ensure that no harmful interference is caused to the frequency 490 kHz.

kHz

505 – 1 606.5

Allocation to Services		
Region 1	Region 2	Region 3
505 – 526.5 MARITIME MOBILE 470 /AERONAUTICAL RADIONAVIGATION/ 465 471 474 475 476	**505 – 510** MARITIME MOBILE 470 471 **510 – 525** MOBILE 474 AERONAUTICAL RADIONAVIGATION	**505 – 526.5** MARITIME MOBILE 470 474 /AERONAUTICAL RADIONAVIGATION/ Aeronautical Mobile Land Mobile 471
526.5 – 1 606.5 BROADCASTING 478	**525 – 535** BROADCASTING 477 AERONAUTICAL RADIONAVIGATION **535 – 1 605** BROADCASTING	**526.5 – 535** BROADCASTING Mobile 479 **535 – 1 606.5** BROADCASTING

473 SUP
Mob-87

474 The conditions for the use of frequency 518 kHz by the maritime mobile
Mob-87 service are prescribed in Articles **38**, **N 38** and **60** (see Resolution **324 (Mob-87)** and Article **14A**).

475 In the band 515.5 - 526.5 kHz, Austria may continue to operate only those broadcasting stations listed in Additional Protocol III to the Final Acts of the Regional Administrative LF/MF Broadcasting Conference (Regions 1 and 3), Geneva, 1975. This operation is allowed until the entry into force of a revision of the Geneva Plan, 1975, and subject to not causing harmful interference to the maritime mobile and aeronautical radionavigation services.

476 *Additional allocation:* in the United Kingdom, the band 519.5 - 526.5 kHz is also allocated to the broadcasting service on a secondary basis for the transmission of public utility information.

477 In Region 2, in the band 525 - 535 kHz the carrier power of broadcasting stations shall not exceed 1 kW during the day and 250 W at night.

478 *Additional allocation:* in Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, the band 526.5 - 535 kHz is also allocated to the mobile service on a secondary basis.

479 *Additional allocation:* in China, the band 526.5 - 535 kHz is also allocated to the aeronautical radionavigation service on a secondary basis.

kHz
1 605 – 1 800

Allocation to Services		
Region 1	Region 2	Region 3
	1 605 – 1 625	
1 606.5 – 1 625 MARITIME MOBILE 480A /FIXED/ /LAND MOBILE/ 483 484	BROADCASTING 480 480A 481	**1 606.5 – 1 800** FIXED MOBILE RADIOLOCATION RADIONAVIGATION
1 625 – 1 635 RADIOLOCATION 487 485 486	**1 625 – 1 705** BROADCASTING 480 /FIXED/ /MOBILE/ Radiolocation 480A 481	
1 635 – 1 800 MARITIME MOBILE 480A /FIXED/ /LAND MOBILE/ 483 484 488	**1 705 – 1 800** FIXED MOBILE RADIOLOCATION AERONAUTICAL RADIONAVIGATION	482

480 Orb-88 In Region 2, the use of the band 1 605 - 1 705 kHz by stations of the broadcasting service is subject to the Plan established by the Regional Administrative Radio Conference (Rio de Janeiro, 1988).

In Region 2, in the band 1 625 - 1 705 kHz, the relationship between the broadcasting, fixed and mobile services is shown in No. **419**. However, the examination of frequency assignments to stations of the fixed and mobile services in the band 1 625 - 1 705 kHz under No. **1241** shall take account of the allotments appearing in the Plan established by the Regional Administrative Radio Conference (Rio de Janeiro, 1988).

480A Mob-87 In the band 1 605 - 1 705 kHz, in cases where a broadcasting station of Region 2 is concerned, the service area of the maritime mobile stations in Region 1 shall be limited to that provided by ground-wave propagation.

481 In Region 2, until the dates decided by the regional administrative radio conference referred to in No. **480**, the band 1 605 - 1 705 kHz is allocated to the fixed, mobile and aeronautical radionavigation services on a primary basis and to the radiolocation service on a secondary basis (see Recommendation **504**).

482 *Additional allocation:* in Australia, Indonesia, New Zealand, the Philippines, Singapore, Sri Lanka and Thailand, the band 1 606.5 - 1 705 kHz is also allocated to the broadcasting service on a secondary basis.

483 *Different category of service:* in Bulgaria, Hungary, Mongolia, Nigeria, Poland, the German Democratic Republic, Chad, Czechoslovakia and the U.S.S.R, the allocation of the bands 1 606.5 - 1 625 kHz, 1 635 - 1 800 kHz and 2 107 - 2 160 kHz to the fixed and land mobile services is on a primary basis (see No. **425**).

484 Some countries of Region 1 use radiodetermination systems in the bands 1 606.5 - 1 625 kHz, 1 635 - 1 800 kHz, 1 850 - 2 160 kHz, 2 194 - 2300 kHz, 2 502 - 2 850 kHz and 3 500 - 3 800 kHz. The establishment and operation of such systems are subject to agreement obtained under the procedure set forth in Article **14**. The radiated mean power of these stations shall not exceed 50 W.

485 *Additional allocation:* in Angola, Bulgaria, Hungary, Mongolia, Nigeria, Poland, the German Democratic Republic, Chad, Czechoslovakia and the U.S.S.R., the bands 1 625 - 1 635 kHz, 1 800 - 1 810 kHz and 2 160 - 2 170 kHz are also allocated to the fixed and land mobile services on a primary basis subject to agreement obtained under the procedure set forth in Article **14**.

486 In Region 1, in the bands 1 625 - 1 635 kHz, 1 800 - 1 810 kHz and 2 160 - 2 170 kHz (except in the countries listed in No. **485** and those listed in No. **499** for the band 2 160 - 2 170 kHz), existing stations in the fixed and mobile, except aeronautical mobile, services (and stations of the aeronautical mobile (OR) service in the band 2 160 - 2 170 kHz) may continue to operate on a primary basis until satisfactory replacement assignments have been found and implemented in accordance with Resolution **38**.

487 In Region 1, the establishment and operation of stations of the radiolocation service in the bands 1 625 - 1 635 kHz, 1 800 - 1 810 kHz and 2 160 - 2 170 kHz shall be subject to agreement obtained under the procedure set forth in Article **14** (see also No. **486**). The radiated mean power of radiolocation stations shall not exceed 50 W. Pulse systems are prohibited.

488 In the Federal Republic of Germany, Denmark, Finland, Hungary, Ireland, Israel, Jordan, Malta, Norway, Poland, The German Democratic Republic, the United Kingdom, Sweden, Czechoslovakia and the U.S.S.R., administrations may allocate up to 200 kHz to their amateur service in the bands 1 715 - 1 800 kHz and 1 850 - 2 000 kHz. However, when allocating the bands within this range to their amateur service, administrations shall, after prior consultation with administrations of neighbouring countries, take such steps as may be necessary to prevent harmful interference from their amateur service to the fixed and mobile services of other countries. The mean power of any amateur station shall not exceed 10 W.

kHz
1 800 – 2 065

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>1 800 – 1 810
RADIOLOCATION 487

485 486</td><td rowspan="2">1 800 – 1 850
AMATEUR</td><td rowspan="3">1 800 – 2 000
AMATEUR
FIXED
MOBILE except aeronautical mobile
RADIONAVIGATION
Radiolocation</td></tr>
<tr><td>1 810 – 1 850
AMATEUR

490 491 492 493</td></tr>
<tr><td>1 850 – 2 000
FIXED
MOBILE except aeronautical mobile

484 488 495</td><td>1 850 – 2 000
AMATEUR
FIXED
MOBILE except aeronautical mobile
RADIOLOCATION
RADIONAVIGATION

494</td><td>489</td></tr>
<tr><td>2 000 – 2 025
FIXED
MOBILE except aeronautical mobile (R)

484 495</td><td colspan="2" rowspan="2">2 000 – 2 065
FIXED
MOBILE</td></tr>
<tr><td>2 025 – 2 045
FIXED
MOBILE except aeronautical mobile (R)
Meteorological Aids 496

484 495</td></tr>
</table>

489 Mob-87 In Region 3, the Loran system operates either on 1 850 kHz or 1 950 kHz, the bands occupied being 1 825 - 1 875 kHz and 1 925 - 1 975 kHz respectively. Other services to which the band 1 800 - 2 000 kHz is allocated may use any frequency therein on condition that no harmful interference is caused to the Loran system operating on 1 850 kHz or 1 950 kHz.

490 *Alternative allocation:* in the Federal Republic of Germany, Angola, Austria, Belgium, Bulgaria, Cameroon, the Congo, Denmark, Egypt, Spain, Ethiopia, France, Greece, Italy, the Lebanon, Luxembourg, Malawi, the Netherlands, Portugal, Syria, the German Democratic Republic, Somalia, Tanzania, Tunisia, Turkey and the U.S.S.R., the band 1 810 - 1 830 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

491 *Additional allocation:* In Saudi Arabia, Iraq, Israel, Libya, Poland, Roumania, Chad, Czechoslovakia, Togo and Yugoslavia, the band 1 810 - 1 830 kHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

492 In Region 1, the use of the band 1 810 - 1 850 kHz by the amateur service is subject to the condition that satisfactory replacement assignments have been found and implemented in accordance with Resolution **38**, for frequencies to all existing stations of the fixed and mobile, except aeronautical mobile, services operating in this band (except for the stations of the countries listed in Nos. **490**, **491** and **493**). On completion of satisfactory transfer, the authorization to use the band 1 810 - 1 830 kHz by the amateur service in countries situated totally or partially north of 40° N shall be given only after consultation with the countries mentioned in Nos. **490** and **491** to define the necessary steps to be taken to prevent harmful interference between amateur stations and stations of other services operating in accordance with Nos. **490** and **491**.

493 *Alternative allocation:* In Burundi and Lesotho, the band 1 810 - 1 850 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

494 *Alternative allocation:* In Argentina, Bolivia, Chile, Mexico, Paraguay, Peru, Uruguay and Venezuela, the band 1 850 - 2 000 kHz is allocated to the fixed, mobile except aeronautical mobile, radiolocation and radionavigation services on a primary basis.

495 In Region 1, in making assignments to stations in the fixed and mobile services in the bands 1 850 - 2 045 kHz, 2 194 - 2 498 kHz, 2 502 - 2 625 kHz and 2 650 - 2 850 kHz, administrations should bear in mind the special requirements of the maritime mobile service.

496 In Region 1, the use of the band 2 025 - 2 045 kHz by the meteorological aids service is limited to oceanographic buoy stations.

kHz
2 045 – 2 501

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>2 045 – 2 160
MARITIME MOBILE
/FIXED/
/LAND MOBILE/

483 484</td><td colspan="2"></td></tr>
<tr><td rowspan="2">2 160 – 2 170
RADIOLOCATION 487

485 486 499</td><td colspan="2">2 065 – 2 107
MARITIME MOBILE 497

498</td></tr>
<tr><td colspan="2">2 107 – 2 170
FIXED
MOBILE</td></tr>
<tr><td>2 170 – 2 173.5</td><td colspan="2">MARITIME MOBILE</td></tr>
<tr><td>2 173.5 – 2 190.5</td><td colspan="2">MOBILE (distress and calling)

500 500A 500B 501</td></tr>
<tr><td>2 190.5 – 2 194</td><td colspan="2">MARITIME MOBILE</td></tr>
<tr><td>2 194 – 2 300
FIXED
MOBILE except
aeronautical mobile (R)

484 495 502</td><td colspan="2">2 194 – 2 300
FIXED
MOBILE

502</td></tr>
<tr><td>2 300 – 2 498
FIXED
MOBILE except
aeronautical mobile (R)
BROADCASTING 503

495</td><td colspan="2">2 300 – 2 495
FIXED
MOBILE
BROADCASTING 503</td></tr>
<tr><td>2 498 – 2 501
STANDARD FREQUENCY
AND TIME SIGNAL
(2 500 kHz)</td><td colspan="2">2 495 – 2 501
STANDARD FREQUENCY AND
TIME SIGNAL (2 500 kHz)</td></tr>
</table>

497 Mob-87 In Region 2, except in Greenland, coast stations and ship stations using radiotelephony in the band 2 065 - 2 107 kHz shall be limited to class R3E or J3E emissions and to a peak envelope power not exceeding 1 kW. Preferably, the following carrier frequencies should be used: 2 065.0 kHz, 2 079.0 kHz, 2 082.5 kHz, 2 086.0 kHz, 2 093.0 kHz, 2 096.5 kHz, 2 100.0 kHz and 2 103.5 kHz. In Argentina, Brazil and Uruguay, the carrier frequencies 2 068.5 kHz and 2 075.5 kHz are also used for this purpose, while the frequencies within the band 2 072 - 2 075.5 kHz are used as provided in No. **4323BD**.

498 In Regions 2 and 3, provided no harmful interference is caused to the maritime mobile service, the frequencies between 2 065 kHz and 2 107 kHz may be used by stations of the fixed service communicating only within national borders and whose mean power does not exceed 50 W. In notifying the frequencies, the attention of the International Frequency Registration Board should be drawn to these provisions.

499 *Additional allocation:* in Saudi Arabia, Botswana, Ethiopia, Iraq, Lesotho, Libya, Malawi, Somalia, Swaziland and Zambia, the band 2 160 - 2 170 kHz is also allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis. The mean power of stations in these services shall not exceed 50 W.

500 Mob-87 The carrier frequency 2 182 kHz is an international distress and calling frequency for radiotelephony. The conditions for the use of the band 2 173.5 - 2 190.5 kHz are prescribed in Articles **37**, **38**, **N 38** and **60**.

500A Mob-87 The frequencies 2 187.5 kHz, 4 207.5 kHz, 6 312 kHz, 8 414.5 kHz, 12 577 kHz and 16 804.5 kHz are international distress frequencies for digital selective calling. The conditions for the use of these frequencies are prescribed in Article **N 38**.

500B Mob-87 The frequencies 2 174.5 kHz, 4 177.5 kHz, 6 268 kHz, 8 376.5 kHz, 12 520 kHz and 16 695 kHz are international distress frequencies for narrow-band direct-printing telegraphy. The conditions for the use of these frequencies are prescribed in Article **N 38**.

501 Mob-87 The carrier frequencies 2 182 kHz, 3 023 kHz, 5 680 kHz, 8 364 kHz and the frequencies 121.5 MHz, 156.8 MHz and 243 MHz may also be used, in accordance with the procedures in force for terrestrial radiocommunication services, for search and rescue operations concerning manned space vehicles. The conditions for the use of the frequencies are prescribed in Articles **38** and **N 38**.

The same applies to the frequencies 10 003 kHz, 14 993 kHz and 19 993 kHz, but in each of these cases emissions must be confined in a band of ± 3 kHz about the frequency.

502 *Alternative allocation:* in Belgium, Cyprus, Denmark, Spain, France, Greece, Iceland, Italy, Malta, Norway, the Netherlands, Portugal, the United Kingdom, Singapore, Sri Lanka, Sweden, Turkey and Yugoslavia, the band 2 194 - 2 300 kHz is allocated to the maritime mobile service on a primary basis and to the fixed and land mobile services on a permitted basis.

503 For the conditions for the use of the bands 2 300 - 2 495 kHz (2 498 kHz in Region 1), 3 200 - 3 400 kHz, 4 750 - 4 995 kHz and 5 005 - 5 060 kHz by the broadcasting service, see Nos. **406** to **410**, **411** and **2666** to **2673**.

kHz
2 501 – 3 230

Allocation to Services		
Region 1	Region 2	Region 3
2 501 – 2 502	STANDARD FREQUENCY AND TIME SIGNAL Space Research	
2 502 – 2 625 FIXED MOBILE except aeronautical mobile (R) 484 495 504	**2 502 – 2 505** STANDARD FREQUENCY AND TIME SIGNAL	
2 625 – 2 650 MARITIME MOBILE MARITIME RADIONAVIGATION 484	**2 505 – 2 850** FIXED MOBILE	
2 650 – 2 850 FIXED MOBILE except aeronautical mobile (R) 484 495		
2 850 – 3 025	AERONAUTICAL MOBILE (R) 501 505	
3 025 – 3 155	AERONAUTICAL MOBILE (OR)	
3 155 – 3 200	FIXED MOBILE except aeronautical mobile (R) 506 507	
3 200 – 3 230	FIXED MOBILE except aeronautical mobile (R) BROADCASTING 503 506	

504 *Alternative allocation:* in Belgium, Cyprus, Denmark, Spain, France, Greece, Iraq, Italy, Malta, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Turkey and Yugoslavia, the band 2 502 - 2 625 kHz is allocated to the maritime mobile service on a primary basis and to the fixed and land mobile services on a permitted basis.

505 Mob-87 The carrier (reference) frequencies 3 023 kHz and 5 680 kHz may also be used, in accordance with Articles **38** and **N 38** by stations of the maritime mobile service engaged in coordinated search and rescue operations.

506 Administrations are urged to authorize the use of the band 3 155 - 3 195 kHz to provide a common worldwide channel for low power wireless hearing aids. Additional channels for these devices may be assigned by administrations in the bands between 3 155 kHz and 3 400 kHz to suit local needs.

It should be noted that frequencies in the range 3 000 kHz to 4 000 kHz are suitable for hearing aid devices which are designed to operate over short distances within the induction field.

507 *Alternative allocation:* in Belgium, Cameroon, Cyprus, the Ivory Coast, Denmark, Egypt, Spain, France, Greece, Iceland, Italy, Liberia, Malta, Norway, the Netherlands, the United Kingdom, Singapore, Sri Lanka, Sweden, Togo, Turkey and Yugoslavia, the band 3 155 - 3 200 kHz is allocated to the maritime mobile service on a primary basis and to the fixed and land mobile services on a permitted basis.

kHz
3 230 – 4 063

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 230 – 3 400</td><td colspan="2">FIXED
MOBILE except aeronautical mobile
BROADCASTING 503

506 508</td></tr>
<tr><td>3 400 – 3 500</td><td colspan="2">AERONAUTICAL MOBILE (R)</td></tr>
<tr><td>3 500 – 3 800
AMATEUR 510
FIXED
MOBILE except aeronautical mobile

484</td><td rowspan="3">3 500 – 3 750
AMATEUR 510

509 511

3 750 – 4 000
AMATEUR 510
FIXED
MOBILE except aeronautical mobile (R)

511 512 514 515</td><td rowspan="2">3 500 – 3 900
AMATEUR 510
FIXED
MOBILE</td></tr>
<tr><td>3 800 – 3 900
FIXED
AERONAUTICAL MOBILE (OR)
LAND MOBILE</td></tr>
<tr><td>3 900 – 3 950
AERONAUTICAL MOBILE (OR)

513</td><td>3 900 – 3 950
AERONAUTICAL MOBILE
BROADCASTING</td></tr>
<tr><td>3 950 – 4 000
FIXED
BROADCASTING</td><td>3 950 – 4 000
FIXED
BROADCASTING

516</td></tr>
<tr><td>4 000 – 4 063</td><td colspan="2">FIXED
MARITIME MOBILE 517

516</td></tr>
</table>

508 *Additional allocation:* in Australia, Brazil, Canada, the United States, Japan, Mexico, New Zealand, Peru and Uruguay, the band 3 230 - 3 400 kHz is also allocated to the radiolocation service on a secondary basis.

509 *Additional allocation:* in Honduras, Mexico, Peru and Venezuela, the band 3 500 - 3 750 kHz is also allocated to the fixed and mobile services on a primary basis.

510 For the use of the bands allocated to the amateur service at 3.5 MHz, 7.0 MHz, 10.1 MHz, 14.0 MHz, 18.068 MHz, 21.0 MHz, 24.89 MHz and 144 MHz in the event of natural disasters, see Resolution **640**.

511 *Additional allocation:* in Brazil, the band 3 700 - 4 000 kHz is also allocated to the radiolocation service on a primary basis.

512 *Alternative allocation:* in Argentina, Bolivia, Chile, Ecuador, Paraguay, Peru and Uruguay, the band 3 750 - 4 000 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

513 *Alternative allocation:* in Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe, the band 3 900 - 3 950 kHz is allocated to the broadcasting service on a primary basis. The use of this band by the broadcasting service is subject to agreement obtained under the procedure set forth in Article **14** with neighbouring countries having services operating in accordance with the Table.

514 *Additional allocation:* in Canada, the band 3 950 - 4 000 kHz is also allocated to the broadcasting service on a primary basis. The power of broadcasting stations operating in this band shall not exceed that necessary for a national service within the frontier of this country and shall not cause harmful interference to other services operating in accordance with the Table.

515 *Additional allocation:* in Greenland, the band 3 950 - 4 000 kHz is also allocated to the broadcasting service on a primary basis. The power of the broadcasting stations operating in this band shall not exceed that necessary for a national service and shall in no case exceed 5 kW.

516 In Region 3, the stations of those services to which the band 3 995 - 4 005 kHz is allocated may transmit standard frequency and time signals.

517 Mob-87 The use of the band 4 000 - 4 063 kHz by the maritime mobile service is limited to ship stations using radiotelephony (see No. **4374** and Appendix **16**).

kHz
4 063 – 5 450

Allocation to Services		
Region 1	Region 2	Region 3
4 063 – 4 438	MARITIME MOBILE 500A 500B 520 520A 520B 518 519	
4 438 – 4 650 FIXED MOBILE except aeronautical mobile (R)		**4 438 – 4 650** FIXED MOBILE except aeronautical mobile
4 650 – 4 700	AERONAUTICAL MOBILE (R)	
4 700 – 4 750	AERONAUTICAL MOBILE (OR)	
4 750 – 4 850 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE BROADCASTING 503	**4 750 – 4 850** FIXED MOBILE except aeronautical mobile (R) BROADCASTING 503	**4 750 – 4 850** FIXED BROADCASTING 503 Land Mobile
4 850 – 4 995	FIXED LAND MOBILE BROADCASTING 503	
4 995 – 5 003	STANDARD FREQUENCY AND TIME SIGNAL (5 000 kHz)	
5 003 – 5 005	STANDARD FREQUENCY AND TIME SIGNAL Space Research	
5 005 – 5 060	FIXED BROADCASTING 503	
5 060 – 5 250	FIXED Mobile except aeronautical mobile 521	
5 250 – 5 450	FIXED MOBILE except aeronautical mobile	

518 In Afghanistan, Argentina, Australia, Botswana, China, India, Swaziland, Chad and the U.S.S.R., in the bands 4 063 - 4 123 kHz, 4 130 - 4 133 kHz and 4 408 - 4 438 kHz, stations of limited power in the fixed service which are situated at least 600 km from the coast may operate on condition that harmful interference is not caused to the maritime mobile service.

519 On condition that harmful interference is not caused to the maritime mobile service, the frequencies in the bands 4 063 - 4 123 kHz and 4 130 - 4 438 kHz may be used exceptionally by stations in the fixed service communicating only within the boundary of the country in which they are located with a mean power not exceeding 50 W.

520 Mob-87 The conditions for the use of the carrier frequencies 4 125 kHz and 6 215 kHz are prescribed in Articles **37**, **38**, **N 38** and **60**.

520A Mob-87 The frequency 4 209.5 kHz is used exclusively for the transmission by coast stations of meteorological and navigational warnings and urgent information to ships by means of narrow-band direct-printing techniques (see Resolution **332 (Mob-87)**).

520B Mob-87 The frequencies 4 210 kHz, 6 314 kHz, 8 416.5 kHz, 12 579 kHz, 16 806.5 kHz, 19 680.5 kHz, 22 376 kHz and 26 100.5 kHz are the international frequencies for the transmission of Maritime Safety Information (MSI) (see Resolution **333 (Mob-87)** and Appendix **31**).

521 *Different category of service:* In the U.S.S.R., the allocation of the band 5 130 - 5 250 kHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. **425**).

kHz

5 450 – 7 100

Allocation to Services		
Region 1	Region 2	Region 3
5 450 – 5 480 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	**5 450 – 5 480** AERONAUTICAL MOBILE (R)	**5 450 – 5 480** FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE
5 480 – 5 680	AERONAUTICAL MOBILE (R) 501 505	
5 680 – 5 730	AERONAUTICAL MOBILE (OR) 501 505	
5 730 – 5 950 FIXED LAND MOBILE	**5 730 – 5 950** FIXED MOBILE except aeronautical mobile (R)	**5 730 – 5 950** FIXED Mobile except aeronautical mobile (R)
5 950 – 6 200	BROADCASTING	
6 200 – 6 525	MARITIME MOBILE 500A 500B 520 520B 522	
6 525 – 6 685	AERONAUTICAL MOBILE (R)	
6 685 – 6 765	AERONAUTICAL MOBILE (OR)	
6 765 – 7 000	FIXED Land Mobile 525 524	
7 000 – 7 100	AMATEUR 510 AMATEUR-SATELLITE 526 527	

522 On condition that harmful interference is not caused to the maritime mobile service, the bands 6 200 - 6 213.5 kHz and 6 220.5 - 6 525 kHz may be used exceptionally by stations in the fixed service, communicating only within the boundary of the country in which they are located, with a mean power not exceeding 50 W. At the time of notification of these frequencies, the attention of the International Frequency Registration Board will be drawn to the above conditions.

523 SUP
Mob-83

524 The band 6 765 - 6 795 kHz (centre frequency 6 780 kHz) is designated for industrial, scientific and medical (ISM) applications. The use of this frequency band 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 CCIR Recommendations.

525 *Different category of service:* in Mongolia and the U.S.S.R., the allocation of the band 6 765 - 7 000 kHz to the land mobile service is on a primary basis (see No. **425**).

526 *Additional allocation:* in Angola, Iraq, Kenya, Rwanda, Somalia and Togo, the band 7 000 - 7 050 kHz is also allocated to the fixed service on a primary basis.

527 *Alternative allocation:* in Egypt, Ethiopia, Guinea, Libya, Madagascar, Malawi and Tanzania, the band 7 000 - 7 050 kHz is allocated to the fixed service on a primary basis.

kHz
7 100 – 10 100

Allocation to Services		
Region 1	Region 2	Region 3
7 100 – 7 300 BROADCASTING	**7 100 – 7 300** AMATEUR 510 528	**7 100 – 7 300** BROADCASTING
7 300 – 8 100	FIXED Land Mobile 529	
8 100 – 8 195	FIXED MARITIME MOBILE	
8 195 – 8 815	MARITIME MOBILE 500A 500B 520B 529A 501	
8 815 – 8 965	AERONAUTICAL MOBILE (R)	
8 965 – 9 040	AERONAUTICAL MOBILE (OR)	
9 040 – 9 500	FIXED	
9 500 – 9 900	BROADCASTING 530 531	
9 900 – 9 995	FIXED	
9 995 – 10 003	STANDARD FREQUENCY AND TIME SIGNAL (10 000 kHz) 501	
10 003 – 10 005	STANDARD FREQUENCY AND TIME SIGNAL Space Research 501	
10 005 – 10 100	AERONAUTICAL MOBILE (R) 501	

528 The use of the band 7 100 - 7 300 kHz in Region 2 by the amateur service shall not impose constraints on the broadcasting service intended for use within Region 1 and Region 3.

529 In Region 3, the stations of those services to which the band 7 995 - 8 005 kHz is allocated may transmit standard frequency and time signals.

529A Mob-87 The conditions for the use of the carrier frequencies 8 291 kHz, 12 290 kHz and 16 420 kHz are prescribed in Articles **38**, **N 38** and **60**.

530 On condition that harmful interference is not caused to the broadcasting service, frequencies in the bands 9 775 - 9 900 kHz, 11 650 - 11 700 kHz and 11 975 - 12 050 kHz may be used by stations in the fixed service communicating only within the boundary of the country in which they are located, each station using a total radiated power not exceeding 24 dBW.

531 HFBC-87 The bands 9 775 - 9 900 kHz, 11 650 - 11 700 kHz, 11 975 - 12 050 kHz, 13 600 - 13 800 kHz, 15 450 - 15 600 kHz, 17 550 - 17 700 kHz and 21 750 - 21 850 kHz are allocated to the fixed service on a primary basis subject to the procedure described in Resolution **8**. The use of these bands by the broadcasting service shall be subject to provisions established by the World Administrative Radio Conference for the Planning of the HF Bands Allocated to the Broadcasting Service (see Resolution **508**). The provisions of Resolution **512 (HFBC-87)** also apply. Within these bands, the date of commencement of operations in the broadcasting service on a planned channel shall not be earlier than the date of completion of satisfactory transfer, according to the procedures described in Resolution **8**, of all assignments to stations in the fixed service operating in accordance with the Table and other provisions of the Radio Regulations, which are recorded in the Master Register and which may be affected by broadcasting operations on that channel.

kHz

10 100 – 14 250

Allocation to Services		
Region 1	Region 2	Region 3
10 100 – 10 150	FIXED Amateur 510	
10 150 – 11 175	FIXED Mobile except aeronautical mobile (R)	
11 175 – 11 275	AERONAUTICAL MOBILE (OR)	
11 275 – 11 400	AERONAUTICAL MOBILE (R)	
11 400 – 11 650	FIXED	
11 650 – 12 050	BROADCASTING 530 531	
12 050 – 12 230	FIXED	
12 230 – 13 200	MARITIME MOBILE 500A 500B 520B 529A 532	
13 200 – 13 260	AERONAUTICAL MOBILE (OR)	
13 260 – 13 360	AERONAUTICAL MOBILE (R)	
13 360 – 13 410	FIXED RADIO ASTRONOMY 533	
13 410 – 13 600	FIXED Mobile except aeronautical mobile (R) 534	
13 600 – 13 800	BROADCASTING 531	
13 800 – 14 000	FIXED Mobile except aeronautical mobile (R)	
14 000 – 14 250	AMATEUR 510 AMATEUR-SATELLITE	

532 The bands 12 230 - 12 330 kHz, 16 360 - 16 460 kHz, 17 360 - 17 410 kHz, 18 780 - 18 900 kHz, 19 680 - 19 800 kHz and 22 720 - 22 855 kHz are allocated to the fixed service on a primary basis subject to the procedure described in Resolution **8**. The use of these bands by the maritime mobile service shall be subject to provisions to be decided by a competent world administrative radio conference. The date of commencement of operations in the maritime mobile service on a frequency in accordance with the above-mentioned provisions shall not be earlier than the date of completion of satisfactory transfer, in accordance with the procedure described in Resolution **8**, of all assignments to stations in the fixed service operating in accordance with the Table and other provisions of the Radio Regulations which are recorded in the Master Register and which may be affected by maritime mobile operations on that frequency.

533 In making assignments to stations of other services to which the band 13 360 - 13 410 kHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

534 The band 13 553 - 13 567 kHz (centre frequency 13 560 kHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services 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. **1815**.

kHz

14 250 – 18 068

Allocation to Services		
Region 1	Region 2	Region 3
14 250 – 14 350	AMATEUR 510 535	
14 350 – 14 990	FIXED Mobile except aeronautical mobile (R)	
14 990 – 15 005	STANDARD FREQUENCY AND TIME SIGNAL (15 000 kHz) 501	
15 005 – 15 010	STANDARD FREQUENCY AND TIME SIGNAL Space Research	
15 010 – 15 100	AERONAUTICAL MOBILE (OR)	
15 100 – 15 600	BROADCASTING 531	
15 600 – 16 360	FIXED 536	
16 360 – 17 410	MARITIME MOBILE 500A 500B 520B 529A 532	
17 410 – 17 550	FIXED	
17 550 – 17 900	BROADCASTING 531	
17 900 – 17 970	AERONAUTICAL MOBILE (R)	
17 970 – 18 030	AERONAUTICAL MOBILE (OR)	
18 030 – 18 052	FIXED	
18 052 – 18 068	FIXED Space Research	

535 *Additional allocation:* in Afghanistan, China, the Ivory Coast, Iran and the U.S.S.R., the band 14 250 - 14 350 kHz is also allocated to the fixed service on a primary basis. Stations of the fixed service shall not use a radiated power exceeding 24 dBW.

536 In Region 3, the stations of those services to which the band 15 995 - 16 005 kHz is allocated may transmit standard frequency and time signals.

kHz
18 068 – 21 870

Allocation to Services		
Region 1	Region 2	Region 3
18 068 – 18 168	AMATEUR 510 AMATEUR-SATELLITE 537 538	
18 168 – 18 780	FIXED Mobile except aeronautical mobile	
18 780 – 18 900	MARITIME MOBILE 532	
18 900 – 19 680	FIXED	
19 680 – 19 800	MARITIME MOBILE 520B 532	
19 800 – 19 990	FIXED	
19 990 – 19 995	STANDARD FREQUENCY AND TIME SIGNAL Space Research 501	
19 995 – 20 010	STANDARD FREQUENCY AND TIME SIGNAL (20 000 kHz) 501	
20 010 – 21 000	FIXED Mobile	
21 000 – 21 450	AMATEUR 510 AMATEUR-SATELLITE	
21 450 – 21 850	BROADCASTING 531	
21 850 – 21 870	FIXED 539	

537 The band 18 068 - 18 168 kHz is allocated to the fixed service on a primary basis subject to the procedure described in Resolution **8**. The use of this band by the amateur and amateur-satellite services shall be subject to the completion of satisfactory transfer of all assignments to stations in the fixed service operating in this band and recorded in the Master Register, in accordance with the procedure described in Resolution **8**.

538 *Additional allocation:* in the U.S.S.R., the band 18 068 - 18 168 kHz is also allocated to the fixed service on a primary basis for use within the boundary of the U.S.S.R., with a peak envelope power not exceeding 1 kW.

539 *Alternative allocation:* in Bulgaria, Hungary, Mongolia, Poland, Czechoslovakia and the U.S.S.R., the band 21 850 - 21 870 kHz is allocated to the aeronautical fixed and the aeronautical mobile (R) services on a primary basis.

kHz
21 870 – 25 070

Allocation to Services		
Region 1	Region 2	Region 3
21 870 – 21 924	AERONAUTICAL FIXED	
21 924 – 22 000	AERONAUTICAL MOBILE (R)	
22 000 – 22 855	MARITIME MOBILE 520B 532 540	
22 855 – 23 000	FIXED 540	
23 000 – 23 200	FIXED Mobile except aeronautical mobile (R) 540	
23 200 – 23 350	AERONAUTICAL FIXED AERONAUTICAL MOBILE (OR)	
23 350 – 24 000	FIXED MOBILE except aeronautical mobile 541 542	
24 000 – 24 890	FIXED LAND MOBILE 542	
24 890 – 24 990	AMATEUR 510 AMATEUR-SATELLITE 542 543	
24 990 – 25 005	STANDARD FREQUENCY AND TIME SIGNAL (25 000 kHz)	
25 005 – 25 010	STANDARD FREQUENCY AND TIME SIGNAL Space Research	
25 010 – 25 070	FIXED MOBILE except aeronautical mobile	

540 *Additional allocation:* in Nigeria, the band 22 720 - 23 200 kHz is also allocated to the meteorological aids service (radiosondes) on a primary basis.

541 The use of the band 23 350 - 24 000 kHz by the maritime mobile service is limited to inter-ship radiotelegraphy.

542 *Additional allocation:* in Kenya, the band 23 600 - 24 900 kHz is also allocated to the meteorological aids service (radiosondes) on a primary basis.

543 The band 24 890 - 24 990 kHz is allocated to the fixed and land mobile services on a primary basis subject to the procedure described in Resolution **8**. The use of this band by the amateur and amateur-satellite services shall be subject to the completion of the satisfactory transfer of all assignments to fixed and land mobile stations operating in this band and recorded in the Master Register, in accordance with the procedure described in Resolution **8**.

kHz
25 070 – 27 500

Allocation to Services		
Region 1	Region 2	Region 3
25 070 – 25 210	MARITIME MOBILE 544	
25 210 – 25 550	FIXED MOBILE except aeronautical mobile	
25 550 – 25 670	RADIO ASTRONOMY 545	
25 670 – 26 100	BROADCASTING	
26 100 – 26 175	MARITIME MOBILE 520B 544	
26 175 – 27 500	FIXED MOBILE except aeronautical mobile 546	

544 The bands 25 110 - 25 210 kHz and 26 100 - 26 175 kHz are also allocated to the fixed and land mobile services on a primary basis subject to the procedure described in Resolution **8**. The use of these bands on an exclusive basis by the maritime mobile service shall be subject to provisions to be decided by a competent world administrative radio conference. The date of commencement of operations in the maritime mobile service on a frequency in accordance with the above-mentioned provisions shall not be earlier than the date of completion of satisfactory transfer, in accordance with the procedure described in Resolution **8**, of all assignments to stations in the fixed and land mobile services operating in accordance with the Table and other provisions of the Radio Regulations recorded in the Master Register and which may be affected by such maritime mobile operations on that frequency.

545 The band 25 550 - 25 600 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis subject to the procedure described in Resolution **8**. The use of this band by the radio astronomy service shall be subject to the completion of the satisfactory transfer of all assignments to stations in the fixed and mobile, except aeronautical mobile, services operating in this band and recorded in the Master Register, in accordance with the procedure described in Resolution **8**. The band 25 600 - 25 670 kHz is allocated to the broadcasting service on a primary basis, subject to provisions to be established by the world administrative radio conference for the planning of HF bands allocated to the broadcasting service (see Resolution **508**). After completion of all the above-mentioned provisions, all emissions capable of causing harmful interference to the radio astronomy service in the band 25 550 - 25 670 kHz shall be avoided. The use of passive sensors by other services will also be authorized.

546 The band 26 957 - 27 283 kHz (centre frequency 27 120 kHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services 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. **1815**.

MHz
27.5 – 40.98

Allocation to Services		
Region 1	Region 2	Region 3
27.5 – 28	METEOROLOGICAL AIDS FIXED MOBILE	
28 – 29.7	AMATEUR AMATEUR-SATELLITE	
29.7 – 30.005	FIXED MOBILE	
30.005 – 30.01	SPACE OPERATION (satellite identification) FIXED MOBILE SPACE RESEARCH	
30.01 – 37.5	FIXED MOBILE	
37.5 – 38.25	FIXED MOBILE Radio Astronomy 547	
38.25 – 39.986	FIXED MOBILE	
39.986 – 40.02	FIXED MOBILE Space Research	
40.02 – 40.98	FIXED MOBILE 548	

547 In making assignments to stations of other services to which the band 37.5 - 38.25 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

548 The band 40.66 - 40.70 MHz (centre frequency 40.68 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services 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. **1815**.

MHz
40.98 – 68

Allocation to Services		
Region 1	Region 2	Region 3
40.98 – 41.015	FIXED MOBILE Space Research 549 550 551	
41.015 – 44	FIXED MOBILE 549 550 551	
44 – 47	FIXED MOBILE 551 552	
47 – 68 BROADCASTING 553 554 555 559 561	**47 – 50** FIXED MOBILE	**47 – 50** FIXED MOBILE BROADCASTING
	50 – 54 AMATEUR 556 557 558 560	
	54 – 68 BROADCASTING Fixed Mobile 562	**54 – 68** FIXED MOBILE BROADCASTING

549 *Additional allocation:* in Botswana, Burundi, Lesotho, Malawi, Namibia, Rwanda, South Africa, Swaziland, Zaire, Zambia and Zimbabwe the band 41 - 44 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

550 *Additional allocation:* in Iran and Japan, the band 41 - 44 MHz is also allocated to the radiolocation service on a secondary basis.

551 *Additional allocation:* in France and Monaco, the band 41 - 47 MHz is also allocated to the broadcasting service on a primary basis until 1 January 1986 and, in the United Kingdom, until 1 January 1987.

552 *Additional allocation:* in Australia and New Zealand, the band 44 - 47 MHz is also allocated to the broadcasting service on a primary basis.

553 *Additional allocation:* in Hungary, Kenya, Mongolia, Czechoslovakia and the U.S.S.R., the bands 47 - 48.5 MHz and 56.5 - 58 MHz are also allocated to the fixed and land mobile services on a secondary basis.

554 *Additional allocation:* in Albania, the Federal Republic of Germany,
Mob-87 Austria, Belgium, Bulgaria, Côte d'Ivoire, Denmark, Spain, Finland, France, Gabon, Greece, Ireland, Israel, Italy, Jordan, Lebanon, Lybia, Liechtenstein, Luxembourg, Madagascar, Mali, Malta, Morocco, Mauritania, Monaco, Nigeria, Norway, the Netherlands, Poland, the German Democratic Republic, the United Kingdom, Senegal, Sweden, Switzerland, Swaziland, Syria, Togo, Tunisia, Turkey and Yugoslavia, the band 47 - 68 MHz and in Romania, the band 47 - 58 MHz, are also allocated to the land mobile service on a permitted basis. However, stations of the land mobile service in the countries mentioned in connection with each band referred to in this footnote shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations of countries other than those mentioned in connection with the band.

555 *Additional allocation:* in Angola, Cameroon, the Congo, Madagascar, Mozambique, Somalia, Sudan, Tanzania, Chad and Yemen (P.D.R. of), the band 47 - 68 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a permitted basis.

556 *Alternative allocation:* in New Zealand, the band 50 - 51 MHz is allocated to the fixed, mobile and broadcasting services on a primary basis; the band 53 - 54 MHz is allocated to the fixed and mobile services on a primary basis.

557 *Alternative allocation:* in Afghanistan, Bangladesh, Brunei, India, Indonesia, Iran, Malaysia, Pakistan, Singapore and Thailand, the band 50 - 54 MHz is allocated to the fixed, mobile and broadcasting services on a primary basis.

558 *Additional allocation:* in Australia, China and the Democratic People's Republic of Korea, the band 50 - 54 MHz is also allocated to the broadcasting service on a primary basis.

559 *Alternative allocation:* in Botswana, Burundi, Lesotho, Malawi, Namibia, Rwanda, South Africa, Swaziland, Zaire, Zambia and Zimbabwe, the band 50 - 54 MHz is allocated to the amateur service on a primary basis.

560 *Additional allocation:* in New Zealand, the band 51 - 53 MHz is also allocated to the fixed and mobile services on a primary basis.

561 *Additional allocation:* in Botswana, Burundi, Lesotho, Malawi, Mali, Namibia, Rwanda, South Africa, Swaziland, Zaire, Zambia and Zimbabwe, the band 54 - 68 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

562 *Different category of service:* in the French Overseas Departments in Region 2, Guyana, Jamaica and Mexico, the allocation of the band 54 - 68 MHz to the fixed and mobile services is on a primary basis (see No. **425**).

MHz
68 – 75.2

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="4">68 – 74.8
FIXED
MOBILE except aeronautical mobile

564 565 567
568 571 572</td><td>68 – 72
BROADCASTING
Fixed
Mobile

563</td><td rowspan="4">68 – 74.8
FIXED
MOBILE

566 568 571 572</td></tr>
<tr><td>72 – 73
FIXED
MOBILE</td></tr>
<tr><td>73 – 74.6
RADIO ASTRONOMY

569 570</td></tr>
<tr><td>74.6 – 74.8
FIXED
MOBILE

572</td></tr>
<tr><td>74.8 – 75.2</td><td colspan="2">AERONAUTICAL RADIONAVIGATION

572 572A</td></tr>
</table>

563 *Different category of service:* in Cuba, the French Overseas Departments in Region 2, Guyana, Jamaica and Mexico, the allocation of the band 68 - 72 MHz to the fixed and mobile services is on a primary basis (see No. **425**).

564 *Alternative allocation:* in Bulgaria, Hungary, Poland, Roumania and Czechoslovakia, the band 68 - 73 MHz is allocated to the broadcasting service on a primary basis and used in accordance with the decisions in the Final Acts of the Special Regional Conference, Geneva, 1960.

565 *Alternative allocation:* in Mongolia and the U.S.S.R., the bands 68 - 73 MHz and 76 - 87.5 MHz are allocated to the broadcasting service on a primary basis. The services to which these bands are allocated in other countries and the broadcasting service in Mongolia and the U.S.S.R. are subject to agreements with the neighbouring countries concerned.

566 *Additional allocation:* in Australia, China, the Republic of Korea, the Philippines, the Democratic People's Republic of Korea and Western Samoa, the band 68 - 74 MHz is also allocated to the broadcasting service on a primary basis.

567 *Additional allocation:* in Bulgaria, Hungary, Mongolia, Poland, Czechoslovakia, and the U.S.S.R., the band 73 - 74 MHz is also allocated to the broadcasting service on a primary basis. The use of this band by the broadcasting service in Bulgaria, Hungary, Mongolia, Poland, Czechoslovakia and the U.S.S.R. is subject to agreement obtained under the procedure set forth in Article **14**.

568 In making assignments to stations of other services to which the band 73 - 74.6 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

569 In Region 2, the fixed, mobile and broadcasting services previously authorized in the band 73 - 74.6 MHz may continue to operate on a non-interference basis to the radio astronomy service until 31 December 1985.

570 *Additional allocation:* in Colombia, Costa Rica, Cuba, El Salvador, Ecuador, Guatemala, Guyana, Honduras and Nicaragua, the band 73 - 74.6 MHz is also allocated to the fixed and mobile services on a secondary basis.

571 *Additional allocation:* in Bulgaria, China, Hungary, Mongolia, Poland, Czechoslovakia and the U.S.S.R., the bands 74.6 - 74.8 MHz and 75.2 - 75.4 MHz are also allocated to the aeronautical radionavigation service, on a primary basis, for ground-based transmitters only.

572 The frequency 75 MHz is assigned to aeronautical marker beacons. Administrations shall refrain from assigning frequencies close to the limits of the guardband to stations of other services which, because of their power or geographical position, might cause harmful interference or otherwise place a constraint on marker beacons.

Until 31 December 1989, administrations in Regions 2 and 3 should refrain from assigning frequencies to stations of other services in the bands 74.6 - 74.8 MHz and 75.2 - 75.4 MHz.

In the future every effort should be made to improve further the characteristics of airborne receivers and to limit the power of transmitting stations close to the limits 74.8 MHz and 75.2 MHz.

572A Mob-87 *Additional allocation:* in Afghanistan, the Federal Republic of Germany, Austria, Belgium, Cyprus, Denmark, Egypt, Spain, France, Greece, Israel, Italy, Japan, Jordan, Lebanon, Malta, Morocco, Monaco, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Switzerland, Syria and Turkey, the band 74.8 - 75.2 MHz is also allocated to the mobile service on a secondary basis subject to agreement obtained under the procedure set forth in Article **14**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of Article **14**.

MHz
75.2 – 88

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">75.2 – 87.5
FIXED
MOBILE except aeronautical mobile

565 571 572 575 578</td><td>75.2 – 75.4
FIXED
MOBILE

571 572</td><td></td></tr>
<tr><td>75.4 – 76
FIXED
MOBILE

76 – 88
BROADCASTING
Fixed
Mobile

576</td><td>75.4 – 87
FIXED
MOBILE

573 574 577 579

87 – 100
FIXED
MOBILE
BROADCASTING</td></tr>
<tr><td>87.5 – 100
BROADCASTING

581 582</td><td>88 – 100
BROADCASTING</td><td>580</td></tr>
<tr><td>100 – 108</td><td colspan="2">BROADCASTING

582 584 585 586 587 588 589</td></tr>
<tr><td>108 – 117.975</td><td colspan="2">AERONAUTICAL RADIONAVIGATION

590A</td></tr>
<tr><td>117.975 – 136</td><td colspan="2">AERONAUTICAL MOBILE (R)

501 591 592 593 594</td></tr>
<tr><td>136 – 137</td><td colspan="2">AERONAUTICAL MOBILE (R)
Fixed
Mobile except aeronautical mobile (R)

591 594A 595</td></tr>
</table>

573 *Additional allocation:* in Western Samoa, the band 75.4 - 87 MHz is also allocated to the broadcasting service on a primary basis.

574 *Additional allocation:* in China, the Republic of Korea, Japan, the Philippines and the Democratic People's Republic of Korea, the band 76 - 87 MHz is also allocated to the broadcasting service on a primary basis.

575 *Additional allocation:* in Bulgaria, Hungary, Poland, Roumania and Czechoslovakia, the band 76 - 87.5 MHz is also allocated to the broadcasting service on a primary basis and used in accordance with the decisions contained in the Final Acts of the Special Regional Conference, Geneva, 1960.

576 *Different category of service:* in the United States, the French Overseas Departments in Region 2, Guyana, Jamaica, Mexico and Paraguay, the allocation of the band 76 - 88 MHz to the fixed and mobile services is on a primary basis (see No. **425**).

577 In Region 3 (except in the Republic of Korea, India, Japan, Malaysia, the Philippines, Singapore and Thailand), the band 79.75 - 80.25 MHz is also allocated to the radio astronomy service on a primary basis. In making assignments to stations of other services, administrations are urged to take all practicable steps in the band to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

578 *Alternative allocation:* in Albania, the band 81 - 87.5 MHz is allocated to the broadcasting service on a primary basis and used in accordance with the decisions contained in the Final Acts of the Special Regional Conference, Geneva, 1960.

579 *Additional allocation:* in Afghanistan and Australia, the band 85 - 87 MHz is also allocated to the broadcasting service on a primary basis. The introduction of the broadcasting service in these countries is subject to special agreements between the administrations concerned.

580 *Alternative allocation:* in New Zealand, the band 87 - 88 MHz is allocated to the land mobile service on a primary basis.

581 *Additional allocation:* in the Federal Republic of Germany, Spain, France, Ireland, Italy, Liechtenstein, Monaco, the United Kingdom, Switzerland and Yemen (P.D.R.), the band 87.5 - 88 MHz is also allocated to the land mobile service on a permitted basis and subject to agreement obtained under the procedure set forth in Article **14**.

582 *Additional allocation:* in the United Kingdom, the band 97.6 - 102.1 MHz is also allocated to the land mobile service on a permitted basis until 31 December 1989. The use of this band by the land mobile service is restricted to those stations in operation on 1 January 1980. The withdrawal of land mobile stations will be arranged in consultation with the administrations concerned.

583 SUP
Mob-87

584 Broadcasting stations in the band 100 - 108 MHz in Region 1 shall be established and operated in accordance with an agreement and associated plan for the band 87.5 - 108 MHz to be drawn up by a regional broadcasting conference (see Resolution **510**). Prior to the date of entry into force of this agreement, broadcasting stations may be introduced subject to agreement between administrations concerned, on the understanding that such an operation shall in no case prejudice the establishment of the plan.

585 *Additional allocation:* in China, the Republic of Korea, the Philippines and Singapore, the band 100 - 108 MHz is also allocated to the fixed and mobile services on a permitted basis.

586 *Alternative allocation:* in New Zealand, the band 100 - 108 MHz is allocated to the land mobile service on a primary basis and to the broadcasting service on a secondary basis.

587 *Additional allocation:* in Austria, Bulgaria, Hungary, Israel, Kenya, Mon-
Mob-87 golia, Poland, Syria, the German Democratic Republic, the United Kingdom, Somalia, Czechoslovakia, Turkey and the USSR, the band 104 - 108 MHz is also allocated to the mobile, except aeronautical mobile (R), service on a permitted basis until 31 December 1995 and, thereafter, on a secondary basis.

588 *Additional allocation:* in Finland and Yugoslavia, the band 104 - 108 MHz is also allocated to the fixed service on a permitted basis, until 31 December 1995. The effective radiated power of any station shall not exceed 25 W.

589 *Additional allocation:* in France, Romania, Sweden and Yugoslavia, the
Mob-87 band 104 - 108 MHz is also allocated to the mobile, except aeronautical mobile (R), service on a permitted basis until 31 December 1995.

590 SUP
Mob-87

590A *Additional allocation:* in Afghanistan, the Federal Republic of Germany,
Mob-87 Austria, Cyprus, Denmark, Egypt, Spain, France, Israel, Italy, Japan, Jordan, Lebanon, Malta, Morocco, Monaco, Norway, Pakistan, Portugal, the United Kingdom, Sweden, Switzerland, Syria and Turkey, the band 108 - 111.975 MHz is also allocated to the mobile service on a secondary basis subject to agreement obtained under the procedure set forth in Article **14**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administrations which may be identified in the application of Article **14**.

591 Subject to agreement obtained under the procedure set forth in Article **14**, the band 117.975 - 137 MHz is also allocated to the aeronautical mobile-satellite (R) service on a secondary basis and on the condition that harmful interference is not caused to the aeronautical mobile (R) service.

592 The bands 121.45 - 121.55 MHz and 242.95 - 243.05 MHz are also allocated
Mob-83 to the mobile-satellite service for the reception on board satellites of emissions from emergency position-indicating radiobeacons transmitting at 121.5 MHz and 243 MHz (see Nos. **3259** and **3267**).

593 In the band 117.975 - 136 MHz, the frequency 121.5 MHz is the aeronaut-
Mob-87 ical emergency frequency and, where required, the frequency 123.1 MHz is the aeronautical frequency auxiliary to 121.5 MHz. Mobile stations of the maritime mobile service may communicate on these frequencies under the conditions laid down in Articles **38** and **N 38** for distress and safety purposes with stations of the aeronautical mobile service.

594 *Additional allocation:* in Angola, Bulgaria, Hungary, Iran, Iraq, Japan, Mongolia, Mozambique, Papua New Guinea, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 132 - 136 MHz is also allocated to the aeronautical mobile (OR) service on a permitted basis.

594A *Different category of service:* as from 1 January 1990, in Bulgaria, Poland,
Mob-87 the German Democratic Republic, Romania, Czechoslovakia, Turkey and the USSR, the allocation of the band 136 - 137 MHz to the aeronautical mobile (OR) service is on a permitted basis.

595 Until 1 January 1990, the band 136 - 137 MHz is also allocated to the space
Mob-87 operation service (space-to-Earth), meteorological-satellite service (space-to-Earth) and the space research service (space-to-Earth) on a primary basis. The introduction of stations of the aeronautical mobile (R) service shall only occur after that date. After 1 January 1990, the band 136 - 137 MHz will also be allocated to the above-mentioned space radiocommunication services on a secondary basis (see Resolution **408 (Mob-87)**).

MHz
137 – 146

Allocation to Services		
Region 1	Region 2	Region 3
137 – 138	SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Fixed Mobile except aeronautical mobile (R) 596 597 598 599	
138 – 143.6 AERONAUTICAL MOBILE (OR) 600 601 602 604	**138 – 143.6** FIXED MOBILE /RADIOLOCATION/ Space Research (space-to-Earth)	**138 – 143.6** FIXED MOBILE Space Research (space-to-Earth) 599 603
143.6 – 143.65 AERONAUTICAL MOBILE (OR) SPACE RESEARCH (space-to-Earth) 601 602 604	**143.6 – 143.65** FIXED MOBILE SPACE RESEARCH (space-to-Earth) /RADIOLOCATION/	**143.6 – 143.65** FIXED MOBILE SPACE RESEARCH (space-to-Earth) 599 603
143.65 – 144 AERONAUTICAL MOBILE (OR) 600 601 602 604	**143.65 – 144** FIXED MOBILE /RADIOLOCATION/ Space Research (space-to-Earth)	**143.65 – 144** FIXED MOBILE Space Research (space-to-Earth) 599 603
144 – 146	AMATEUR 510 AMATEUR-SATELLITE 605 606	

596 *Different category of service:* in Afghanistan, Saudi Arabia, Bahrain, Brunei, China, the United Arab Emirates, India, Indonesia, Iran, Iraq, Kuwait, Malaysia, Oman, Pakistan, Qatar, Singapore, Thailand, Yemen A.R. and Yemen (P.D.R. of), the allocation of the band 137 - 138 MHz to the fixed and mobile, except aeronautical mobile (R), services is on a primary basis (see No. **425**).

597 *Different category of service:* in Israel, Jordan and Syria, the allocation of the band 137 - 138 MHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. **425**).

598 *Different category of service:* in Austria, Bulgaria, Egypt, Finland, Greece, Hungary, the Lebanon, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia, the U.S.S.R. and Yugoslavia, the allocation of the band 137 - 138 MHz to the aeronautical mobile (OR) service is on a primary basis (see No. **425**).

599 *Additional allocation:* in Australia, the band 137 - 144 MHz is also allocated to the broadcasting service on a primary basis until that service can be accommodated within regional broadcasting allocations.

600 *Additional allocation:* in the Federal Republic of Germany, Austria, Belgium, France, Israel, Italy, Liechtenstein, Luxembourg, the United Kingdom, Sweden, Switzerland and Czechoslovakia, the bands 138 - 143.6 MHz and 143.65 - 144 MHz are also allocated to the space research service (space-to-Earth) on a secondary basis.

601 *Additional allocation:* in the Federal Republic of Germany, Saudi Arabia, Austria, Bahrain, Belgium, Denmark, The United Arab Emirates, Spain, Finland, Greece, Ireland, Israel, Kenya, Kuwait, Liechtenstein, Luxembourg, Mali, Malta, Norway, the Netherlands, Qatar, the United Kingdom, Somalia, Sweden, Switzerland, Tanzania, Tunisia, Turkey and Yugoslavia, the band 138 - 144 MHz is also allocated to the maritime mobile and land mobile services on a primary basis.

602 *Alternative allocation:* in Angola, Botswana, Burundi, Cameroon, the Central African Republic, the Congo, Gabon, Gambia, Ghana, Guinea, Iraq, Jordan, Lesotho, Liberia, Libya, Malawi, Mozambique, Namibia, Nigeria, Oman, Rwanda, Sierra Leone, South Africa, Swaziland, Chad, Togo, Zaire, Zambia and Zimbabwe, the band 138 - 144 MHz is allocated to the fixed and mobile services on a primary basis.

603 *Additional allocation:* in China, the band 138 - 144 MHz is also allocated to the radiolocation service on a primary basis.

604 *Additional allocation:* in Ethiopia, Finland, Kenya, Malta, Somalia, Sudan, Tanzania, Yemen A.R. and Yugoslavia, the band 138 - 144 MHz is also allocated to the fixed service on a primary basis.

605 *Additional allocation:* in Singapore, the band 144 - 145 MHz is also allocated to the fixed and mobile services on a primary basis. Such use is limited to systems in operation on or before 1 January 1980, which in any case shall cease by 31 December 1995.

606 *Additional allocation:* in China, the band 144 - 146 MHz is also allocated to the aeronautical mobile (OR) service on a secondary basis.

MHz

146 – 156.8375

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="2">146 – 149,9
FIXED
MOBILE except aeronautical mobile (R)

608</td><td>146 – 148
AMATEUR

607</td><td>146 – 148
AMATEUR
FIXED
MOBILE

607</td></tr>
<tr><td colspan="2">148 – 149.9
FIXED
MOBILE

608</td></tr>
<tr><td>149.9 – 150.05</td><td colspan="2">RADIONAVIGATION-SATELLITE

609 609A</td></tr>
<tr><td>150.05 – 153
FIXED
MOBILE except aeronautical mobile
RADIO ASTRONOMY

610 612</td><td rowspan="3" colspan="2">150.05 – 156.7625
FIXED
MOBILE

611 613 613A</td></tr>
<tr><td>153 – 154
FIXED
MOBILE except aeronautical mobile (R)
Meteorological Aids</td></tr>
<tr><td>154 – 156.7625
FIXED
MOBILE except aeronautical mobile (R)

613 613A</td></tr>
<tr><td>156.7625 – 156.8375</td><td colspan="2">MARITIME MOBILE (distress and calling)

501 613</td></tr>
</table>

607 *Alternative allocation:* in Afghanistan, Bangladesh, Cuba, Guyana and India, the band 146 - 148 MHz is allocated to the fixed and mobile services on a primary basis.

608 Subject to agreement obtained under the procedure set forth in Article **14**, the band 148 - 149.9 MHz may be used by the space operation service (Earth-to-space). The bandwidth of an individual transmission shall not exceed ± 25 kHz.

609 Emissions of the radionavigation-satellite service in the bands 149.9 - 150.05 MHz and 399.9 - 400.05 MHz may also be used by receiving earth stations of the space research service.

609A Mob-87 Recognizing that the use of the band 149.9 - 150.05 MHz by the fixed and mobile services may cause harmful interference to the radionavigation-satellite service, administrations are urged not to authorize such use in application of No. **342**.

610 In making assignments to stations of other services to which the band 150.05 - 153 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

611 *Additional allocation:* in Australia and India, the band 150.05 - 153 MHz is also allocated to the radio astronomy service on a primary basis.

612 *Additional allocation:* in Sweden and Switzerland the band 150.05 - 153 MHz is also allocated to the aeronautical mobile (OR) service on a secondary basis.

613 Mob-87 The frequency 156.8 MHz is the international distress, safety and calling frequency for the maritime mobile VHF radiotelephone service. The conditions for the use of this frequency are contained in Articles **38** and **N 38**.

In the bands 156 - 156.7625 MHz, 156.8375 - 157.45 MHz, 160.6 - 160.975 MHz and 161.475 - 162.05 MHz, each administration shall give priority to the maritime mobile service on only such frequencies as are assigned to stations of the maritime mobile service by the administration (see Articles **38**, **N 38** and **60**).

Any use of frequencies in these bands by stations of other services to which they are allocated should be avoided in areas where such use might cause harmful interference to the maritime mobile VHF radiocommunication service.

However, the frequency 156.8 MHz and the frequency bands in which priority is given to the maritime mobile service may be used for radiocommunications on inland waterways subject to agreement between interested and affected administrations and taking into account current frequency usage and existing agreements.

613A Mob-87 In the maritime mobile VHF service the frequency 156.525 MHz is to be used exclusively for digital selective calling for distress, safety and calling (see Resolution **323 (Mob-87)**). The conditions for the use of this frequency are prescribed in Articles **38**, **N 38** and **60** and in Appendix **18**.

MHz
156.8375 – 235

Allocation to Services		
Region 1	Region 2	Region 3
156.8375 – 174 FIXED MOBILE except aeronautical mobile 613 613B 614 615	**156.8375 – 174** FIXED MOBILE 613 616 617 618	
174 – 223 BROADCASTING 621 623 628 629	**174 – 216** BROADCASTING Fixed Mobile 620	**174 – 223** FIXED MOBILE BROADCASTING 619 624 625 626 630
	216 – 220 FIXED MARITIME MOBILE Radiolocation 627 627A	
223 – 230 BROADCASTING Fixed Mobile 622 628 629 631 632 633 634 635	**220 – 225** AMATEUR FIXED MOBILE Radiolocation 627	**223 – 230** FIXED MOBILE BROADCASTING AERONAUTICAL RADIONAVIGATION Radiolocation 636 637
230 – 235 FIXED MOBILE 629 632 633 634 635 638 639	**225 – 235** FIXED MOBILE	**230 – 235** FIXED MOBILE AERONAUTICAL RADIONAVIGATION 637

613B Mob-87 *Additional allocation:* in Ireland and in the United Kingdom, the band 161.3875 - 161.4125 MHz is also allocated to the maritime radionavigation service on a primary basis, subject to agreement obtained under the procedure set forth in Article **14**.

614 *Alternative allocation:* in France and Monaco, the band 162 - 174 MHz is allocated to the broadcasting service on a primary basis until 1 January 1985.

615 *Alternative allocation:* in Morocco, the band 162 - 174 MHz is allocated to the broadcasting service on a primary basis. The use of this band shall be subject to agreement with administrations having services, operating or planned, in accordance with the Table which are likely to be affected. Stations in existence on 1 January 1981, with their technical characteristics as of that date, are not affected by such agreement.

616 *Additional allocation:* in China, the band 163 - 167 MHz is also allocated to the space operation service (space-to-Earth) on a primary basis subject to agreement obtained under the procedure set forth in Article **14**.

617 *Additional allocation:* in Afghanistan, China and Pakistan, the band 167 - 174 MHz is also allocated to the broadcasting service on a primary basis. The introduction of the broadcasting service into this band shall be subject to agreement with the neighbouring countries in Region 3 whose services are likely to be affected.

618 *Additional allocation:* in Japan, the band 170 - 174 MHz is also allocated to the broadcasting service on a primary basis.

619 *Additional allocation:* in China, the band 174 - 184 MHz is also allocated to the space research (space-to-Earth) and the space operation (space-to-Earth) services on a primary basis subject to agreement obtained under the procedure set forth in Article **14**. These services shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations.

620 *Different category of service:* in Mexico, the allocation of the band 174 - 216 MHz to the fixed and mobile services is on a primary basis (see No. **425**).

621 Mob-87 *Additional allocation:* in the Federal Republic of Germany, Austria, Belgium, Denmark, Spain, Finland, France, Israel, Italy, Liechtenstein, Monaco, Norway, the Netherlands, the United Kingdom, Sweden, Switzerland and Yemen (P.D.R. of), the band 174 - 223 MHz is also allocated to the land mobile service on a permitted basis. However, the stations of the land mobile service shall not cause harmful interference to, nor claim protection from, broadcasting stations, existing or planned, in countries other than those listed in this footnote.

622 *Different category of service:* In the Federal Republic of Germany, Austria, Belgium, Denmark, Spain, Finland, France, Israel, Italy, Liechtenstein, Luxembourg, Monaco, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Switzerland and Yemen (P.D.R. of), the band 223 - 230 MHz is allocated to the land mobile service on a permitted basis (see No. **425**). However, the stations of the land mobile service shall not cause harmful interference to, nor claim protection from, broadcasting stations, existing or planned, in countries other than those listed in this footnote.

623 *Additional allocation:* in the Congo, Ethiopia, Gambia, Guinea, Kenya, Libya, Malawi, Mali, Uganda, Senegal, Sierra Leone, Somalia, Tanzania and Zimbabwe, the band 174 - 223 MHz is also allocated to the fixed and mobile services on a secondary basis.

624 *Additional allocation:* in Bangladesh, India, Pakistan and the Philippines, the band 200 - 216 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

625 *Additional allocation:* in Australia and Papua New Guinea, the bands 204 - 208 MHz and 222 - 223 MHz are also allocated to the aeronautical radionavigation service on a primary basis.

626 *Additional allocation:* In China, India and Thailand, the band 216 - 223 MHz is also allocated to the aeronautical radionavigation service on a primary basis and to the radiolocation service on a secondary basis.

627 In Region 2, the band 216 - 225 MHz is allocated to the radiolocation service on a primary basis until 1 January 1990. On and after 1 January 1990, no new stations in that service may be authorized. Stations authorized prior to 1 January 1990 may continue to operate on a secondary basis.

627A **Mob-87** *Additional allocation:* in Canada, the band 216 - 220 MHz is also allocated to the land mobile service on a primary basis.

628 *Additional allocation:* in Somalia, the band 216 - 225 MHz is also allocated to the aeronautical radionavigation service on a primary basis, subject to not causing harmful interference to existing or planned broadcasting services in other countries.

629 *Additional allocation:* in Oman, the United Kingdom and Turkey, the band 216 - 235 MHz is also allocated to the radiolocation service on a secondary basis.

630 *Additional allocation:* in Japan, the band 222 - 223 MHz is also allocated to the aeronautical radionavigation service on a primary basis and to the radiolocation service on a secondary basis.

631 *Different category of service:* in Spain and Portugal, the band 223 - 230 MHz is allocated to the fixed service on a permitted basis (see No. **425**). Stations of this service shall not cause harmful interference to, or claim protection from, broadcasting stations of other countries, whether existing or planned, that operate in accordance with the Table.

632 *Additional allocation:* in Saudi Arabia, Bahrain, the United Arab Emirates, Israel, Jordan, Oman, Qatar and Syria, the band 223 - 235 MHz is also allocated to the aeronautical radionavigation service on a permitted basis.

633 *Additional allocation:* in Spain and Portugal, the band 223 - 235 MHz is also allocated to the aeronautical radionavigation service on a permitted basis until 1 January 1990, subject to not causing harmful interference to existing or planned broadcasting stations in other countries.

634 *Additional allocation:* in Sweden, the band 223 - 235 MHz is also allocated to the aeronautical radionavigation service on a permitted basis until 1 January 1990, subject to agreement obtained under the procedure set forth in Article **14**, and on condition that no harmful interference is caused to existing and planned broadcasting stations in other countries.

635 *Alternative allocation:* in Botswana, Lesotho, Namibia, South Africa, Swaziland and Zambia, the bands 223 - 238 MHz and 246 - 254 MHz are allocated to the broadcasting service on a primary basis subject to agreement obtained under the procedure set forth in Article **14**.

636 *Alternative allocation:* in New Zealand, Western Samoa and the Niue and Cook Islands, the band 225 - 230 MHz is allocated to the fixed, mobile and aeronautical radionavigation services on a primary basis.

637 *Additional allocation:* in China, the band 225 - 235 MHz is also allocated to the radio astronomy service on a secondary basis.

638 *Additional allocation:* in Nigeria, the band 230 - 235 MHz is also allocated to the aeronautical radionavigation service on a primary basis, subject to agreement obtained under the procedure set forth in Article **14**.

639 *Additional allocation:* in Yugoslavia, the band 230 - 235 MHz is also allocated to the aeronautical radionavigation service on a primary basis, until 1 January 1995. The use of this band by the aeronautical radionavigation service in Yugoslavia is restricted to the stations in operation by 1 January 1980.

MHz
235 – 400.05

Allocation to Services		
Region 1	Region 2	Region 3
235 – 267	FIXED MOBILE 501 592 635 640 641 642	
267 – 272	FIXED MOBILE Space Operation (space-to-Earth) 641 643	
272 – 273	SPACE OPERATION (space-to-Earth) FIXED MOBILE 641	
273 – 322	FIXED MOBILE 641	
322 – 328.6	FIXED MOBILE RADIO ASTRONOMY 644	
328.6 – 335.4	AERONAUTICAL RADIONAVIGATION 645 645A	
335.4 – 399.9	FIXED MOBILE 641	
399.9 – 400.05	RADIONAVIGATION-SATELLITE 609 645B	

640 *Additional allocation:* in New Zealand, the band 235 - 239.5 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

641 Subject to agreement obtained under the procedure set forth in Article **14**, the bands 235 - 322 MHz and 335.4 - 399.9 MHz may be used by the mobile-satellite service, on condition that stations in this service do not cause harmful interference to those of other services operating or planned to be operated in accordance with the Table.

642 Mob-87 The frequency 243 MHz is the frequency in this band for use by survival craft stations and equipment used for survival purposes (see Article **38**).

643 Subject to agreement obtained under the procedure set forth in Article **14**, the band 267 - 272 MHz may be used by administrations for space telemetry in their countries on a primary basis.

644 In making assignments to stations of other services to which the band 322 - 328.6 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

645 Limited to Instrument Landing Systems (glide path).

645A Mob-87 *Additional allocation:* in Afghanistan, the Federal Republic of Germany, Austria, Belgium, Cyprus, Denmark, Egypt, Spain, France, Greece, Israel, Italy, Japan, Jordan, Malta, Morocco, Monaco, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Switzerland, Syria and Turkey, the band 328.6 - 335.4 MHz is also allocated to the mobile service on a secondary basis subject to agreement obtained under the procedure set forth in Article **14**. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of Article **14**.

645B Mob-87 Recognizing that the use of the band 399.9 - 400.05 MHz by the fixed and mobile services may cause harmful interference to the radionavigation satellite service, administrations are urged not to authorize such use in application of No. **342**.

MHz
400.05 – 406.1

Allocation to Services		
Region 1	Region 2	Region 3
400.05 – 400.15	STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (400.1 MHz) 646 647	
400.15 – 401	METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Space Operation (space-to-Earth) 647	
401 – 402	METEOROLOGICAL AIDS SPACE OPERATION (space-to-Earth) Earth Exploration-Satellite (Earth-to-space) Fixed Meteorological-Satellite (Earth-to-space) Mobile except aeronautical mobile	
402 – 403	METEOROLOGICAL AIDS Earth Exploration-Satellite (Earth-to-space) Fixed Meteorological-Satellite (Earth-to-space) Mobile except aeronautical mobile	
403 – 406	METEOROLOGICAL AIDS Fixed Mobile except aeronautical mobile 648	
406 – 406.1	MOBILE-SATELLITE (Earth-to-space) 649 649A	

646 Emissions shall be confined in a band of ± 25 kHz about the standard frequency 400.1 MHz.

647 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Bulgaria, Colombia, Costa Rica, Cuba, Egypt, the United Arab Emirates, Ecuador, Hungary, Indonesia, Iran, Iraq, Israel, Kuwait, Liberia, Malaysia, Nigeria, Oman, Pakistan, the Philippines, Poland, Qatar, Syria, the German Democratic Republic, Roumania, Singapore, Somalia, Sri Lanka, Czechoslovakia, Thailand, the U.S.S.R. and Yugoslavia, the band 400.05 - 401 MHz is also allocated to the fixed and mobile services on a primary basis.

648 *Additional allocation:* in Canada, the bands 405.5 - 406 MHz and 406.1 - 410 MHz are also allocated to the mobile-satellite, except aeronautical mobile-satellite, service (Earth-to-space), on a primary basis, subject to agreement obtained under the procedure set forth in Article **14**.

649 Mob-87 The use of the band 406 - 406.1 MHz by the mobile-satellite service is limited to low power satellite emergency position-indicating radiobeacons (see also Articles **38** and **N 38**).

649A Mob-87 Any emission capable of causing harmful interference to the authorized uses of the band 406 - 406.1 MHz is prohibited.

MHz
406.1 – 470

Allocation to Services		
Region 1	Region 2	Region 3
406.1 – 410	FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 648 650	
410 – 420	FIXED MOBILE except aeronautical mobile	
420 – 430	FIXED MOBILE except aeronautical mobile Radiolocation 651 652 653	
430 – 440 AMATEUR RADIOLOCATION 653 654 655 656 657 658 659 661 662 663 664 665	**430 – 440** RADIOLOCATION Amateur 653 658 659 660 660A 663 664	
440 – 450	FIXED MOBILE except aeronautical mobile Radiolocation 651 652 653 666 667 668	
450 – 460	FIXED MOBILE 653 668 669 670	
460 – 470	FIXED MOBILE Meteorological-Satellite (space-to-Earth) 669 670 671 672	

650 In making assignments to stations of other services to which the band 406.1 - 410 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

651 *Different category of service:* in Australia, the United States, India, Japan and the United Kingdom, the allocation of the bands 420 - 430 MHz and 440 - 450 MHz to the radiolocation service is on a primary basis (see No. **425**).

652 *Additional allocation:* in Australia, the United States, Jamaica and the Philippines, the bands 420 - 430 MHz and 440 - 450 MHz are also allocated to the amateur service on a secondary basis.

653 *Additional allocation:* in China, India, the German Democratic Republic, the United Kingdom and the U.S.S.R., the band 420 - 460 MHz is also allocated to the aeronautical radionavigation service (radio altimeters) on a secondary basis.

654 *Different category of service:* in France, the allocation of the band 430 - 434 MHz to the amateur service is on a secondary basis (see No. **424**).

655 *Different category of service:* in Denmark, Libya, Norway and Sweden, the allocation of the bands 430 - 432 MHz and 438 - 440 MHz to the radiolocation service is on a secondary basis (see No. **424**).

656 *Alternative allocation:* in Denmark, Norway and Sweden, the bands 430 - 432 MHz and 438 - 440 MHz are allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

657 *Additional allocation:* in Finland, Libya and Yugoslavia, the bands 430 - 432 MHz and 438 - 440 MHz are also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

658 *Additional allocation:* in Afghanistan, Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei, Burundi, Egypt, the United Arab Emirates, Ecuador, Ethiopia, Greece, Guinea, India, Indonesia, Iran, Iraq, Israel, Italy, Jordan, Kenya, Kuwait, the Lebanon, Libya, Liechtenstein, Malaysia, Malta, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syria, Singapore, Somalia, Switzerland, Tanzania, Thailand and Togo, the band 430 - 440 MHz is also allocated to the fixed service on a primary basis and the bands 430 - 435 MHz and 438 - 440 MHz are also allocated to the mobile, except aeronautical mobile, service on a primary basis.

659 *Additional allocation:* in Angola, Bulgaria, Cameroon, the Congo, Gabon, Hungary, Mali, Mongolia, Niger, Poland, the German Democratic Republic, Roumania, Rwanda, Chad, Czechoslovakia and the U.S.S.R., the band 430 - 440 MHz is also allocated to the fixed service on a primary basis.

660 *Different category of service:* 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. **425**).

660A Mob-87 *Additional allocation:* in Mexico, the bands 430 - 435 MHz and 438 - 440 MHz are also allocated on a primary basis to the land mobile service, subject to agreement obtained under the procedure set forth in Article **14**.

661 In Region 1, except in the countries mentioned in No. **662**, the band 433.05 - 434.79 MHz (centre frequency 433.92 MHz) is designated for industrial, scientific and medical (ISM) applications. The use of this frequency band 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 CCIR Recommendations.

662 In the Federal Republic of Germany, Austria, Liechtenstein, Portugal, Switzerland and Yugoslavia, 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. **1815**.

663 *Additional allocation:* in Brazil, France and the French Overseas Departments in Region 2, and India, the band 433.75 - 434.25 MHz is also allocated to the space operation service (Earth-to-space) on a primary basis until 1 January 1990, subject to agreement obtained under the procedure set forth in Article **14**. After 1 January 1990, the band 433.75 - 434.25 MHz will be allocated in the same countries to the same service on a secondary basis.

664 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. **435**). 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. **2741**. 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.

665 *Additional allocation:* in Austria, the band 438 - 440 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

666 *Additional allocation:* in Canada, New Zealand and Papua New Guinea, the band 440 - 450 MHz is also allocated to the amateur service on a secondary basis.

667 *Different category of service:* in Canada, the allocation of the band 440 - 450 MHz to the radiolocation service is on a primary basis (see No. **425**).

668 Subject to agreement obtained under the procedure set forth in Article **14**, the band 449.75 - 450.25 MHz may be used for the space operation service (Earth-to-space) and the space research service (Earth-to-space).

669 In the maritime mobile service, the frequencies 457.525 MHz, 457.550 MHz, 457.575 MHz, 467.525 MHz, 467.550 MHz and 467.575 MHz may be used by on-board communication stations. The use of these frequencies in territorial waters may be subject to the national regulations of the administration concerned. The characteristics of the equipment used shall conform to those specified in Appendix **20**.

670 In the territorial waters of Canada, the United States and the Philippines, the preferred frequencies for use by on-board communication stations shall be 457.525 MHz, 457.550 MHz, 457.575 MHz and 457.600 MHz paired, respectively, with 467.750 MHz, 467.775 MHz, 467.800 MHz and 467.825 MHz. The characteristics of the equipment used shall conform to those specified in Appendix **20**.

671 Earth exploration-satellite service applications, other than the meteorological-satellite service, may also be used in the bands 460 - 470 MHz and 1 690 - 1 710 MHz for space-to-Earth transmissions subject to not causing harmful interference to stations operating in accordance with the Table.

672 *Different category of service:* in Afghanistan, Bulgaria, China, Cuba, Hungary, Japan, Mongolia, Poland, Czechoslovakia and the U.S.S.R., the allocation of the band 460 - 470 MHz to the meteorological-satellite service (space-to-Earth) is on a primary basis (see No. **425**) and is subject to agreement obtained under the procedure set forth in Article **14**.

MHz
470 – 890

Allocation to Services		
Region 1	Region 2	Region 3
470 – 790 BROADCASTING 676 677A 682 683 684 685 686 686A 687 689 693 694	**470 – 512** BROADCASTING Fixed Mobile 674 675	**470 – 585** FIXED MOBILE BROADCASTING 673 677 679
	512 – 608 BROADCASTING 678	**585 – 610** FIXED MOBILE BROADCASTING RADIONAVIGATION 688 689 690
	608 – 614 RADIO ASTRONOMY Mobile-Satellite except aeronautical mobile-satellite (Earth-to-space)	
790 – 862 FIXED BROADCASTING 694 695 695A 696 697 702	**614 – 806** BROADCASTING Fixed Mobile 675 692 692A 693	**610 – 890** FIXED MOBILE BROADCASTING
862 – 890 FIXED MOBILE except aeronautical mobile BROADCASTING 703 704	**806 – 890** FIXED MOBILE BROADCASTING 692A 700	677 688 689 690 691 693 701

673 *Additional allocation:* in China, the band 470 - 485 MHz is also allocated to the space research (space-to-Earth) and the space operation (space-to-Earth) services on a primary basis subject to agreement obtained under the procedure set forth in Article **14**, subject to not causing harmful interference to existing and planned broadcasting stations.

674 Mob-87 *Different category of service:* in Mexico and Venezuela, the allocation of the band 470 - 512 MHz to the fixed and mobile services, and in Argentina and Uruguay to the mobile service, is on a primary basis (see No. **425**), subject to agreement obtained under the procedure set forth in Article **14**.

675 *Different category of service:* in Chile, Colombia, Ecuador, the United States, Guyana and Jamaica, the allocation of the bands 470 - 512 MHz and 614 - 806 MHz to the fixed and mobile services is on a primary basis (see No. **425**), subject to agreement obtained under the procedure set forth in Article **14**.

676 *Additional allocation:* in Burundi, Cameroon, the Congo, Ethiopia, Israel, Kenya, Libya, Senegal, Sudan, Syria, and Yemen (P.D.R. of), the band 470 - 582 MHz is also allocated to the fixed service on a secondary basis.

677 *Alternative allocation:* in Pakistan, the bands 470 - 582 MHz and 610 - 890 MHz are allocated to the broadcasting service on a primary basis.

677A Mob-87 *Additional allocation:* in the Federal Republic of Germany, Austria, Belgium, Cyprus, Denmark, Spain, Finland, France, Ireland, Israel, Italy, Libya, Malta, Morocco, Monaco, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Switzerland, Swaziland, Syria, Tunisia and Turkey, the band 470 - 790 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting. Stations of the land mobile service in the countries mentioned in this footnote, shall not cause harmful interference to existing or planned stations operating in accordance with the Table of Frequency Allocations in countries other than those listed in this footnote.

678 *Additional allocation:* in Costa Rica, El Salvador, Ecuador, the United States, Guatemala, Guyana, Honduras, Jamaica and Venezuela, the band 512 - 608 MHz is also allocated to the fixed and mobile services on a primary basis, subject to agreement obtained under the procedure set forth in Article **14**.

679 *Additional allocation:* in India, the band 549.75 - 550.25 MHz is also allocated to the space operation service (space-to-Earth) on a secondary basis.

680* and **681** SUP
Mob-87

682 *Additional allocation:* in France and Italy, the band 582 - 606 MHz is also allocated to the radionavigation service on a permitted basis until 1 January 1990.

683 *Additional allocation:* in Oman, the band 582 - 606 MHz is also allocated to the radionavigation service on a secondary basis.

684 *Additional allocation:* in Israel, Libya, Syria and Sudan, the band 582 - 790 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis.

685 *Additional allocation:* in Denmark and Kuwait, the band 590 - 598 MHz is also allocated to the aeronautical radionavigation service on a primary basis until 1 January 1995.

686 *Additional allocation:* in the United Kingdom, the band 590 - 598 MHz is also allocated to the aeronautical radionavigation service on a primary basis. All new assignments to stations in the aeronautical radionavigation service, including those transferred from the adjacent bands, shall be subject to coordination with the Administrations of the following countries: the Federal Republic of Germany, Belgium, Denmark, Spain, France, Ireland, Luxembourg, Morocco, Norway and the Netherlands.

686A Mob-87 *Additional allocation:* in the United Kingdom, the band 598 - 606 MHz is also allocated to the aeronautical radionavigation service on a primary basis until 31 December 1994. All new assignments to stations in the aeronautical radionavigation service in this band are subject to the agreement of the Administrations of the following countries: the Federal Republic of Germany, Belgium, Denmark, Spain, France, Ireland, Luxembourg, Morocco, Norway and the Netherlands.

687 *Additional allocation:* in the African Broadcasting Area (see Nos. **400** to **403**), the band 606 - 614 MHz is also allocated to the radio astronomy service on a permitted basis.

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* *Note by the General Secretariat:* This note has been renumbered **686A**, to preserve the chronological order.

688 *Additional allocation:* in China, the band 606 - 614 MHz is also allocated to the radio astronomy service on a primary basis.

689 In Region 1, except in the African Broadcasting Area (see Nos. **400** to **403**), and in Region 3, the band 608 - 614 MHz is also allocated to the radio astronomy service on a secondary basis. In making assignments to stations to other services to which the band is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

690 *Additional allocation:* in India, the band 608 - 614 MHz is also allocated to the radio astronomy service on a primary basis.

691 *Additional allocation:* in New Zealand, the band 610 - 620 MHz is also allocated to the amateur service on a secondary basis.

692 *Different category of service:* in Costa Rica, El Salvador and Honduras, the allocation of the band 614 - 806 MHz to the fixed service is on a primary basis (see No. **425**), subject to agreement obtained under the procedure set forth in Article **14**.

692A Mob-87 *Additional allocation:* in Cuba, the band 614 - 890 MHz is also allocated to the radionavigation service on a primary basis, subject to agreement obtained under the procedure set forth in Article **14**.

693 Within the frequency band 620 - 790 MHz, assignments may be made to television stations using frequency modulation in the broadcasting-satellite service subject to agreement between the administrations concerned and those having services, operating in accordance with the Table, which may be affected (see Resolutions **33** and **507**). Such stations shall not produce a power flux-density in excess of the value -129 dB (W/m^2) for angles of arrival less than 20° (see Recommendation **705**) within the territories of other countries without the consent of the administrations of those countries.

694 *Additional allocation:* in Bulgaria, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 645 - 862 MHz is also allocated to the aeronautical radionavigation service on a permitted basis.

695 *Alternative allocation:* in Spain and France, the band 790 - 830 MHz is allocated to the broadcasting service on a primary basis.

695A Mob-87 *Additional allocation:* in Austria, Italy, the United Kingdom and Swaziland, the band 790 - 862 MHz is also allocated to the land mobile service on a secondary basis.

696 *Alternative allocation:* in Greece, Italy, Morocco and Tunisia, the band 790 - 838 MHz is allocated to the broadcasting service on a primary basis.

697 Mob-87 *Additional allocation:* in the Federal Republic of Germany, Denmark, Egypt, Finland, Israel, Kenya, Libya, Liechtenstein, Monaco, Norway, the Netherlands, Sweden, Switzerland and Yugoslavia, the band 790 - 830 MHz, and in these same countries and in Spain, France, Malta and Syria, the band 830 - 862 MHz, are also allocated to the mobile, except aeronautical mobile, service on a primary basis. However, stations of the mobile service in the countries mentioned in connection with each band referred to in this footnote shall not cause harmful interference to, or claim protection from, stations of services operating in accordance with the Table in countries other than those mentioned in connection with the band.

698 and 699 SUP
Mob-87

700 Mob-87 *Additional allocation:* in Region 2, the band 806 - 890 MHz is also allocated to the mobile-satellite service on a primary basis. The use of this service is intended for operation within national boundaries and subject to agreement obtained under the procedure set forth in Article 14.

701 Mob-87 *Additional allocation:* in Region 3, the bands 806 - 890 MHz and 942 - 960 MHz are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service on a primary basis. The use of this service is limited to operation within national boundaries and subject to agreement obtained under the procedure set forth in Article 14. In seeking such agreement, appropriate protection shall be afforded to services operating in accordance with the Table, to ensure that no harmful interference is caused to such services.

702 *Alternative allocation:* in Italy, the band 838 - 854 MHz is allocated to the broadcasting service on a primary basis as from 1 January 1995.

703 In Region 1, in the band 862 - 960 MHz, stations of the broadcasting service shall be operated only in the African Broadcasting Area (see Nos. 400 to 403) excluding Algeria, Egypt, Libya and Morocco. Such operations shall be in accordance with the Final Acts of the African VHF/UHF Broadcasting Conference, Geneva, 1963.

704 *Additional allocation:* in Bulgaria, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 862 - 960 MHz is also allocated to the aeronautical radionavigation service on a permitted basis until 1 January 1998. Up to this date, the aeronautical radionavigation service may use the band, subject to agreement obtained under the procedure set forth in Article 14. After this date, the aeronautical radionavigation service may continue to operate on a secondary basis.

MHz
890 – 1 240

Allocation to Services		
Region 1	Region 2	Region 3
890 – 942 FIXED MOBILE except aeronautical mobile BROADCASTING 703 Radiolocation 704	**890 – 902** FIXED MOBILE except aeronautical mobile Radiolocation 704A 705 **902 – 928** FIXED Amateur Mobile except aeronautical mobile Radiolocation 705 707 707A **928 – 942** FIXED MOBILE except aeronautical mobile Radiolocation 705	**890 – 942** FIXED MOBILE BROADCASTING Radiolocation 706
942 – 960 FIXED MOBILE except aeronautical mobile BROADCASTING 703 704	**942 – 960** FIXED Mobile 708	**942 – 960** FIXED MOBILE BROADCASTING 701
960 – 1 215	AERONAUTICAL RADIONAVIGATION 709	
1 215 – 1 240	RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) 710 711 712 712A 713	

704A Mob-87 *Additional allocation:* in Brazil, Canada and the United States of America, the band 890 - 896 MHz is also allocated to the mobile-satellite service on a primary basis. The use of this service is intended for operation within national boundaries and subject to agreement obtained under the procedure set forth in Article **14**. In seeking such agreement, appropriate protection shall be afforded to services operating in accordance with the Table.

705 *Different category of service:* in the United States, the allocation of the band 890 - 942 MHz to the radiolocation service is on a primary basis (see No. **425**) and subject to agreement obtained under the procedure set forth in Article **14**.

706 *Different category of service:* in Australia, the allocation of the band 890 - 942 MHz to the radiolocation service is on a primary basis (see No. **425**).

707 In Region 2, the band 902 - 928 MHz (centre frequency 915 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services 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. **1815**.

707A Mob-87 *Different category of service:* in Chile, the band 903 - 905 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis and is subject to agreement obtained under the procedure set forth in Article **14**.

708 *Different category of service:* in the United States, the allocation of the bands 942 - 947 MHz and 952 - 960 MHz to the mobile service is on a primary basis (see No. **425**) and subject to agreement obtained under the procedure set forth in Article **14**.

709 The band 960 - 1 215 MHz is reserved on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based facilities.

710 Use of the radionavigation-satellite service in the band 1 215 - 1 260 MHz shall be subject to the condition that no harmful interference is caused to the radionavigation service authorized under No. **712**.

711 *Additional allocation:* in Afghanistan, Angola, Saudi Arabia, Bahrain, Bangladesh, Cameroon, China, the United Arab Emirates, Ethiopia, Guinea, Guyana, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kuwait, the Lebanon, Libya, Malawi, Morocco, Mozambique, Nepal, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syria, Somalia, Sudan, Sri Lanka, Chad, Thailand, Togo and Yemen (P.D.R. of), the band 1 215 - 1 300 MHz is also allocated to the fixed and mobile services on a primary basis.

712 *Additional allocation:* in Algeria, the Federal Republic of Germany, Austria, Bahrain, Belgium, Benin, Burundi, Cameroon, China, Denmark, the United Arab Emirates, France, Greece, India, Iran, Iraq, Kenya, Liechtenstein, Luxembourg, Mali, Mauritania, Norway, Oman, Pakistan, the Netherlands, Portugal, Qatar, Senegal, Somalia, Sudan, Sri Lanka, Sweden, Switzerland, Tanzania, Turkey and Yugoslavia, the band 1 215 - 1 300 MHz is also allocated to the radionavigation service on a primary basis.

712A Mob-87 *Additional allocation:* in Cuba, the band 1 215 - 1 300 MHz is also allocated to the radionavigation service on a primary basis subject to the agreement obtained under the procedure set forth in Article 14.

713 In the bands 1 215 - 1 300 MHz, 3 100 - 3 300 MHz, 5 250 - 5 350 MHz, 8 550 - 8 650 MHz, 9 500 - 9 800 MHz and 13.4 - 14.0 GHz, radiolocation stations installed on spacecraft may also be employed for the earth exploration-satellite and space research services on a secondary basis.

MHz
1 240 – 1 429

Allocation to Services		
Region 1	Region 2	Region 3
1 240 – 1 260	RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) 710 Amateur 711 712 712A 713 714	
1 260 – 1 300	RADIOLOCATION Amateur 664 711 712 712A 713 714	
1 300 – 1 350	AERONAUTICAL RADIONAVIGATION 717 Radiolocation 715 716 718	
1 350 – 1 400 FIXED MOBILE RADIOLOCATION 718 719 720	**1 350 – 1 400** RADIOLOCATION 714 718 720	
1 400 – 1 427	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 721 722	
1 427 – 1 429	SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 722	

714 *Additional allocation:* 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.

715 *Additional allocation:* in Indonesia, the band 1 300 - 1 350 MHz is also allocated to the fixed and mobile services on a primary basis.

716 *Alternative allocation:* in Ireland and the United Kingdom, the band 1 300 - 1 350 MHz is allocated to the radiolocation service on a primary basis.

717 The use of the bands 1 300 - 1 350 MHz, 2 700 - 2 900 MHz and 9 000 - 9 200 MHz by the aeronautical radionavigation service is restricted to ground-based radars and to associated airborne transponders which transmit only on frequencies in these bands and only when actuated by radars operating in the same band.

718 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service from harmful interference in the band 1 330 - 1 400 MHz. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

719 In Bulgaria, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the existing installations of the radionavigation service may continue to operate in the band 1 350 - 1 400 MHz.

720 The bands 1 370 - 1 400 MHz, 2 640 - 2 655 MHz, 4 950 - 4 990 MHz and 15.20 - 15.35 GHz are also allocated to the space research (passive) and earth exploration-satellite (passive) services on a secondary basis.

721 All emissions in the band 1 400 - 1 427 MHz are prohibited.

722 In the bands 1 400 - 1 727 MHz, 101 - 120 GHz and 197 - 220 GHz, passive research is being conducted by some countries in a programme for the search for intentional emissions of extra-terrestrial origin.

MHz

1 429 – 1 533

Allocation to Services		
Region 1	Region 2	Region 3
1 429 – 1 525 FIXED MOBILE except aeronautical mobile 722	**1 429 – 1 525** FIXED MOBILE 723 722	
1 525 – 1 530 SPACE OPERATION (space-to-Earth) FIXED Earth Exploration-Satellite Mobile except aeronautical mobile 724 722 725	**1 525 – 1 530** SPACE OPERATION (space-to-Earth) Earth Exploration-Satellite Fixed Mobile 723 722 723A	**1 525 – 1 530** SPACE OPERATION (space-to-Earth) FIXED Earth Exploration-Satellite Mobile 723 724 722
1 530 – 1 533 SPACE OPERATION (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) LAND MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite Fixed Mobile except aeronautical mobile 722 726 726A	**1 530 – 1 533** SPACE OPERATION (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) LAND MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite Fixed Mobile 723 722 726 726A	

723 In Region 2, in Australia and Papua New Guinea, the use of the band 1 435 - 1 535 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile service.

723A Mob-87 *Different category of service:* in Cuba, the band 1 525 - 1 530 MHz is allocated to the aeronautical mobile service on a primary basis, under the conditions specified in No. 723.

724 *Different category of service:* in Afghanistan, Saudi Arabia, Bahrain, Bulgaria, Cameroon, Egypt, the United Arab Emirates, France, Hungary, Iran, Iraq, Israel, Kuwait, the Lebanon, Morocco, Mongolia, Oman, Poland, Qatar, Syria, the German Democratic Republic, Roumania, Czechoslovakia, the U.S.S.R., Yemen (P.D.R. of) and Yugoslavia, the allocation of the band 1 525 - 1 530 MHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. 425).

725 *Additional allocation:* in the U.S.S.R., the band 1 525 - 1 530 MHz is also allocated to the aeronautical mobile service on a primary basis.

726 The allocation to the maritime mobile-satellite service in the band 1 530 - 1 535 MHz shall be effective from 1 January 1990. Up to that date the allocation to the fixed service shall be on a primary basis in Regions 1 and 3.

726A Mob-87 The bands 1 530 - 1 544 MHz, 1 545 - 1 559 MHz, 1 626.5 - 1 645.5 MHz and 1 646.5 - 1 660.5 MHz shall not be used for feeder links of any service. In exceptional circumstances, however, an earth station at a specified fixed point in any of the mobile-satellite services may be authorized by an administration to communicate via space stations using these bands.

MHz

1 533 – 1 610

Allocation to Services		
Region 1	Region 2	Region 3
1 533 – 1 535 SPACE OPERATION (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite Fixed Mobile except aeronautical mobile Land Mobile-Satellite (space-to-Earth) 726B 722 726 726A	**1 533 – 1 535** SPACE OPERATION (space-to-Earth) MARITIME MOBILE-SATELLITE (space-to-Earth) Earth Exploration-Satellite Fixed Mobile 723 Land Mobile-Satellite (space-to-Earth) 726B 722 726 726A	
1 535 – 1 544	MARITIME MOBILE-SATELLITE (space-to-Earth) Land Mobile-Satellite (space-to-Earth) 726B 722 726A 727	
1 544 – 1 545	MOBILE-SATELLITE (space-to-Earth) 722 727 727A	
1 545 – 1 555	AERONAUTICAL MOBILE-SATELLITE (R) (space-to-Earth) 722 726A 727 729 729A 730	
1 555 – 1 559	LAND MOBILE-SATELLITE (space-to-Earth) 722 726A 727 730 730A	
1 559 – 1 610	AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) 722 727 730 731 731A 731B 731C 731D	

726B Mob-87 The use of the bands 1 533 - 1 544 MHz, 1 626.5 - 1 631.5 MHz and 1 634.5 - 1 645.5 MHz by the land mobile-satellite service is limited to non-speech low bit-rate data transmissions.

727 *Additional allocation:* In Afghanistan, Saudi Arabia, Bahrain, Bangladesh, the Congo, Egypt, the United Arab Emirates, Ethiopia, Iran, Iraq, Israel, Jordan, Kuwait, the Lebanon, Malta, Morocco, Niger, Oman, Pakistan, Qatar, Syria, Somalia, Sudan, Sri Lanka, Chad, Thailand, Togo, Yemen (P.D.R. of) and Zambia, the bands 1 540 - 1 645.5 MHz and 1 646.5 - 1 660 MHz are also allocated to the fixed service on a secondary basis.

727A Mob-87 The use of the band 1 544 - 1 545 MHz by the mobile-satellite service (space-to-Earth) is limited to distress and safety communications (see Article **N 38**).

728* Mob-87 SUP

729 Mob-87 Transmissions in the band 1 545 - 1 555 MHz from terrestrial aeronautical stations directly to aircraft stations, or between aircraft stations, in the aeronautical mobile (R) service are also authorized when such transmissions are used to extend or supplement the satellite-to-aircraft links.

729A Mob-87 Notwithstanding any other provisions of the Radio Regulations relating to restrictions in the use of the bands allocated to the aeronautical mobile-satellite (R) service for public correspondence, the bands 1 545 - 1 555 MHz and 1 646.5 - 1 656.5 MHz may be authorized by administrations for public correspondence with aircraft earth stations. Such communications must cease immediately, if necessary, to permit transmission of messages with priority 1 to 6 in Article **51**.

730 *Additional allocation:* in the Federal Republic of Germany, Austria, Bulgaria, Cameroon, Guinea, Hungary, Indonesia, Libya, Mali, Mongolia, Nigeria, Poland, the German Democratic Republic, Roumania, Senegal, Czechoslovakia and the U.S.S.R., the bands 1 550 - 1 645.5 MHz and 1 646.5 - 1 660 MHz are also allocated to the fixed service on a primary basis.

730A Mob-87 In the bands 1 555 - 1 559 MHz and 1 656.5 - 1 660.5 MHz administrations may also authorize aircraft earth stations and ship earth stations to communicate with space stations in the land mobile-satellite service (see Resolution **208 (Mob-87)**).

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* *Note by the General Secretariat:* This note has been renumbered **734B**, to preserve the chronological order.

731 Mob-87 *Alternative allocation:* in Sweden, the band 1 590 - 1 626.5 MHz is allocated to the aeronautical radionavigation service on a primary basis.

731A Mob-87 In Region 1, stations of the aeronautical mobile service using the bands 1 593 - 1 594 MHz and 1 625.5 - 1 626.5 MHz shall not claim protection from, or cause harmful interference to, stations of the aeronautical radionavigation and radionavigation-satellite services, as applicable.

731B Mob-87 *Additional allocation:* the bands 1 593 - 1 594 MHz and 1 625.5 - 1 626.5 MHz are also allocated to the aeronautical mobile service in Region 1 (except in Syria and Tunisia) on a primary basis, and in Regions 2 and 3 (and in Syria and Tunisia) on a secondary basis. The use of these bands in the aeronautical mobile service is limited to public correspondence with aircraft (see Recommendation **408 (Mob-87)**). The use of the band 1 593 - 1 594 MHz is limited to transmissions from aeronautical stations and the use of the band 1 625.5 - 1 626.5 MHz is limited to transmissions from aircraft stations.

731C Mob-87 *Different category of service:* the bands listed in No. **731B** are allocated, subject to agreement obtained in accordance with the procedures set forth in Article **14**, to the aeronautical mobile service on a primary basis in Greenland, the French Overseas Territories in Regions 2 and 3, Bermuda, British Virgin Islands, Cayman Islands, Montserrat and Pitcairn Island (see Recommendation **408 (Mob-87)**).

731D Mob-87 In Region 1, stations of the aeronautical mobile service using the bands 1 593 - 1 594 MHz and 1 625.5 - 1 626.5 MHz shall not cause harmful interference to stations of the fixed service operating in the countries listed in No. **730**.

MHz
1 610 – 1 660

Allocation to Services		
Region 1	Region 2	Region 3
1 610 – 1 626.5 AERONAUTICAL RADIONAVIGATION 722 727 730 731 731A 731B 731D 732 733 733A 733B 733E 733F 734	**1 610 – 1 626.5** AERONAUTICAL RADIONAVIGATION RADIODETERMINATION-SATELLITE (Earth-to-space) 733A 733E 722 731B 731C 732 733 733C 733D 734	**1 610 – 1 626.5** AERONAUTICAL RADIONAVIGATION Radiodetermination-Satellite (Earth-to-space) 733A 733E 722 727 730 731B 731C 732 733 733B 734
1 626.5 – 1 631.5	MARITIME MOBILE-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) 726B 722 726A 727 730	
1 631.5 – 1 634.5	MARITIME MOBILE-SATELLITE (Earth-to-space) LAND MOBILE-SATELLITE (Earth-to-space) 722 726A 727 730 734A	
1 634.5 – 1 645.5	MARITIME MOBILE-SATELLITE (Earth-to-space) Land Mobile-Satellite (Earth-to-space) 726B 722 726A 727 730	
1 645.5 – 1 646.5	MOBILE-SATELLITE (Earth-to-space) 722 734B	
1 646.5 – 1 656.5	AERONAUTICAL MOBILE-SATELLITE (R) (Earth-to-space) 722 726A 727 729A 730 735	
1 656.5 – 1 660	LAND MOBILE-SATELLITE (Earth-to-space) 722 726A 727 730 730A 734A	

732 The band 1 610 - 1 626.5 MHz is reserved on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities. Such satellite use is a subject to agreement obtained under the procedure set forth in Article **14**.

733 The bands 1 610 - 1 626.5 MHz, 5 000 - 5 250 MHz and 15.4 - 15.7 GHz are also allocated to the aeronautical mobile-satellite (R) service on a primary basis. Such use is subject to agreement obtained under the procedure set forth in Article **14**.

733A **Mob-87** In respect of the radiodetermination-satellite service the provisions of No. **953** do not apply in the frequency band 1 610 - 1 626.5 MHz.

733B **Mob-87** *Different category of service:* in Angola, Australia, Burundi, Côte d'Ivoire, Ethiopia, India, the Islamic Republic of Iran, Israel, Italy, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New Guinea, Senegal, Sudan, Swaziland, Syria, Tanzania, Thailand, Togo, Zaire and Zambia the allocation of the band 1 610 - 1 626.5 MHz to the radiodetermination-satellite service (Earth-to-space) is on a primary basis (see No. **425**) subject to agreement obtained under the procedure set forth in Article **14** with other countries not listed in this provision.

733C **Mob-87** *Different category of service:* in Venezuela, the allocation to the radiodetermination-satellite service in the band 1 610 - 1 626.5 MHz (Earth-to-space) is on a secondary basis.

733D **Mob-87** *Alternative allocation:* in Cuba, the band 1 610 - 1 626.5 MHz is allocated exclusively to the aeronautical radionavigation service on a primary basis.

733E **Mob-87** In Regions 1 and 3 harmful interference shall not be caused to stations of the radioastronomy service using the band 1 610.6 - 1 613.8 MHz by stations of the radiodetermination-satellite service.

733F **Mob-87** In Region 1, the bands 1 610 - 1 626.5 MHz (Earth-to-space) and 2 483.5 - 2 500 MHz (space-to-Earth) are also allocated to the radiodetermination-satellite service on a secondary basis.

734 The band 1 610.6 - 1 613.8 MHz is also allocated to the radio astronomy service on a secondary basis for spectral line observations. In making assignments to stations of other services to which the band is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

734A / Mob-87 Land earth stations and ship earth stations in the mobile-satellite service operating in the bands 1 631.5 - 1 634.5 MHz and 1 656.5 - 1 660 MHz shall not cause harmful interference to the stations in the fixed service operating in the countries listed in No. **730**.

734B Mob-87 The use of the band 1 645.5 - 1 646.5 MHz by the mobile-satellite service (Earth-to-space) and for inter-satellite links is limited to distress and safety communications (see Article N 38).

735 Mob-87 Transmissions in the band 1 646.5 - 1 656.5 MHz from aircraft stations in the aeronautical mobile (R) service directly to terrestrial aeronautical stations, or between aircraft stations, are also authorized when such transmissions are used to extend or supplement the aircraft-to-satellite links.

MHz
1 660 – 1 700

Allocation to Services		
Region 1	Region 2	Region 3
1 660 – 1 660.5	RADIO ASTRONOMY LAND MOBILE-SATELLITE (Earth-to-space) 722 726A 730A 736	
1 660.5 – 1 668.4	RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 722 736 737 738 739	
1 668.4 – 1 670	METEOROLOGICAL AIDS FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 722 736	
1 670 – 1 690	METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 722	
1 690 – 1 700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) Fixed Mobile except aeronautical mobile 671 722 741	**1 690 – 1 700** METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) 671 722 740 742	

736 In making assignments to stations of other services to which the band 1 660 - 1 670 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

737 *Different category of service:* in Afghanistan, Saudi Arabia, Bahrain, Benin, Bulgaria, Cameroon, the Central African Republic, the Congo, Cuba, Egypt, the United Arab Emirates, Ethiopia, Hungary, India, Indonesia, Iran, Israel, Kenya, Kuwait, the Lebanon, Malaysia, Mongolia, Oman, Uganda, Pakistan, Poland, Qatar, Syria, the German Democratic Republic, Singapore, Somalia, Sri Lanka, Chad, Czechoslovakia, Thailand, Tunisia, the U.S.S.R., Yemen A.R., Yemen (P.D.R. of) and Yugoslavia, the allocation of the band 1 660.5 - 1 668.4 MHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis until 1 January 1990 (see No. **425**).

738 *Additional allocation:* in Bangladesh, India, Indonesia, Nigeria, Pakistan, Sri Lanka and Thailand, the band 1 660.5 - 1 668.4 MHz is also allocated to the meteorological aids service on a secondary basis.

739 In view of the successful detection by radio astronomers of two hydroxyl spectral lines in the region of 1 665 MHz and 1 667 MHz, administrations are urged to give all practicable protection in the band 1 660.5 - 1 668.4 MHz for future research in radio astronomy, particularly by eliminating air-to-ground transmissions in the meteorological aids service in the band 1 664.4 - 1 668.4 MHz as soon as practicable.

740 *Additional allocation:* in Afghanistan, Costa Rica, Cuba, India, Iran, Malaysia, Pakistan, Singapore, Sri Lanka and Thailand, the band 1 690 - 1 700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

741 *Different category of service:* in Saudi Arabia, Austria, Bahrain, Bulgaria, the Congo, Egypt, the United Arab Emirates, Ethiopia, Guinea, Hungary, Iraq, Israel, Jordan, Kenya, Kuwait, the Lebanon, Mauritania, Mongolia, Oman, Poland, Qatar, Syria, the German Democratic Republic, Roumania, Somalia, Tanzania, Czechoslovakia, the U.S.S.R., Yemen A.R., Yemen (P.D.R. of) and Yugoslavia, the allocation of the band 1 690 - 1 700 MHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. **425**).

742 *Additional allocation:* in Australia and Indonesia, the band 1 690 - 1 700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis.

MHz

1 700 – 2 450

Allocation to Services		
Region 1	Region 2	Region 3
1 700 – 1 710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) Mobile except aeronautical mobile 671 722 743A	**1 700 – 1 710** FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 671 722 743	
1 710 – 2 290 FIXED Mobile 722 743A 744 746 747 748 750	**1 710 – 2 290** FIXED MOBILE 722 744 745 746 747 748 749 750	
2 290 – 2 300 FIXED SPACE RESEARCH (deep space) (space-to-Earth) Mobile except aeronautical mobile 743A	**2 290 – 2 300** FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	
2 300 – 2 450 FIXED Amateur Mobile Radiolocation 664 743A 752	**2 300 – 2 450** FIXED MOBILE RADIOLOCATION Amateur 664 751 752	

743 *Additional allocation:* in India, Indonesia, Japan and Thailand, the band 1 700 - 1 710 MHz is also allocated to the space research service (space-to-Earth) on a primary basis.

743A Mob-87 *Different category of service:* in the Federal Republic of Germany, Austria, Denmark, Finland, Israel, Norway, the Netherlands, the United Kingdom, Switzerland and Syria, in the band 1 700 - 2 450 MHz, in Sweden in the bands 1 700 - 1 710 MHz and 2 290 - 2 450 MHz and in Yugoslavia in the band 2 300 - 2 450 MHz, the allocation to the land mobile service is on a primary basis (see No. **425**), subject to agreement obtained under the procedure set forth in Article **14**.

744 The band 1 718.8 - 1 722.2 MHz is also allocated to the radio astronomy service on a secondary basis for spectral line observations. In making assignments to stations of other services to which the band is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

745 Subject to agreement obtained under the procedure set forth in Article **14** and having particular regard to tropospheric scatter systems, the band 1 750 - 1 850 MHz may also be used for space operation (Earth-to-space) and space research (Earth-to-space) services in Region 2, in Afghanistan, Australia, India, Indonesia, Japan and Thailand.

746 *Additional allocation:* in Bulgaria, Cuba, Hungary, Mali, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 1 770 - 1 790 MHz is also allocated to the meteorological-satellite service on a primary basis, subject to agreement obtained under the procedure set forth in Article **14**.

747 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 025 - 2 110 MHz may also be used for Earth-to-space and space-to-space transmissions in the space research, space operation and earth exploration-satellite services. The services using space-to-space transmissions shall operate in accordance with the provisions of Nos. **2557** to **2560** and shall not cause harmful interference to the other space services.

748 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 110 - 2 120 MHz may also be used for Earth-to-space transmissions in the space research (deep space) service.

749 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 110 - 2 120 MHz may also be used in Japan for the space research (Earth-to-space) and space operation (Earth-to-space) services until 31 December 1990.

750 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 200 - 2 290 MHz may also be used for space-to-Earth and space-to-space transmissions in the space research, space operations and earth exploration-satellite services. These services shall operate in accordance with the provisions of Nos. **2557** to **2560**; the space-to-space transmissions shall not cause harmful interference to the other space services.

751 In Australia, the United States and Papua New Guinea, the use of the band 2 310 - 2 390 MHz by the aeronautical mobile service for telemetry has priority over other uses by the mobile services.

752 The band 2 400 - 2 500 MHz (centre frequency 2 450 MHz) is designated for industrial, scientific and medical (ISM) applications. Radio services 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. **1815**.

MHz
2 450 – 2 655

Allocation to Services		
Region 1	Region 2	Region 3
2 450 – 2 483.5 FIXED MOBILE Radiolocation 752 753	**2 450 – 2 483.5** FIXED MOBILE RADIOLOCATION 752	
2 483.5 – 2 500 FIXED MOBILE Radiolocation 733F 752 753A 753B 753C 753E	**2 483.5 – 2 500** FIXED MOBILE RADIODETERMINATION-SATELLITE (space-to-Earth) 753A RADIOLOCATION 752 753D	**2 483.5 – 2 500** FIXED MOBILE RADIOLOCATION Radiodetermination-Satellite (space-to-Earth) 753A 752 753C
2 500 – 2 655 FIXED 762 763 764 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 720 753 756 758 759	**2 500 – 2 655** FIXED 762 764 FIXED SATELLITE (space-to-Earth) 761 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 720 755	**2 500 – 2 535** FIXED 762 764 FIXED SATELLITE (space-to-Earth) 761 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 754 754A **2 535 – 2 655** FIXED 762 764 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 720

753 Mob-87 *Alternative allocation:* in France, the bands 2 450 - 2 483.5 MHz and 2 500 - 2 550 MHz are allocated on a primary basis to the radiolocation service and on a secondary basis to the fixed and mobile services (see Nos. **424** and **425**). Such use is subject to agreement with the administrations having services operating or planned to operate in accordance with the Table which may be affected.

753A Mob-87 In respect of the radiodetermination-satellite service in the band 2 483.5 - 2 500 MHz, the provisions of No. **953** do not apply.

753B Mob-87 In Region 1, in countries other than those listed in No. **753C**, harmful interference shall not be caused to, or protection shall not be claimed from, stations of the radiolocation service by stations of the radiodetermination-satellite service.

753C Mob-87 *Different category of service:* in Angola, Australia, Burundi, Côte d'Ivoire, Ethiopia, India, the Islamic Republic of Iran, Israel, Italy, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New Guinea, Senegal, Sudan, Swaziland, Syria, Tanzania, Thailand, Togo, Zaire and Zambia, the allocation of the band 2 483.5 - 2 500 MHz to the radiodetermination-satellite service (space-to-Earth) is on a primary basis (see No. **425**) subject to agreement obtained under the procedure of Article **14** with other countries not listed in this provision.

753D Mob-87 *Alternative allocation:* in Cuba, the band 2 483.5 - 2 500 MHz is allocated only to the fixed, mobile and radiolocation services on a primary basis.

753E Mob-87 *Alternative allocation:* in France, the band 2 483.5 - 2 500 MHz is allocated on a primary basis to the radiolocation service and on a secondary basis to the mobile service (see Nos. **424** and **425**). Such use is subject to agreement with the administrations having services operating or planned to operate in accordance with the Table which may be affected.

754 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 500 - 2 535 MHz may also be used in Region 3 for the mobile-satellite (space-to-Earth), except aeronautical mobile-satellite, service for operation limited to within national boundaries.

754A Mob-87 *Additional allocation:* subject to agreement obtained under the procedure set forth in Article **14**, the band 2 500 - 2 516.5 MHz may also be used in India, the Islamic Republic of Iran, Papua New Guinea and Thailand for the radiodetermination-satellite service (space-to-Earth) for operation limited to within national boundaries.

755 *Additional allocation:* in Canada, the band 2 500 - 2 550 MHz is also allocated to the radiolocation service on a primary basis.

756 *Additional allocation:* in the United Kingdom, the band 2 500 - 2 600 MHz is also allocated to the radiolocation service on a secondary basis.

757 The use of the band 2 500 - 2 690 MHz by the broadcasting-satellite service is limited to national and regional systems for community reception and such use shall be subject to agreement obtained under the procedure set forth in Article **14**. The power flux-density at the Earth's surface shall not exceed the values given in Nos. **2561** to **2564**.

758 *Alternative allocation:* in the Federal Republic of Germany and Greece, the band 2 500 - 2 690 MHz is allocated to the fixed service on a primary basis.

759 *Alternative allocation:* in Bulgaria and the U.S.S.R., the band 2 500 - 2 690 MHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

760 In the design of systems in the broadcasting-satellite service in the bands between 2 500 MHz and 2 690 MHz, administrations are urged to take all necessary steps to protect the radio astronomy service in the band 2 690 - 2 700 MHz.

761 The use of the bands 2 500 - 2 690 MHz in Region 2 and 2 500 - 2 535 MHz and 2 655 - 2 690 MHz in Region 3 by the fixed-satellite service is limited to national and regional systems; such use shall be subject to agreement obtained under the procedure set forth in Article **14**, giving particular attention to the broadcasting-satellite service in Region 1. In the direction space-to-Earth, the power flux-density at the Earth's surface shall not exceed the values given in Nos. **2561** to **2564**.

762 Administrations shall make all practicable efforts to avoid developing new tropospheric scatter systems in the band 2 500 - 2690 MHz.

763 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 500 - 2 690 MHz may be used for tropospheric scatter systems in Region 1.

764 When planning new tropospheric scatter radio-relay links in the band 2 500 - 2 690 MHz, all possible measures shall be taken to avoid directing the antennae of these links towards the geostationary-satellite orbit.

MHz

2 655 – 3 300

Allocation to Services		
Region 1	Region 2	Region 3
2 655 – 2 690 FIXED 762 763 764 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 Earth Exploration-Satellite (passive) Radio Astronomy Space Research (passive) 758 759 765	**2 655 – 2 690** FIXED 762 764 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 761 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 Earth Exploration-Satellite (passive) Radio Astronomy Space Research (passive) 765	**2 655 – 2 690** FIXED 762 764 FIXED-SATELLITE (Earth-to-space) 761 MOBILE except aeronautical mobile BROADCASTING-SATELLITE 757 760 Earth Exploration-Satellite (passive) Radio Astronomy Space Research (passive) 765 766
2 690 – 2 700	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 767 768 769	
2 700 – 2 900	AERONAUTICAL RADIONAVIGATION 717 Radiolocation 770 771	
2 900 – 3 100	RADIONAVIGATION 773 Radiolocation 772 775A	
3 100 – 3 300	RADIOLOCATION 713 777 778	

765 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference in the band 2 655 - 2 690 MHz. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

766 Subject to agreement obtained under the procedure set forth in Article **14**, the band 2 655 - 2 690 MHz may also be used in Region 3 for the mobile-satellite (Earth-to-space), except aeronautical mobile-satellite, service for operation limited to within national boundaries.

767 *Additional allocation:* in the Federal Republic of Germany and Austria, the band 2 690 - 2 695 MHz is also allocated to the fixed service on a primary basis. Such use is limited to equipment in operation by 1 January 1985.

768 All emissions in the band 2 690 - 2 700 MHz are prohibited, except those provided for by Nos. **767** and **769**.

769 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Bulgaria, Cameroon, the Central African Republic, the Congo, the Ivory Coast, Cuba, Egypt, the United Arab Emirates, Ethiopia, Gabon, Guinea, Guinea-Bissau, Hungary, Iran, Iraq, Israel, the Lebanon, Malaysia, Malawi, Mali, Morocco, Mauritania, Mongolia, Nigeria, Oman, Pakistan, the Philippines, Poland, Qatar, Syria, the German Democratic Republic, Roumania, Singapore, Somalia, Sri Lanka, Czechoslovakia, Thailand, Tunisia, the U.S.S.R., Yemen A.R., Yemen (P.D.R. of), Yugoslavia, Zaire and Zambia, the band 2 690 - 2 700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985.

770 In the band 2 700 - 2 900 MHz, ground-based radars used for meteorological purposes are authorized to operate on a basis of equality with stations of the aeronautical radionavigation service.

771 *Additional allocation:* in Canada, the band 2 850 - 2900 MHz is also allocated to the maritime radionavigation service, on a primary basis, for use by shore-based radars.

772 Mob-87 In the band 2 900 - 3 100 MHz, the use of the shipborne interrogator-transponder system (SIT) shall be confined to the sub-band 2 930 - 2 950 MHz.

773 The use of the band 2 900 - 3 100 MHz by the aeronautical radionavigation service is limited to ground-based radars.

774 and 775 SUP
Mob-87

775A Mob-87 In the bands 2 900 - 3 100 MHz and 9 300 - 9 500 MHz, the response from radar transponders shall not be capable of being confused with the response from radar beacons (racons) and shall not cause interference to ship or aeronautical radars in the radionavigation service, having regard, however, to No. **347** of these Regulations.

776 SUP
Mob-87

777 *Additional allocation:* in Bulgaria, Canada, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 3 100 - 3 300 MHz is also allocated to the radionavigation service on a primary basis.

778 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service from harmful interference in the bands 3 260 - 3 267 MHz, 3 332 - 3 339 MHz, 3 345.8 - 3 352.5 MHz and 4 825 - 4 835 MHz. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

MHz
3 300 – 4 500

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>3 300 – 3 400
RADIOLOCATION

778 779 780</td><td>3 300 – 3 400
RADIOLOCATION
Amateur
Fixed
Mobile

778 780</td><td>3 300 – 3 400
RADIOLOCATION
Amateur

778 779</td></tr>
<tr><td>3 400 – 3 600
FIXED
FIXED SATELLITE
(space-to-Earth)
Mobile
Radiolocation

781 782 785</td><td colspan="2">3 400 – 3 500
FIXED
FIXED SATELLITE (space-to-Earth)
Amateur
Mobile
Radiolocation 784

664 783</td></tr>
<tr><td rowspan="2">3 600 – 4 200
FIXED
FIXED-SATELLITE
(space-to-Earth)
Mobile</td><td colspan="2">3 500 – 3 700
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile
Radiolocation 784

786</td></tr>
<tr><td colspan="2">3 700 – 4 200
FIXED
FIXED-SATELLITE (space-to-Earth)
MOBILE except aeronautical mobile

787</td></tr>
<tr><td>4 200 – 4 400</td><td colspan="2">AERONAUTICAL RADIONAVIGATION 789

788 790 791</td></tr>
<tr><td>4 400 – 4 500</td><td colspan="2">FIXED
MOBILE</td></tr>
</table>

779 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Bangladesh, China, the Congo, the United Arab Emirates, India, Indonesia, Iran, Iraq, Israel, Japan, Kuwait, the Lebanon, Libya, Malaysia, Oman, Pakistan, Qatar, Syria, Singapore, Sri Lanka and Thailand, the band 3 300 - 3 400 MHz is also allocated to the fixed and mobile services on a primary basis. The countries bordering the Mediterranean shall not claim protection for their fixed and mobile services from the radiolocation service.

780 *Additional allocation:* in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 3 300 - 3 400 MHz is also allocated to the radionavigation service on a primary basis.

781 *Additional allocation:* in the Federal Republic of 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.

782 *Different category of service:* in Austria, the allocation of the band 3 400 - 3 500 MHz to the radiolocation service is on a primary basis (see No. **425**), subject to the agreement of the Administrations of the following countries: Hungary, Italy, the German Democratic Republic, Czechoslovakia and Yugoslavia. Such use is limited to ground-based stations. However, this Administration is urged to cease operations by 1985. After this date, this Administration shall take all practicable steps to protect the fixed-satellite service and coordination requirements shall not be imposed on the fixed-satellite service.

783 *Different category of service:* in Indonesia, Japan, Pakistan and Thailand, the allocation of the band 3 400 - 3 500 MHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. **425**).

784 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.

785 In Denmark, Norway and the United Kingdom, the fixed, radiolocation and fixed-satellite services operate on a basis of equality of rights in the band 3 400 - 3 600 MHz. However, these Administrations operating radiolocation systems in this band are urged to cease operations by 1985. After this date, these Administrations shall take all practicable steps to protect the fixed-satellite service and coordination requirements shall not be imposed on the fixed-satellite service.

786 In Japan, in the band 3 620 - 3 700 MHz, the radiolocation service is excluded.

787 *Additional allocation:* in New Zealand, the band 3 700 - 3 770 MHz is also allocated to the radiolocation service on a secondary basis.

788 *Additional allocation:* in the Federal Republic of Germany, Denmark, Norway and Sweden, the band 4 200 - 4 210 MHz is also allocated to the fixed service on a secondary basis.

789 Use of the band 4 200 - 4 400 MHz by the aeronautical radionavigation service is reserved exclusively for radio altimeters installed on board aircraft and for the associated transponders on the ground. However, passive sensing in the earth exploration-satellite and space research services may be authorized in this band on a secondary basis (no protection is provided by the radio altimeters).

790 *Additional allocation:* in China, Iran, Libya, the Philippines and Sri Lanka, the band 4 200 - 4 400 MHz is also allocated to the fixed service on a secondary basis.

791 The standard frequency and time signal-satellite service may be authorized to use the frequency 4 202 MHz for space-to-Earth transmissions and the frequency 6 427 MHz for Earth-to-space transmissions. Such transmissions shall be confined within the limits of ± 2 MHz of these frequencies and shall be subject to agreement obtained under the procedure set forth in Article 14.

MHz

4 500 – 5 470

Allocation to Services		
Region 1	Region 2	Region 3
4 500 – 4 800	FIXED FIXED-SATELLITE (space-to-Earth) 792A MOBILE	
4 800 – 4 990	FIXED MOBILE 793 Radio Astronomy 720 778 794	
4 990 – 5 000	FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY Space Research (passive) 795	
5 000 – 5 250	AERONAUTICAL RADIONAVIGATION 733 796 797 797A 797B	
5 250 – 5 255	RADIOLOCATION Space Research 713 798	
5 255 – 5 350	RADIOLOCATION 713 798	
5 350 – 5 460	AERONAUTICAL RADIONAVIGATION 799 Radiolocation	
5 460 – 5 470	RADIONAVIGATION 799 Radiolocation	

792 SUP
Orb-88

792A The use of the bands 4 500 - 4 800 MHz, 6 725 - 7 025 MHz, 10.7 -
Orb-88 10.95 GHz, 11.2 - 11.45 GHz and 12.75 - 13.25 GHz by the fixed-satellite service shall be in accordance with the provisions of Appendix **30B**.

793 In the bands 4 825 - 4 835 MHz and 4 950- 4 990 MHz, the allocation to the mobile service is restricted to the mobile, except aeronautical mobile, service.

794 *Different category of service:* in Argentina, Australia and Canada, the allocation of the bands 4 825 - 4 835 MHz and 4 950 - 4 990 MHz to the radio astronomy service is on a primary basis (see No. **425**). In making assignments to stations of other services to which these bands are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

795 In making assignments to stations of other services to which the band 4 990 - 5 000 MHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

796 The band 5 000 - 5 250 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. The requirements of this system shall take precedence over other uses of this band.

797 The bands 5 000 - 5 250 MHz and 15.4 - 15.7 GHz are also allocated to the fixed-satellite service and the inter-satellite service, for connection between one or more earth stations at specified fixed points on the Earth and space stations, when these services are used in conjunction with the aeronautical radionavigation and/or aeronautical mobile (R) service. Such use shall be subject to agreement obtained under the procedure set forth in Article **14**.

797A *Additional allocation:* in the countries listed in Nos. **733B** and **753C**, and
Mob-87 subject to agreement obtained under the procedure set forth in Article **14**, the band 5 150 - 5 216 MHz is also allocated to the radiodetermination-satellite service (space-to-Earth) on a primary basis. In Region 2, the band is also allocated to the radiodetermination-satellite service (space-to-Earth) on a primary basis. In Regions 1 and 3, except those countries listed in Nos. **733B** and **753C**, the band is also allocated to the radiodetermination-satellite service (space-to-Earth) on a secondary basis. The use by the radiodetermination-satellite service is limited to feeder links in conjunction with the radiodetermination-satellite service operating in the bands 1 610 - 1 626.5 MHz and/or 2 483.5 - 2 500 MHz. The total power flux-density at the Earth's surface shall in no case exceed -159 dBW/m^2 in any 4 kHz band for all angles of arrival.

797B *Additional allocation:* in the Federal Republic of Germany, Austria,
Mob-87 Denmark, Spain, France, Finland, Israel, Italy, Jordan, Morocco, Norway, the Netherlands, Pakistan, the United Kingdom, Sweden, Switzerland, Syria and Tunisia, the band 5 150 - 5 250 MHz is also allocated to the mobile service, on a primary basis, subject to the agreement obtained under the procedure set forth in Article **14**.

798 *Additional allocation:* in Austria, Bulgaria, Hungary, Libya, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 5 250 - 5 350 MHz is also allocated to the radionavigation service on a primary basis.

799 The use of the band 5 350 - 5 470 MHz by the aeronautical radionavigation service is limited to airborne radars and associated airborne beacons.

MHz
5 470 – 7 250

Allocation to Services		
Region 1	Region 2	Region 3
5 470 – 5 650	MARITIME RADIONAVIGATION Radiolocation 800 801 802	
5 650 – 5 725	RADIOLOCATION Amateur Space Research (deep space) 664 801 803 804 805	
5 725 – 5 850 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur 801 803 805 806 807 808	**5 725 – 5 850** RADIOLOCATION Amateur 803 805 806 808	
5 850 – 5 925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 806	**5 850 – 5 925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 806	**5 850 – 5 925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation 806
5 925 – 7 075	FIXED FIXED-SATELLITE (Earth-to-space) 792A MOBILE 791 809	
7 075 – 7 250	FIXED MOBILE 809 810 811	

800 *Additional allocation:* in Afghanistan, Austria, Bulgaria, Hungary, Iran, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 5 470 - 5 650 MHz is also allocated to the aeronautical radionavigation service on a primary basis.

801 *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. **2502**, **2505**, **2506** and **2507** shall apply in the band 5 725 - 5 850 MHz.

802 Between 5 600 MHz and 5 650 MHz, ground-based radars used for meteorological purposes are authorized to operate on a basis of equality with stations of the maritime radionavigation service.

803 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Bangladesh, Cameroon, the Central African Republic, China, the Congo, the Republic of Korea, Egypt, the United Arab Emirates, Gabon, Guinea, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kuwait, the Lebanon, Libya, Madagascar, Malaysia, Malawi, Malta, Niger, Nigeria, Pakistan, the Philippines, Qatar, Syria, Singapore, Sri Lanka, Tanzania, Chad, Thailand and Yemen (P.D.R. of), the band 5 650 - 5 850 MHz is also allocated to the fixed and mobile services on a primary basis.

804 *Different category of service:* in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the allocation of the band 5 670 - 5 725 MHz to the space research service is on a primary basis (see No. **425**).

805 *Additional allocation:* in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the band 5 670 - 5 850 MHz is also allocated to the fixed service on a primary basis.

806 The band 5 725 - 5 875 MHz (centre frequency 5 800 MHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services 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. **1815**.

807 *Additional allocation:* in the Federal Republic of Germany and in Cameroon, the band 5 755 - 5 850 MHz is also allocated to the fixed service on a primary basis.

808 The band 5 830 - 5 850 MHz is also allocated to the amateur-satellite service (space-to-Earth) on a secondary basis.

809 In the band 6 425 - 7 075 MHz, passive microwave sensor measurements are carried out over the oceans. In the band 7 075 - 7 250 MHz, passive microwave sensor measurements are carried out. Administrations should bear in mind the needs of the earth exploration-satellite (passive) and space research (passive) services in their future planning of this band.

810 Subject to agreement obtained under the procedure set forth in Article **14**, in Region 2, the band 7 125 - 7 155 MHz may be used for Earth-to-space transmissions in the space operation service.

811 Subject to agreement obtained under the procedure set forth in Article **14**, the band 7 145 - 7 235 MHz may be used for Earth-to-space transmissions in the space research service. The use of the band 7 145 - 7 190 MHz is restricted to deep space; no emissions to deep space shall be effected in the band 7 190 - 7 235 MHz.

MHz

7 250 – 8 175

Allocation to Services		
Region 1	Region 2	Region 3
7 250 – 7 300	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE 812	
7 300 – 7 450	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 812	
7 450 – 7 550	FIXED FIXED-SATELLITE (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	
7 550 – 7 750	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	
7 750 – 7 900	FIXED MOBILE except aeronautical mobile	
7 900 – 8 025	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 812	
8 025 – 8 175 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Earth Exploration-Satellite (space-to-Earth) 813 815	**8 025 – 8 175** EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 814	**8 025 – 8 175** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Earth Exploration-Satellite (space-to-Earth) 813 815

812 The bands 7 250 - 7 375 MHz (space-to-Earth) and 7 900 - 8 025 MHz (Earth-to-space) may also be used by the mobile-satellite service. The use of these bands by this service shall be subject to agreement obtained under the procedure set forth in Article 14.

813 In the band 8 025 - 8 400 MHz, the power flux-density limits specified in No. **2570** shall apply in Regions 1 and 3 to the earth exploration-satellite service.

814 In Region 2, aircraft stations are not permitted to transmit in the band 8 025 - 8 400 MHz.

815 Subject to agreement obtained under the procedure set forth in Article 14, the band 8 025 - 8 400 MHz may be used for the earth exploration-satellite service (space-to-Earth) in Bangladesh, Benin, Cameroon, China, the Central African Republic, the Ivory Coast, Egypt, France, Guinea, Upper Volta, India, Iran, Israel, Italy, Japan, Kenya, Libya, Mali, Niger, Pakistan, Senegal, Somalia, Sudan, Sweden, Tanzania, Zaire and Zambia, on a primary basis.

MHz

8 175 – 8 750

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>8 175 – 8 215
FIXED

FIXED-SATELLITE
(Earth-to-space)
METEOROLOGICAL-
SATELLITE
(Earth-to-space)
MOBILE

Earth Exploration-Satellite
(space-to-Earth)
813 815</td><td>8 175 – 8 215
EARTH EXPLORATION-
SATELLITE
(space-to-Earth)
FIXED

FIXED-SATELLITE
(Earth-to-space)

METEOROLOGICAL-
SATELLITE
(Earth-to-space)
MOBILE 814</td><td>8 175 – 8 215
FIXED

FIXED-SATELLITE
(Earth-to-space)
METEOROLOGICAL-
SATELLITE
(Earth-to-space)
MOBILE

Earth Exploration-Satellite
(space-to-Earth)
813 815</td></tr>
<tr><td>8 215 – 8 400
FIXED

FIXED-SATELLITE
(Earth-to-space)
MOBILE

Earth Exploration-Satellite
(space-to-Earth)
813 815</td><td>8 215 – 8 400
EARTH EXPLORATION-
SATELLITE
(space-to-Earth)
FIXED

FIXED-SATELLITE
(Earth-to-space)
MOBILE 814</td><td>8 215 – 8 400
FIXED

FIXED-SATELLITE
(Earth-to-space)
MOBILE

Earth Exploration-Satellite
(space-to-Earth)
813 815</td></tr>
<tr><td>8 400 – 8 500</td><td colspan="2">FIXED
MOBILE except aeronautical mobile
SPACE RESEARCH (space-to-Earth) 816 817

818</td></tr>
<tr><td>8 500 – 8 750</td><td colspan="2">RADIOLOCATION

713 819 820</td></tr>
</table>

816 In the space research service, the use of the band 8 400 - 8 450 MHz is limited to deep space.

817 *Different category of service:* in Belgium, Israel, Luxembourg, Malaysia, Singapore and Sri Lanka, the allocation of the band 8 400 - 8 500 MHz to the space research service is on a secondary basis (see No. **424**).

818 *Alternative allocation:* in the United Kingdom, the band 8 400 - 8 500 MHz is allocated to the radiolocation and space research services on a primary basis.

819 *Additional allocation:* in Saudi Arabia, Bahrain, Bangladesh, Burundi, Cameroon, China, the Congo, Costa Rica, Egypt, the United Arab Emirates Gabon, Guinea, Guyana, Indonesia, Iran, Iraq, Israel, Jamaica, Kuwait, Libya, Malaysia, Mali, Morocco, Mauritania, Nepal, Niger, Nigeria, Oman, Pakistan, Qatar, Syria, Senegal, Singapore, Somalia, Sri Lanka, Tanzania, Chad, Thailand, Togo and Tunisia, the band 8 500 - 8 750 MHz is also allocated to the fixed and mobile services on a primary basis.

820 *Additional allocation:* in Bulgaria, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 8 500 - 8 750 MHz is also allocated to the land mobile and radionavigation services on a primary basis.

MHz

8 750 – 10 000

Allocation to Services		
Region 1	Region 2	Region 3
8 750 – 8 850	RADIOLOCATION AERONAUTICAL RADIONAVIGATION 821 822	
8 850 – 9 000	RADIOLOCATION MARITIME RADIONAVIGATION 823 824	
9 000 – 9 200	AERONAUTICAL RADIONAVIGATION 717 Radiolocation 822	
9 200 – 9 300	RADIOLOCATION MARITIME RADIONAVIGATION 823 824 824A	
9 300 – 9 500	RADIONAVIGATION 825A Radiolocation 775A 824A 825	
9 500 – 9 800	RADIOLOCATION RADIONAVIGATION 713	
9 800 – 10 000	RADIOLOCATION Fixed 826 827 828	

821 The use of the band 8 750 - 8 850 MHz by the aeronautical radionavigation service is limited to airborne Doppler navigation aids on a centre frequency of 8 800 MHz.

822 *Additional allocation:* in Algeria, the Federal Republic of Germany, Bahrain, Belgium, China, the United Arab Emirates, France, Greece, Indonesia, Iran, Libya, the Netherlands, Qatar, Sudan and Thailand, the bands 8 825 - 8 850 MHz and 9 000 - 9 200 MHz are also allocated to the maritime radionavigation service, on a primary basis, for use by shore-based radars only.

823 In the bands 8 850 - 9 000 MHz and 9 200 - 9 225 MHz, the maritime radionavigation service is limited to shore-based radars.

824 *Additional allocation:* in Austria, Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the bands 8 850 - 9 000 MHz and 9 200 - 9 300 MHz are also allocated to the radionavigation service on a primary basis.

824A Mob-87 In the band 9 200 - 9 500 MHz, search and rescue transponders (SART) may be used, having due regard to the appropriate CCIR Recommendation (see also Article N 38).

825 The use of the band 9 300 - 9 500 MHz by the aeronautical radionavigation service is limited to airborne weather radars and ground-based radars. In addition, ground-based radar beacons in the aeronautical radionavigation service are permitted in the band 9 300 - 9 320 MHz on condition that harmful interference is not caused to the maritime radionavigation service. In the band 9 300 - 9 500 MHz, ground-based radars used for meteorological purposes have priority over other radiolocation devices.

825A Mob-87 In the band 9 300 - 9 320 MHz in the radionavigation service, the use of shipborne radars, other than those existing on 1 January 1976, is not permitted until 1 January 2001.

826 *Different category of service:* in Afghanistan, Algeria, Saudi Arabia, Austria, Bahrain, Bangladesh, Cameroon, the Republic of Korea, Egypt, the United Arab Emirates, Ethiopia, Guyana, India, Indonesia, Iran, Iraq, Israel, Jamaica, Japan, Jordan, Kuwait, the Lebanon, Liberia, Malaysia, Nigeria, Pakistan, Qatar, Singapore, Somalia, Sudan, Sri Lanka, Sweden, Thailand, Trinidad and Tobago, and Yemen (P.D.R. of), the allocation of the band 9 800 - 10 000 MHz to the fixed service is on a primary basis (see No. 425).

827 *Additional allocation:* in Bulgaria, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czechoslovakia and the U.S.S.R., the band 9 800 - 10 000 MHz is also allocated to the radionavigation service on a primary basis.

828 The band 9 975 - 10 025 MHz is also allocated to the meteorological-satellite service on a secondary basis for use by weather radars.

GHz
10 – 10.7

Allocation to Services		
Region 1	Region 2	Region 3
10 – 10.45 FIXED MOBILE RADIOLOCATION Amateur 828	**10 – 10.45** RADIOLOCATION Amateur 828 829	**10 – 10.45** FIXED MOBILE RADIOLOCATION Amateur 828
10.45 – 10.5	RADIOLOCATION Amateur Amateur-Satellite 830	
10.5 – 10.55 FIXED MOBILE Radiolocation	**10.5 – 10.55** FIXED MOBILE RADIOLOCATION	
10.55 – 10.6	FIXED MOBILE except aeronautical mobile Radiolocation	
10.6 – 10.68	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) Radiolocation 831 832	
10.68 – 10.7	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 833 834	

829 *Additional allocation:* in Costa Rica, Ecuador, Guatemala and Honduras, the band 10 - 10.45 GHz is also allocated to the fixed and mobile services on a primary basis.

830 *Additional allocation:* in the Federal Republic of Germany, Angola, China, Ecuador, Spain, Japan, Kenya, Morocco, Nigeria, Sweden, Tanzania and Thailand, the band 10.45 - 10.5 GHz is also allocated to the fixed and mobile services on a primary basis.

831 In the band 10.6 - 10.68 GHz, stations of the fixed and mobile, except aeronautical mobile, services shall be limited to a maximum equivalent isotropically radiated power of 40 dBW and the power delivered to the antenna shall not exceed −3 dBW. These limits may be exceeded subject to agreement obtained under the procedure set forth in Article **14**. However, in Afghanistan, Saudi Arabia, Bahrain, Bangladesh, China, the United Arab Emirates, Finland, India, Indonesia, Iran, Iraq, Japan, Kuwait, the Lebanon, Nigeria, Pakistan, the Philippines, Qatar, Syria and the U.S.S.R., the restrictions on the fixed and mobile, except aeronautical mobile, services are not applicable.

832 In making assignments to stations of other services to which the band 10.6 - 10.68 GHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airbone stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

833 All emissions in the band 10.68 - 10.7 GHz are prohibited, except for those provided for by No. **834**.

834 *Additional allocation:* in Saudi Arabia, Bahrain, Bulgaria, Cameroon, China, Colombia, the Republic of Korea, Costa Rica, Cuba, Egypt, the United Arab Emirates, Ecuador, Hungary, Iran, Iraq, Israel, Japan, Kuwait, the Lebanon, Mongolia, Pakistan, Poland, Qatar, the German Democratic Republic, Roumania, Czechoslovakia, the U.S.S.R. and Yugoslavia, the band 10.68 - 10.7 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985.

GHz

10.7 – 12.75

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>10.7 – 11.7
FIXED
FIXED-SATELLITE
(space-to-Earth)
(Earth to space)
792A 835
MOBILE except
aeronautical mobile</td><td colspan="2">10.7 – 11.7
FIXED
FIXED-SATELLITE (space-to-Earth) 792A
MOBILE except aeronautical mobile</td></tr>
<tr><td rowspan="3">11.7 – 12.5
FIXED
BROADCASTING
BROADCASTING-
SATELLITE
Mobile except
aeronautical mobile

838</td><td>11.7 – 12.1
FIXED 837
FIXED-SATELLITE
(space-to-Earth)
Mobile except
aeronautical mobile
836 839</td><td rowspan="2">11.7 – 12.2
FIXED
MOBILE except
aeronautical mobile
BROADCASTING
BROADCASTING-
SATELLITE

838</td></tr>
<tr><td>12.1 – 12.2
FIXED-SATELLITE
(space-to-Earth)
836 839 842</td></tr>
<tr><td>12.2 – 12.7
FIXED
MOBILE except
aeronautical mobile
BROADCASTING
BROADCASTING-
SATELLITE
839 844 846</td><td>12.2 – 12.5
FIXED
MOBILE except
aeronautical mobile
BROADCASTING
838 845</td></tr>
<tr><td>12.5 – 12.75
FIXED-SATELLITE
(space-to-Earth)
(Earth-to-space)

848 849 850</td><td>12.7 – 12.75
FIXED
FIXED-SATELLITE
(Earth-to-space)
MOBILE except
aeronautical mobile</td><td>12.5 – 12.75
FIXED
FIXED-SATELLITE
(space-to-Earth)
MOBILE except
aeronautical mobile
BROADCASTING-
SATELLITE 847</td></tr>
</table>

835 In Region 1, the use of the band 10.7 - 11.7 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service.

836 Orb-85 In Region 2, in the band 11.7 - 12.2 GHz, transponders on space stations in the fixed-satellite service may be used additionally for transmissions in the broadcasting-satellite service, provided that such transmissions do not have a maximum e.i.r.p. greater than 53 dBW per television channel and do not cause greater interference or require more protection from interference than the coordinated fixed-satellite service frequency assignments. With respect to the space services, this band shall be used principally for the fixed-satellite service.

837 Orb-85 *Different category of service:* in Canada, Mexico and the United States, the allocation of the band 11.7 - 12.1 GHz to the fixed service is on a secondary basis (see No. **424**).

838 In the band 11.7 - 12.5 GHz in Regions 1 and 3, the fixed, fixed-satellite, mobile, except aeronautical mobile, and broadcasting services, in accordance with their respective allocations, shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the provisions of Appendix **30** *.

839 Orb-88 The use of the bands 11.7 - 12.2 GHz by the fixed-satellite service in Region 2 and 12.2 - 12.7 GHz by the broadcasting-satellite service in Region 2 is limited to national and subregional systems. The use of the band 11.7 - 12.2 GHz by the fixed-satellite service in Region 2 is subject to previous agreement between the administrations concerned and those having services, operating or planned to operate in accordance with the Table, which may be affected (see Articles **11**, **13** and **14**). For the use of the band 12.2 - 12.7 GHz by the broadcasting-satellite service in Region 2, see Article **15**.

840 and **841** SUP
Orb-85

842 Orb-85 *Additional allocation:* the band 12.1 - 12.2 GHz in Brazil and Peru, is also allocated to the fixed service on a primary basis.

843 SUP
Orb-85

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* *Note by the General Secretariat:* Appendix **30** has been revised by the First Session of the World Administrative Radio Conference on the Use of the Geostationary-Satellite Orbit and the Planning of Space Services Utilizing It, Geneva, 1985, and becomes Appendix **30 (Orb-85)**.

844 Orb-85 In Region 2, in the band 12.2 - 12.7 GHz, existing and future terrestrial radiocommunication services shall not cause harmful interference to the space services operating in conformity with the Broadcasting-Satellite Plan for Region 2 contained in Appendix **30 (Orb-85)**.

845 In Region 3, the band 12.2 - 12.5 GHz is also allocated to the fixed-satellite (space-to-Earth) service limited to national and sub-regional systems. The power flux-density limits in No. **2574** shall apply to this frequency band. The introduction of the service in relation to the broadcasting-satellite service in Region 1 shall follow the procedures specified in Article 7 of Appendix **30** *, with the applicable frequency band extended to cover 12.2 - 12.5 GHz.

846 Orb-85 In Region 2, in the band 12.2 - 12.7 GHz, assignments to stations of the broadcasting-satellite service in the Plan for Region 2 contained in Appendix **30 (Orb-85)** may also be used for transmissions in the fixed-satellite service (space-to-Earth), provided that such transmissions do not cause more interference or require more protection from interference than the broadcasting-satellite service transmissions operating in conformity with the Region 2 Plan. With respect to the space services, this band shall be used principally for the broadcasting-satellite service.

847 Orb-85 The broadcasting-satellite service in the band 12.5 - 12.75 GHz in Region 3 is limited to community reception with a power flux-density not exceeding -111 dB(W/m^2) as defined in Annex **5** of Appendix **30 (Orb-85)**. See also Resolution **34**.

848 *Additional allocation:* in Algeria, Angola, Saudi Arabia, Bahrain, Cameroon, the Central African Republic, the Congo, the Ivory Coast, Egypt, the United Arab Emirates, Ethiopia, Gabon, Ghana, Guinea, Iraq, Israel, Jordan, Kenya, Kuwait, the Lebanon, Libya, Madagascar, Mali, Morocco, Mongolia, Niger, Nigeria, Qatar, Syria, Senegal, Somalia, Sudan, Chad, Togo, Yemen (P.D.R. of) and Zaire, the band 12.5 - 12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis.

849 *Additional allocation:* in the Federal Republic of Germany, Belgium, Denmark, Spain, Finland, France, Greece, Liechtenstein, Luxembourg, Monaco, Norway, Uganda, the Netherlands, Portugal, Roumania, Sweden, Switzerland, Tanzania, Tunisia and Yugoslavia, the band 12.5 - 12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis.

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* *Note by the General Secretariat:* See *Note* relating to No. **838**.

850 *Additional allocation:* in Austria, Bulgaria, Hungary, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the band 12.5 - 12.75 GHz is also allocated to the fixed service and the mobile, except aeronautical mobile, service on a primary basis. However, stations in these services shall not cause harmful interference to fixed-satellite service earth stations of countries in Region 1 other than those mentioned in this footnote. Coordination of these earth stations is not required with stations of the fixed and mobile services of the countries mentioned in this footnote. The power flux-density limit at the Earth's surface given in No. **2574** for the fixed-satellite service shall apply on the territory of the countries mentioned in this footnote.

GHz
12.75 – 14.4

Allocation to Services		
Region 1	Region 2	Region 3
12.75 – 13.25	FIXED FIXED-SATELLITE (Earth-to-space) 792A MOBILE Space Research (deep space) (space-to-Earth)	
13.25 – 13.4	AERONAUTICAL RADIONAVIGATION 851 852 853	
13.4 – 14	RADIOLOCATION Standard Frequency and Time Signal-Satellite (Earth-to-space) Space Research 713 853 854 855	
14 – 14.25	FIXED-SATELLITE (Earth-to-space) 858 RADIONAVIGATION 856 Space Research 857 859	
14.25 – 14.3	FIXED-SATELLITE (Earth-to-space) 858 RADIONAVIGATION 856 Space Research 857 859 860 861	
14.3 – 14.4 FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Radionavigation-Satellite 859	**14.3 – 14.4** FIXED-SATELLITE (Earth-to-space) 858 Radionavigation-Satellite 859	**14.3 – 14.4** FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Radionavigation-Satellite 859

851 The use of the band 13.25 - 13.4 GHz by the aeronautical radionavigation service is limited to Doppler navigation aids.

852 Subject to agreement obtained under the procedure set forth in Article **14**, the band 13.25 - 13.4 GHz may also be used in the space research service (Earth-to-space) on a secondary basis.

853 *Additional allocation:* in Bangladesh, India and Pakistan, the band 13.25 - 14 GHz is also allocated to the fixed service on a primary basis.

854 *Additional allocation:* in Afghanistan, Algeria, Angola, Saudi Arabia, Bahrain, Cameroon, the Republic of Korea, Egypt, the United Arab Emirates, Finland, Gabon, Guinea, Indonesia, Iran, Iraq, Israel, Jordan, Kuwait, the Lebanon, Madagascar, Malaysia, Malawi, Mali, Malta, Morocco, Mauritania, Niger, Nigeria, Pakistan, Qatar, Syria, Senegal, Singapore, Sudan, Sri Lanka, Sweden, Chad, Thailand and Tunisia, the band 13.4 - 14 GHz is also allocated to the fixed and mobile services on a primary basis.

855 *Additional allocation:* in Austria, Bulgaria, Hungary, Japan, Mongolia, Poland, the German Democratic Republic, Roumania, the United Kingdom, Czechoslovakia and the U.S.S.R., the band 13.4 - 14 GHz is also allocated to the radionavigation service on a primary basis.

856 The use of the band 14 - 14.3 GHz by the radionavigation service shall be such as to provide sufficient protection to space stations of the fixed-satellite service (see Recommendation **708**).

857 *Additional allocation:* in Afghanistan, Algeria, Angola, Saudi Arabia, Australia, Bahrain, Bangladesh, Botswana, Cameroon, China, the Republic of Korea, Egypt, the United Arab Emirates, Gabon, Guatemala, Guinea, India, Indonesia, Iran, Iraq, Israel, Japan, Kenya, Kuwait, Lesotho, the Lebanon, Malaysia, Malawi, Mali, Malta, Morocco, Mauritania, Niger, Pakistan, the Philippines, Qatar, Syria, Senegal, Singapore, Somalia, Sudan, Sri Lanka, Swaziland, Tanzania, Chad, Thailand and Yemen (P.D.R. of), the band 14 - 14.3 GHz is also allocated to the fixed service on a primary basis.

858 **Orb-88** The band 14 - 14.5 GHz may be used, within the fixed-satellite service (Earth-to-space), for feeder links for the broadcasting-satellite service, subject to coordination with other networks in the fixed-satellite service. Such use of feeder links is reserved for countries outside Europe.

859 The band 14 - 14.5 GHz is also allocated to the land mobile-satellite service (Earth-to-space) on a secondary basis.

860 *Additional allocation:* in the Federal Republic of Germany, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Ireland, Iceland, Italy, Jordan, Libya, Liechtenstein, Luxembourg, Norway, the Netherlands, Portugal, the United Kingdom, Sweden, Switzerland, Turkey and Yugoslavia, the band 14.25 - 14.3 GHz is also allocated to the fixed service on a primary basis.

861 *Additional allocation:* in Japan, Pakistan, the United Kingdom and Thailand, the band 14.25 - 14.3 GHz is also allocated to the mobile, except aeronautical mobile, service on a primary basis.

GHz
14.4 – 16.6

Allocation to Services		
Region 1	Region 2	Region 3
14.4 – 14.47	FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Space Research (space-to-Earth) 859	
14.47 – 14.5	FIXED FIXED-SATELLITE (Earth-to-space) 858 MOBILE except aeronautical mobile Radio Astronomy 859 862	
14.5 – 14.8	FIXED FIXED-SATELLITE (Earth-to-space) 863 MOBILE Space Research	
14.8 – 15.35	FIXED MOBILE Space Research 720	
15.35 – 15.4	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 864 865	
15.4 – 15.7	AERONAUTICAL RADIONAVIGATION 733 797	
15.7 – 16.6	RADIOLOCATION 866 867	

862 In making assignments to stations of other services to which the band 14.47 - 14.5 GHz is allocated, administrations are urged to take all practicable steps to protect spectral line observations of the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

863 **Orb-88** The use of the band 14.5 - 14.8 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. This use is reserved for countries outside Europe.

864 All emissions in the band 15.35 - 15.4 GHz are prohibited, except those provided for by No. **865**.

865 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Cameroon, Egypt, the United Arab Emirates, Guinea, Iran, Iraq, Israel, Kuwait, the Lebanon, Libya, Pakistan, Qatar, Syria, Somalia and Yugoslavia, the band 15.35 - 15.4 GHz is also allocated to the fixed and mobile services on a secondary basis.

866 *Additional allocation:* in Afghanistan, Algeria, Angola, Saudi Arabia, Austria, Bahrain, Bangladesh, Cameroon, Costa Rica, Egypt, El Salvador, the United Arab Emirates, Finland, Guatemala, India, Indonesia, Iran, Kuwait, Libya, Malaysia, Malawi, Malta, Morocco, Mozambique, Nepal, Nicaragua, Oman, Pakistan, Qatar, Singapore, Somalia, Sudan, Sri Lanka, Sweden, Tanzania, Chad, Thailand, Yemen (P.D.R. of) and Yugoslavia, the band 15.7 - 17.3 GHz is also allocated to the fixed and mobile services on a primary basis.

867 *Additional allocation:* in Israel, the band 15.7 - 17.3 GHz is also allocated to the fixed and mobile services on a primary basis. These services shall not claim protection from or cause harmful interference to services operating in accordance with the Table in countries other than those included in No. **866**.

GHz
16.6 – 18.8

Allocation to Services		
Region 1	Region 2	Region 3
16.6 – 17.1	RADIOLOCATION Space Research (deep space) (Earth-to-space) 866 867	
17.1 – 17.2	RADIOLOCATION 866 867	
17.2 – 17.3	RADIOLOCATION Earth Exploration-Satellite (active) Space Research (active) 866 867	
17.3 – 17.7	FIXED-SATELLITE (Earth-to-space) 869 Radiolocation 868	
17.7 – 18.1	FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 869 MOBILE	
18.1 – 18.6	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE 870	
18.6 – 18.8 FIXED FIXED-SATELLITE (space-to-Earth) 872 MOBILE except aeronautical mobile Earth Exploration-Satellite (passive) Space Research (passive) 871	18.6 – 18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 872 MOBILE except aeronautical mobile SPACE RESEARCH (passive) 871	18.6 – 18.8 FIXED FIXED SATELLITE (space-to-Earth) 872 MOBILE except aeronautical mobile Earth Exploration-Satellite (passive) Space Research (passive) 871

868 Orb-88 *Additional allocation:* in Afghanistan, Algeria, the Federal Republic of Germany, Angola, Saudi Arabia, Austria, Bahrain, Bangladesh, Cameroon, Costa Rica, El Salvador, the United Arab Emirates, Finland, Guatemala, Honduras, India, Indonesia, the Islamic Republic of Iran, Iraq, Israel, Japan, Kuwait, Libya, Nepal, Nicaragua, Oman, Pakistan, Qatar, Sudan, Sri Lanka, Sweden, Thailand and Yugoslavia, the band 17.3 - 17.7 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits given in Nos. **2505** and **2508** shall apply.

869 Orb-85 The use of the band 17.3 - 18.1 GHz by the fixed-satellite service (Earth-to-space) is limited to feeder links for the broadcasting-satellite service. For the use of the band 17.3 - 17.8 GHz in Region 2 by the feeder links for the broadcasting-satellite service in the band 12.2 - 12.7 GHz, see Article **15A**.

870 The band 18.1 - 18.3 GHz is also allocated to the meteorological-satellite service (space-to-Earth) on a primary basis. Its use is limited to geostationary satellites and shall be in accordance with the provisions of No. **2578**.

871 In making assignments to stations in the fixed and mobile services, administrations are invited to take account of passive sensors in the earth-exploration satellite and space research services operating in the band 18.6 - 18.8 GHz. In this band, administrations should endeavour to limit as far as possible both the power delivered by the transmitter to the antenna and the e.i.r.p. in order to reduce the risk of interference to passive sensors to the minimum.

872 In assigning frequencies to stations in the fixed-satellite service in the direction space-to-Earth, administrations are requested to limit as far as practicable the power flux-density at the Earth's surface in the band 18.6 - 18.8 GHz, in order to reduce the risk of interference to passive sensors in the earth exploration-satellite and space research services.

GHz
18.8 – 22.5

Allocation to Services		
Region 1	Region 2	Region 3
18.8 – 19.7	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	
19.7 – 20.2	FIXED-SATELLITE (space-to-Earth) Mobile-Satellite (space-to-Earth) 873	
20.2 – 21.2	FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Standard Frequency and Time Signal-Satellite (space-to-Earth) 873	
21.2 – 21.4	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive)	
21.4 – 22	FIXED MOBILE	
22 – 22.21	FIXED MOBILE except aeronautical mobile 874	
22.21 – 22.5	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 875 876	

873 *Additional allocation:* in Afghanistan, Algeria, Angola, Saudi Arabia, Bahrain, Bangladesh, Brazil, Cameroon, China, the Congo, the Republic of Korea, Costa Rica, Egypt, the United Arab Emirates, Gabon, Guatemala, Guinea, India, Indonesia, Iran, Iraq, Israel, Japan, Kenya, Kuwait, Malaysia, Mali, Morocco, Mauritania, Nepal, Niger, Nigeria, Pakistan, the Philippines, Qatar, Syria, Singapore, Somalia, Sudan, Sri Lanka, Tanzania, Chad, Thailand, Togo, Tunisia and Zaire, the band 19.7 - 21.2 GHz is also allocated to the fixed and mobile services on a primary basis. This additional use shall not impose any limitation on the power flux-density of space stations in the fixed-satellite service.

874 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service in the band 22.01 - 22.21 GHz from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see also Nos. **343** and **344** and Article **36**).

875 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference in the band 22.21 - 22.5 GHz. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see also Nos. **343** and **344** and Article **36**).

876 The use of the band 22.21 - 22.5 GHz by the earth exploration-satellite (passive) and space research (passive) services shall not impose constraints upon the fixed and mobile, except aeronautical mobile, services.

GHz
22.5 – 24.25

Allocation to Services		
Region 1	Region 2	Region 3
22.5 – 22.55 FIXED MOBILE	22.5 – 22.55 FIXED MOBILE BROADCASTING-SATELLITE 877 878	
22.55 – 23 FIXED INTER-SATELLITE MOBILE 879	22.55 – 23 FIXED INTER-SATELLITE MOBILE BROADCASTING-SATELLITE 877 878 879	
23 – 23.55	FIXED INTER-SATELLITE MOBILE 879	
23.55 – 23.6	FIXED MOBILE	
23.6 – 24	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 880	
24 – 24.05	AMATEUR AMATEUR-SATELLITE 881	
24.05 – 24.25	RADIOLOCATION Amateur Earth Exploration-Satellite (active) 881	

877 In Regions 2 and 3, the broadcasting-satellite service is authorized in the band 22.5 - 23 GHz, subject to agreement obtained under the procedure set forth in Article **14**.

878 *Additional allocation:* in Japan, the band 22.5 - 23 GHz is also allocated to the broadcasting service on a primary basis.

879 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service in the bands 22.81 - 22.86 GHz and 23.07 - 23.12 GHz from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see also Nos. **343** and **344** and Article **36**).

880 All emissions in the band 23.6 - 24 GHz are prohibited.

881 The band 24 - 24.25 GHz (centre frequency 24.125 GHz) is designated for industrial, scientific and medical (ISM) applications. Radiocommunication services 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. **1815**.

GHz
24.25 – 31.3

Allocation to Services		
Region 1	Region 2	Region 3
24.25 – 25.25	RADIONAVIGATION	
25.25 – 27	FIXED MOBILE Earth Exploration-Satellite (space-to-space) Standard Frequency and Time Signal-Satellite (Earth-to-space)	
27 – 27.5 FIXED MOBILE Earth Exploration-Satellite (space-to-space)	**27 – 27.5** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Earth Exploration-Satellite (space-to-space)	
27.5 – 29.5	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	
29.5 – 30	FIXED-SATELLITE (Earth-to-space) Mobile-Satellite (Earth-to-space) 882 883	
30 – 31	FIXED-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) Standard Frequency and Time Signal-Satellite (space-to-Earth) 883	
31 – 31.3	FIXED MOBILE Standard Frequency and Time Signal-Satellite (space-to-Earth) Space Research 884 885 886	

882 The band 29.95 - 30 GHz may be used for space-to-space links in the earth exploration-satellite service for telemetry, tracking, and control purposes, on a secondary basis.

883 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Cameroon, China, the Republic of Korea, the United Arab Emirates, Ethiopia, India, Indonesia, Iran, Iraq, Israel, Japan, Kenya, Kuwait, the Lebanon, Malaysia, Mali, Morocco, Mauritania, Nepal, Pakistan, Qatar, Syria, Singapore, Somalia, Sudan, Sri Lanka, Chad and Thailand, the band 29.5 - 31 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits specified in Nos. **2505** and **2508** shall apply.

884 Orb-88 In the band 31 - 31.3 GHz the power flux-density limits specified in No. **2582** shall apply to the space research service.

885 *Different category of service:* in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the allocation of the band 31 - 31.3 GHz to the space research service is on a primary basis (see No. **425**).

886 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference in the band 31.2 - 31.3 GHz. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

GHz
31.3 – 33.4

Allocation to Services		
Region 1	Region 2	Region 3
31.3 – 31.5	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 887	
31.5 – 31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 888 889	31.5 – 31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 888	31.5 – 31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 888
31.8 – 32	RADIONAVIGATION Space Research 890 891 892	
32 – 32.3	INTER-SATELLITE RADIONAVIGATION Space Research 890 891 892 893	
32.3 – 33	INTER-SATELLITE RADIONAVIGATION 892 893	
33 – 33.4	RADIONAVIGATION 892	

887 All emissions in the band 31.3 - 31.5 GHz are prohibited.

888 In Regions 1 and 3, in making assignments to stations of other services to which the band 31.5 - 31.8 GHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

In Region 2, all emissions in the band 31.5 - 31.8 GHz are prohibited.

889 *Different category of service:* in Bulgaria, Egypt, Hungary, Mongolia, Poland, the German Democratic Republic, Roumania, Czecholovakia and the U.S.S.R., the allocation of the band 31.5 - 31.8 GHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. **425**).

890 *Different category of service:* in Australia, Spain and the United States, the allocation of the band 31.8 - 32.3 GHz to the space research service (deep space) in the space-to-Earth direction is on a primary basis (see No. **425**). This use shall not impose power flux-density constraints on the inter-satellite service in the band 32 - 32.3 GHz.

891 *Different category of service:* in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the allocation of the band 31.8 - 32.33 GHz to the space research service is on a primary basis (see No. **425**).

892 Subject to agreement obtained under the procedure set forth in Article **14**, the band 31.8 - 33.8 GHz may also be used in Japan for space-to-Earth transmissions in the fixed-satellite service up to 31 December 1990.

893 In designing systems for the inter-satellite and radionavigation services in the band 32 - 33 GHz, administrations shall take all necessary measures to prevent harmful interference between these two services, bearing in mind the safety aspects of the radionavigation service (see Recommendation **707**).

GHz
33.4 – 40.5

Allocation to Services		
Region 1	Region 2	Region 3
33.4 – 34.2	RADIOLOCATION 892 894	
34.2 – 35.2	RADIOLOCATION Space Research 895 896 894	
35.2 – 36	METEOROLOGICAL AIDS RADIOLOCATION 894 897	
36 – 37	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) 898	
37 – 37.5	FIXED MOBILE 899	
37.5 – 39.5	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE 899	
39.5 – 40.5	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	

894 *Additional allocation:* in Afghanistan, Saudi Arabia, Bahrain, Bangladesh, Egypt, the United Arab Emirates, Spain, Finland, Gabon, Guinea, Indonesia, Iran, Iraq, Israel, Kenya, Kuwait, the Lebanon, Libya, Malaysia, Malawi, Mali, Malta, Morocco, Mauritania, Nepal, Niger, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syria, Senegal, Singapore, Somalia, Sudan, Sri Lanka, Sweden, Tanzania, Thailand, Togo, Tunisia, Yemen A.R. and Zaire, the band 33.4 - 36 GHz is also allocated to the fixed and mobile services on a primary basis.

895 *Different category of service:* in Australia, Spain and the United States, the allocation of the band 34.2 - 34.7 GHz to the space research (deep space) (Earth-to-space) service is on a primary basis (see No. **425**).

896 *Different category of service:* in Bulgaria, Cuba, Hungary, Mongolia, Poland, the German Democratic Republic, Czechoslovakia and the U.S.S.R., the allocation of the band 34.2 - 35.2 GHz to the space research service is on a primary basis (see No. **425**).

897 Radars located on spacecraft may be operated on a primary basis in the band 35.5 - 35.6 GHz.

898 In making assignments to stations of other services, administrations are urged to take all practicable steps to protect the spectral line observations of the radio astronomy service in the band 36.43 - 36.5 GHz from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

899 Subject to agreement obtained under the procedure set forth in Article **14**, the band 37 - 39 GHz may also be used in Japan for Earth-to-space transmissions in the fixed-satellite service up to 31 December 1990.

GHz
40.5 – 51.4

Allocation to Services		
Region 1	Region 2	Region 3
40.5 – 42.5	BROADCASTING-SATELLITE /BROADCASTING/ Fixed Mobile	
42.5 – 43.5	FIXED FIXED-SATELLITE (Earth-to-space) 901 MOBILE except aeronautical mobile RADIO ASTRONOMY 900	
43.5 – 47	MOBILE 902 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE 903	
47 – 47.2	AMATEUR AMATEUR-SATELLITE	
47.2 – 50.2	FIXED FIXED-SATELLITE (Earth-to-space) 901 MOBILE 905 904	
50.2 – 50.4	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive)	
50.4 – 51.4	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Mobile-Satellite (Earth-to-space)	

900 In making assignments to stations of other services to which the band 42.5 - 43.5 GHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference, especially in the bands 42.77 - 42.87 GHz, 43.07 - 43.17 GHz, and 43.37 - 43.47 GHz, which are used for spectral line observations of silicon monoxide. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

901 The allocation of the spectrum for the fixed-satellite service in the bands 42.5 - 43.5 GHz and 47.2 - 50.2 GHz for Earth-to-space transmission is greater than that in the band 37.5 - 39.5 GHz for space-to-Earth transmission in order to accommodate feeder links to broadcasting satellites. Administrations are urged to take all praticable steps to reserve the band 47.2 - 49.2 GHz for feeder links for the broadcasting-satellite service operating in the band 40.5 - 42.5 GHz.

902 In the bands 43.5 - 47 GHz, 66 - 71 GHz, 95 - 100 GHz, 134 - 142 GHz, 190 - 200 GHz and 252 - 265 GHz, stations in the land mobile service may be operated subject to not causing harmful interference to the space radiocommunication services to which these bands are allocated (see No. **435**).

903 In the bands 43.5 - 47 GHz, 66 - 71 GHz, 95 -100 GHz, 134 - 142 GHz, 190 - 200 GHz and 252 - 265 GHz, satellite links connecting land stations at specified fixed points are also authorized when used in conjunction with the mobile-satellite service or the radionavigation-satellite service.

904 The bands 48.94 - 49.04 GHz and 97.88 - 98.08 GHz, are also allocated to the radio astronomy service on a primary basis for spectral line observations. In making assignments to stations of other services to which these bands are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne strations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

905 In the band 48.94 - 49.04 GHz, all emissions from airborne stations are prohibited.

GHz
51.4 – 66

Allocation to Services		
Region 1	Region 2	Region 3
51.4 – 54.25	EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 906 907	
54.25 – 58.2	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE 909 SPACE RESEARCH (passive) 908	
58.2 – 59	EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 906 907	
59 – 64	FIXED INTER-SATELLITE MOBILE 909 RADIOLOCATION 910 911	
64 – 65	EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 906 907	
65 – 66	EARTH EXPLORATION-SATELLITE SPACE RESEARCH Fixed Mobile	

906 In the bands 51.4 - 54.25 GHz, 58.2 - 59 GHz, 64 - 65 GHz and 72.77 - 72.91 GHz, radio astronomy observations may be carried out under national arrangements. Administrations are urged to take all practicable steps to protect radio astronomy observations in these bands from harmful interference.

907 In the bands 51.4 - 54.25 GHz, 58.2 - 59 GHz, 64 - 65 GHz, 86 - 92 GHz, 105 - 116 GHz and 217 – 231 GHz, all emissions are prohibited.

908 *Additional allocation:* in the Federal Republic of Germany, Japan and the United Kingdom, the band 54.25 - 58.2 GHz is also allocated to the radiolocation service on a primary basis.

909 In the bands 54.25 - 58.2 GHz, 59 - 64 GHz, 116 - 134 GHz, 170 - 182 GHz and 185 - 190 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **435**).

910 In the bands 59 - 64 GHz and 126 - 134 GHz, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. **435**).

911 The band 61 - 61.5 GHz (centre frequency 61.25 GHz) is designated for industrial, scientific and medical (ISM) applications. The use of this frequency band 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 CCIR Recommendations.

GHz
66 – 86

Allocation to Services		
Region 1	Region 2	Region 3
66 – 71	MOBILE 902 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE 903	
71 – 74	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) 906	
74 – 75.5	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	
75.5 – 76	AMATEUR AMATEUR-SATELLITE	
76 – 81	RADIOLOCATION Amateur Amateur-Satellite 912	
81 – 84	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	
84 – 86	FIXED MOBILE BROADCASTING BROADCASTING-SATELLITE 913	

912 In the band 78 - 79 GHz radars located on space stations may be operated on a primary basis in the earth exploration-satellite service and in the space research service.

913 In the band 84 - 86 GHz, stations in the fixed, mobile and broadcasting services shall not cause harmful interference to broadcasting-satellite stations operating in accordance with the decisions of the appropriate frequency assignment planning conference for the broadcasting-satellite service.

GHz
86 – 116

Allocation to Services		
Region 1	Region 2	Region 3
86 – 92	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 907	
92 – 95	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIOLOCATION 914	
95 – 100	MOBILE 902 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation 903 904	
100 – 102	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) 722	
102 – 105	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE 722	
105 – 116	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 722 907	

914 The band 93.07 - 93.27 GHz is also used by the radio astronomy service for spectral line observations. In making assignments to stations of the services to which this band is allocated, administrations are urged to take all practicable steps to protect radio astronomy observations from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

GHz
116 – 151

Allocation to Services		
Region 1	Region 2	Region 3
116 – 126	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE 909 SPACE RESEARCH (passive) 722 915 916	
126 – 134	FIXED INTER-SATELLITE MOBILE 909 RADIOLOCATION 910	
134 – 142	MOBILE 902 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE Radiolocation 903 917 918	
142 – 144	AMATEUR AMATEUR-SATELLITE	
144 – 149	RADIOLOCATION Amateur Amateur-Satellite 918	
149 – 150	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	
150 – 151	EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE SPACE RESEARCH (passive) 919	

915 The band 119.98 - 120.02 GHz is also allocated to the amateur service on a secondary basis.

916 The band 122 - 123 GHz (centre frequency 122.5 GHz) is designated for industrial, scientific and medical (ISM) applications. The use of this frequency band 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 CCIR Recommendations.

917 In the band 140.69 - 140.98 GHz all emissions from airborne stations, and from space stations in the space-to-Earth direction, are prohibited.

918 The bands 140.69 - 140.98 GHz, 144.68 - 144.98 GHz, 145.45 - 145.75 GHz and 146.82 - 147.12 GHz are also allocated to the radio astronomy service on a primary basis for spectral line observations. In making assignments to stations of other services to which the bands are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

919 The bands 150 - 151 GHz, 174.42 - 175.02 GHz, 177 - 177.4 GHz, 178.2 - 178.6 GHz, 181 - 181.46 GHz and 186.2 - 186.6 GHz are also allocated to the radio astronomy service on a secondary basis for spectral line observations. In making assignments to stations of other services to which these bands are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

GHz
151 – 185

Allocation to Services		
Region 1	Region 2	Region 3
151 – 164	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE	
164 – 168	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)	
168 – 170	FIXED MOBILE	
170 – 174.5	FIXED INTER-SATELLITE MOBILE 909 919	
174.5 – 176.5	EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE MOBILE 909 SPACE RESEARCH (passive) 919	
176.5 – 182	FIXED INTER-SATELLITE MOBILE 909 919	
182 – 185	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 920 921	

920 *Additional allocation:* in the United Kingdom, the band 182 - 185 GHz is also allocated to the fixed and mobile services on a primary basis.

921 In the band 182 - 185 GHz all emissions are prohibited except for those under the provisions of No. **920**.

GHz
185 – 235

Allocation to Services		
Region 1	Region 2	Region 3
185 – 190	FIXED INTER-SATELLITE MOBILE 909 919	
190 – 200	MOBILE 902 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE 722 903	
200 – 202	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) 722	
202 – 217	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 722	
217 – 231	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 722 907	
231 – 235	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	

GHz
235 – 400

Allocation to Services		
Region 1	Region 2	Region 3
235 – 238	EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) MOBILE SPACE RESEARCH (passive)	
238 – 241	FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation	
241 – 248	RADIOLOCATION Amateur Amateur-Satellite 922	
248 – 250	AMATEUR AMATEUR-SATELLITE	
250 – 252	EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 923	
252 – 265	MOBILE 902 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE 903 923 924 925	
265 – 275	FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY 926	
275 – 400	(Not allocated) 927	

922 The band 244 - 246 GHz (centre frequency 245 GHz) is designated for industrial, scientific and medical (ISM) applications. The use of this frequency band 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 CCIR Recommendations.

923 The bands 250 - 251 GHz and 262.24 - 262.76 GHz are also allocated to the radio astronomy service on a primary basis for spectral line observations. In making assignments to stations of other services to which these bands are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

924 The band 257.5 - 258 GHz is also allocated to the radio astronomy service on a secondary basis for spectral line observations. In making assignments to stations of other services to which the band is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

925 In the Federal Republic of Germany, Argentina, Spain, Finland, France, India, Italy, the Netherlands and Sweden, the band 261 - 265 GHz is also allocated to the radio astronomy service on a primary basis. In making assignments to stations of other services to which the band is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

926 In making assignments to stations of other services to which the band 265 - 275 GHz is allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference, especially in the bands 265.64 - 266.16 GHz, 267.34 - 267.86 GHz and 271.74 - 272.26 GHz, which are used for spectral line observations. Emissions from space or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. **343** and **344** and Article **36**).

927 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:

- radio astronomy service: 278 - 280 GHz and 343 - 348 GHz;

- space research service (passive) and earth exploration-satellite service (passive): 275 - 277 GHz, 300 - 302 GHz, 324 - 326 GHz, 345 - 347 GHz, 363 - 365 GHz and 379 - 381 GHz.

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 administrative radio conference.

928 to **952** NOT allocated.