World Radiocommunication Seminar
Geneva, 12-16 December 2016

INTERNATIONAL TELECOMMUNICATION UNION

Source: Document WRS10/2

Document WRS16/9-E
31 October 2016
Original: English

Terrestrial Services Department

TERRESTRIAL SERVICES IN BANDS SHARED WITH SPACE SERVICES

1 Introduction

As frequency spectrum is a limited natural resource it is often that two or more radiocommunication services have to use the same frequency band, in which case the concerned allocations are called shared bands. One example is frequency bands shared between terrestrial and space services. The principle of sharing is applied to enable efficient and effective operation of all radiocommunication services bearing in mind that radio frequencies and in this case, the geostationary-satellite orbit, are limited and that they must be used rationally, efficiently and economically.

These basic and very simple principles are defined in numerous parts of the ITU Radio Regulations (RR) and other texts of an international regulatory nature.

Many parts of the RR deal with provisions on frequency sharing between terrestrial and space services, and the relevant coordination, notification and recording procedures for frequency assignments. The following summarizes some basic regulatory and technical principles of these rather complex procedures.

2 Frequency allocation aspects

Terrestrial services sharing the same frequency band with the space services are listed either in the Table of Frequency Allocations of Article **5** of the RR or in one of the footnotes to Article **5**. Terrestrial services can have either primary or secondary category of service. Depending on the geographical area, shared allocations having primary category of service for both terrestrial and space services could be divided into three different categories: worldwide, regional or sub-regional allocations.

In the case of worldwide primary service terrestrial allocations, they can be used in designated frequency bands throughout the whole world with equal rights as space services and are subjected to the relevant conditions applicable to sharing with space services. One example of that kind is the frequency band from 7 550 MHz to 7 750 MHz.

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

Subregional allocations are usually allocated to terrestrial services by means of the footnote of Article **5** of the RR. In cases like this, terrestrial services can be used only in the geographical area indicated in the relevant footnote. In addition, if these allocations are shared with the space services, the terrestrial services are also subjected to the relevant conditions applicable to sharing with space services. One example is the frequency band 14 GHz to 14.25 GHz, where this band is allocated to the terrestrial services on a primary basis only for the countries indicated in footnote No. **5.505**.

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

3 Coordination aspects

One of the main purposes of the international radio regulatory procedures is to enable implementation of new radiocommunication systems while avoiding harmful interference with the other existing and planned users. For this reason the procedure for coordinating the use of frequencies in the non-planned bands represents the basic element of the international radio regulatory arrangement. To facilitate the coordination process, both the RR and ITU-R Recommendations provide additional help and guidance to administrations.

3.1 Special agreements

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

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

3.2 Special terms and definitions concerning coordination

The most important definitions that are applicable to terrestrial stations in bands shared with space services are as follows:

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

1.172 *coordination contour:* The line enclosing the *coordination area*.

1.173 *coordination distance:* When determining the need for coordination, the distance on a given azimuth from an *earth station* sharing the same frequency band with *terrestrial station*s, or from a transmitting *earth station* sharing the same bidirectionally allocated frequency band with receiving *earth station*s, beyond which the level of *permissible interference* will not be exceeded and coordination is therefore not required.

The term *permissible interference*, that is used in the coordination of frequency assignments between administrations, refers to the observed or predicted *interference* which complies with quantitative *interference* and sharing criteria contained in the RR or in ITU-R Recommendations or in special agreements.

3.3 Particular provisions for coordination in the shared bands

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

– No. **9.16**: for a transmitting station of a terrestrial service for which the requirement to coordinate is included in a footnote to the Table of Frequency Allocations referring to No. **9.11A** and which is located within the coordination area of an earth station in a non-geostationary-satellite network;

– No. **9.18**: for any transmitting station of a terrestrial service in frequency bands above 100 MHz allocated with equal rights to space and terrestrial services within the coordination area of an earth station, in respect of this earth station, with the exception of the coordination under Nos. **9.16** and **9.19**;

– No. **9.19**: for any transmitting station of a terrestrial service in a frequency band shared on an equal primary basis with the broadcasting-satellite service, with respect to typical earth stations included in the service area of a space station in the broadcasting-satellite service;

– No. **9.21**: for any station of a service for which the requirement to seek the agreement of other administrations is included in a footnote to the Table of Frequency Allocations referring to No. **9.21** (such as footnotes Nos. **5.410** and **5.447**).

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

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

The provision No. **9.19** relates to the requirements of coordination between transmitting terrestrial stations and BSS earth stations. To date, there is no ITU-R Recommendation defining the power flux-density level produced by the terrestrial stations at the edge of the service area of non-planned BSS to be used for triggering the coordination. Until such time that a calculation method and technical criteria are included in the relevant ITU-R Recommendations, in applying this provision, for the identification of the affected administration, the Bureau, in addition to the frequency overlap examination, also uses, on a provisional basis, the power flux-density limits in the nearest frequency band(s), where available.

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

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

3.3.1 Identification of administrations with which coordination is to be effected

For the purpose of effecting coordination of a terrestrial station under Article **9** of the RR, except in the case under No. **9.21**, and for identifying the administrations with which coordination is to be effected, the frequency assignments to be taken into account are those in the same frequency band as the terrestrial station, pertaining to a space service to which the band is allocated with equal rights or a higher category of service, which might affect or be affected, as appropriate, and which are identified using the method described in Appendix **5** of the Radio Regulations.

For the application of No. **9.21**, the agreement of an administration may be required with respect to the frequency assignments in the same frequency band as the planned terrestrial assignment, pertaining to the same service or to another service to which the band is allocated with equal rights or a higher category of service, which may affect or be affected, as appropriate, and which are identified using the method described in Appendix **5** of the RR.

For each of the frequency assignments to a station of a terrestrial or space radiocommunication service referred to above, the level of interference shall be determined using the method referred to in Table **5-1** of Appendix **5** to the RR which is appropriate to the particular case.

No coordination of a terrestrial assignment is required in cases such as:

- when the use of a new frequency assignment will not cause or suffer, as appropriate, in respect of any service of another administration, an increase in the level of interference above the threshold calculated in accordance with the method referred to in Table **5-1**; or
- when the characteristics of a new or modified frequency assignment are within the limits of those of a frequency assignment which has previously been coordinated; or
- to change the characteristics of an existing assignment in such a way as not to increase the interference to or from, as appropriate, the assignments of other administrations; or
- to bring into use an assignment to a terrestrial station which is located, in relation to an earth station, outside the coordination area of that earth station; or
- to bring into use an assignment to a terrestrial station within the coordination area of an earth station, provided that the proposed assignment to a terrestrial station is outside any part of a frequency band coordinated for reception by that earth station.

Parts of Table **5-1** applicable to the coordination of terrestrial services are presented below.

TABLE

Methods for identifying the level of interference

Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/ condition	Calculation method	Remarks
No. **9.16** Terrestrial/ non-GSO	A transmitting station in a terrestrial service within the coordination area of an earth station in a non-GSO satellite network in frequency bands for which a footnote refers to No. **9.11A**	Frequency bands for which a footnote refers to No. **9.11A**	Transmitting terrestrial station is situated within the coordination area of a receiving earth station		The coordination area of the affected earth station has already been determined using the method of Appendix **7**
No. **9.18** Terrestrial/ GSO, non-GSO	Any transmitting station of a terrestrial service in the bands referred to in No. **9.17** within the coordination area of an earth station, in respect of this earth station, with the exception of the coordination under Nos. **9.16** and **9.19**	Any frequency band allocated to a space service	Transmitting terrestrial station is situated within the coordination area of a receiving earth station	See Remarks column	The coordination area of the affected earth station has already been determined using the calculation method of No. **9.17**
No. **9.19** Terrestrial GSO, non-GSO/ GSO, non-GSO	Any transmitting station of a terrestrial service or a transmitting earth station in the FSS (Earth-to-space) in a frequency band shared on an equal primary basis with the BSS, with respect to typical earth stations included in the service area of a space station in the BSS	620-790 MHz (see Resolution **549 (WRC-07)**) 1 452-1 492 MHz 2 310-2 360 MHz (terrestrial services in all three Regions in respect of BSS allocation in No. **5.393**) 2 520-2 670 MHz (see No. **5.416**) 11.7-12.7 GHz (see Article **6** of Appendix **30**) 12.5-12.7 GHz (terrestrial services in Nos.	i) Necessary bandwidths overlap; and ii) the pfd of the interfering station at the edge of the BSS service area exceeds the permissible level	Check by using the assigned frequencies and bandwidths	See also Article **6** of Appendix **30**

Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/ condition	Calculation method	Remarks
		5.494 and **5.496** as well as in Regions 2 and 3, or transmitting earth station in the FSS (Earth-to-space) in Region 1, in respect of BSS allocation in Region 3) 12.7-12.75 GHz (terrestrial services in Nos. **5.494** and **5.496** as well as in Regions 2 and 3, or transmitting earth station in the FSS (Earth-to-space) in Regions 1 and 2, in respect of BSS allocation in Region 3) 17.7-17.8 GHz (terrestrial services in all three Regions in respect of BSS allocation in Region 2) 17.3-17.8 GHz (transmitting earth stations in the FSS (Earth-to-space) in respect of BSS allocation in Region 2) (see Article **4** of Appendix **30A**) 40.5-42.5 GHz 74-76 GHz			

Reference of Article 9	Case	Frequency bands (and Region) of the service for which coordination is sought	Threshold/ condition	Calculation method	Remarks
No. **9.21** Terrestrial, GSO, non-GSO/ terrestrial, GSO, non-GSO	A station of a service for which the requirement to obtain the agreement of other administrations is included in a footnote to the Table of Frequency Allocations referring to No. **9.21**	Band(s) indicated in the relevant footnote	Incompatibility established by the use of Appendices **7**, **8**, technical Annexes of Appendices **30**, **30A**, pfd values specified in some of the footnotes, other technical provisions of the Radio Regulations or ITU-R Recommendations, as appropriate	Methods specified in, or adapted from, Appendices **7**, **8**, **30**, **30A**, other technical provisions of the Radio Regulations or ITU-R Recommend-ations	

3.3.2 Methods for the determination of the coordination area

Appendix **7** to the RR contains procedures and system parameters for calculating an earth station's coordination area, including predetermined distances for the frequency bands between 100 MHz and 105 GHz.

The procedures allow the determination of a distance in all azimuthal directions around a transmitting or receiving earth station.

The basic concept is based on two propagation modes:

- *Propagation mode (1)*: propagation phenomena in clear air (tropospheric scatter, ducting, layer reflection/refraction, gaseous absorption and site shielding). These phenomena are confined to propagation along the great-circle path.
- *Propagation mode (2)*: hydrometeor scatter.

Tables 7 and 8 of Annex 7 to Appendix **7** to the RR specify the system parameters required for the determination of coordination distances for different frequency bands and different services.

The row in each table entitled "method to be used" directs the user to the appropriate section of the main body of Appendix **7** which describes the methods to be followed for the determination of the coordination area.

In addition, Appendix **7** in Table **10** provides information on predetermined coordination distances, which are applicable under certain sharing situations as follows:

Frequency sharing situation		Coordination distance (in sharing situations involving services allocated with equal rights) (km)
Type of earth station	**Type of terrestrial station**	
Ground-based in the bands below 1 GHz to which No. **9.11A** applies. Ground-based mobile in the bands within the range 1-3 GHz to which No. **9.11A** applies	Mobile (aircraft)	500
Aircraft (mobile) (all bands)	Ground-based	500
Aircraft (mobile) (all bands)	Mobile (aircraft)	1 000
Ground-based in the bands: 400.15-401 MHz 1 668.4-1 675 MHz	Station in the meteorological aids service (radiosonde)	580
Aircraft (mobile) in the bands: 400.15-401 MHz 1 668.4-1 675 MHz	Station in the meteorological aids service (radiosonde)	1 080
Ground-based in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	100
Airborne earth station in the radiodetermination-satellite service (RDSS) in the bands: 1 610-1 626.5 MHz 2 483.5-2 500 MHz 2 500-2 516.5 MHz	Ground-based	400
Receiving earth stations in the meteorological-satellite service	Station in the meteorological aids service	The coordination distance is considered to be the visibility distance as a function of the earth station horizon elevation angle for a radiosonde at an altitude of 20 km above mean sea level, assuming 4/3 Earth radius (see Note 1 of AP7-Table 10). The minimum and maximum coordination distances are 100 km and 582 km, and correspond to physical horizon angles greater than 11° and less than 0°.
Non-GSO MSS feeder-link earth stations (all bands)	Mobile (aircraft)	500

Frequency sharing situation		Coordination distance (in sharing situations involving services allocated with equal rights) (km)
Type of earth station	**Type of terrestrial station**	
Non-GSO MSS feeder-link earth stations in the band 5 091-5 150 MHz	Station in the aeronautical radionavigation service	For the coordination distance in the frequency band 5 091-5 150 MHz vis-à-vis stations in the aeronautical radionavigation service, see No. **5.444A**.
Receiving earth stations in the space research service in the band: 2 200-2 290 MHz	Mobile (aircraft)	880
Ground-based in the bands in which the frequency sharing situation is not covered in the rows above	Mobile (aircraft)	500

4 Basic provisions concerning notification and recording of coordinated frequency assignments in the shared bands

The coordination procedure as outlined in Article **9** of the RR should normally precede the submission of notices relating to assignments to terrestrial stations involved in coordination with a satellite network. Such notices in the shared bands shall reach the Radiocommunication Bureau not earlier than three years before the assignments are brought into use (Provision No. **11.25** of the RR).

There are two types of examinations applicable to an assignment notified in a shared band:

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

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

When both examinations result in a favourable finding, the assignment is recorded in the Master Register indicating the administrations with which the coordination procedure has been completed. When one of the findings is unfavourable, the notice is returned to the notifying administration, with an indication of the appropriate action (Provision No. **11.37** of the RR).

5 Technical criteria and examination aspects for terrestrial services in shared frequency bands

5.1 Limitations for terrestrial stations in the sub-bands shared with satellite services that use transmission in the direction from Earth-to-space

Article **21** provides guidance on the choice of sites, frequencies and power limits applicable to terrestrial stations in frequency bands over 1 GHz.

Provision No. **21.1**: Sites and frequencies for terrestrial stations and earth stations, operating in frequency bands shared with equal rights between terrestrial radiocommunication and space radiocommunication services, shall be selected having regard to the relevant ITU-R Recommendations with respect to geographical separation between earth stations and terrestrial stations.

Provision No. **21.2**: As far as practicable, sites for transmitting stations, in the fixed or mobile service, employing maximum values of equivalent isotropically radiated power (e.i.r.p.) exceeding the values given in the table below in the frequency bands indicated, should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit by at least the angle in degrees shown in the table, taking into account the effect of atmospheric refraction (as given in the most recent version of Recommendation ITU-R SF.765).

Frequency band (GHz)	**e.i.r.p. value (dBW) (see also Nos. S21.2 and S21.4)**	**Minimum separation angle with respect to geostationary-satellite orbit (degrees)**
1-10	+35	2
10-15	+45	1.5
25.25-27.5	+24 (in any 1 MHz band)	1.5
Other bands above 15 GHz	+55	No limit

In the shared bands, the following general power limits for terrestrial stations are applied:

Provision No. **21.3**: the maximum equivalent isotropically radiated power (e.i.r.p.) of a station in the fixed or mobile service shall not exceed +55 dBW.

Provision No. **21.4**: where compliance with No. **21.2** for frequency bands between 1 GHz and 10 GHz is impracticable, the maximum equivalent isotropically radiated power (e.i.r.p.) of a station in the fixed or mobile service shall not exceed:

- +47 dBW in any direction within 0.5° of the geostationary-satellite orbit; or
- +47 dBW to +55 dBW, on a linear decibel scale (8 dB per degree), in any direction between 0.5° and 1.5° of the geostationary-satellite orbit, taking into account the effect of atmospheric refraction (Recommendation ITU-R SF.765).

Provision No. **21.5**: The power delivered by a transmitter to the antenna of a station in the fixed or mobile service shall not exceed +13 dBW in frequency bands between 1 GHz and 10 GHz, or +10 dBW in frequency bands above 10 GHz, except for the cases cited in No. **21.5A**.

Provision No. **21.5A**: As an exception to power levels given in No. **21.5**, the sharing environment within which the Earth exploration-satellite (passive) and space research (passive) services shall operate in the band 18.6-18.8 GHz is defined by the following limitations on the operation of the fixed service: the power of each RF carrier frequency delivered to the input of each antenna of a station in the fixed service in the band 18.6-18.8 GHz shall not exceed –3 dBW.

Provision No. **21.6**: The limits given in Nos. **21.2**, **21.3**, **21.4**, **21.5** and **21.5A** apply, where applicable, to the services and frequency bands indicated in Table **21-2** for reception by space stations where the frequency bands are shared with equal rights with the fixed or mobile service.

Provision **21.6.1**: The equality of right to operate when a band of frequencies is allocated in different Regions to different services of the same category is established in No. **4.8** of the RR.

Therefore any limits concerning inter-Regional interference which may appear in ITU-R Recommendations should, as far as practicable, be observed by administrations.

Provision No. **21.7**: Transhorizon systems in the 1 700-1 710 MHz, 1 980-2 010 MHz, 2 025-2 110 MHz and 2 200-2 290 MHz bands may exceed the limits given in Nos. **21.3** and **21.5**, but the provisions of Nos. **21.2** and **21.4** should be observed. Considering the difficult sharing conditions with other services, administrations are urged to keep the number of transhorizon systems in these bands to a minimum.

TABLE

Frequency bands in which power limits are applied

Frequency band	**Geographical area in which terrestrial stations can operate**	**Service**	**Applied limits (specified in Nos.)**
1 427-1 429 MHz	Worldwide	Fixed-satellite	**21.2, 21.3, 21.4** and **21.5**
1 610-1 645.5 MHz	No. **5.359**	Meteorological-satellite	
1 646.5-1 660 MHz	No. **5.359**	Space research	
1 980-2 010 MHz	Worldwide	Space operation	
2 010-2 025 MHz	Region 2	Earth exploration-satellite	
2 025-2 110 MHz	Worldwide	Mobile-satellite	
2 200-2 290 MHz	Worldwide		
2 655-2 670** MHz	Region 2 and Region 3		
2 670-2 690** MHz	Region 2 and Region 3 No. **5.453**, **5.455**		
5 670-5 725 MHz	Region 1 countries listed in No. **5.453** and **5.455**		
5 725-5 755** MHz	Region 1 countries listed in No. **5.453**and **5.455**		
5 755-5 850** MHz	Worldwide		
5 850-7 075 MHz	Worldwide		
7 145-7 235 MHz*	Worldwide		
7 900-8 400 MHz			
10.7-11.7** GHz	Region 1	Fixed-satellite	**21.2**, **21.3** and **21.5**
12.5-12.75** GHz	Nos. **5.494** and **5.496**		
12.7-12.75** GHz	Region 2		
12.75-13.25 GHz	Worldwide		
13.75-14 GHz	Nos. **5.499** and **5.500**		
14.0-14.25 GHz	No. **5.505**		
14.25-14.3 GHz	Nos. **5.505** and **5.508**		
14.3-14.4** GHz	Regions 1 and Region 3		
14.4-14.5 GHz	Worldwide		
14.5-14.8 GHz	Worldwide		

Frequency band	Geographical area in which terrestrial stations can operate	Service	Applied limits (specified in Nos.)
17.7-18.4 GHz	Worldwide	Fixed-satellite	**21.2**, **21.3**, **21.5** and **21.5A**
18.6-18.8 GHz	Worldwide	Earth exploration-satellite	
19.3-19.7 GHz	Worldwide	Space research	
22.55-23.55 GHz	Worldwide	Inter-satellite	
24.45-24.75 GHz	Region 1 and Region 3		
24.75-25.25 GHz	Region 3		
25.25-29.5	Worldwide		

***** For this frequency band only the limits of Nos. **21.3** and **21.5** apply.

****** Provision No. **21.6.1** applies in this case.

In addition to those frequency bands listed in the table above, there is a number of other shared frequency allocations where the specific power limits are not applicable, mainly in the frequency bands below 1 GHz and above 30 GHz. The question is continuing to be studied in ITU-R, and may lead in the future to a revision of the limits. At the present time, no definitive changes are proposed to the limits as laid down in the RR.

6 Some ITU-R references concerning coordination and sharing

There are a large number of Resolutions and Recommendations contained in Volumes 3 and 4 of the RR and in the different series of ITU-R Recommendations dealing with particular coordination and sharing aspects. Many of them may serve as a supporting tool to administrations when considering the coordination of terrestrial stations in the shared frequency bands.

The most recent versions of the following Recommendations, for example, may be considered in the coordination of fixed service stations with mobile satellite service stations:

- Recommendation ITU-R F.1245-2: Mathematical model of average and related radiation patterns for line-of-sight point-to-point fixed wireless system antennas for use in certain coordination studies and interference assessment in the frequency range from 1 GHz to about 70 GHz.
- Recommendation ITU-R M.1141-2: Sharing in the 1-3 GHz frequency range between non-geostationary space stations operating in the mobile-satellite service and stations in the fixed service.
- Recommendation ITU-R M.1142-2: Sharing in the 1-3 GHz frequency range between geostationary space stations operating in the mobile-satellite service and stations in the fixed service.
- Recommendation ITU-R M.1143-3: System specific methodology for coordination of non-geostationary space stations (space-to-Earth) operating in the mobile-satellite service with the fixed service.
- Recommendation ITU-R M.1319-3: The basis of a methodology to assess the impact of interference from a time division multiple access/frequency division multiple access (TDMA/FDMA) mobile-satellite service (MSS) space-to-Earth transmissions on the performance of line-of-sight fixed service receivers in the frequency range 1-3 GHz.

- Recommendation ITU-R F.1108-4: Determination of the criteria to protect fixed service receivers from the emissions of space stations operating in non-geostationary orbits in shared frequency bands.
- Recommendation ITU-R F.699-7: Reference radiation patterns for fixed wireless system antennas for use in coordination studies and interference assessment in the frequency range from 100 MHz to about 70 GHz.

Furthermore, technical guidance and a planning tool are provided in Recommendation ITU-R F.1335 and could be considered when planning the transition of fixed service systems from the bands 1 980-2 010 MHz and 2 170-2 200 MHz in all three Regions, and 2 010-2 025 MHz and 2 160-2 170 MHz in Region 2.

7 Conclusion

The use of detailed technical characteristics, the availability of detailed terrain data along the radio paths, the application of agreed coordination procedures and principles, the application of recommended coordination tools and procedures, together with international or regional harmonization activities are the keys to achieving successful coordination.

Frequency assignment data recorded in the ITU Master International Frequency Register, the procedures approved by the administrations of Member States of the ITU, the Recommendations developed by the ITU membership, and the tools made available to the ITU membership should also be applied and used to reach this aim. They can contribute to a successful coordination, and they will complement bilateral and multilateral activities which are also very essential in the process of ensuring that sharing between terrestrial and space services is enabling efficient and effective operation of all radiocommunication services.