CHAPTER 4

Compatibility with other primary services

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4 Introduction

This Chapter considers compatibility of digital terrestrial sound and television broadcasting with primary services other than terrestrial broadcasting.

4.1 Compatibility with other primary services in the planned bands

4.1.1 Other primary services and sharing situations in the bands 174-230 MHz and 470-862 MHz

Most countries of the planning area use the broadcasting service in the bands 174-230 MHz and 470-862 MHz; however, the broadcasting service does not have exclusive access to these bands. The following sharing situations with other primary services need to be taken into account:

In the VHF band between the broadcasting and the following primary services:

– the fixed service;

– the mobile service;

– the aeronautical radionavigation service.

In the UHF band between the broadcasting and the following primary services:

– the fixed service;

– the mobile service;

– the radionavigation service (including the aeronautical radionavigation service);

– the radio astronomy service;

– the broadcasting-satellite service;

– the mobile-satellite (except aeronautical mobile-satellite) service.

For terrestrial services and radio astronomy, compatibility with digital terrestrial broadcasting can be achieved by translating technical requirements into spatial separations. Further details concerning the sharing situation with other primary services are given in § 4.1.1.1.

For space services, other information such as pfd limits are needed. Some information on the sharing situations between digital terrestrial television and space services is included in § 4.1.1.2.

4.1.1.1 Sharing situations with other primary services

In the VHF band, the following primary allocations exist for other services in the planning area in the band 174-230 MHz:

– the **fixed service** in the Islamic Republic of Iran, in the band 174-230 MHz;

– the **mobile service** in the Islamic Republic of Iran, in the band 174-230 MHz;

– the **aeronautical radionavigation service** in the Islamic Republic of Iran and in the countries of Region 1 listed in RR No. 5.247, in the band 223-230 MHz;

– the **land mobile service** in the band 174-223 MHz, to countries listed in RR No. 5.235. Protection is required only between the countries mentioned in that provision.

In the UHF band, the following primary allocations exist in the planning area in the band 470-862 MHz:

– the **fixed service** in Region 1 and in the Islamic Republic of Iran in the band 790-862 MHz, and in the Islamic Republic of Iran in the band 470-790 MHz;

– the **mobile service** in the Islamic Republic of Iran, in the band 470-862 MHz;

– the **mobile, except aeronautical mobile, service** in the band 790-862 MHz, to the countries of Region 1 listed in RR No. 5.316. Protection is required only between countries mentioned in that provision;

– the **radionavigation service** in the Islamic Republic of Iran, in the band 585-610 MHz;

– the **aeronautical radionavigation service** in the United Kingdom in the band 590-598 MHz according to RR No. 5.302, in the countries of Region 1 listed in RR No. 5.312 in the band 645-862 MHz;

– the **radio astronomy service** in the whole of the African Broadcasting Area, in the band 606-614 MHz, according to RR No. 5.304;

– the **broadcasting-satellite service** in the band 620-790 MHz. Protection is required only for those systems which are in operation;

– the **mobile-satellite, except aeronautical mobile-satellite (R), service** in the bands 806-840 MHz (Earth-to-space) and 856-862 MHz (space-to-Earth) to the countries listed in RR No. 5.319 and used only by countries mentioned in that provision.

4.1.1.2 Sharing situations with primary space services

In the UHF band there are primary allocations to the mobile-satellite service (MSS) and the broadcasting-satellite service (BSS).

4.1.1.2.1 Compatibility with the mobile-satellite service

RR No. 5.319 states:

"**5.319** *Additional allocation*: in Belarus, Russian Federation and Ukraine, the bands 806-840 MHz (Earth-to-space) and 856-890 MHz (space-to-Earth) are also allocated to the mobile-satellite, except aeronautical mobile-satellite (R), service. The use of these bands by this service shall not cause harmful interference to, or claim protection from, services in other countries operating in accordance with the Table of Frequency Allocations and is subject to special agreements between the administrations concerned."

Therefore, the issue of sharing between the MSS (except aeronautical mobile-satellite (R) service) and the broadcasting service needs to be considered only between the countries mentioned in RR No. 5.319.

4.1.1.2.2 Compatibility with the broadcasting-satellite service

The band 620-790 MHz is allocated to the BSS with the conditions stipulated in RR No. 5.311 (as modified by WRC-03).

4.1.1.2.2.1 WRC-03, under agenda item 1.37, reviewed the sharing situation as prescribed in RR No. 5.311 and took the following decisions:

a) Modified RR No. 5.311 with immediate effect (as of 4 July 2003) as follows:

"**5.311** 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 (Rev.WRC-03)** and **507 (Rev.WRC-03)**). 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. Resolution **545 (WRC-03)** applies."

b) Adopted a new Resolution (Resolution 545 (WRC-03)), *resolves* 1-to 3 and 5 of which stipulated that:

"1 that the processing of submissions of GSO BSS networks and non-GSO BSS satellite networks or systems in the frequency band 620-790 MHz received by the Bureau and not brought into use prior to 5 July 2003, irrespective of their date of receipt, shall be suspended pending WRC-07 decisions on the sharing criteria, including the pfd required to protect the terrestrial services in this frequency band;

2 to suspend the application of No. **5.311** and Recommendation **705** until the end of WRC-07 with respect to the GSO BSS networks and non-GSO BSS satellite networks or systems in the frequency band 620-790 MHz and for which notification is received between 5 July 2003 and the end of WRC-07;

3 that GSO BSS networks and non-GSO BSS satellite networks or systems in the frequency band 620-790 MHz other than those notified, brought into use and the date of bringing into use confirmed before the end of WRC-03, shall not be brought into use before the end of WRC-07;"

4 NOTE – Not applicable to this Report;

"5 that the BSS systems referred to in *resolve*s 1 above shall not be taken into account in the application of *resolves* 3.1C and 3.4 of Council Resolution 1185;"

Under the *invites* part of the Resolution mentioned above the Conference decided to invite ITU-R:

"to conduct studies as a matter of urgency, and develop sharing criteria and regulatory provisions, prior to WRC-07, for the protection of terrestrial services, in particular terrestrial television broadcasting services, in the 620-790 MHz band from GSO BSS networks and non-GSO BSS satellite networks or systems which it is planned to operate in this band,"

Under the *instructs* parts of the above-mentioned Resolution, the conference decided to

"*instructs the Director of the Radiocommunication Bureau*

subject to the decisions taken by WRC-07, to resume, as appropriate, the application of Nos. **5.311**, **9.34** and **11.30** and other relevant associated provisions of the Radio Regulations,

instructs the Secretary-General

to bring this Resolution to the attention of the Regional Radiocommunication Conference, 2004/2005 (RRC-04/05)."

4.1.1.2.2.2 In addition, the first session of the Regional Radiocommunication Conference (RRC) has approved Resolution [COM4/1], which recommends to the second session to adopt necessary regulatory procedures for protection of DVB-T systems from the BSS service in the band 620-790 MHz.

4.1.2 Protection of terrestrial services including aeronautical stations of other primary services against transmissions of digital terrestrial broadcasting

4.1.2.1 Input information needed to calculate the interference into other primary services

The input information format of other primary services are available in Chapter 6.

4.1.2.1.1 Information concerning protection needs of other primary services

Basic parameters which are needed for the protection of other primary services are:

– centre frequency;
– detailed type of service;
– field strength to be protected;
– protection ratio as a function of frequency separation between the digital terrestrial broadcasting and the other primary services' centre frequencies;
– percentage of the time for which protection is required.

Additional parameters which are needed have to do with the location of the stations to be protected, directional discrimination and the polarization of the electromagnetic wave.

The location of the stations of the other primary service is usually described by a set of test points (latitude, longitude, and height above ground or sea), which represent the boundary of the area for which protection is required, or by the locations where receiving stations of the service to be protected are installed or may be installed.

For receiving stations installed at fixed locations which use directional antennas pointing at a fixed direction, the antenna pattern, the polarization and the main beam direction are needed.

For mobile stations, polarization and direction discrimination cannot be taken into account.

Intermodulation interference and near field effects will not be addressed, but they may need to be addressed at the national level.

4.1.2.1.2 Information concerning interference potential of digital terrestrial broadcasting

The input information which can be used depends on whether assignment or allotment planning has been chosen.

In the case of assignments, the specific transmitting locations are known and appropriate parameters may be identified:

– centre frequency (of broadcast channel);
– type of the broadcasting system;
– radiated power as a function of azimuth angle and polarization;

– transmitting antenna location (longitude, latitude and height above sea level as well as height above ground, and effective height).

In the case of allotments, as specific transmitting locations are not known, a method situating reference sources at each of the test points around the boundary of the allotments may be used. Further details can be found in Chapter 5.

4.1.2.2 Supply of the information needed to calculate interference into other primary services

The information needed is to be supplied by the administrations involved in accordance with what is specified in Chapter 6 on input parameters, except where the information is already available in the Master International Frequency Register (MIFR).

Protection criteria for other primary services are given in Annexes 4.1 and 4.2. This includes some generic information as well as default values for field strength to be protected, protection ratios as a function of frequency separation, and receiving antenna heights for some typical systems.

Annex 4.1 supplies protection criteria for other primary services interfered with by digital sound broadcasting (T-DAB), and Annex 4.2 supplies protection criteria for other primary services interfered with by digital terrestrial television broadcasting (DVB-T).

4.1.2.3 Calculations required to protect other primary services

A calculation needs to be made for all fixed locations and all test points defining the boundary of the service area of the other primary service.

Calculate the interfering field strength (50% of the locations value and the appropriate time percentage value) caused by the digital terrestrial broadcasting assignment or allotment, taking into account the directivity of the transmitting antenna if relevant.

Calculate from this the nuisance field strength caused by the digital terrestrial broadcasting assignment or allotment, taking into account the protection ratio and, if relevant, receiving antenna discrimination (directivity, polarization).

Subtracting the nuisance field strength (caused by the broadcasting assignment or allotment) and the combined location correction factor from the minimum field strength (50% of the locations value), gives the protection margin which can be used for the coordination process.

Calculation methods are described in Chapter 5.

Information on the propagation models to be used for the calculations can be found in Chapter 2.

4.1.3 Protection of receiving space stations of other primary services against transmissions of digital terrestrial broadcasting

It does not seem feasible to have receiving satellites in the same band and area as broadcasting, as there seems to be no possibility to protect the satellite. (Using highly directive antennas is a problem in the frequency ranges concerned; moreover, it is not appropriate for broadcasting. Severe restrictions of the number and the effective radiated power (e.r.p.) of broadcasting stations would not be acceptable to terrestrial broadcasting as a primary allocation.)

At present, no entries exist in the ITU database for receiving space stations in the broadcasting bands.

4.1.4 Protection of digital terrestrial broadcasting against transmissions of stations of other primary terrestrial services

This paragraph describes the protection of digital terrestrial broadcasting. It is applicable for protection against transmissions of stations of other primary terrestrial services including aeronautical services.

4.1.4.1 Input information needed to calculate interference into digital terrestrial broadcasting

This paragraph lists basic parameters required for calculations to protect digital terrestrial broadcasting; further discussion is provided in Chapter 6.

4.1.4.1.1 Information concerning protection needs of digital terrestrial broadcasting

a) Basic elements which are needed for the protection of digital terrestrial broadcasting assignments are:

- centre frequency;
- type of service;
- field strength to be protected;
- protection ratio as a function of frequency separation between other service and digital terrestrial broadcasting centre frequencies;
- percentage of time for which protection is required.

The coverage area of digital terrestrial broadcasting assignments is usually described by a set of test points (latitude, longitude and height above ground) or by transmitting antennas location and radiated power.

For fixed reception, the antenna pattern, polarization, and the main beam direction are needed.

b) Basic elements which are needed for the protection of digital terrestrial broadcasting allotments are:

- centre frequency;
- type of service;
- field strength to be protected;
- protection ratio as a function of frequency separation between other service and digital terrestrial broadcasting centre frequencies;
- percentage of time for which protection is required.

The coverage area of digital terrestrial broadcasting allotments is usually described by a set of test points (latitude, longitude and height above ground).

Because the geographical relationship between transmitting and receiving locations is not known, directivity discrimination cannot be taken into account.

Intermodulation interference and near field effects will not be addressed, but they may need to be addressed at the national level.

4.1.4.1.2 Information concerning the interference potential of terrestrial stations of other primary services

The following basic elements are needed:

– centre frequency;

– the type of service;

– radiated power as a function of azimuth angle and polarization;

– transmitting antenna location (longitude, latitude and height).

In addition, the channel bandwidth of the system needs to be known.

Information on unwanted emissions is available in Recommendations ITU-R SM.328, ITU-R SM.329, ITU-R SM.1540 and ITU-R SM.1541.

4.1.4.2 Supply of the information needed to calculate the interference into digital terrestrial broadcasting

The information needed is to be supplied by the administrations involved in accordance with what is specified in Chapter 6 on input parameters, except where the information is already available in the MIFR.

In Annexes 4.3 and 4.4, protection criteria for digital terrestrial broadcasting are given, such as minimum field strength to be protected and protection ratios as a function of frequency separation.

Annex 4.3 supplies protection criteria for T-DAB interfered with by other primary services, and Annex 4.4 supplies protection criteria for DVB-T interfered with by other primary services.

4.1.4.3 Calculations required to protect digital terrestrial broadcasting

A calculation needs to be made for each of the test points defining the coverage area of a digital terrestrial broadcasting requirement.

Calculate the interfering field strength (50% of the locations value and the appropriate time percentage value) caused by the other primary service, taking into account the directivity of the transmitting antennas if relevant.

Calculate from this the nuisance field strength caused by the other primary service, taking into account the protection ratio and, if relevant, receiving antenna discrimination (directivity, polarization).

Subtracting the nuisance field strength (caused by the other primary service) and the combined location correction factor from the minimum field strength to be protected (50% of the locations value) gives the protection margin which can be used for the coordination process.

Calculation methods are described in Chapter 5.

Information on the propagation models to be used for the calculations can be found in Chapter 2.

4.2 Compatibility with primary non-broadcasting services in adjacent bands

Interference between digital terrestrial broadcasting and primary non-broadcasting services may occur not only within the bands 174-230 MHz and 470-862 MHz, but also in adjacent bands. In order to minimize interference problems involving adjacent bands, careful design of all the equipment involved is necessary, especially appropriate filtering. This could include improved masks for the services concerned.

However, for adjacent bands, the probability of interference is relatively low as the systems are usually decoupled by frequency separation (the systems are outside the bands discussed). It is therefore suggested not to include systems outside the bands 174-230 MHz and 470-862 MHz in the coordination process.

4.3 Regulatory procedures

Relevant regulatory procedures are dealt with in Chapter 7.

ANNEX 4.1

Protection criteria for other primary services interfered with by digital terrestrial sound broadcasting

The following tables contain the protection ratio values to be used and the field strengths to be protected.

The required separation distance is given where known.

Aeronautical safety service: 0

Service type code: AA

Field strength to be protected (dB(µV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–2.500	–2.000	–1.500	–1.000	0.000	1.000	2.000	3.000	4.000	5.000	5.630
PR 1% (dB)	–0.1	3.8	21.0	32.0	39.8	43.0	39.5	37.3	39.3	38.0	24.5
PR 50% (dB)	5.9	10.3	25.5	38.0	46.8	48.3	44.3	41.8	45.5	42.5	30.0

The rows in the Table have the following meaning:

Δf: frequency difference (MHz), i.e. interfering T-DAB block centre frequency minus centre frequency of interfered-with other primary service

PR 1%: protection ratio (dB) required for tropospheric interference

PR 50%: protection ratio (dB) required for continuous interference (if known).

Aeronautical safety service: 1

Service type code: AL

Field strength to be protected (dB(µV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–10.000	–9.000	–0.800	–0.600	–0.400	–0.200	0.000	0.200	0.400	0.600	0.800
PR 1% (dB)	–66.0	–6.6	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6
Δf (MHz)	9.000	10.000									
PR 1% (dB)	–6.6	–66.0									

Fixed service, values used as for PMR (5 kHz channel spacing).

Service type code: CA

Field strength to be protected (dB(µV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Aeronautical safety service 2; type A receiver. First channel 230.05 MHz.

Service type code: DA

Field strength to be protected (dB(µV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–10.20	–6.550	–6.350	–6.150	–5.930	–5.770	0.000	10.000			
PR 1% (dB)	–56.0	–56.0	–54.0	–49.0	–33.0	6.0	6.0	6.0			

Aeronautical safety service DB. The centre frequency is 235.0 MHz and the first channel is at 231.0 MHz.

Service type code: DB

Field strength to be protected (dB(µV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–5.250	–4.470	–4.270	0.000	9.770	9.970	10.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

Fixed service (224.25 MHz). S1 (WB FM mono) data used.

Service type code: IA

Field strength to be protected (dB(μV/m)): 48.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.00	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–22.0	–16.0	18.0	18.0	18.0	–16.0	–22.0				

Land mobile service (173-174 MHz). Not applicable in general. Centre frequency 173.95 MHz.

Service type code: MA

Field strength to be protected (dB(μV/m)): 4.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	0.000	0.900	1.000						
PR 1% (dB)	–60.0	–40.0	12.0	–40.0	–60.0						

National defence air-ground-air system, analogue (type B and C receivers). Minimum separation distance is 1 km. Frequency range is 230 MHz to just above 240 MHz, but channel frequencies are not identical in all countries.

Service type code: ME

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

National defence air-ground-air system, digital (230-243 MHz). ME data used.

Service type code: MF

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

National defence air-ground-air system, frequency hopping (230-243 MHz). ME data used.

Service type code: MG

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

Mobile navy service, analogue (230-243 MHz). ME data used.

Service type code: MI

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

Mobile navy service, digital (230-243 MHz). ME data used.

Service type code: MJ

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

Mobile navy service, frequency hopping (230-243 MHz). ME data used.

Service type code: MK

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.770	0.000	0.770	0.970	1.750				
PR 1% (dB)	–81.0	–46.0	–1.0	–1.0	–1.0	–46.0	–81.0				

National defence fixed services (230-243 MHz). MT values used.

Service type code: ML

Field strength to be protected (dB(μV/m)): 20.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–2.000	–1.000	0.000	1.000	2.000						
PR 1% (dB)	–5.0	15.0	25.0	15.0	–5.0						

National defence mobile service. Centre frequency 232.625 MHz.

Service type code: MQ

Field strength to be protected (dB(μV/m)): 26.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–2.63	–2.625	0.000	2.625	2.630						
PR 1% (dB)	–60.0	–1.0	–1.0	–1.0	–60.0						

National defence mobile and fixed (tactical) services.

Service type code: MT

Field strength to be protected (dB(μV/m)): 20.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–2.000	–1.000	0.000	1.000	2.000						
PR 1% (dB)	–5.0	15.0	25.0	15.0	–5.0						

Mobile radio – low-power devices. Wideband FM (stereo) data used.

Service type code: MU

Field strength to be protected (dB(µV/m)): 54.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–12.0	5.0	38.0	38.0	38.0	5.0	–12.0				

Mobile services – narrow-band FM system (12.5 kHz) interfered with by a single T-DAB block.
T-DAB assumed to be always higher in frequency than PMR: M2 values used.

Service type code: M1

Field strength to be protected (dB(µV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–.92	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Narrow-band FM system interfered with by two or more T-DAB blocks.

Service type code: M2

Field strength to be protected (dB(µV/m)): 36.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Mobile services – narrow-band FM system (12.5 kHz) interfered with by a single T-DAB block. T-DAB assumed to be always higher in frequency than PMR: M2 values used.

Service type code: RA

Field strength to be protected (dB(μV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Medical telemetry service. Centre frequency 224.1 MHz.

Service type code: R1

Field strength to be protected in (dB(μV/m)): 32.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.800	–1.600	0.000	1.600	1.800						
PR 1% (dB)	–60.0	–6.0	–6.0	–6.0	–60.0						

Mobile service – remote control. Centre frequency is 224 MHz. S2 (wideband FM stereo) data used.

Service type code: R3

Field strength to be protected (dB(μV/m)): 30.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–12.0	5.0	38.0	38.0	38.0	5.0	–12.0				

Mobile service – remote control. Centre frequency is 224 MHz. S2 (wideband FM stereo) data used.

Service type code: R4

Field strength to be protected (dB(μV/m)): 30.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–12.0	5.0	38.0	38.0	38.0	5.0	–12.0				

PMR (5 kHz channel spacing).

Service type code: XA

Field strength to be protected (dB(μV/m)): 15.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.920	–0.870	–0.820	–0.795	–0.782	–0.770	0.000	0.770	0.782	0.795	0.820
PR 1% (dB)	–58.0	–49.0	–41.0	–37.0	–34.0	–14.0	–12.0	–14.0	–34.0	–37.0	–41.0
Δf (MHz)	0.870	0.920									
PR 1% (dB)	–49.0	–58.0									

Alarm system. Frequency range 230 to 231 MHz.

Service type code: XB

Field strength to be protected (dB(μV/m)): 37.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.600	–0.500	0.000	0.500	0.600						
PR 1% (dB)	–60.0	10.0	10.0	10.0	–60.0						

National defence air-ground-air system based on aeronautical blocks. No information (–60 dB).

Service type code: XE

Field strength to be protected (dB(μV/m)): 0.0

Receiver height (m): 0.0

Separation distance (m)

Δf (MHz)	–0.100	0.000	0.100								
PR 1% (dB)	–60.0	–60.0	–60.0								

Radio microphones (VHF). S1 (wideband FM mono) data used.

Service type code: XM

Field strength to be protected (dB(μV/m)): 48.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–22.0	–16.0	18.0	18.0	18.0	–16.0	–22.0				

Audio link (F).

Service type code: YA

Field strength to be protected (dB(μV/m)): 29.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–0.900	–0.800	–0.700	0.000	0.700	0.800	0.900				
PR 1% (dB)	–60.0	–6.0	30.0	30.0	30.0	–6.0	–60.0				

Video link (F).

Service type code: YB

Field strength to be protected (dB(μV/m)): 29.0

Receiver height (m): 500.0

Separation distance (m)

Δf (MHz)	–13.000	–12.000	0.000	12.000	13.000						
PR 1% (dB)	–46.0	20.0	20.0	20.0	–46.0						

Air-ground-air system 1 (F).

Service type code: YC

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.750	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.750			
PR 1% (dB)	–84.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–84.0			

Air-ground-air system 2 (F).

Service type code: YD

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.75	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.750			
PR 1% (dB)	–84.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–84.0			

Navy channels (F).

Service type code: YE

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.75	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.750			
PR 1% (dB)	–84.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–84.0			

National defence mobile and fixed (tactical) services. Tactical link (F).

Service type code: YF

Field strength to be protected (dB(μV/m)): 20.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–2.000	–1.000	0.000	1.000	2.000						
PR 1% (dB)	–5.0	15.0	25.0	15.0	–5.0						

Safety and distress (F).

Service type code: YG

Field strength to be protected (dB(μV/m)): 16.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–0.800	–0.600	–0.400	–0.200	0.000	0.200	0.400	0.600	0.800		
PR 1% (dB)	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6		

Audio link (F).

Service type code: YH

Field strength to be protected (dB(μV/m)): 29.0

Receiver height (m): 5 000.0

Separation distance (m)

Δf (MHz)	–0.900	–0.800	–0.700	0.700	0.800	0.900					
PR 1% (dB)	–60.0	–6.0	30.0	30.0	–6.0	–60.0					

Telemetry as air-ground-air system 1 (F) YC.

Service type code: YT

Field strength to be protected dB(μV/m): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.10	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.100			
PR 1% (dB)	–60.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–60.0			

Telemetry as air-ground-air system 1 (F) YC.

Service type code: YW

Field strength to be protected (dB(μV/m)): 10.0

Receiver height (m): 10 000.0

Separation distance (m): 1 000.0

Δf (MHz)	–1.100	–0.970	–0.930	–0.770	0.770	0.930	0.970	1.100			
PR 1% (dB)	–60.0	–49.0	–40.0	–4.0	–4.0	–40.0	–49.0	–60.0			

Short-range system DGPT (F).

Service type code: YY

Field strength to be protected (dB(μV/m)): 40.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.000	–0.900	–0.800	0.000	0.800	0.900	1.000				
PR 1% (dB)	–22.0	–5.0	28.0	28.0	28.0	–5.0	–22.0				

DGPT, not used as TV.

Service type code: YZ

Field strength to be protected in (dB(μV/m)): 55.0

Receiver height (m): 10.0

Separation distance (m)

Δf (MHz)	–1.900	–1.000	0.000	1.000	2.000	3.000	4.000	5.000	5.200	5.740	6.440
PR 1% (dB)	–1.5	30.0	42.0	42.0	37.0	32.0	39.0	39.0	30.5	32.0	30.0
PR 50% (dB)	1.8	36.0	48.0	48.0	42.0	36.0	45.3	45.3	38.3	40.0	38.0
Δf (MHz)	6.490	6.740	7.240								
PR 1% (dB)	27.0	1.0	0.2								
PR 50% (dB)	35.0	9.0	7.7								

Where no information concerning protection ratios for other primary services interfered with by T-DAB has been supplied to the planning meeting, the administrations concerned should develop appropriate sharing criteria by mutual agreement or use the relevant ITU-R Recommendations, if available.

Symbols of service type codes used in this Annex are listed in the Table below.

Table of service type codes

(protection of other primary services from T-DAB)

Service type code	Radio Regulations provision (RR No.)	Service
AA	1.34	aeronautical mobile (OR)
AL	1.34	aeronautical mobile (OR)
CA	1.20	fixed
DA	1.34	aeronautical mobile (OR)
DB	1.34	aeronautical mobile (OR)
IA	1.20	fixed
MA	1.26	land mobile
ME	1.34	aeronautical mobile (OR)
MF	1.34	aeronautical mobile (OR)
MG	1.34	aeronautical mobile (OR)
MI	1.28	maritime mobile
MJ	1.28	maritime mobile
MK	1.28	maritime mobile
ML	1.20	fixed
MQ	1.24	mobile
MT	1.20	fixed
MU	1.24	mobile
M1	1.24	mobile
M2	1.24	mobile
RA	1.24	mobile
R1	1.26	land mobile
R3	1.24	mobile
R4	1.24	mobile
XA	1.26	land mobile
XB	1.20	fixed
XE	1.34	aeronautical mobile (OR)
XM	1.26	land mobile
YA	1.26	land mobile
YB	1.26	land mobile
YC	1.34	aeronautical mobile (OR)
YD	1.34	aeronautical mobile (OR)
YE	1.28	maritime mobile
YF	1.20	fixed
YG	1.34	aeronautical mobile (OR)
YH	1.26	land mobile
YT	1.34	aeronautical mobile (OR)
YW	1.34	aeronautical mobile (OR)
YY	1.26	land mobile
YZ	1.26	land mobile

ANNEX 4.2

Protection criteria for other primary services interfered with by DVB-T

A.4.2.1 Protection criteria for VHF and UHF fixed services

Recommendation ITU-R F.1670 – Protection of fixed wireless systems from terrestrial digital video broadcasting systems in the VHF and UHF shared bands, provides the protection criteria for VHF and UHF fixed systems.

The following sharing situations need to be addressed between the broadcasting service and the primary fixed service, bearing in mind the allocations to the fixed service in the Table of Frequency Allocations:

– in the VHF band: for the Islamic Republic of Iran, in the band 174-230 MHz;

– in the UHF band: for Region 1 in the band 790-862 MHz, for the Islamic Republic of Iran in the band 470-862 MHz.

A.4.2.1.1 Protection criteria for two examples of the fixed service

Example 1 contains information for the protection of a relocatable system (service type code FF) used in the Netherlands. For this system, the following technical characteristics[1] are supplied:

Minimum receiver input power: –95 dBm

Frequency: 862 MHz

Antenna gain: 15 dBi

Cable loss: 8 dB

As a result, a minimum field strength of 35 dB(μV/m) is given.

For the interference in the co-channel case a protection ratio (PR) of 11 dB is supplied. The full set of protection ratios as a function of frequency separation is as follows:

PRs of relocatable system (1 024 kbit/s) vs. DVB-T/8 MHz

Δf (MHz)	–6.0	–5.0	–4.0	0.0	4.0	5.0	6.0
PR (dB)	–46	–39	7	11	7	–39	–46

[1] The technical information is from ERC Report 106 (CEPT) (February 2001).

Example 2 contains information for the protection of a point-to-multipoint (P-MP) system (service type code FH) used in Ukraine. For this system, the following technical characteristics[1] are supplied:

Minimum receiver input power: –130 dBW

Wave length: 0.36 m

Antenna gain: 17 dBi

Cable loss: 3 dB

As a result of this, a minimum field strength of 18 dB(µV/m) has been calculated.

For the interference in the co-channel case a protection ratio of –1 dB is supplied. The full set of PRs as a function of frequency separation is as follows:

Protection ratios of P-MP interfered with by DVB-T/8 MHz

Δf (MHz)	–6.0	–4.2	–3.9	–3.4	0	3.4	3.9	4.2	6.0
PR (dB)	–65	–54	–4	–1	–1	–1	–4	–54	–65

A.4.2.1.2 Protection criteria for any cases where no system information is available

The wanted level to be protected is –114 + 10 log *B* (dBm).

The field strength to be protected is –44 + 20 log *f* + 10 log *B* (dB(µV/m)).

B is the necessary bandwidth (MHz) of the system of the fixed service and *f* is the centre frequency (MHz).

"Generic" PRs table for the fixed service interfered with by DVB-T (7 MHz) (service type code FK7)

Δf (MHz)	**±10**	**±9**	**±8**	**±7**	**±6**
PR (dB) using the non-critical DVB-T mask	–75	–70	–65	–61	–56
PR (dB) using the sensitive DVB-T mask	–85	–80	–75	–71	–66

Δf (MHz)	**±5**	**±4**	**±3**	**±2**	**±1**
PR (dB) using the non-critical DVB-T mask	–50	–43	0	0	0
PR (dB) using the sensitive DVB-T mask	–60	–53	0	0	0

"Generic" PRs table for the fixed service interfered with by DVB-T (8 MHz)
(service type code FK8)

Δ*f* (MHz)	**±12**	**±10**	**±9**	**±8**	**±7**	**±6**
PR (dB) using the non-critical DVB-T mask	–77	–69	–65	–61	–56	–52
PR (dB) using the sensitive DVB-T mask	–87	–79	–75	–71	–66	–62

Δ*f* (MHz)	**±5**	**±4**	**±3**	**±2**	**±1**
PR (dB) using the non-critical DVB-T mask	–45	–13	0	0	0
PR (dB) using the sensitive DVB-T mask	–55	–17	0	0	0

The generic PR tables given above may only be used for systems having a bandwidth which is small compared to the bandwidth of DVB-T.

A.4.2.1.3 Antenna discrimination

Antennas can be found deployed in vertical or horizontal polarizations; therefore, it may be appropriate to assume cross-polarization advantage. Any cross polarization between the horizontal (mainly used) DVB-T and the fixed system antenna (both polarizations are used) will result in higher DVB-T interfering power. For any interfering DVB-T signal arriving in the side-lobe of the fixed system antenna, the side-lobe gain is to be compared to the main-lobe antenna gain.

For fixed systems, the adjustment factor, resulting from the antenna polarization discrimination for horizontally polarized broadcasting emissions, may rise to –18 dB (refer to Recommendation ITU-R SM.851). Where vertically or mixed polarized broadcasting emissions are used, no antenna polarization discrimination is to be taken into account.

Most DVB-T operate in horizontal polarization, therefore, it could be appropriate to assume a 10-18 dB cross-polarization advantage, at least for the vertical fixed system station. Assuming different cross polarization between the horizontal (most common) DVB-T and the fixed system antenna would yield different DVB-T interference levels.

There might also be attenuation in the antenna elevation pattern, due to elevation angle of fixed system or DVB-T antennas in high mountains.

For any interfering DVB-T signal arriving through a side-lobe of the fixed system antenna, the side-lobe gain is to be compared to the assumed 15 dBi gain. Actual antenna radiation patterns should be used. If they are not available, to assess the antenna gain in the side-lobe for frequencies in the range 100 MHz to 1 GHz, in cases where the ratio of the antenna diameter to the wavelength is greater than 0.63 (G_{max} is greater than 3.7 dBi), the following equations given in Recommendation ITU-R F.699 are to be used:

$$G(\varphi) = G_{max} - 2.5 \times 10^{-3} \left(\frac{D}{\lambda}\varphi\right)^2 \qquad \text{for } 0° < \varphi < \varphi_m$$

$$G(\varphi) = G_1 \qquad \text{for } \varphi_m \leq \varphi < 100\,\frac{\lambda}{D}$$

$$G(\varphi) = 52 - 10 \log \frac{D}{\lambda} - 25 \log \varphi \qquad \text{for } 100\,\frac{\lambda}{D} \leq \varphi < \varphi_s$$

$$G(\varphi) = -2 - 5 \log \frac{D}{\lambda} \qquad \text{for } \varphi_s \leq \varphi \leq 180°$$

where:

$G(\varphi)$: gain relative to isotropic antenna

φ: off-axis angle

D: antenna diameter
λ: wavelength
} expressed in the same units

G_1: gain of the first side-lobe $= 2 + 15 \log \frac{D}{\lambda}$

φ_m and φ_s are defined as follows:

$$\varphi_m = \frac{20\lambda}{D}\sqrt{G_{max} - G_1} \qquad \text{degrees}$$

$$\varphi_s = 144.5\left(\frac{D}{\lambda}\right)^{-0.2} \qquad \text{degrees}$$

In cases where only the maximum antenna gain is known, D/λ may be estimated from the following expression:

$$20 \log \frac{D}{\lambda} \approx G_{max} - 7.7$$

where G_{max} is the main-lobe antenna gain (dBi).

For antennas with asymmetrical apertures, the D/λ value computed from G_{max} is an equivalent D/λ and not the actual D/λ.

A.4.2.2 Protection criteria for radio astronomy

The frequency band 608-614 MHz is also allocated to the radio astronomy service. In Africa this allocation is on a primary basis (RR No. 5.304); however, currently there is no indication that a station exists. In Europe it is on a secondary basis (RR No. 5.305). European administrations have agreed, in the Chester, 1997 Agreement*, to coordinate TV transmitters in Channel 38 (606-614 MHz) with their radio astronomy stations. This can be continued through bilateral or multilateral agreements.

The protection criteria for single telescope observations and very long baseline interferometry (VLBI) observations are given in Recommendation ITU-R RA.769**. Whilst this Recommendation provides for a protection level of –253 dB(W/(m^2 · Hz)) for single-dish observations, the limit for VLBI is –212 dB(W/(m^2 · Hz)). Taking into account a bandwidth of 6 MHz (68 dBHz), the levels of maximum power flux-density (pfd) to be protected are –185 dB(W/m^2) for single-dish telescopes and –143 dB(W/m^2) for VLBI.

These pfd limits correspond to a field strength to be protected of –39 dB(µV/m) for single-dish telescopes, and of 3 dB(µV/m) for VLBI.

Protection from adjacent channels also needs to be taken into account. Taking into account the DVB-T spectrum mask for the sensitive case (see § 3.5) and the fact that only three quarters of the total DVB-T transmitted power falls into the 6 MHz radio astronomy band, the following Tables result:

Wanted: radio astronomy single-dish telescope (service type code XA8) in the band 608-614 MHz

Default field strength to be protected (dB(µV/m)): –39

Default receiving antenna height (m): 50

Unwanted: DVB-T/8 MHz

Δf (MHz)	–9.0	–7.0	–6.8	0.0	6.8	7.0	9.0		
PR (dB)	–66.2	–45.8	–1.2	–1.2	–1.2	–45.8	–66.2		

* The Chester 1997 Multilateral Coordination Agreement relating to Technical Criteria, Coordination Principles and Procedures for the introduction of DVB-T.

** The Arab Administrations, during RA-03, objected to those values of protection of the radio astronomy service which are contained in Recommendation ITU-R RA.769.

Wanted: radio astronomy VLBI (service type code XB8) in the band 608-614 MHz

Default field strength to be protected (dB(µV/m)): 3

Default receiving antenna height (m): 50

Unwanted: DVB-T/8 MHz

Δf (MHz)	–9.0	–7.0	–6.8	0.0	6.8	7.0	9.0		
PR (dB)	–66.2	–45.8	–1.2	–1.2	–1.2	–45.8	–66.2		

A.4.2.3 Protection criteria for the land mobile service

A.4.2.3.1 Protection criteria for analogue systems of the land mobile service

1) Protection criteria for 12.5 kHz systems subjected to emissions from DVB-T (8 MHz)

The tables below give the protection ratios required for different frequency offsets between DVB-T and analogue PMR. The land mobile service has various applications, and the required quality of service will be dependent on the specific application.

Below are two tables giving examples for different values of wanted signal level.

PMR protection ratios in the presence of an offset DVB-T for a wanted level of –107.0 dBm (service type code NV)

Unwanted signal: DVB-T 8 MHz

Wanted signal: FM, 1 kHz tone, 1.5 kHz deviation, at –107.0 dBm

For a receiving base station to be protected: default field strength to be protected (at 174 MHz): 7 dB(µV/m), default receiving antenna height: 20 m

For a receiving mobile station to be protected: default field strength to be protected (at 174 MHz): 15 dB(µV/m), default receiving antenna height: 1.5 m

Failure criteria: reduction of SINAD to 14.0 dB

Δf (MHz)	–10.0	–9.0	–8.0	–7.0	–6.0	–5.0	–4.0	–3.9	–3.8	–3.7	–3.0	–1.0	0.0
PR (dB)	–81.8	–79.7	–77.8	–76.0	–74.0	–71.8	–71.5	–52.6	–24.1	–23.0	–23.0	–23.0	–23.0
Δf (MHz)	+1.0	+3.0	+3.7	+3.8	+3.9	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0	+10.0	
PR (dB)	–23.0	–23.0	–23.0	–24.1	–52.6	–71.5	–71.8	–74.0	–76.0	–77.8	–79.7	–81.8	

PMR protection ratios in the presence of an offset DVB-T for a wanted level of –87.0 dBm (service type code NX)

Unwanted signal: DVB-T 8 MHz

Wanted signal: FM, 1 kHz tone, 1.5 kHz deviation, at –87.0 dBm

For a receiving base station to be protected: default field strength to be protected (at 174 MHz): 27 dB(µV/m), default receiving antenna height: 20 m

For a receiving mobile station to be protected: default field strength to be protected (at 174 MHz): 35 dB(µV/m), default receiving antenna height: 1.5 m

Failure criteria: reduction of SINAD to 14.0 dB

Δf (MHz)	–10.0	–9.0	–8.0	–7.0	–6.0	–5.0	–4.0	–3.9	–3.8	–3.7	–3.0	–1.0	0.0
PR (dB)	–70.5	–67.9	–65.8	–64.3	–63.0	–61.8	–61.2	–52.3	–24.0	–23.2	–23.2	–23.2	–23.2
Δf (MHz)	+1.0	+3.0	+3.7	+3.8	+3.9	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0	+10.0	
PR (dB)	–23.2	–23.2	–23.2	–24.0	–52.3	–61.2	–61.8	–63.0	–64.3	–65.8	–67.9	–70.5	

2) Protection criteria for 20/25 kHz land mobile systems subjected to emissions from DVB-T (8 MHz)

Protection ratios have been measured for a few narrow-band FM UHF handhelds operating in the frequency range 470-500 MHz and having channel bandwidths of 20 or 25 kHz.

The failure criteria was degradation of SINAD from 20 dB to 19 dB.

The resulting protection ratios for the most susceptible piece of equipment (service type code NY) are as follows:

Δf = 0 MHz –10 dB

Δf = 3.8 MHz –17 dB

Δf = 4.2 MHz –55 dB.

The resulting protection ratios for the least susceptible piece of equipment (service type code NZ) are as follows:

Δf = 0 MHz –17 dB

Δf = 3.8 MHz –20 dB

Δf = 4.2 MHz –71 dB.

The fact that the co-channel protection ratios are negative can be explained by the small bandwidth of the systems. This implies that only a very small percentage of the DVB-T energy falls in the bandwidth of the mobile system.

Typical values for field strength to be protected are 31 dB(μV/m).

3) Protection criteria for service ancillary to broadcasting/service ancillary to programme-making (SAB/SAP)

Default values for field strength to be protected as well as protection ratios as a function of frequency separation for radiomicrophones, OB links (audio), and talkback links are given in the following tables.

All these values have been derived from measurements, involving a large number of pieces of equipment.

The failure criteria was degradation of SINAD from 20 dB to 19 dB for the FM talkback equipment. For the OB links and radiomicrophones, the failure criteria was degradation of the *S*/*N* by 3 dB.

Wanted: radio microphone (companded) (service type code NR7)

Default field strength to be protected (dB(μV/m)): 68

Frequency (MHz): 650

Default receiving antenna height (m): 1.5

Unwanted: DVB-T/7 MHz

Δf (MHz)	–10.5	–8.75	–7.0	–5.25	–3.68	–3.32	–3.15	0.0	3.15	3.32
PR (dB)	–49.0	–49.0	–44.0	–39.0	–34.0	8.0	13.0	13.0	13.0	8.0
Δf (MHz)	3.68	5.25	7.0	8.75	10.5					
PR (dB)	–34.0	–39.0	–44.0	–49.0	–49.0					

Wanted: radio-microphone (companded) (service type code NR8)

Default field strength to be protected (dB(μV/m)): 68

Frequency (MHz): 650

Default receiving antenna height (m): 1.5

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.2	–3.8	–3.6	0.0	3.6	3.8
PR (dB)	–50.0	–50.0	–45.0	–40.0	–35.0	7.0	12.0	12.0	12.0	7.0
Δf (MHz)	4.2	6.0	8.0	10.0	12.0					
PR (dB)	–35.0	–40.0	–45.0	–50.0	–50.0					

Wanted: OB link (stereo, non-companded) (service type code NS7)

Default field strength to be protected (dB(μV/m)): 86

Frequency (MHz): 650

Default receiving antenna height (m): 10

Unwanted: DVB-T/7 MHz

Δf (MHz)	–10.5	–8.75	–7.0	–5.25	–3.68	–3.32	–3.15	0.0	3.15	3.32
PR (dB)	–17.0	–16.0	–11.0	–8.0	–4.0	37.0	44.0	44.0	44.0	37.0
Δf (MHz)	3.68	5.25	7.0	8.75	10.5					
PR (dB)	–4.0	–8.0	–11.0	–16.0	–17.0					

Wanted: OB link (stereo, non-companded) (service type code NS8)

Default field strength to be protected (dB(μV/m)): 86

Frequency (MHz): 650

Default receiving antenna height (m): 10

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.2	–3.8	–3.6	0.0	3.6	3.8
PR (dB)	–18.0	–17.0	–12.0	–9.0	–5.0	36.0	43.0	43.0	43.0	36.0
Δf (MHz)	4.2	6.0	8.0	10.0	12.0					
PR (dB)	–5.0	–9.0	–12.0	–17.0	–18.0					

Wanted: Talkback (non-companded) (service type code NT7)

Default field strength to be protected (dB(μV/m)): 31

Frequency (MHz): 650

Default receiving antenna height (m): 1.5

Unwanted: DVB-T/7 MHz

Δf (MHz)	–10.5	–8.75	–7.0	–5.25	–3.68	–3.32	–3.15	0.0	3.15	3.32
PR (dB)	–96.0	–91.0	–84.0	–79.0	–69.0	–19.0	–13.0	–13.0	–13.0	–19.0
Δf (MHz)	3.68	5.25	7.0	8.75	10.5					
PR (dB)	–69.0	–79.0	–84.0	–91.0	–96.0					

Wanted: Talkback (non-companded) (service type code NT8)

Default field strength to be protected (dB(µV/m)): 31

Frequency (MHz): 650

Default receiving antenna height (m): 1.5

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.2	–3.8	–3.6	0.0	3.6	3.8
PR (dB)	–97.0	–92.0	–85.0	–80.0	–70.0	–20.0	–14.0	–14.0	–14.0	–20.0
Δf (MHz)	4.2	6.0	8.0	10.0	12.0					
PR (dB)	–70.0	–80.0	–85.0	–92.0	–97.0					

A.4.2.3.2 Protection criteria for digital equipment in the land mobile service in the band 790-862 MHz operating in countries listed in RR No. 5.316 and in the band 470-862 MHz in the Islamic Republic of Iran

The field strength to be protected is 13 dB(µV/m) (8 MHz) for a base station.

The protection ratios (PR) for the digital land mobile service (for example CDMA) interfered with by emissions from DVB-T (8 MHz) service type code NA are as follows:

Δf (MHz)	**±7.5**	**±6.25**	**±5**	**±3.75**	**±2.5**	**±1.25**	**0**
PR (dB) using DVB-T mask, non-critical cases	–63	–57	–50	–7	–5	–5	–5
PR (dB) using DVB-T mask, sensitive cases	–73	–67	–60	–7	–5	–5	–5

The protection ratios in the Table above are based on the DVB-T transmitter masks as quoted in Chapter 3 (§ 3.5.2.1 “Symmetrical spectrum mask for DVB-T in 8 and 7 MHz channels”).

A.4.2.3.3 Protection criteria for any VHF/UHF land mobile service systems not covered previously and for which no system information is available

In cases where no system information is available, the following protection criteria may be used during negotiations by concerned administrations:

The maximum allowable field strength to be protected depends on the bandwidth and equals:

– for base stations (14 dBi equivalent antenna gain):

Frequency (MHz)	174	230	470	790	862
Field strength (dB(µV/m))	1 + 10 log *B*	4 + 10 log *B*	10 + 10 log *B*	14 + 10 log *B*	15 + 10 log *B*

B is the necessary bandwidth (MHz).

For other frequencies, it is proposed to use the higher frequency limit, or to interpolate:

– for mobile stations (no directive antenna):

Frequency (MHz)	174	230	470	790	862
Field strength (dB(µV/m))	15 + 10 log *B*	18 + 10 log *B*	24 + 10 log *B*	28 + 10 log *B*	29 + 10 log *B*

For other frequencies, it is proposed to use the higher frequency field strength and signal levels, or to interpolate.

The following protection ratios may be used during negotiations by concerned administrations:

"Generic" protection ratios for the mobile service interfered with by DVB-T (7 MHz) (service type code NB7)

Δ*f* (MHz)	**±10**	**±9**	**±8**	**±7**	**±6**
PR (dB) using the DVB-T mask, non-critical cases	–75	–70	–65	–61	–56
PR (dB) using the DVB-T mask, sensitive cases	–85	–80	–75	–71	–66

Δ*f* (MHz)	**±5**	**±4**	**±3**	**±2**	**±1**
PR (dB) using the DVB-T mask, non-critical cases	–50	–43	0	0	0
PR (dB) using the DVB-T mask, sensitive cases	–60	–53	0	0	0

"Generic" protection ratios for the mobile service interfered with by DVB-T (8 MHz) (service type code NB8)

Δf (MHz)	±12	±10	±9	±8	±7	±6
PR (dB) using the DVB-T mask, non-critical cases	–77	–69	–65	–61	–56	–52
PR (dB) using the DVB-T mask, sensitive cases	–87	–79	–75	–71	–66	–62

Δf (MHz)	±5	±4	±3	±2	±1
PR (dB) using the DVB-T mask, non-critical cases	–45	–13	0	0	0
PR (dB) using the DVB-T mask, sensitive cases	–55	–17	0	0	0

The generic protection ratio tables given above may only be used for systems having a bandwidth which is small compared to the DVB-T bandwidth.

A.4.2.4 Protection criteria for aeronautical radionavigation service

A.4.2.4.1 Protection criteria for aeronautical radionavigation systems used in the band 645-862 MHz in several countries of Region 1 according to RR No. 5.312 and in the bands 223-230 MHz and 585-610 MHz in the Islamic Republic of Iran

In accordance with provision RR No. 5.312, the band 645-862 MHz is allocated in several countries to the aeronautical radionavigation service on a primary basis.

In accordance with the Table of Frequency Allocations, the band 223-230 MHz is allocated to the aeronautical radionavigation service and the band 585-610 MHz is allocated to the radionavigation service[2] in Region 3 (the Islamic Republic of Iran) on a primary basis.

Several types of radionavigation systems are used in the aeronautical radionavigation service including:

– short range radionavigation system (RSBN);

– air traffic control secondary radars, which include ground radar and aircraft responders;

– air traffic control aerodrome primary radars and route primary radars.

All indicated systems are used for navigation and air traffic control.

[2] The information contained in this section is limited to the aeronautical radionavigation service only.

A.4.2.4.1.1 Protection criteria for the air-to-ground component of the RSBN system

Background information

The RSBN aeronautical radionavigation system is used in several countries of Region 1 and in the Islamic Republic of Iran in Region 3.

Field strength to be protected and protection ratios for the air-to-ground component of the RSBN system operating in the UHF band

Many measurements have been made and some theoretical work has been done to study the protection of the system against transmissions of digital terrestrial television. However, the results of the measurements differ, i.e. the measured values for the level to be protected differ significantly by around 20 dB and the measured values for the PR values show some differences.

Considering the theoretical and measured values, the use of a field strength to be protected of 42 dB(µV/m), corresponding to a *C*/*I* value of 3 dB, has been accepted. This leads to an operational range of 400 km and sometimes even more for the RSBN system.

The PRs given below are close to the measured PRs for RSBN receivers with field-strength values to be protected between 42 dB(µV/m) and 49 dB(µV/m).

Wanted: Aeronautical radionavigation RSBN

Default field strength to be protected (dB(µV/m)): 42

Default receiving antenna height (m): 10

Service type code: AA8

Unwanted: DVB-T/8 MHz

Δf (MHz)	–12.0	–10.0	–8.0	–6.0	–4.0	–2.0	–0.0	+2.0	+4.0
PR (dB)	**–65.0**	**–50.0**	**–27.0**	**–16.0**	**–5.0**	**0.0**	**0.0**	**0.0**	**–5.0**
Δf (MHz)	+6.0	+8.0	+10.0	+12.0					
PR (dB)	**–16.0**	**–40.0**	**–52.0**	**–65.0**					

Guidance for application

Protection is sought for the RSBN ground receivers at airports or zones around airports, but not for the entire territory of countries. It is recommended to take into account additional decoupling of both stations caused by, for example, terrain irregularity transmitting and receiving antenna pattern. Moreover, realistic assumptions for the operational range of the RSBN station should be made.

The field strength to be protected given in the table corresponds to the lowest possible field strength received by a RSBN receiver. During the coordination of DVB-T assignments it is advisable to use values for the field strength to be protected that are close to the realistic useful signal strengths, which could be received by a RSBN receiver, derived by taking into account the location of the RSBN ground receivers.

To calculate the interfering field strength of the DVB-T station, propagation curves from Recommendation ITU-R P.1546-1 have to be used (see Chapter 2). Protection of the RSBN systems should be provided for 90% of the time.

A.4.2.4.1.2 Protection criteria for air traffic control radars operating in the band 645-862 MHz in several countries of Region 1 and in the bands 223-230 MHz and 585-610 MHz in the Islamic Republic of Iran which are interfered with by DVB-T

The band 645-862 MHz is used by air traffic control radars in the aeronautical radionavigation service, which, according to RR No. 5.312, has a primary allocation in several countries of Region 1. The bands 223-230 MHz and 585-610 MHz are used for the same purposes in the Islamic Republic of Iran according to the Table of Frequency Allocations. Recommendation ITU-R M.1461 provides guidance on the protection criteria for radars operating in the radiodetermination service. However, no studies have been conducted within ITU-R on the protection criteria for these air traffic control radars interfered with by DVB-T. ITU-R studies on these issues have been requested, on an urgent basis, by Resolution COM4/3 of RRC-04 in order to provide adequate protection for these systems.

A.4.2.4.2 Protection criteria for the aeronautical radionavigation system used in the United Kingdom in the band 590-598 MHz

The band 590-598 MHz is allocated on a primary basis to the aeronautical radionavigation service in the United Kingdom as per RR No. 5.302. The following protection criteria need to be applied to protect the system (service type code XG).

Wanted: CH36 airport radars (UK)

Default field strength to be protected (dB(μV/m)): –12

Default receiving antenna height (m): 7

Unwanted: DVB-T/8 MHz

Δf (MHz)	–5.0	–4.0	–3.0	0.0	3.0	4.0	5.0		
PR (dB)	–79.0	–40.0	0.0	0.0	0.0	–40.0	–79.0		

Symbols of service type codes used in this Annex are listed in the table below.

Table of service type codes

(protection of other primary services from DVB-T)

Service type code	RR No.	Service
AA8	1.46	aeronautical radionavigation
FF	1.20	fixed
FH	1.20	fixed
FK7	1.20	fixed
FK8	1.20	fixed
NA	1.26	land mobile
NB7	1.26	land mobile
NB8	1.26	land mobile
NR7	1.26	land mobile
NR8	1.26	land mobile
NS7	1.26	land mobile
NS8	1.26	land mobile
NT7	1.26	land mobile
NT8	1.26	land mobile
NV	1.26	land mobile
NX	1.26	land mobile
NY	1.26	land mobile
NZ	1.26	land mobile
XA8	1.58	radio astronomy
XB8	1.58	radio astronomy
XG	1.46	aeronautical radionavigation

ANNEX 4.3

Protection criteria for digital terrestrial sound broadcasting (T-DAB) interfered with by other primary services

Protection criteria for T-DAB interfered with by other primary services can be found in Recommendation ITU-R BS.1660 – Technical basis for planning of terrestrial digital sound broadcasting in the VHF band.

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Protection criteria for digital terrestrial television broadcasting (DVB-T) interfered with by other primary services

Protection ratios for DVB-T are provided in this Annex. Information on minimum field strengths for DVB-T can be found in Chapter 3.

Resolution COM4/2 has been adopted by the first session of the RRC to carry out additional studies, as a matter of urgency, in order to develop protection criteria for DVB-T systems interfered with by those primary service systems operating in the bands 174-230 MHz and 470-862 MHz for which no information is contained in Recommendation ITU-R BT.1368-4.

Protection ratios for DVB-T subjected to continuous wave (CW) or narrow-band FM signals

The following protection ratio table can be used for interfering signals with narrow bandwidth, e.g. analogue sound carriers or non-broadcasting services.

Co-channel protection ratios (dB) for a DVB-T 8 MHz 64-QAM code rate 2/3 signal interfered with by a CW or an FM carrier (non-controlled frequency offset)

Δf (MHz)	–12	–4.5	–3.9	0	3.9	4.5	12
PR (dB)	–38	–33	–3	–3	–3	–33	–38

where:

Δf: frequency difference between centre frequencies

PR: required protection ratio.

The following protection ratio table can be used for interfering signals with narrow bandwidth, e.g. analogue sound carriers or non-broadcasting services. It should be noted that the fine structure of the protection ratio versus frequency offset between the OFDM signal and the interfering CW signal exhibits a cyclic variation. The values shown in the table below are for the optimum offset.

Co-channel protection ratios (dB) for a DVB-T 7 MHz 64-QAM code rate 2/3 signal interfered with by a CW carrier (controlled frequency offset)

Δf (MHz)	–8	–4	–3	0	3	4	8
PR (dB)	–48	–41	–8	–9	–6	–39	–48

Protection ratios for DVB-T interfered with by the fixed service with the following characteristics:

Technical characteristics of the application of the fixed service (relocatable system)

– typical output power: less than or equal to 1 W;

– typical antenna gain: around 15 dBi;

– modulation: 2-FSK;

– bandwidth at –60 dB: 2 MHz.

More information on fixed service systems may be found in Recommendation ITU-R F.758-3 – Considerations in the development of criteria for sharing between terrestrial fixed service and other services.

Basic conditions for the measurements

The protection ratios given below are based on the following characteristics of DVB-T:

– modulation: 64-QAM;

– code rate: 2/3;

– channel bandwidth: 8 MHz.

The measured receiver sensitivity is –78 dBm.

For all the measurements of the protection ratios a wanted DVB-T signal level of –70 dBm or greater is assumed. (This is the wanted signal level at which the protection ratios are stable, for lower levels of the wanted signal, larger protection ratios are needed.)

Protection ratios for DVB-T subjected to transmissions of system described above

The following protection ratios are derived from the measurements:

Δf (MHz)	–12	–4.5	–3.75	0	3.75	4.5	12
PR(dB)	–45	–27	1	4	1	–27	–45