UPDATES to the

Rules of Procedure

(Edition of 2012)

approved by the Radio Regulations Board

Revision (Circular No.)	Date	Part	AR/AP	RR No. or other reference[1]	Pages to be removed	Pages to be inserted
1 See CR/339	September 2012	A1	AR5	5.316A[*] 5.327A[**] 5.397 5.399 5.410[*] 5.444B[**] 5.446A	5 7-8 13-15	5 (rev.1) 7-8 (rev.1) 13-15 (rev.1)
			Receivability	1, 1.1[**], 1.2 2 *b)*	1-3	1-3 (rev.1)
			AR21	21.16, 3	2	2 (rev.1)
			AP18	AP18[*]	1-2	-
			AP30	An. 1, 1 *b)*	14-16	14-16 (rev.1)
			AP30A	An. 1, 4 *b)*	13-16	13-15 (rev.1)
			AP30B	6.3 *a)*, 2.3 6.16 Art. 8, 8.17[**]	2-6	2-7 (rev.1)
		Table of content			1	1 (rev.1)
2 See CR/342	November 2012	A1	AR9	9.2 9.11A-1 9.11A-2 9.21[**]-9.27 9.41-9.42[**]	1-2 10-11 16-17 19-22 25	1-2 (rev.2) 10-11 (rev.2) 16-17 (rev.2) 19-22 (rev.2) 25 (rev.2)
			AR11	11.43A[**] 11.44[**] 11.44B[**] 11.47[**] 11.49[**]	19-23	19-23 (rev.2)

Revision (Circular No.)	Date	Part	AR/AP	RR No. or other reference[1]	Pages to be removed	Pages to be inserted
3 See CR/346	April 2013	A1	AR9	Council decision 482	1-2	1-1*bis* (rev.3), 2
			AR11	Apendix 4 (Annex2, A4) ***,	1-2	1-1*bis* (rev.3), 1*ter*, 2
				11.31	6	6 (rev.3)
			Resolution 51	1-2.2.2	1	-
		A6	GE89	4	2	2 (rev.3)
		C		1.4, 1.6, 1.9-1.12	1-4	1-4 (rev.3)
		Table of content			1	1 (rev.3)
4 See CR/351	August 2013	C		1.6 *bis*	2-6	2-6 (rev.4)
5 See CR/355	January 2014	A1	AR5	5.132A, 5.145A, 5.161A	3-4	3-3*bis* (rev.5)-4
				5.399	7-8	7 (rev.5)-8
			AR11	11.41, 11.41.2	19-20	19 (rev.5)-20
				11.44****	21-22	21 (rev.5)-22
			AR21	Table 21-2	1-2	1-1*bis* (rev.5)-2
			AP30B	Annex 4, 2.2****	7-8	7-8 (rev.5)
		A10	GE06	Appendix 2.1, Section A2.1.8.1	7-8	7-7*bis* (rev.5)-8
		Table of content			1-2	1 (rev.5)-2
6 See CR/368	August 2014	A1	Receivability	1.1	1 (rev.1)	1 (rev.6)
				2 *b)*	2 (rev.1)	2 (rev.6)
			AR9	9.2B	1*bis* (rev.2)	1*bis* (rev.6)
				9.5B*****	2 (rev.2)	2 (rev.6)
				9.47	25 (rev.2)	25 (rev.6)
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7 See CR/373	November 2014	A1	AR11	11.50	23 (rev.2)	23-25 (rev.7)
		Table of content			1 (rev.6)-2	1 (rev.7)-2
8 See CR/390		A10	GE06	******	1-10	1 (rev.8)-12
		B3		******	1-14	1 (rev.8)-19 (rev.8)
		Table of content			2	2(rev.8)

[1]   The new Rules or modifications to the existing Rules of Procedure take effect immediately or as otherwise indicated.
*   Effective date of suppression: 1 January 2013.
**   Effective date of application: 1 January 2013.
***   Effective date of application: 1 July 2013.
****   Effective date of application: 1 January 2014.
*****   Effective date of application: 1 January 2015.
*****   Effective date of application: 6 February 2016.

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PART A

PART B

PART A10

Rules concerning the Regional Agreement relating to the planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz (Geneva, 2006) (GE06)

1   Receivability of notices

In the application of the Regional Agreement relating to the planning of the digital terrestrial broadcasting service in Region 1 (parts of Region 1 situated to the west of meridian 170° E and to north of parallel 40° S, except the territory of Mongolia) and in the Islamic Republic of Iran, in the frequency bands 174-230 MHz and 470-862 MHz (Geneva, 2006), the Bureau will apply the procedures contained in Articles 4 and 5 of the Agreement and associated technical criteria with respect to the notices from all administrations having territories in the planning area, provided that the station concerned (or the allotment area concerned) is situated within the planning area.

(ADD RRB16/21)

2   Protection of a Plan entry from interference caused by a Plan entry of another Administration and with which the coordination procedure was not triggered in the application of Article 4 of the GE06 Agreement

1)   During the RRC-06 Conference, a compatibility analysis for all requirements (allotments and assignments) was carried out in two directions (transmission and reception). When requirements were not compatible with each other in one or both directions, the administrations concerned had to resolve the incompatibility. This ensured that all entries in the Plan, as adopted by RRC-06, were evaluated and agreed as compatible by the concerned administrations.

2)   Since then, new or modified assignments/allotments were included in the Plan following the successful application of the procedure of Article 4 of the GE06 Agreement. This procedure however, considers administrations as affected by a proposed modification only when the limits given in Section I of Annex 4 of the Agreement are exceeded. This approach was designed to trigger the need to coordinate with the potentially affected administration(s) in order to ensure that the proposed modification will not affect the ability of other administrations to receive broadcasting emissions on any channel over their territory. Nonetheless, the Agreement does not address the interference that a proposed modification will receive from assignments previously recorded in the Plan.

3)   In the application of Article 4 of the GE06 Agreement, the Bureau received a request from an administration to be included in the list of administrations affected by a proposed modification to the Plan because that modification might be affected by that administration's own entries in the plan. However, since the proposed modification did not exceed the limits of Annex 4 of the GE06 Agreement, the Bureau could not accede to this request.

4)   This situation highlights that the procedures of the GE06 Agreement do not require, prior to its inclusion in the Plan, to coordinate the protection of a proposed modification to the Plan from the interference that may be caused to it by entries already recorded in the Plan.

5)   The Board considered that a general principle of the Radio Regulations is that the status, i.e. the rights for transmission or the rights for protection of new assignments are derived from the successful application of the relevant procedures (See RR No. **8.3**).

6)   In the absence of a relevant procedure in the GE06 Agreement to acquire such rights, the Board considered that, unless otherwise agreed between the administrations concerned, an assignment in conformity with the Plan and recorded in the Master Register cannot claim protection from assignments that are in conformity with the Plan, irrespective of whether or not the corresponding Plan entries have any Plan remarks (R2, R3), corresponding to an entry which was recorded in the Plan prior to the entry corresponding to the assignment for which protection is claimed.

7)   The Board noted that several provisions of the GE06 Agreement indicate that, after successful application of the procedure, the new entry will have the same status as the other entries in the Plan. Consistent with the above considerations, the Board is of the view that all entries in the plan involve a right for transmission for the corresponding assignments and a right for protection of these assignments against subsequent entries in the plan. Conformity with the plan does not involve the right for protection against previous entries in the plan.

8)   The Board also noted that several administrations had communicated to the Bureau proposed modifications to the GE06 Plan on the basis of low power stations located near the border of their territory in a way that does not trigger the limits of Annex 4 of the GE06 Agreement. Consistent with the above considerations, the Board is of the view that the inclusion in the Plan and/or the MIFR of the corresponding assignments does not provide any additional rights to protect these assignments from assignments previously included in the Plan[1] as protection from these assignments cannot be obtained from application of Article 4 if the limits in Annex 4 are not exceeded.

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[1] Similarly no protection should be claimed from assignments stemming from those allotments that were previously recorded in the Plan.

9)   The Board also noted that this Rule of Procedure does not require any modification to the current practice by the Bureau in processing notices for the application of Articles 4 and 5 of the GE06 Agreement. Similarly this Rule of Procedure does not apply to other primary terrestrial services.

10)   This ROP is applicable immediately, irrespective of the date of entry in the Plan/MIFR of the concerned assignments/allotments.

Art. 4

Procedure for modifications to the Plans and procedure for coordination of other primary terrestrial services

4.1.1

1)   This provision specifies the various cases envisaged in the procedure for modifications to the Plans. Essentially, the procedure provides a phased approach in the case when an administration wishes to add to the digital Plan an allotment and assignment(s) stemming from that allotment: the administration firstly needs to successfully complete the Plan modification procedure for the allotment and, once the allotment is entered in the digital Plan, the administration could apply the procedure referred to in No. 4.1.1 *c)*. Therefore, the Board concluded that there was no possibility for simultaneous application of the procedure for adding an allotment to the Plan and the procedure of adding assignment(s) stemming from that allotment and instructed the Bureau to act accordingly.

2)   In the case of proposed changes to the characteristics of an allotment already included in the Plan, which also comprises one or several assignments stemming from the allotment already included in the Plan, the Bureau will follow the following procedure:

−   in the application of No. 4.1.1 *a)*, the Bureau will publish the characteristics of the modified allotment; to this end, the Bureau will include such notes in the concerned Special Section, as may be appropriate, to indicate the applicable situations, notably: (1) that the Plan contains one or more assignments stemming from the original allotment which would be reviewed after the successful completion of the Plan modification procedure in respect of the concerned allotment, and (2) that the administration concerned announced a submission of other assignments stemming from the modified allotment, which would be examined after the successful completion of the Plan modification procedure for the modified allotment and appropriately reflected in another Special Section;

−   until the successful completion of the Plan modification procedure for the modified allotment, the Bureau will retain the previous allotment (together with the assignments stemming from that allotment);

−   after the successful completion of the Plan modification procedure for the modified allotment, the Bureau will include it in the Plan (as a replacement for the previous allotment) and will examine all the assignments stemming from the previous allotment, if any, with respect to their conformity with the replacement allotment. If the assignments are in conformity with the replacement allotment, they will be maintained in the Plan; otherwise they will be deleted from the Plan and the administration concerned will be informed accordingly. The notifying administration, if it so wishes, may submit other assignment(s) stemming from the modified allotment under provision No. 4.1.1 *c)*; upon receipt of these other assignments stemming from the modified allotment, the Bureau will examine them under No. 4.1.2.7 and will act accordingly.

Art. 5

Notification of frequency assignments

5.1.2

1)   This provision deals with the examination by the Bureau of the assignment with respect to No. **11.34** of the Radio Regulations (RR), i.e., its conformity with the Plans and the associated provisions. For the case of an analogue television assignment, sub-paragraph a) applies and it requires that the conditions of Section II of Annex 4 be met. However, Section II of Annex 4 deals only with the examination of conformity with the digital Plan entry. The Board concluded that, by analogy with § 4.2 of Section II of Annex 4 (dealing with digital plan entry comprising one assignment only), the notified frequency assignment to an analogue television assignment will be considered as compliant with the analogue television Plan if it fulfils the conditions specified in § 4.2 of Section II of Annex 4, as adapted to the case of analogue television assignment.

2)   In addition, the Board concluded that the analogue television assignments in the bands 174-230 MHz (for Morocco 170-230 MHz) and 470-862 MHz, which were recorded in the Master Register at the time of the establishment of the GE06 analogue Plan with favourable findings under No. **11.34** of the RR, shall retain such favourable findings as long as their characteristics and the characteristics of the equivalent entry in the analogue television plan of the GE06 Agreement remain unchanged.

5.1.2 *e)*

1)   If the digital Plan entry bears a remark with respect to assignments in the analogue Plan or to existing assignments to other primary terrestrial services, the finding of the notified frequency assignment referring to this digital Plan entry and being within the scope of provision No. 5.1.2 *e)* shall be favourable if all the necessary agreements have been obtained and if the conditions specified in Section II of Annex 4 are met.

2)   If the digital Plan entry bears a remark with respect to entries in the digital Plan, the finding of the notified frequency assignment referring to this digital Plan entry and being within the scope of provision No. 5.1.2 *e)* shall be favourable if the notifying administration states that all conditions associated with the remark are fully met, and the conditions of Section II of Annex 4 are met.

3)   For the case of a T-DAB frequency assignment, notified under No. 5.1.2 *e)* of the GE06 Agreement, using a DVB-T single assignment Plan entry in the digital Plan, if the notified frequency assignment uses the same part of the spectrum of the DVB-T Plan assignment more than once, the finding of the notified assignment will be unfavourable and the notice will be returned to the notifying administration.

4)   For the case of a T-DAB frequency assignment, notified under No. 5.1.2 *e)* of the GE06 Agreement, using a DVB-T Plan (assignment or allotment) entry, when examining if the conditions in Section II of Annex 4 of the GE06 Agreement are met, the Bureau will augment the notified e.r.p. of the T-DAB assignment by a corresponding correction factor indicated in the table below to take into account the difference in spectral power densities as a result of the different bandwidths of the T-DAB assignment and the DVB-T Plan entry. The values of the correction factor are calculated as the ratio of the digital television broadcasting Plan entry bandwidth and the necessary bandwidth of the notified assignment.

**Correction factor to be applied to the e.r.p.
of notified T-DAB assignments**

	DVB-T Plan entry channel arrangement	
	7 MHz	8 MHz
Correction factor	6.371 dB	6.950 dB

NOTE − If there is one or more DVB-T Plan entries using system variant of 64-QAM 7/8, located within 1000 km (the limit of the propagation model described in Annex 2 of the Agreement) of the transmitter site of the notified T-DAB assignment, a correction factor of 8.1 dB will be used.

5.1.3

1)   This provision deals with notification of a digital broadcasting entry in the Plan with characteristics different from those appearing in the Plan. The definition of the "digital Plan entry", as contained in No. 1.3.18 of Annex 1 to the GE06 Agreement, includes both assignments and allotments. However, and in view of the formulation of No. 5.1 of the GE06 Agreement, the Board concluded that, in the application of No. 5.1.3 of the GE06 Agreement, administrations can notify only frequency assignments.

2)   For the examination of the conformity of the frequency assignment in the broadcasting service or in other primary services, notified under No. 5.1.3 of the GE06 Agreement, with the corresponding "digital entry in the Plan", the Bureau would need to ascertain that the notified frequency assignment does not exceed the interference potential of the corresponding digital broadcasting entry in the Plan. Provision No. 5.1.3 indicates only the condition that the peak power density of the notified frequency assignment, in any 4 kHz, shall not exceed the spectral power density in the same 4 kHz of the digital broadcasting entry in the Plan. Item 5.6 of Table 3 of Annex 3 to the GE06 Agreement indicates that this is the spectral power density delivered to the antenna transmission line. The Board understands that the maximum spectral power-density (dB(W/Hz)) (Item 8AC, Annex 1 of Appendix **4** (Rev.WRC-07)) averaged over the worst 4 kHz band is based on the maximum effective radiated power. The Bureau will take into account the spectral power-density of the notified assignment by first calculating the equivalent maximum effective radiated power (e.r.p.) of the notified frequency assignment to which is applied a correction factor that takes into account the difference in spectral power-densities as a result of the different necessary bandwidths of the frequency assignment and the corresponding Plan entry. The equivalent effective radiated power is derived from the necessary bandwidth and the peak spectral power-density of the notified assignment and the bandwidth of the digital broadcasting Plan entry, as given in the equation below:

$$e.r.p._{eq,\ max} = SPD_{max} + 10\log_{10}\left(BW_{NA}\right) + 10\log_{10}\left(\frac{BW_{PE}}{BW_{NA}}\right) \qquad \text{dBW}$$

where:

SPD_{max}:   maximum spectral power density (dB(W/Hz)) (Item 8AC, Annex 1 to Appendix **4** (Rev.WRC-07)) averaged over the worst 4 kHz band and based on the maximum effective radiated power

BW_{NA}:   notified necessary bandwidth (Hz) (Item 7AB, Annex 1 to Appendix **4** (Rev.WRC-07));

BW_{PE}: bandwidth (Hz) for the relevant system of the digital broadcasting Plan entry. For DVB-T Plan entries the bandwidth is 7.61×10^6 Hz in the case of 8 MHz systems and 6.66×10^6 Hz for 7 MHz systems, and for T-DAB Plan entries, 1.536×10^6 Hz.

In order to ascertain that the field strength produced by the notified frequency assignment(s), in any direction, does not create more interference than the corresponding digital broadcasting Plan entry, the Bureau would need complete characteristics of the notified frequency assignment, such as geographical information (effective antenna heights in 36 azimuths) and transmission information (polarization, e.r.p., including antenna attenuation in the horizontal and vertical planes if, for example, the digital broadcasting Plan entry has a directional antenna pattern). Therefore, when notifying frequency assignments under No. 5.1.3 of the GE06 Agreement, administrations need to supply all the relevant characteristics that are necessary, for the Bureau, to ascertain that the notified frequency assignment is within the envelope of the digital broadcasting Plan entry.

3)   If the digital Plan entry bears a remark with respect to assignments in the analogue Plan or to existing assignments to other primary terrestrial services, the finding of the notified frequency assignment referring to this digital Plan entry and being within the scope of provision No. 5.1.3 shall be favourable if all the necessary agreements have been obtained and if the results of all the required examinations are favourable.

If the digital Plan entry bears a remark with respect to entries in the digital Plan, the finding of the notified frequency assignment referring to this digital Plan entry and being within the scope of provision No. 5.1.3 shall be favourable if the notifying administration states that all conditions associated with the remark are fully met and if the results of all the required examinations are favourable.

Art. 12

Entry into force, duration and provisional application of the Agreement

12.6

Footnote 7, associated with this provision, lists the countries for which the transition period for the VHF band (174-230 MHz; for Morocco: 170-230 MHz) shall end on 17 June 2020 at 0001 hours UTC. The same footnote further specifies the option, for the administrations which were not present at RRC-06 and whose names are listed in footnote 7, of selecting another date for the end of the transition period in the VHF band (notably 17 June 2015 at 0001 hours UTC), provided that these administrations communicate such a decision to the Bureau within a 90-day period from the end of RRC-06.

After the end of RRC-06, the Bureau contacted the administrations of the Member States listed in footnote 7 of this provision which were not present at RRC-06 and informed them of the decisions of RRC-06 in this respect. No administration of the Member States concerned informed the Bureau, within the specified period, that it selected 17 June 2015 for the end of the transition period. Therefore, for all countries listed in footnote 7, the transition period for the VHF band shall end on 17 June 2020 at 0001 hours UTC.

Annex 2

Technical elements and criteria used in the development of the Plan and the implementation of the Agreement

Appendix 2.1
Section A2.1.8.1   (ADD RRB13/64)

This Section deals with the mixed path interpolation factor A used for calculating the field strength for path crossing multiple propagation zones. The interpolation factor A is a function of basic interpolation factor A_0 whose value is determined by reading from the curve in Figure A.2.1-2. This may result in different interpretations of A_0 values. Such situation could lead to different field strength values calculated for path crossing multiple propagation zones and therefore different list of administrations potentially affected by proposed modifications to the Plans. Therefore, the Board concluded that the basic interpolation factor $A_0 (F_s)$ as shown in Fig. A.2.1-2 shall be calculated using the following formula:

$$A_0(F_s) = 1 - (1 - F_s)^{2/3}$$

The application of this formula is consistent with the method adopted by RRC-06 Conference, recommended in Recommendation ITU-R P.1546 and currently used by the Bureau in implementing the GE06 Agreement.

Appendix 3.1
Table A3.1-3

This Table also applies to the geographical areas XGZ and XWB.

Appendix 3.1
Table A3.1-8

This Table also applies to the geographical area AOE, except channels 4 and 5.

Appendix 3.3

Section A.3.3.4 of this Appendix provides information on the protection ratios for analogue television. However, this section does not provide any information on the protection ratios for the case when the analogue television is interfered with by assignments in other primary terrestrial services. Calculations requested in application of § 4.2.4.11 and 4.2.4.12 of the Agreement shall be made by using Recommendation ITU-R SM.851-1, for the cases covered by this Recommendation. For the other cases not covered by that Recommendation, the pertinent ITU-R Recommendations may be used.

Annex 3
Table 3

Data for assignments to stations of other primary terrestrial services

No. 7.1 of this Table specifies that, for the application of Article 4 of the Agreement, the regular hours (UTC) of operation of the frequency assignment (cross-referenced as item 10B in Appendix **4** of the RR) are mandatory if used as a basis to effect coordination with another administration (character "C"). On the other hand, this data item is indicated as mandatory for the application of Article 5 of the Agreement (character "X"). Therefore, for the examinations under § 5.2.2 of the Agreement, where the regular hours of operation are mandatory, the Bureau needs to ascertain that the notified hours of operation are compliant with those resulting from the successful application of the procedure contained in § 4.2 of the Agreement. In view of the above, the Board concluded that the item "regular hours (UTC) of operation of the frequency assignment" would need to be considered as mandatory for all submissions under Article 4 of the Agreement for assignments to stations of other primary terrestrial services.

Annex 4

Section I: Limits and methodology for determining when agreement with another administration is required

2.1

Step 3 of this Section specifies that any assignment in the other primary service is selected for consideration, if it belongs to an administration within the 1 000 km contour, provided that the assignment is contained in the List or the coordination procedure under Article 4 of the GE06 Agreement for its inclusion into the List has already been initiated. The Board concluded that Bureau shall take into account only those eligible frequency assignments in other primary services that have frequency overlap with relevant broadcasting assignment/allotment (i.e., the proposed modification to the Plan).

2.2

This Section specifies the general methodology for constructing the coordination contours for the application of the coordination procedure referred to in § 4.2 of the Agreement. Given the fact that the frequency assignments in the other primary service (OPS) include transmitting and receiving stations, the methodology takes account of the impact of the transmitting station in the OPS to the broadcasting service, as well as the likely impact of the broadcasting service to the receiving stations in the OPS. Therefore, this Section specifies the need for constructing separate coordination contours for the same assignment: for the transmitting stations and for the receiving stations. This Section further specifies that, for identification of affected administrations, the larger of the two contours is to be taken into account.

Given the variety of situations which could be covered by assignments in OPS, there may be situations where the constructed coordination contours for the transmitting stations and for receiving stations of the same assignment are not overlapped or partially overlapped. Therefore, the Board decided that for the cases where the coordination contours for the transmitting stations and for receiving stations of the same assignment are not overlapped or partially overlapped, the combined result of the two coordination contours is to be taken into account for the identification of affected administrations.

5.1.2

This Section indicates Tables A.1.2 to A.1.8 of Appendix 1 to this Section as tables that contain the coordination trigger field-strength values for protection of other primary terrestrial services, applying the procedure of Article 4 of the GE06 Agreement (construction of coordination contours). However, § A.2 to A.4 of Appendix 1 to Section I, which include Tables A.1.2 to A.1.8, do not provide information on the trigger values to be used for protection of other primary terrestrial services from analogue television assignments. Such values are necessary for the application of the procedure of Article 4 of the GE06 Agreement (see § 4.1.2.8 *a)* and 4.1.2.3). Calculations requested in application of § 4.1.2.8 *a)* of the Agreement shall be made using the pertinent ITU-R Recommendations and the indications therein. Recommendations ITU-R F.758-4, ITU-R F.759, and ITU-R SM.851-1 are to be used in this regard. As Recommendation ITU-R F.758-4 does not contain information relating to

analogue systems in the fixed service, and given the indications therein, the Board concluded that version ITU-R F.758-2 shall be used in the case of analogue systems in the fixed service. For cases not covered by any ITU-R Recommendation, the Board concluded that the calculations shall be made using the trigger values for DVB-T in combination with the approach of relative protection ratios for analogue television as described in Recommendation ITU-R SM.851-1.

Therefore, trigger values to be used for protection of other primary terrestrial services from analogue television assignments for cases not covered by any ITU-R Recommendation shall be calculated using the following formula:

$$F_{trigger\,ATV} = F_{trigger\,DVB\text{-}T} - RPR$$

where:

$F_{trigger\,ATV}$: trigger value for analogue television

$F_{trigger\,DVB\text{-}T}$: trigger value for digital television

RPR: relative protection ratio in accordance with Recommendation ITU-R SM.851-1.

5.2.2

1)   For carrying out the calculations referred to in this provision, the Bureau will assume that the reference broadcasting station referred to in this provision (with a maximum radiated power of 53 dBW, maximum effective antenna height of 600 m, mixed polarization) operates in DVB-T system with 8 MHz bandwidth in the UHF band and with 7 MHz bandwidth in the VHF band.

2)   The maximum coordination distance for aircraft receivers is to be set to 420 km (calculated as a geometrical contour around the service area of the receiving aeronautical station), irrespective of the indications in this provision, given the indications in other relevant provisions (e.g., Nos. 5.1.2 and 5.2.1 in Section I of Annex 4).

3)   Given the formulation of § 4.5, which describes the basic assumptions for the construction of the coordination contours for mobile (except aeronautical mobile) stations, the RRB instructed the Bureau to implement the following methodology for the construction of the coordination contour for a receiving station in the mobile (except aeronautical mobile) service intended to operate in a specified service area:

a)   Determine the centre of gravity of the specified service area.

b)   Determine the 360 points on the boundary of the specified service area ("boundary points") at which the field strength from the reference broadcasting station is evaluated. These boundary points are determined as intersection points of the boundary of the service area and 360 radials centred around the centre of gravity of the specified service area[1]. In case of multiple intersections of a given radial with the service area, the "boundary point" would be the intersection point which is furthest situated from the centre of gravity.

c)   Determine the 360 points on the 1 000 km geometrical contour ("initial reference transmitter points") at which the reference broadcasting station is first located. These initial reference transmitter points are determined as intersection points of the 1 000 km geometrical contour around the specified service area and 360 radials centred around the centre of gravity of the specified service area.

d)   Determine the coordination distance for each radial as follows:

1)   place the reference broadcasting transmitter at the initial reference transmitter point for this radial and calculate the field strength from this location at all boundary points;

2)   if the field strength from the reference broadcasting station exceeds or is equal to the trigger field strength at any of the "boundary points", then the initial reference transmitter point determines the coordination distance for this radial;

3)   if the field strength from the reference broadcasting station is less than the trigger field strength at all "boundary points", then the reference broadcasting station is moved along the radial in 10 km steps towards the centre of gravity of the service area until the field strength, produced from this new location, exceeds or is equal to the trigger field strength at any of the "boundary points". The location of the reference broadcasting station, from which the reference broadcasting station produces a field strength which exceeds or is equal to the trigger field strength at any of the "boundary points", determines the coordination distance for this radial.

4)   In the case of a receiving airborne station in the aeronautical mobile service or in aeronautical radionavigation service, the Bureau will use the same methodology as the one described in § 3 above, by replacing the 1 000 km geometrical contour with 420 km geometrical contour, in accordance with § 2 above.

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[1]   The service area does not extend beyond the national territory of the administration concerned.

PART B

SECTION B3

Rules concerning methodology for calculation of probability of harmful interference between satellite networks (*C/I* ratios)   (MOD RRB16/21)

1   Introduction

In application of the provisions of No. **11.32A** when, as a consequence of continuing disagreement (Nos. **9.63** to **9.65**) between two (or a limited number of) administrations, the notifying administration requests the Radiocommunication Bureau, an examination of the probability of harmful interference under No. **11.32A** is carried out. For the calculation method and criteria to be used for the interference assessment as well as the Findings to be formulated with respect to coordination of their networks under No. **9.7**, the Bureau shall proceed as follows.

2   Probability of harmful interference

The Bureau, in performing its mandatory tasks relating to the application of the above-mentioned provisions, shall proceed as follows:

2.1   Recommendation ITU-R S.741-2, shall be used to examine the subject assignments with respect to the provisions of No. **11.32A**.

2.2   The Bureau shall use the mutually agreed criteria provided by the administrations concerned for accepted interference in the format appearing in Table 2 of Recommendation ITU-R S.741-2, or, in the absence of such information, the Bureau shall use the single entry limits defined in Table 2 of § 3.2 below, which is derived from Table 2 of Recommendation ITU-R S.741-2, together with the information submitted in accordance with Appendix **4**.

2.2.1   In the case where this information is provided by the administrations concerned:

a)   The probability of harmful interference is considered to be negligible if the *C/I* calculation shows that the applicable criteria for a particular examination between two networks concerned are satisfied. The finding in Column 13A3 shall thus be favourable.

b)   The probability of harmful interference is considered not to be negligible, if the *C/I* calculation shows that the applicable criteria for a particular examination between two networks concerned are not satisfied. The finding in Column 13A3 shall be unfavourable.

2.2.2   In the case where this information is not provided by the administrations concerned:

a)   The probability of harmful interference is considered to be negligible if the interference is less than or equal to the single-entry interference limits indicated in Table 2 of § 3.2 below. The finding in Column 13A3 shall be favourable.

b)   The probability of harmful interference is considered not to be negligible, if the interference is greater than the single-entry interference limits indicated in Table 2 of § 3.2 below. The finding in Column 13A3 shall be unfavourable.

3   Methodology

To perform the above-mentioned compatibility analysis the following methodology will be used.

The methodology is based on Recommendation ITU-R S.741-2. A set of carrier-to-interference (C/I) calculations, using power values submitted by notifying administrations in items C.8.a.1/C.8.b.1 (i.e. the maximum value of the peak envelope power/the total peak envelope power) of Appendix **4** for both wanted and interference carrier levels, are performed following the geometrical considerations of Recommendation ITU-R S.740 and an interference adjustment factor is calculated as shown below to take into consideration the frequency offset situations as well as the difference in the bandwidths between the wanted and the interfering carriers. These C/I values are then compared with the required C/I values derived from the criteria appearing in Table 2 of § 3.2 below which contains a set of single entry interference criteria to protect different types of carriers. In the case of required C/I values agreed by administrations and communicated to the Bureau, the calculated C/I values will be compared with these mutually agreed C/I values.   (MOD RRB16/21)

Thereafter, a set of margins M (C/I calculated − C/I required) are derived. It should be noted that to evaluate the C/I required, a set of carrier-to-noise ratio (C/N) objectives are used (performance) and a K value, generally of either 12.2 or 14.0 dB, is added in accordance with the above-mentioned Table 2 of § 3.2 below. It should also be noted that these values correspond to a maximum permissible interference of 6% or 4% of the total noise power N of the protected assignments (performance).   (MOD RRB16/21)

In order to identify C/I required to be used for calculations, two scenarios are analyzed:

I.   The assessment of interference caused by incumbent networks into the network submitted for the examination under No. **11.32A**:

         In this case, to calculate the required C/I of the examined network, the C/N objective of the network (see item C.8.e.1 of Annex 2 of Appendix **4**) submitted by the notifying administration for examination under No. **11.32A** is used.

II.   The assessment of interference caused by the network submitted for examination under No. **11.32A** into incumbent networks:

         In this case, to calculate the required C/I of each of the incumbent networks, the lower value between the submitted C/N objective (see item C.8.e.1 of Annex 2 of Appendix **4**) and the calculated C/N (using power values submitted by the notifying administration in items C.8.a.1/C.8.b.1 of Appendix **4**) of the incumbent network is used.

If no *C/N* objectives are submitted by notifying administrations (since this was not required in the past), the calculated *C/N* values are used.   (ADD RRB16/21)

In respect of *C/N* ratio calculations used to define single entry protection criteria (*C/I* required), Table 2 of Recommendation ITU-R S.741-2 (see below) defines "*C/N*" as a "ratio (dB) of carrier to total noise power which includes all internal system noise and interference from other systems". Therefore, and to comply with this definition, an additional margin of 0.46 dB for cases involving wanted analogue TV emissions and 1.87 dB for other wanted emissions will be added to the margins calculated on the basis of the internal system noise values provided by the concerned administrations. Attachment 2 contains the calculation methodology used for deriving the above-mentioned additional margin.   (MOD RRB16/21)

3.1   Interfering cases

Table 1 below presents a summary of the different interfering situations to be dealt with when performing *C/I* calculations.

TABLE 1

Interference cases

	Digital	Analogue (TV-FM)	Analogue (other than TV-FM)	Other
Desired / **Interfering**				
Digital	Use C/I plus interference adjustment factor[1] (I)	Use C/I plus interference adjustment factor[1] (II)	Use C/I plus interference adjustment factor[1] (III)	Use C/I plus interference adjustment factor[1] (XI)
Analogue (TV-FM)	Use C/I plus interference adjustment factor[2] (IV)	*Co-frequency*: use C/I plus interference adjustment factor[1] (X) / *Non co-frequency*: use relative protection ratio mask[3] (V)	Use C/I plus interference adjustment factor[2] (VI)	Use C/I plus interference adjustment factor[2] (XII)
Analogue (other than TV-FM)	Use C/I plus interference adjustment factor[2] (VII)	Use C/I plus interference adjustment factor[2] (VIII)	Use C/I plus interference adjustment factor[2] (IX)	Use C/I plus interference adjustment factor[2] (XIII)
Other	Use C/I plus interference adjustment factor[2] (XIV)	Use C/I plus interference adjustment factor[2] (XV)	Use C/I plus interference adjustment factor[2] (XVI)	Use C/I plus interference adjustment factor[2] (XVII)

[1]   Interference adjustment factor for Cases I, II, III, X and XI is the same (see § 2.1.1 of Attachment 1).

[2]   Interference adjustment factor for Cases IV, VI to IX and XII to XVII is the same (see § 3.5 below).

[3]   See § 3.1 of Attachment 1.

The selection of an interference case defined in Table 1 above requires the identification of the type of each carrier. Taking into account the information submitted to the Bureau by administrations in accordance with Appendix **4** (i.e. the class of emission as defined in Annex 2 item C.7.a), the Bureau shall use the following carrier type definition:

−   Analogue (TV-FM):

   When the Class of Emission (item C.7.a of Annex 2 to Appendix **4**) is defined with "F" for the first character and with "F" or "W" for the third character.

−   Analogue (other than TV-FM):

   When the first character of the Class of Emission is "F" and the third character is anything other than "F" or "W".

- Digital:

  When the first character of the Class of Emission is "G".

- Other:

  When the first character of the Class of Emission is anything other than "F" or "G".

3.2 Margin *M*, *C/I*, *C/N* algorithms

The algorithms described in Attachment 1 shall be used to evaluate compliance with the mutually accepted interference criteria or with the single entry limits established in Table 2.

Table 2 provided below takes into account the information submitted to the Bureau by administrations in accordance with Appendix **4** and the carrier type definition in § 3.1 above and is a simplification of Table 2 of Recommendation ITU-R S.741-2.

TABLE 2

Single entry interference (SEI) protection criteria   (MOD RRB16/21)

Interfering carrier type / Desired carrier type	Analogue (TV-FM) or other	Digital	Analogue (other than TV-FM)
Analogue (TV-FM)	C/N_{tot} + 14 (dB)		
Digital	If DeNeBd ≤ InEqBd then C/N_{tot} + 9.4 + 3.5 log (δ) − 6 log (i/10) (dB) (i.e. C/N_{tot} + 5.5 + 3.5 log (DeNeBd (MHz))) Otherwise if DeNeBd > InEqBd then C/N_{tot} + 12.2 (dB)	C/N_{tot} + 12.2 (dB)	
Analogue (other than TV-FM)	13.5 + 2 log (δ) − 3 log (i/10) (dB) (i.e. 11.4 + 2 log (DeNeBd (MHz)))	C/N_{tot} + 12.2 (dB)	
Other	13.5 + 2 log (δ) − 3 log (i/10) (dB) (i.e. 11.4 + 2 log (DeNeBd (MHz)))	C/N_{tot} + 14 (dB)	

where:

C/N_{tot}: ratio (dB) of carrier to total noise power which includes all internal system noise and interference from other systems, related to C/N_i internal as follows:

$$\left(\frac{C}{N_{tot}}\right) = \left(\frac{C}{N_i}\right) - X$$

Where X is the value of additional margin defined in Attachment 2, Sections 3 to 5 and C/N_i is based on internal system noise power and defined in Attachment 1, Section 3.

DeNeBd: necessary bandwidth of desired carrier (Appendix **4**, Annex 2, item C.7.a)

InEqBd: equivalent bandwidth of interfering carrier (equal to total power to power density ratio (see Appendix **4**, Annex 2, items C.8.a.1 and C.8.a.2 respectively))

δ: ratio of desired signal bandwidth to peak-to-peak deviation of the TV carrier caused by the energy dispersal signal (a peak-to-peak deviation of 4 MHz is used in all cases)

i: pre-demodulation interference power in the desired signal bandwidth expressed as a percentage of the total pre-demodulation noise power (a value of 20 is used in all cases).

3.3 Single channel per carrier (SCPC) cases

When dealing with composite interference from a number of narrow-band carriers such as a transponder loaded with SCPC carriers the assumption is made, in the absence of more detailed data from administrations, that the interfering satellite has its transponder fully loaded with SCPC carriers and the individual carriers can be replaced with one wideband carrier which has a total power equal to the sum of the powers of the individual SCPC carriers. The protection ratios given in Recommendation ITU-R S.671 are used to protect SCPC transmissions interfered with by analogue television carriers only modulated with energy dispersal signals.

3.4 Interference between analogue FDM-FM signals (Case (IX) in Table 1 above)

When dealing with FDM-FM carriers, and to find out the resulting margin, the *C/I* ratio is calculated and compared with the required *C/I*. However a *C/N* + *K* type protection criteria is developed based on the equations of Recommendation ITU-R SF.766 which are required to calculate the *B* factor (interference reduction factor). In the absence of detailed information for the calculation of the *B* factor, the interference adjustment factor described in § 3.5 below shall be used.

3.5 Other interference cases

For cases (IV), (VI), (VII), (VIII), IX and (XI) to (XVII) in Table 1 above, the interference adjustment factor mentioned in § 3 above shall be used. In calculating this factor consideration shall be given to the third paragraph of § 3.4 of Annex 1 to Recommendation ITU-R S.741-2.

ATTACHMENT 1

Calculation algorithms (*M, C/I, C/N*)

1 Margin algorithm (MOD RRB16/21)

To compute the margins, it is necessary first to determine the required $\left(\dfrac{C}{I}\right)_m$ value, which is a function of the *C/N* and the *K* factor:

$$\left(\frac{C}{I}\right)_m = \left(\frac{C}{N_i}\right) + K - X$$

where:

$\left(\dfrac{C}{I}\right)_m$: required C/I value (dB)

$\left(\dfrac{C}{N_i}\right)$: C/N_i objective or calculated value of C/N_i (dB) (see § 3 above and section 3 below).

K : factor used in computing the required C/I (dB). Generally, this will be either 14.0 or 12.2, depending on the modulation characteristics of the desired signals (see Recommendations ITU-R S.483 and ITU-R S.523).

X : Additional margin to comply with the definition of carrier to total noise power which includes all internal system noise and interference from other systems. Attachment 2 contains methodology used for deriving the additional margin.   (ADD RRB16/21)

Since $\left(\dfrac{C}{I}\right)_m$ and $\left(\dfrac{C}{I}\right)_a$ will vary depending on the geographical location within the service, area both values are computed:

− At the geographical locations of the associated specific earth stations, if any, or,

− In case of associated typical Earth Stations, at the test point located within the service area where the $\left(\dfrac{C}{I}\right)_a$ value is minimum in accordance with the method given in Attachment 3.   (MOD RRB16/21)

The margin is the difference between the calculated C/I value and the required C/I value:

$$M = \left(\dfrac{C}{I}\right)_a - \left(\dfrac{C}{I}\right)_m$$

where:

M : margin (dB)

$\left(\dfrac{C}{I}\right)_a$: adjusted value of C/I, taking into account the interference adjustment factor (dB)

$\left(\dfrac{C}{I}\right)_m$: is the required C/I value (dB) computed above.

Therefore, substituting, we have:

$$M = \left(\frac{C}{I}\right)_a - \left(\frac{C}{N}\right) - K$$

2 The $\left(\dfrac{C}{I}\right)_a$ algorithm for interfering situations (MOD RRB16/21)

The basic C/I is adjusted as follows:

$$\left(\frac{C}{I}\right)_a = \left(\frac{C}{I}\right)_b - I_a$$

where:

$\left(\dfrac{C}{I}\right)_a$: adjusted value of C/I, taking into account the interference adjustment factor (dB)

$\left(\dfrac{C}{I}\right)_b$: basic calculated value of C/I, before taking into account the interference adjustment factor (dB)

I_a : interference adjustment factor (dB).

2.1 Determination of interference adjustment factor

2.1.1 Interference from noise-like digital carriers (interference adjustment factor 1)

The current version of Recommendation ITU-R S.741-2 covers the case of co-frequency interference from noise-like digital carriers. For non-co-frequency interference, an interference adjustment factor (or bandwidth advantage factor) resulted from the work of ITU-R study groups concerning the methodology to treat cases of frequency offset carriers. This is reflected in the application of a factor A defined below (mentioned as I_a in § 2 above).

For the case of frequency offset between carriers, the resultant C/I can be determined by the following equation:

$$C/I = 10 \log (c/i) - A$$

where A is the bandwidth advantage factor (dB).

The factor A is the ratio of the interfering carrier power contained in the desired signal bandwidth to the total interfering carrier power under the assumption that the interfering carrier has uniform power spectral density across its occupied bandwidth.

2.1.2 Interference from noise-like analogue carriers (interference adjustment factor 2)

For these cases, the resultant *C/I* can be determined by using the equation in § 2.1.1 above where the factor *A* is the ratio of the interfering carrier power contained in the desired signal bandwidth to the interfering carrier power with the approximation that the power spectral density of the interfering carrier is constant over the bandwidth of the desired carrier and is equal to the maximum value (see the third paragraph of § 3.4 of Annex 1 to Recommendation ITU-R S.741-2).

3 The *C/N* algorithm (MOD RRB16/21)

The algorithm for *C/N* requires the computation of the value of *N*, as follows:

$$N_i = -228,6 + 10\left[\log_{10}(T_R) + 6 + \log_{10}(BW)\right]$$

where:

N_i : value of internal system noise (dBW)

T_R : receiving system noise temperature (K)

BW : bandwidth (MHz).

The value of N_i is determined once for the uplink (if there is an uplink) and once for the downlink (if there is a downlink) for the desired system.

Once N_i is determined, C/N_i will be computed at each uplink test point (if there is an uplink) and each downlink test point (if there is a downlink):

$$\left(\frac{C}{N_i}\right) = C - N_i$$

where:

C : carrier (dBW)

N_i : internal system noise (dBW) computed above.

3.1 Determination of relative protection ratio for Case (V) in Table 1 above (TV-FM) into (TV-FM)

When dealing with a non-co-frequency interfering situation from a TV-FM carrier into another TV-FM carrier, the Radiocommunication Bureau is using the protection ratio masks defined in the Rules of Procedure relating to § 3.5.1 and § 3.8 of Annex 5 to Appendix **30** for the same case of interference. The resulting protection ratio relaxation is applied to the *K* factor of 14.0 dB established by Recommendation ITU-R S.483.

ATTACHMENT 2

Additional margins to be taken into consideration

1 Introduction

To finally assess the interfering effect on a given emission, it is necessary to adjust the resulting margins taking into consideration the definition of *C*/*N* given by Recommendation ITU-R S.741-2 which, for most of the cases, is the performance reference necessary to derive the single entry interference criteria levels for FSS carriers (see Table 2 of Recommendation ITU-R S.741-2).

In the above-mentioned Table *C*/*N* is defined as: "ratio (dB) of carrier to total noise power which includes all internal system noise and interference from other systems".

2 Calculations performed according to No. 1.174

No. **1.174** defines the equivalent satellite link noise temperature as follows:

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

The internal system noise temperature values provided by the administrations to derive the internal system noise, N, i.e., T_s and T_e are defined in Appendix **8** as follows:

"T_s: the receiving system noise temperature of the space station, referred to the output of the receiving antenna of the space station (K)"

"T_e: the receiving system noise temperature of the earth station, referred to the output of the receiving antenna of the earth station (K)."

The above-mentioned values are combined in accordance with Recommendation ITU-R S.738 to derive T_{min}, lowest *equivalent satellite link noise temperature,* as follows:

$$T_{min} = T_e + \gamma_{min} \, T_s + T_a$$

where:

T_a: other internal noise

γ_{min}: minimum transmission gain of a specific satellite link subject to interference.

Calculation of equivalent satellite link was mandatory before WRC-2000. After the decisions of WRC-2000 RR, Appendix **4** strapping information in Appendix **4**, which is required to conduct overall link calculations became optional.   (ADD RRB16/21)

Therefore, and for simplicity T_s and T_e are used separately to conduct uplink and downlink *C/I* calculations respectively for all the cases.   (ADD RRB16/21)

3   Noise to be calculated in accordance with Recommendation ITU-R S.741-2   (MOD RRB16/21)

To be in accordance with Recommendation ITU-R S.741-2 it seems necessary to add to the values of N calculated by the program on the basis of T_e and T_s mentioned above, the maximum permissible level of aggregate interference caused by other satellite systems as appears in Recommendations ITU-R S.466 (for FDM-FM telephony), ITU-R S.483 (for TV analogue) and ITU-R S.523 (for digital emissions) as well as the contribution of terrestrial emissions sharing the same frequency bands as defined in Recommendations ITU-R SF.356 (into telephone channels employing frequency modulation), and ITU-R SF.558 (into systems employing 8-bit PCM encoded telephony).

4 Calculations of additional margins

4.1 Telephony FDM-FM

4.1.1 Aggregate interference produced by other satellite systems sharing the same frequency band (Recommendation ITU-R S.466) (MOD RRB16/21)

In accordance with Recommendation ITU-R S.466, in frequency bands in which the network does not practice frequency re-use: the aggregate interference noise power should not exceed 2 500 pW0p, psophometrically weighted one minute mean power for more than 20% of any month. This amount corresponds to the 25% of the allowable noise power of 10 000 pW0p established by Recommendation ITU-R S.353 for the same percentage of time.

4.1.2 Maximum allowable values of aggregate interference from radio-relay systems in a telephone channel of a system in the FSS (Recommendation ITU-R SF.356)

In accordance with this Recommendation the interference caused by the aggregate of the transmitters of radio-relay stations should not exceed 1 000 pW0p psophometrically weighted one minute mean power for more than 20% of any month. This amount corresponds to 10% of the allowable noise power of 10 000 pW0p established by Recommendation ITU-R S.353 for the same percentage of time.

4.1.3 Calculation of the additional margin (MOD RRB16/21)

N_{tot}: total link noise including all internal noise and interference from other systems

N_i: link internal noise

X: noise due to interference from other systems

then:

$$N_{tot} = N_i + X$$

where:

$$X = (0.25 + 0.1) N_{tot}$$

Therefore:

$$N_{tot} = N_i + 0.35 N_{tot}$$

$$N_{tot}(1 - 0.35) = N_i$$

$$N_{tot} = 1.53 N_i$$

Additional margin: $10 * \log(1.53) = 1.87$ dB.

4.2   Digital emissions

4.2.1   Aggregate interference produced by other satellite systems sharing the same frequency band (Recommendation ITU-R S.523)   (MOD RRB16/21)

In accordance with Recommendation ITU-R S.523, in frequency bands in which the network does not practice frequency re-use: the aggregate interference power level averaged over any 10 min, should not exceed, for more than 20% of any month, 25% of the total noise power level at the input to the demodulator that would give rise to a bit error ratio of 1 in 10^6 as it is established by Recommendation ITU-R S.522 for the same percentage of time.

4.2.2   Maximum allowable values of aggregate interference from radio-relay systems into systems in the FSS. employing 8-bit PCM encoded telephony (Recommendation ITU-R SF.558)

In accordance with this Recommendation the interference caused by the aggregate of the transmitters of radio-relay stations, averaged over any 10 min, should not exceed, for more than 20% of any month, 10% of the total noise power at the input of the demodulator that would give rise to a bit error ratio of 1 in 10^6 as it is established by Recommendation ITU-R S.522 for the same percentage of time.

4.2.3   Calculation of the additional margin

The same values as in § 4.1.3 above are obtained.

4.3   Analogue TV

4.3.1   Aggregate interference produced by other satellite systems sharing the same frequency band (Recommendation ITU-R S.483)   (MOD RRB16/21)

In accordance with Recommendation ITU-R S.483, the aggregate interference noise power should not exceed 10% of the permissible video noise in the hypothetical reference circuit for more than 1% of the month.

4.3.2 Maximum allowable values of aggregate interference from radio-relay systems into FSS analogue video channel

No recommendations have been arrived at yet for interference from transmitters of the fixed service into FSS analogue video channel.

4.3.3 Calculation of the additional margin

$$N_{tot} = N_i + 0.1 \, N_{tot}$$

$$N_{tot}(1 - 0.1) = N_i$$

$$N_{tot} = 1.11 \, N_i$$

Additional margin: $10 \, {}^* \log(1.11) = 0.46$ dB.

5   Based on the above a value of 0.46 dB should be added to the margins involving wanted analogue TV emissions and 1.87 dB for other wanted emissions.

(ADD RRB16/21)

ATTACHMENT 3

Finding test-points for *C/I* calculation

1   Introduction

The assessment of probability of harmful interference shall be based on:

−   one test-point in downlink within the service area of wanted satellite where the $\left(\dfrac{C}{I}\right)_a$ value is minimum;

−   two test-points in uplink wanted and interfering links producing minimum value of $\left(\dfrac{C}{I}\right)_a$.

$\left(\dfrac{C}{I}\right)_a$ has minimum value when wanted signal is at minimum and interference signal is at maximum.

2 Test-point for the downlink *C/I* calculation

The position of wanted receiving earth station for which *C/I* is calculated is selected using the following criteria:

− Earth station is located within service area of wanted satellite;

− Earth station is visible from interfering satellite;

− The difference between satellite gain of wanted satellite and satellite gain of interfering satellite towards wanted earth station is at minimum.

The minimum gain difference is identified following the procedure below:

− Generating grid-points within wanted satellite service area A_W ;

− Finding wanted satellite gain G_W towards each of the grid-point $a \in A_W$;

− Finding interfering satellite gain G_I towards each of the grid-point $a \in A_W$;

− Finding the grid-point a_{min} where the difference between satellite gains towards each satellite is at minimum, i.e. $Min\left[G_W\left(a_{min}\right) - G_I\left(a_{min}\right)\right]$.

The Bureau developed GIMS gain interpolation library to find the satellite gain for all the grid-points.

Figure A3-1 below gives graphical example of the identified test-point.

3 Test-points for the uplink *C/I* calculation

For the uplink calculation, it is necessary to identify locations of two earth stations − one transmitting earth station in the wanted link and another transmitting station in the interfering link.

The position of these earth stations are selected using the following criteria:

− Wanted earth station is located within service area of wanted satellite;

− Interfering earth station is located within service area of interfering satellite;

− Interfering earth station is visible from wanted satellite;

− The difference between wanted satellite gain towards wanted earth station and interfering earth station is at minimum.

The minimum gain difference is identified following the procedure below:

- Generating grid-points within wanted satellite service area A_W ;

- Generating grid-points within interfering satellite service area A_I ;

- Finding wanted satellite gain G_W towards each of the grid-point in A_W ;

- Selecting test-point $a_W \in A_W$ where wanted satellite gain is at minimum $G_{W_{\min}}$;

- Finding wanted satellite gain G_W towards each of the grid-point in A_I ;

- Selecting test-point $a_I \in A_I$ where wanted satellite gain is at maximum $G_{W_{Max}}$.

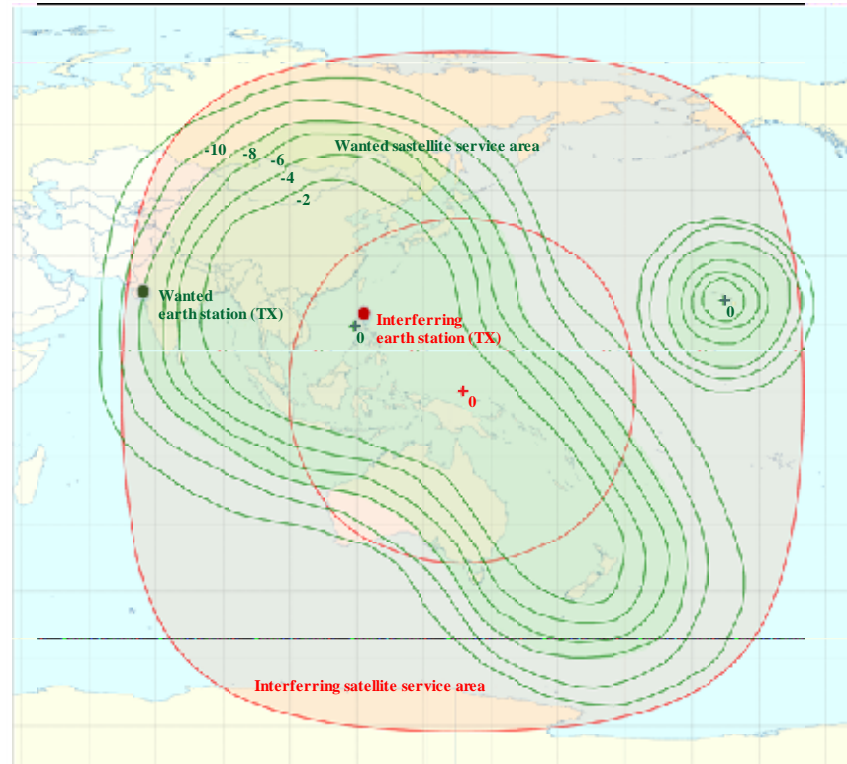Figure A3-2 below gives graphical example of the procedure used.

FIGURE A3-1

Finding worst-test point on the downlink
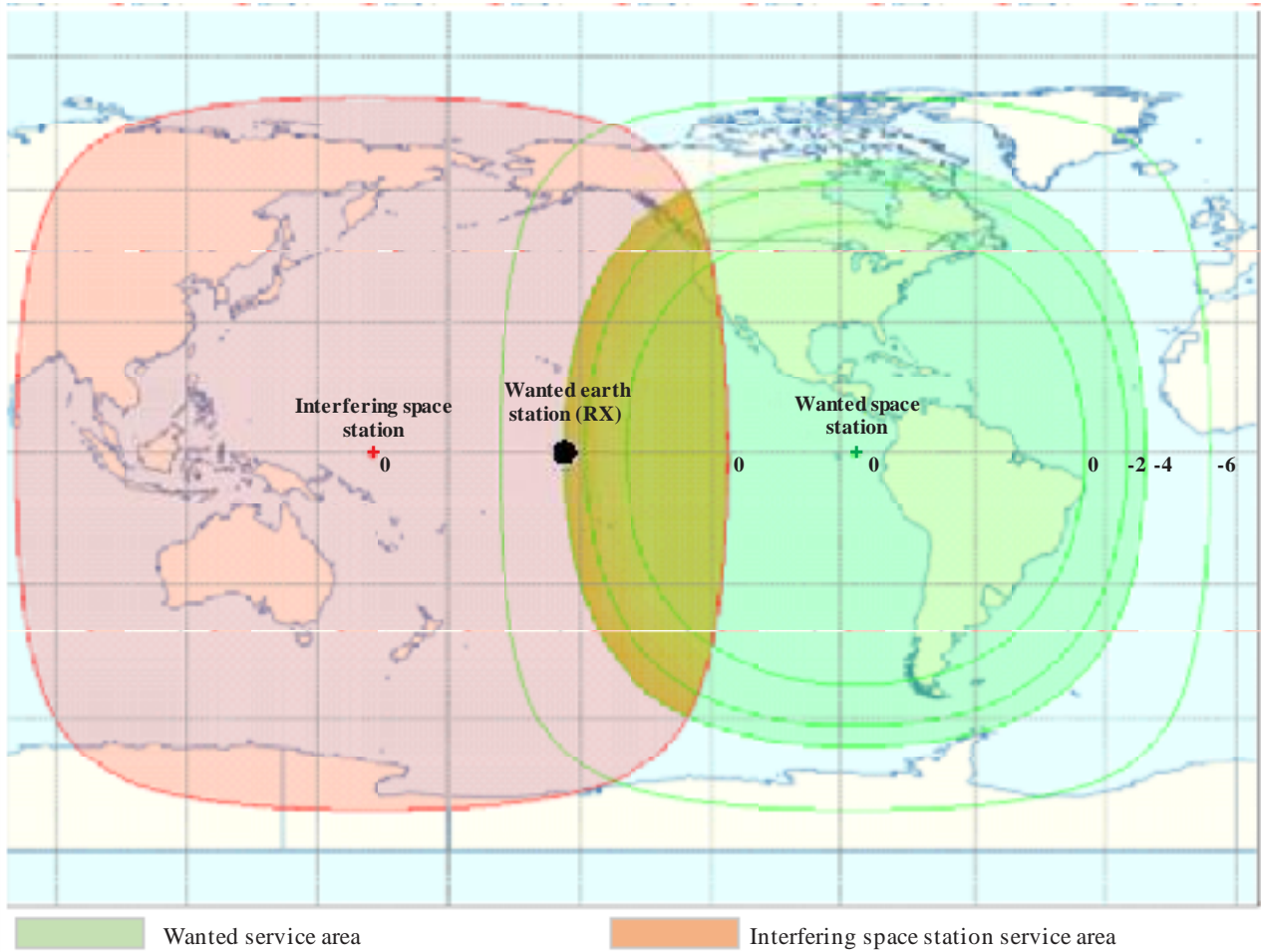
RRB-A3-01

FIGURE A3-2

Finding worst-test points on the uplink

RRB-A3-02