GENERAL NOTICE

NOTICE 1528 OF 2006

INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

The Independent Communications Authority of South Africa (hereinafter referred to as "the Authority"), hereby makes known the outcome of the process initiated by notice in the Government Gazette No. 28547 of 22 February 2006, into its intention to use Channel 65 as described in the Annual Terrestrial Broadcasting Frequency Plan (822-830 MHz) for non broadcasting services.

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1. Background

1.1. The Authority published a notice in the Government Gazette, Notice Number 23618 on 12 July 2002, inviting representations with regard to amendment of note 3.9.2 of the radio frequency band plan for frequency in the range of 20MHz to 3GHz (SABRE1). The closing date for submissions of written comments was 17 August 2002 at 16H00.

1.2. A public hearing on the subject was held on the 23rd of January 2003 at the Authority's head office in Sandton from 09H00 to 16H00 as per Government Gazette No.24263 dated 15 January 2003. The Authority, after having received written comments and conducted a hearing, published its findings in the Government Gazette, Notice Number 25990 on the 3rd of February 2004. The findings were:

- that there appears to be a tangible need for sharing in the 800MHz broadcasting band with WLL and link systems;
- that there appears to be technical and administrative feasibility in sharing the UHF TV channels 64 to 68;
- that the impact on broadcasting can be reduced through proper engineering considerations; and
- that the socio-economic benefits derived from band sharing cannot be overemphasised.

1.3. The Authority subsequently published a Notice on the 22nd of February 2006 ("the 2006 Notice"), under Government Gazette No.28547, inviting representations on its intention to use channel 65 as described in the Annual Terrestrial Broadcasting Frequency Plan (822-830MHz) for non-broadcasting services. The purpose of the discussion paper was to generate comments from all interested parties in relation to the issues raised in the 2006 Notice or on any

other relevant issue to the matter at hand, not specifically raised in the 2006 Notice, including but not limited to the following:

- the overall economic benefit;
- the potential interference to existing users;
- the quality of services that could be offered; and
- the cost of migration of existing broadcasting users.

1.4. The 2006 Notice was published in terms of section 29 **(4)** of the Telecommunications Act 103 of 1996 ("the Telecommunications Act") and in terms of section 31 (2) of the independent Broadcasting Authority Act 153 of 1993 ("the IBAA"). Thus, the 2006 notice was published under the auspices of two different sections, from two different pieces of legislation.

1.5. In terms of the Telecommunications Act, section 29 provides as follows

"*(I) The Authority may from time to time prepare a frequency band pian in respect of any part of the radio frequency spectrum.*

*(2) **A** frequency band plan shall –*

(a) define how the radio spectrum shall be used;
(b) aim at ensuring that the radio frequency spectrum is utilised and managed in an orderly, efficient and effective manner;
(c) aim at reducing congestion in the use of frequencies and at protecting frequency users from any intetference or other inability to make use of the frequencies assigned to them;
(d) avoid obstacles to the introduction of new technologies and telecommunication services;
(e) aim at providing opportunities for the introduction of the widest range of telecommunication services and the maximum number of users thereof as is practically feasible.

(3) In preparing a frequency band plan in terms of this section, the Authority –

(a) shall have due regard to the report of experts in the field of spectrum or frequency band planning and to internationally accepted methods for preparing such plans;

(b) shall take into account existing users of the radio frequency spectrum and any frequency band plans in existence or in the course of preparation.

(4) The Authority shall give notice in the Gazette of its intention to prepare a plan and in such notice invite interested parties to submit their written representations to the Authority within such period as may be specified in such notice.

(5) The Authority may, after the period referred to in subsection (4) has passed, hold a hearing in respect of the proposed plan.

*(6) After the hearing, if any, and after due consideration of any representations received pursuant to the notice mentioned in subsection **(4)** or tendered at the hearing, the Authority shall adopt the frequency band plan in question, with or without amendment, and cause such plan to be published in the Gazette.*

*(7) (a) Any frequency band plan adopted in terms of this section and all such comments, representations and other documents as have been received in response to the notice contemplated in subsection (4) or tendered at the hearing, shall be kept at the offices of the Authority and shall, subject to (b), be open to public inspection **by** interested persons during the normal office hours of the Authority and the Authority shall at the request of any person and on payment of such fee as may be prescribed, furnish him or her with a copy thereof.*

*(b) The provisions of section 34 **(4)** and (5) shall apply, with the necessary changes in relation to any comments or representations contemplated in paragraph (a).*

(8) (a) The Authority may review a frequency band plan adopted in terms of this section.

(b) The provisions of subsection (2) to (7) shall apply, with the necessary changes, in relation to any amendment contemplated in paragraph (a).

3.6. The Authority therefore highlighted the provisions of Section 29 (1) of the Telecommunications Act which makes provision for the Authority to prepare a frequency band plan, from time to time, in respect of any part of the radio frequency spectrum. The provisions of section 29 (8) (a) of the Telecommunications Act were further highlighted, specifically the provision for the Authority to review a frequency band plan adopted in terms of this section. It was submitted that the Authority, in terms of the 2006 Notice, was undertaking a review of the band plan. Section **29** (8) (a) of the Telecommunications Act does not specifically state as to whether such a review is to apply to the band plan in its entirety or to specific parts of the band plan thereof. However, the Authority, in terms of the 2006 Notice, was undertaking a review for Channel 65 (822MHz – 830MHz). As such, and in terms of section 29 (8) (b) of the Telecommunications Act, the provisions of sections 29 (2) to (7) were applicable to the process at hand.

1.7. Section 29 (4) of the Telecommunications Act, read together with section 28 (a) and 28 (b) of the said Act, obliges the Authority to give notice in the Gazette of its intention to *review* a plan and give interested parties an opportunity to submit written representations within a timeframe to be prescribed in the notice. The Authority had stipulated such a period in the 2006 Notice. In terms of section 29 (5) of the Telecommunications Act,

the Authority had a discretion to hold a hearing after the period as contemplated in section 29 (4) of the said Act has passed. Taking into account the interests of the public at large, the Authority decided to hold such hearings. During the public hearing that was held, the provisions of section 29 (2) and 29 (3) of the Telecommunications Act were taken into account, through the various representations that were made by the different parties.

1.8. Section 29 (6) of the Telecommunications Act states that after the hearing is held, and after *"due consideration"* is given by the Authority to all written and oral representations made, "the Authority *shall* adopt the frequency band plan in question, with or without amendment, and cause such plan to be published in the Gazette". It is clear that the Authority is obliged to adopt the frequency band plan whether or not amendments are effected to it, subsequent to the processes in terms of sections 29 (4) and **(5)** of the Telecommunications Act, have been undertaken. However, prior to such an adoption, the Authority must have given *due consideration* to the written and oral representations made. The Authority submitted that in terms of the written and oral representations made, it was apparent that prior to any decision being undertaken in terms of adoptions of the frequency band plan to be made, a study was to be undertaken.

1.9. Section 31 of the IBAA provides as follows:

(1) The Authority shall, as soon as may be reasonably practicable after the commencement of this Act prepare a frequency pian whereby the maximum number of frequencies available for broadcasting services is determined.

(2) In preparing a frequency band plan in terms of this section, the Authority shall-

(a) have due regard to the reports of experts in the field of frequency planning and to internationally accepted methods for preparing such plans:

(b) take into account the existing frequencies used by broadcasting services; and

(c) reserve frequencies on all bands for the different categories of broadcasting licences referred in section 40 (1),

and publish its draft plan by notice in the Gazette and in such notice invite interested parties to submit their written comments and representations to the Authority within such period as may be specified in such notice.

(3) After due consideration of the comments and representations (if any) received pursuant to the notice referred to in subsection (2), the Authority shall determine the frequency plan and cause such plan to be published in the Gazette.

(4) *(a) Any frequency plan determined in terms of this section and all such comments and representations as have been received in response to the notice contemplated in subsection (3), shall be kept at the offices of the Authority and be available for inspection by members of the public during normal office hours of the Authority.*

(b) The Authority shall at the request of any person and on payment of such fee as may be prescribed (if any), furnish him or her with a certified copy of or extract from any part of the documentation contemplated in paragraph (a).

(5) (a) The Authority shall annually review a frequency plan determined in terms of this section.

(b) The provisions of subsections (2), (3) and ***(4)*** *shall mutatis mutandis apply in relation to any amendment contemplated in paragraph (a) of this subsection.*

1.10. In relation to the IBAA, the provisions of section 31 were highlighted by the Authority. Section 31 (1) of the IBAA is akin to that of section 29 (1) of the Telecommunications Act in that provision is made for the Authority to prepare frequency band plans. Section 31 (5) (a) of the IBAA further provides that the Authority may review a frequency plan, determined in terms of this section. However, whereas section 29 **(8)** of the Telecommunications Act does not state a timeframe in which such a review or reviews are to be undertaken, section 31 (5) (a) of the IBAA states that such a review can only be taken annually. The Authority has not, during the course of the year at hand (2006), undertaken such a review. It was submitted that the Authority, in terms of the 2006 Notice, was undertaking an annual review of the frequency plan. Section 31 (5) (a) does not specifically state as to whether such a review is to apply to the frequency plan in its entirety or to specific parts of the frequency plan thereof. However, the Authority, in terms of the 2006 Notice, was undertaking the review for Channel 65 (822MHz – 830MHz). As such, and in terms of section 31 (5) (b), the provisions of sections 31 (2), (3) and **(4)** were applicable to the process at hand.

1.11. Section 31 (2) requires that in the case of a review being undertaken, a notice is to be published in the Gazette, and interested parties are to be invited to make representations in this regard, within the period stipulated in the notice. Whilst no specific mention is made in this section to the Authority holding a public hearing, provision is made for "written comments and representations"to be made to the Authority, and arguably, the Authority can in terms of this section hold public hearings. However, notwithstanding the fact that no specific mention is made for hearings to be held, hearings were held under the auspices of the Telecommunications Act, though the Authority has the discretion not to have such hearings in terms of section 29 (5) of the Telecommunications Act. Section 31 (2) further contains provisions to be taken into account by the Authority in reviewing a frequency plan, and during the public hearing

that was held, the provisions of section **31** (2) (a) to (c) were taken into account, through the various representations that were made by the different parties.

1.12. Section **31 (3)** states that "after due consideration" has been given by the Authority to the comments and representations received, "the Authority ***shall*** determine the frequency band plan and cause such plan to be published in the Gazette".

1.13. It was pointed out that in terms of section **31 (3)** of the **IBAA,** the Authority is obliged to determine the frequency plan, subsequent to the processes in terms of sections 31 (2), having been undertaken. However, prior to such a determination, the Authority must have given ***due consideration*** to the written and oral representations made. It is important to note that the **IBAA** differs from the Telecommunications Act with regard to the authority of the Authority subsequent to the processes having been undertaken in terms of section **31** (2) of the **IBAA** and sections 29 **(4)** and (5) of the Telecommunications Act. Section 31 **(3)** of the IBAA makes provision for the Authority to "determine the frequency plan" whilst section 29 **(6)** of the Telecommunications Act makes provision for the Authority to "adopt the frequency band plan". However, it was indicated that both the adoption and the determination are to **be** preceded by ***due consideration*** to be given to the comments and representations received.

1.14. The Authority submitted that in terms of the written and oral representations made, it was apparent that prior to any decision being undertaken in terms of determinations of the frequency plan to be made or adoption of the frequency band plan, a study is to be undertaken.

1.15. It was further indicated that in terms of both section 29 of the Telecommunications Act and section **31** of the **IBAA,** no provision is made explicitly for the Authority to publish findings and conclusions in respect of the review exercises that have been undertaken. What is however

contemplated is for the Authority to have given due consideration prior to any adoption or determination of any part of the frequency band plan. The outcome of the processes in terms of section 29 of the Telecommunications Act or section 31 of the IBAA is the publication of the frequency band plan or frequency plan in the Gazette.

1.16. However, the Authority indicated that such a publication, which is predicated on adoption or determination, cannot be done without due consideration being given to the written and oral representations made.

1.17. At the public hearing that was held, it became apparent to the Authority that the question as to whether channel 65, as described in the Annual Terrestrial Broadcasting Frequency Plan (822-830MHz), to be used for non-broadcasting services, cannot be considered duly, in the absence of a study being undertaken to determine such use. In this regard, it must also be noted that persons were not precluded, in terms of the 2006 Notice, from making representations on any other relevant issue, whether or not such issue was raised in the discussion document. Therefore, representations focussed not only on channel 65, but went on to elicit other relevant points.

1.18. In terms of the representations, both oral and written that were made, the Authority decided that the process going forward would be as follows:

(a) that a study will be conducted on the technical feasibility of sharing in channel 65 (822MHz to 830MHz) and channel 66 (830MHz to 838MHz) and that this study will be managed by the Authority with participation from interested persons. It must be noted that there were a significant amount of representations made in relation to that of channel 66. Any adoption or determination on the use of channel 65 for non broadcasting purposes cannot be made at the exclusion of representations in relation to channel 66. This is in line with the scope as set out in the 2006 Notice, which allowed for

representations to be made on any matter relevant to the issue at hand, whether or not such issues were raised specifically in the 2006 Notice;

(b) it was indicated that the study **will** entail the investigation into sharing possibilities with the outlook of formulating the sharing details and in particular, the sharing criteria and the appropriate protection ratio in order to ensure that broadcasting and non broadcasting services are able to co-exist effectively; and

(c) meetings were held with all interested parties from the public. The purpose of the meetings was to map the process going forward in relation to the study that was to be undertaken.

1.19. In deciding the process going forward, the Authority had indicated to the public that it has not concluded the processes of adopting the frequency band plan in terms of the Telecommunications Act or determining the frequency plan in terms of the **IBAA.** The Authority indicated that it is in the process of giving due consideration to the issues at hand prior to the conclusion of the processes as outlined in section ***29*** of the Telecommunications Act and section 31 of the **IBAA.**

2. Coming into effect of the Electronic Communications Act 36 of 2006 ("the ECA) and impact on the process undertaken in terms of section 29 of the Telecommunications Act and section 31 of the IBAA

2.1. The ECA came into effect from 19 July 2006. Section 92 (7) of the ECA states as follows:

> *"Any current applications, process, recommendations and regulations pending before the Authority or the Minister upon the coming into force of this Act must be considered to have been submitted in accordance with the provisions of this Act and must be considered in terms of the relevant sections of this Act."*

Section 34 (5) of the ECA states as follows:

> *"The national radio frequency pian must be updated and amended when necessary in order to keep the plan current. When updating and amending this plan due regard must be given to the current and future usage of the radio frequency spectrum"*

It therefore follows that the process initiated under both the IBAA and the Telecomms Act is provided for in terms of section 34 (5) of the ECA Act. The outcome of this process will also inform the process the Authority would be undertaking in terms of Section 34(4) of the ECA.

2.2. As indicated in paragraphs 1.18 and 1.19 above, it was indicated to the public that the Authority would be conducting a study on the technical feasibility of sharing in channel 65 (822MHz to 830MHz) and channel 66 (830MHz to 838MHz) and that this study will be managed by the Authority with participation from interested persons.

2.3. However, participation from the public, specifically the players in the Broadcasting Industry, was not rendered fully possible due to a lack of capacity on their part.

2.4. The Authority, after having been informed by the industry of their lack of capacity to conduct the study, undertook the study unilaterally.

2.5. The outcome of the study is published pursuant to this Gazette. The outcomes can however be summarised as follows:

2.5.1. guided by the provisions of Artcile 4.4 of the ITU Radio Regulations, the Authority will not confine sharing to fixed services;

2.5.2. sharing will happen on the criteria as indicated in the report, and that the sharing will be confined to channel 65 **(822-830MHz)** and **66 (830-838MHz);**

2.5.3. non-broadcasting services are able to be provided in channels 65 and 66;

2.5.4. the Authority will no longer be making assignments from channels 65 and 66 for broadcasting purposes; and

2.5.5. non-broadcasting services will be licensed on channels 65 and 66 on a secondary basis.

REPORT

ON

SHARING BETWEEN

BROADCASTING AND NON BROADCASTING SERVICES

SECTION 1

SHARING BETWEEN THE ANALOGUE BROADCASTING SERVICE AND THE FIXED AND/OR MOBILE SERVICES IN THE VHF AND UHF BANDS

The ITU recommends

1. That frequency separation, geographical separation and time sharing, or a combination thereof, be used to ensure compatibility where sharing is required between different services. In this context, frequency sharing refers to the subdivision of the allocated bands between different services, geographical separation refers to the simultaneous use of a frequency by different services in separate geographical areas, and time sharing refers *to* the use of separate hours of operation for each of the services;

2. That the procedure in Annex 1 be used to determine the protection margin for the broadcasting service (sound and television) when it is operated simultaneously with either the fixed or land mobile service in shared or in adjacent VHF or UHF bands;

3. That the procedure in Annex 2 be used to determine the protection margin for the land mobile service when it is operated simultaneously with the broadcasting service in shared or in adjacent VHF or UHF bands;

4. That the procedure in Annex 3 be used to determine the protection margin for the fixed service when it is operated simultaneously with the broadcasting service in shared or in adjacent VHF or UHF bands;

5. That the system parameters related to determination of these protection margins include: minimum field strengths to be protected, protection ratios, antenna characteristics, propagation conditions and other related factors as described in Annexes 1, 2 and 3;

6. The Authority having considered the above, and having studied the recommendations in details, came to the conclusion that this part of the report provide sufficient technical parameters for sharing to occur in a coordinated manner between analogue broadcasting and fixed or mobile services

7. The Authority has therefore decided to adopt the recommendations as outlined in this section as a basis for a sharing to occur between analogue broadcasting services and fixed or mobile services.

ANNEX1

Protection of the broadcasting service from the fixed and land mobile services

PART I
TO ANNEX 1

Television services

1. Minimum field strength to be protected

Table 1 gives the minimum field strength values to be protected at 10 m above ground level for the broadcasting service (television) and the wanted field strength values from which they are derived.

TABLE 1

	Band I (41-68 MHz)	Band II (76-100 MHz)	Band III (162-230 MHz)	Band IV (470-582 MHz)	Band V (582-960 MHz)
Field strength to be protected (dB(μV/m)) at edge of coverage area (50% of time, 90% of locations)	46	48	49	53	58
Wanted field strength (dB(μV/m)) at edge of coverage area (50% of time, 50% of locations) from Recommendation ITU-R BT.417	48	52	55	65	70

The field strength to be protected is derived from the wanted field strength by taking account of the need to protect 90% of locations and the relatively high man-made noise levels in the VHF bands.

However, the values given in Table 2 are used in North America for the wanted field strength at the edge of coverage area and for the field strength to be protected at 10 m above ground level (50% of time and 50% of locations in both cases).

TABLE 2

	54-88 MHz	174-216 MHz	470-806 MHz
Wanted field strength and field strength to be protected (dB(μV/m)) at edge of coverage area (50% of time and 50% of locations)	47	56	64

2. Protection ratios

2.1 General

Protection ratios for the various television systems are given in Recommendation ITU-R BT.655. The values shown in this Annex are based on these texts as well as on the new studies carried out by some administrations.

Protection ratios covering tropospheric (T) and continuous (C) interference are included, the values being applicable to interference produced by one single source. The ratios applied to tropospheric (T) interference correspond closely to a slightly annoying impairment condition (Grade 3).

They are considered to be acceptable only if the interference occurs for a small percentage of the time, not precisely defined but generally considered to be between 1% and 10%. For substantially non-fading unwanted signals, it is necessary to provide a higher degree of protection. In this case, the protection ratios appropriate to continuous (C) interference, which corresponds closely to perceptible but not annoying (Grade 4), should be used. If the latter ratios are not known, then the tropospheric (T) values increased by 10 dB can be applied.

Within a television channel, the required protection ratios for the vision and the sound signals should be considered separately. Protection ratio requirements, particularly in the out-of-channel range, can be significantly increased due to non-linear effects in the receiver brought about by high level single or multiple unwanted input signals. Studies have shown that values can increase by up to 25 dB.

2.2 Protection ratios for the vision channel

The unwanted signal can fall into any part of the vision channel, therefore the protection ratios for overlapping channels given in Figs. 1 to 3, and Tables 4 to 6 (taken from Recommendation ITU-R BT.655) should be applied.

All the protection ratio values in the figures and tables are relevant for the case of an unwanted CW signal or FM signal, falling into the vision channel, the wanted vision signal being negatively modulated.

The corrections which should be made for positively modulated wanted vision signals and for other types of potentially interfering signals are given in Table 3.

2.2.1 525-line systems

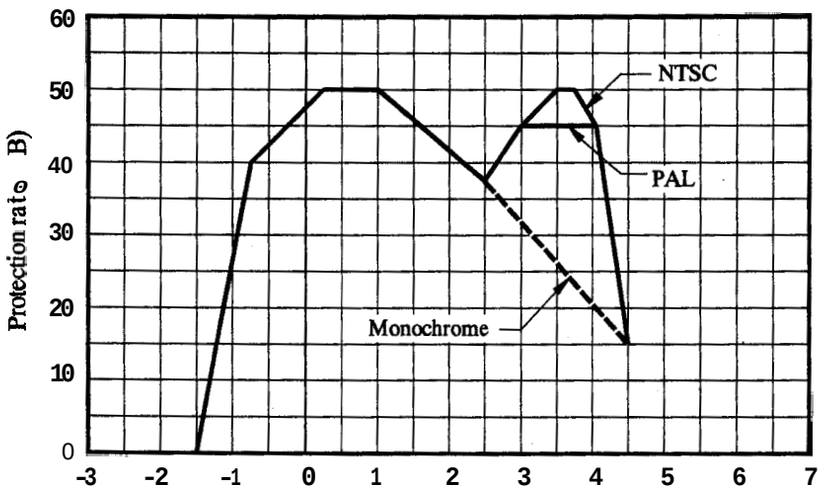
The protection ratio values to be applied for 525-line systems are given in Fig. 1 and Table 4 for tropospheric interference.

For continuous interference the values should be increased by 10 dB.

Unwanted signal / Wanted signal	Correction factors (dB)		
	CW	FM	AM
Vision signal negative modulated	0	0	0
Vision signal positive modulated	-2	-2	-2

FIGURE 1 and TABLE 4

525-line system (M/NTSC and M/PAL) Tropospheric interference
Unwanted signal: CW carrier



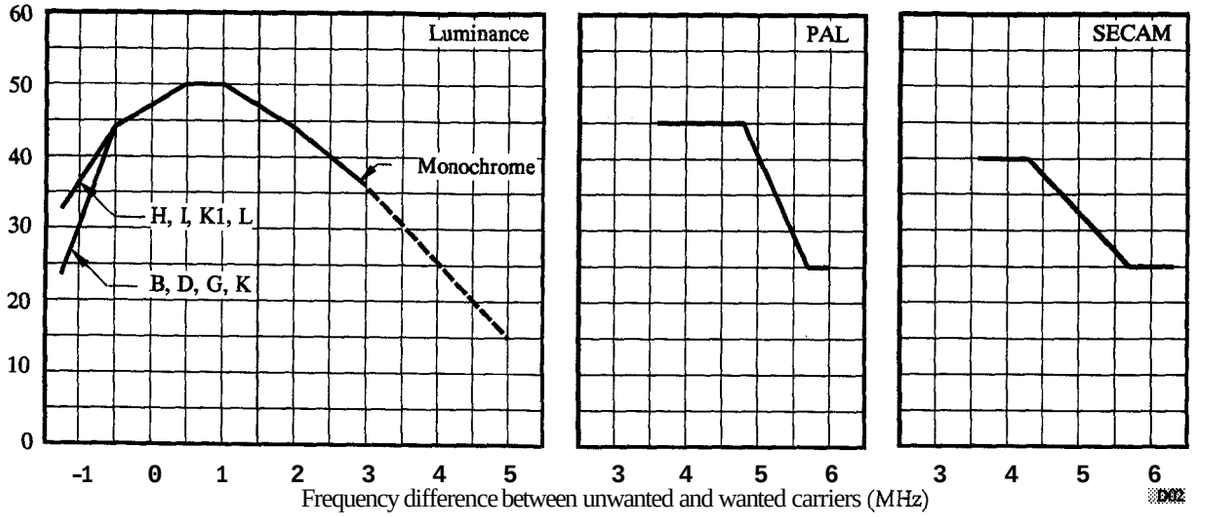
Frequency difference (MHz)	-1.5	-1.0	-0.75	0.3	1.0	2.5	3.0	3.5	3.7	4.1	4.5
NTSC (dB)	0	30	40	50	50	37	45	50	50	45	15
PAL (dB)								45	45		
Monochrome (dB)								26	25	20	

2.2.2 625-line systems

The protection ratio values to be applied for 625-line systems are given in Figs. 2 and 3, and Tables 5 and 6.

FIGURE 2 and **TABLE 5**

625-line systems
Tropospheric interference



	Frequency difference between unwanted and wanted carriers (MHz)											
	Luminance range								PAL		SECAM	
MHz	-1.25 (1)	-1.25 (2)	-0.5	0.0	0.5	1.0	2.0	3.0	3.6-4.8	5.7-6.0 (3) (4)	3.6-4.3(5)	5.7-6.3(3) (4)
dB	32	23	44	47	50	50	44	36	45	25	40	25

(4) This value is valid until the end of the channel.

(5) D/SECAM and WSECAM: add 5 dB.

2.3 Protection ratios for the sound channel

2.3.1 Analogue sound systems (one or two-sound carrier systems)

Protection ratio values for analogue sound signals are given in Table 7.
In the case of a two-sound carrier system each sound carrier must be considered separately.

The maximum deviation of the wanted FM sound carrier is assumed to be 50 kHz.
Corrections should be made for other deviations.

2.3.2 Digital sound systems

Some values for the protection of digital sound signals are given in Table 8.

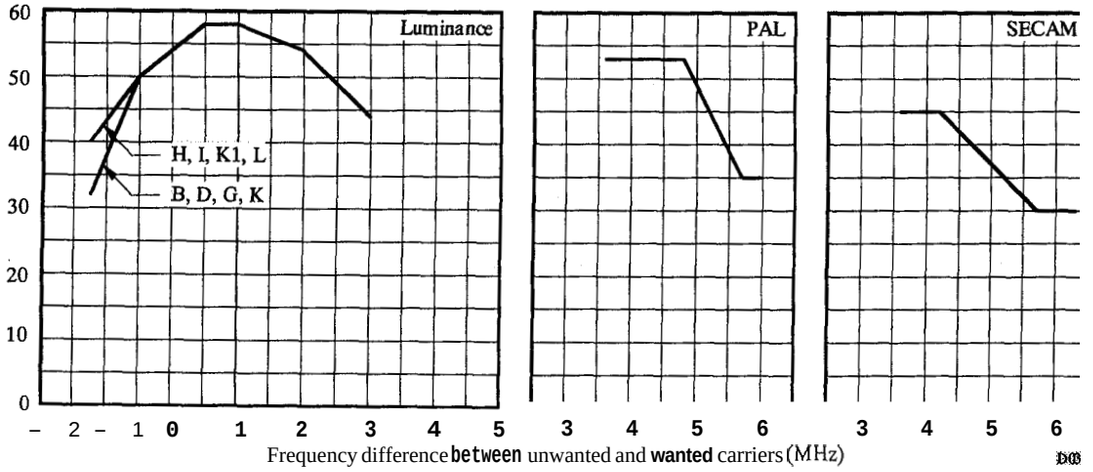
2.4 Protection ratios for out-of-channel interference

2.4.1 Adjacent channels

2.4.1.1 525-line systems

The protection ratio values to be applied for 525-line systems are given in Figs. 4a and 4b and Table 9 for continuous and tropospheric interference.

FIGURE 3 and TABLE 6
625-line systems
Continuous interference



	Frequency difference between unwanted and wanted carriers (MHz)											
	Luminance range								PAL		SECAM	
MHz	–1.25 (1)	–1.25 (2)	–0.5	0.0	0.5	1.0	2.0	3.0	3.6-4.8	5.7-6.0 (3) (4)	3.6-4.3 (5)	5.7-6.3 (3) (4)
dB	40	32	50	54	58	58	54	44	53	35	45	30

TABLE 7

Protection ratios for wanted analogue sound carriers of a television signal (dB)
Unwanted signal: CW or FM sound carrier

Difference between wanted sound carrier and unwanted carrier (kHz)	Wanted sound signal			
	Tropospheric interference		Continuous interference	
	FM	AM	FM	AM
0	32	49	39	56
15	30	40	35	50
50	22	10	24	15
250	– 6	7	– 6	12

Wanted	Unwanted	FM/CW (1)	AM (1)	Digital (2)
Digital	T	12	11	12
	C	12	11	12

FIGURE 4a

Protection ratios for the lower adjacent channel, NTSC/system M

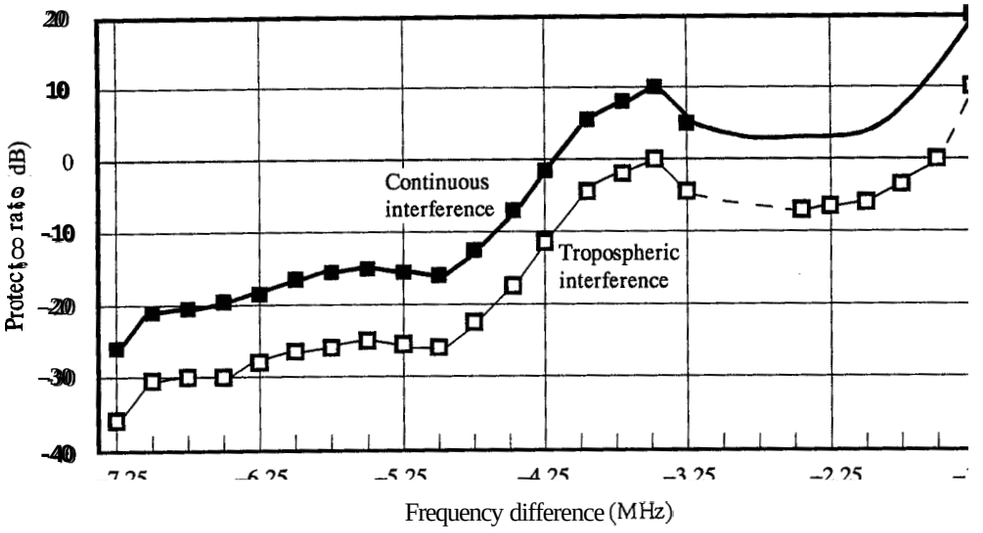


FIGURE 4b

Protection ratios for the upper adjacent channel, NTSC/system M

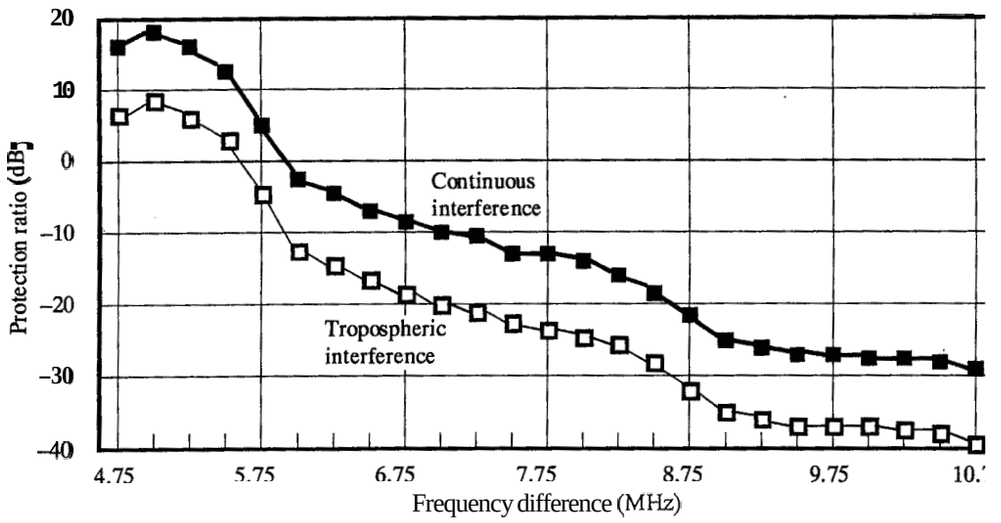


TABLE 9

Protection ratios for the adjacent channels, 525-line NTSC systems

Frequency difference (MHz)	Protection ratio (dB)	
	Continuous	Tropospheric
–7.25	–26	–36
–5.25	–15	–25
–3.5	10	0
–2.25	3	–7
–1.25	20	10
4.75	16	6
5.75	5	–5
6.75	–9	–19
8.75	–22	–32
10.75	–30	–40

2.4.1.2 625-line systems

The protection ratio values to be applied for 625-line systems are given in Table 10 and in Figs. 5 and 6 for tropospheric and continuous interference. For system I/PAL the values for the lower adjacent channel are given in Fig. 7 and Table 11.

TABLE 10

Protection ratios for the adjacent channels, 625-line systems

(MHz)			
	Continuous	Tropospheric	TV systems
–14.0	–10	–15	B, D, G, H, K, K1, L
–6.0	–10	–15	B, D, G, H, K, K1, L
–2.5	11	1	B, D, G, H, K, K1, L
–1.5	11	1	B, D, G, H, K, K1, L
–1.25	40	32	H. K1, L
–1.25	32	23	B, D, G, K
5.75	30	25	B, G, WSECAM
5.75	35	25	B. G. H/PAL
6.2	–2	–12	B. G. H
6.75	30	25	L, D, K, K1/SECAM
8.5	–2	–12	L, D, K, K1/SECAM
15.0	–2	–12	B, D, G, H, K1, L

FIGURE *5*

Protection ratios for the adjacent channels, 625-line systems tropospheric interference

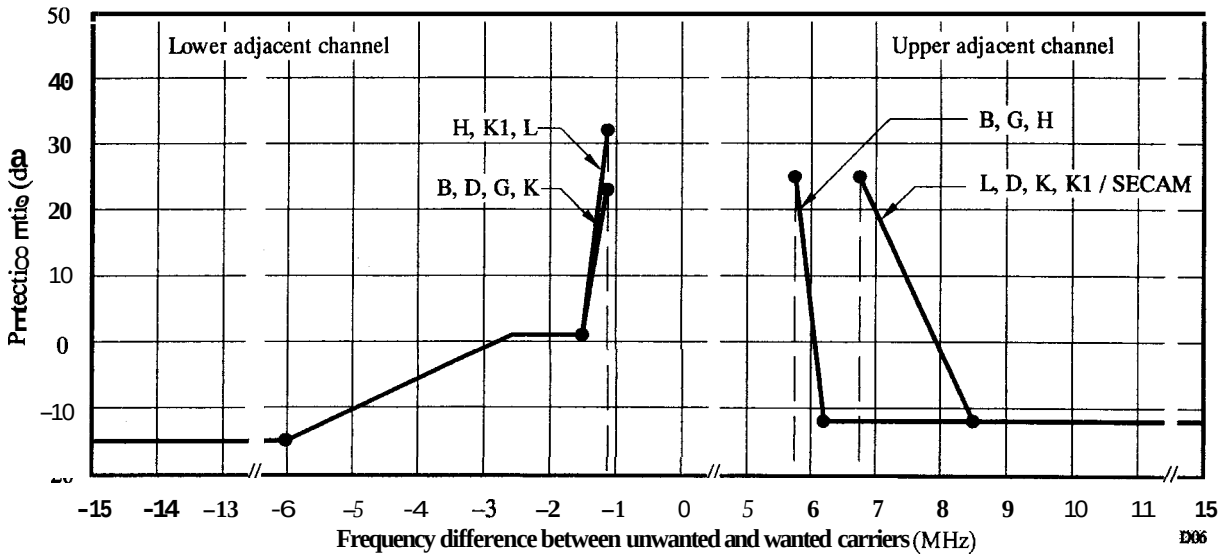


FIGURE 6

Protection ratios for the adjacent channels, 625-line systems continuous interference

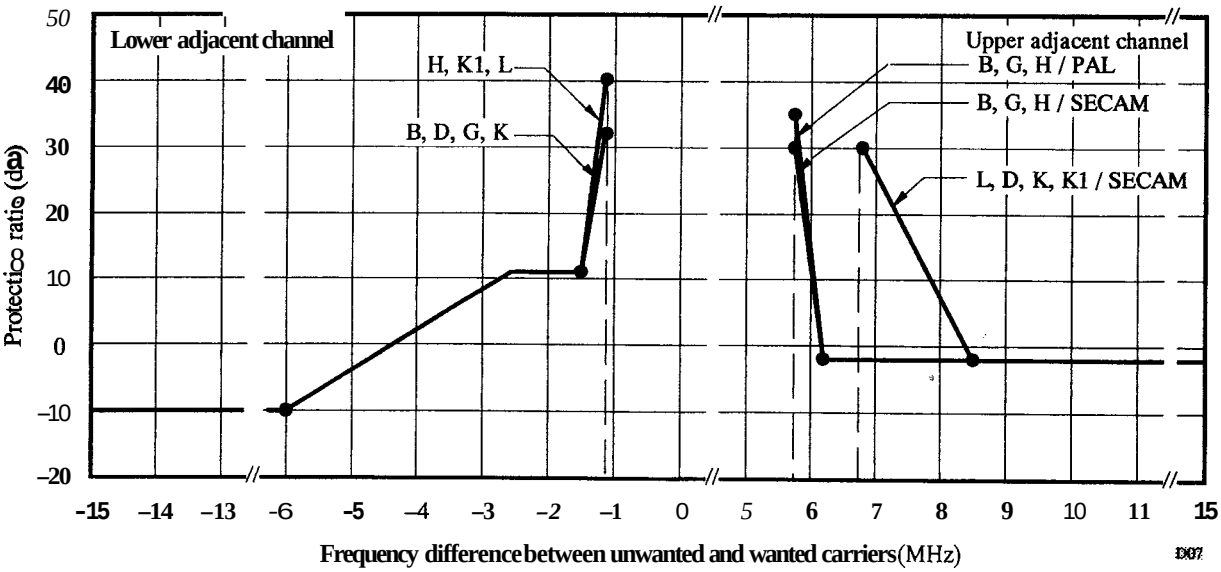


FIGURE 7a

Protection ratios for **the lower adjacent channel, 625 lines I/PAL system**

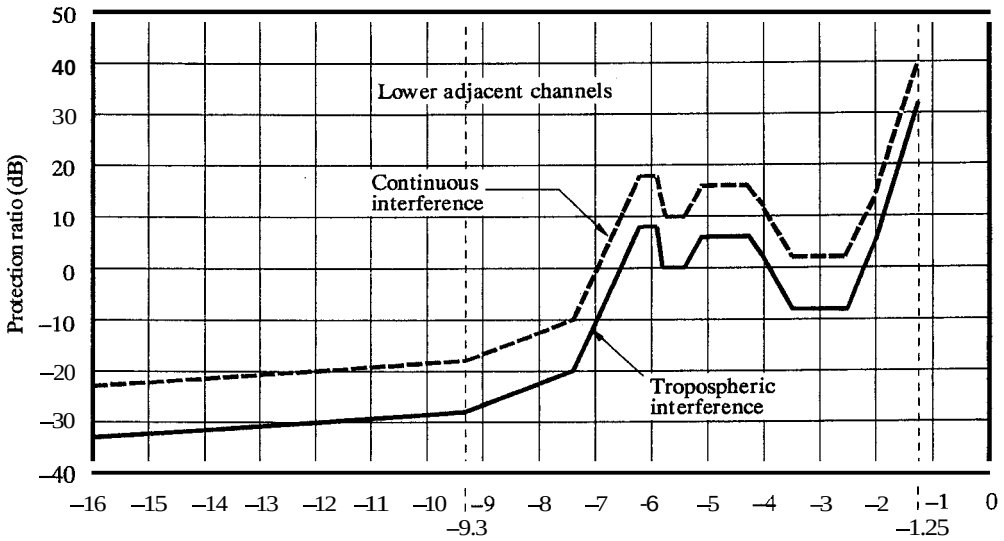


FIGURE 7b

Protection ratios for **the upper adjacent channel, 625 lines I/PAL system**

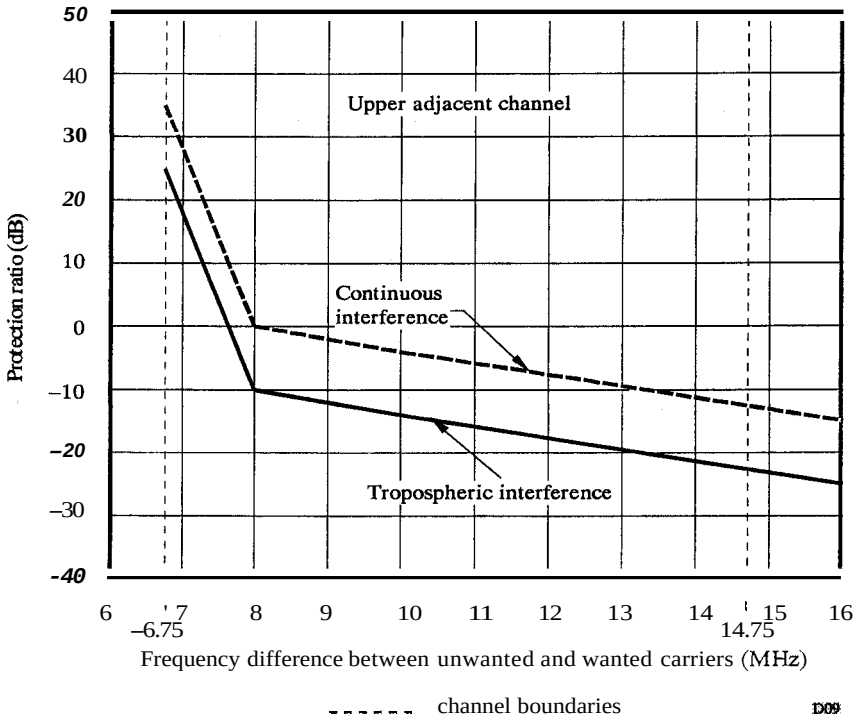


TABLE 11

Protection ratio for the adjacent channels, 625 lines I/PAL system

Frequency difference (MHz)	Protection ratio (dB)	
	Continuous	Tropospheric
–16.0	–23	–33
–9.3	–18	–28
–7.4	–10	–20
–6.5	11	1
–6.2	18	8
–5.9	18	8
–5.8	10	0
–5.4	10	0
–5.1	16	6
–5.0	16	6
–4.3	16	6
–4.0	12	2
–3.5	2	–8
–3.0	2	–8
–2.5	2	–8
–2.0	14	4
–1.25	40	32
+6.75	35	25
+8.0	0	–10
+10	–4	–14
+14.75	–13	–23
+16.0	–15	–25

2.4.2 Image channels

The protection ratio required will depend on the intermediate frequency and image-channel rejection of the receiver, and on the type of unwanted signal falling in the image channel. It can be determined by subtracting the image rejection figure from the required protection ratio given in §§ 2.2 and 2.3 above.

Image-channel rejection:

systems D and WSECAM : 45 dB (VHF) and 30 dB (UHF)

system D/PAL: 45 dB (VHF) and 40 dB (UHF)

system I: 50 dB (UHF)

system M (Japan): 60 dB (VHF) and 45 dB (UHF)

all other systems: 40 dB (UHF).

2.4.3 Other types of interference

In the out-of-channel range some specific frequencies, depending upon the technology used in the TV receiver, such as local oscillator frequency, IF spacing, half IF spacing, etc., may require higher values of protection ratio.

3. Protection margin for television services

The protection margin ***(PM)*** is given (dB) by:

$PM = FS$ – combined value of $(NF + AF)$ for all interfering sources

where:

FS : relevant field-strength value (dB(μV/m)) given in § 1 above

AF : adjustment factor (dB), intended to deal with antenna discrimination and clutter loss (see § ***4.1*** below)

NF : nuisance field and the larger of E_C and E_T given below (dB(μV/m)).
For continuous interference:

$$E_C = E_{(50,50)} + P + A_C$$

For tropospheric interference:

$$E_T = E_{(50,t)} + P + A_T$$

where:

$E_{(50,t)}$: field strength (dB(μV/m)) of the interfering transmitter, normalized to 1 kW, and exceeded during t% of the time, determined using Recommendation ITU-R ***PN.370.***

For tropospheric interference the value ***of t*** is between 1 and 10 (the precise value should be specified by each administration)

P : e.r.p. (dB(kW)) of the interfering transmitter

A : protection ratio (dB)

and where the indices ***C*** and ***T*** indicate continuous and tropospheric interference respectively.

The protection ratio for continuous interference is applicable when the resulting nuisance field is stronger than that resulting ***from*** tropospheric interference, that is, when:

$$E_C > E_T$$

This means that E_C should be used in all cases when:

$$E_{(50,50)} + A_C > E_{(50,t)} + A_T$$

The calculated protection margin should be positive at all locations where a television service is required.

The combination of multiple interference from co-sited and non co-sited sources is discussed in § ***4.2*** and ***4.3*** below.

Information regarding fixed services or base stations of the land mobile service with effective antenna heights of less than ***37.5*** m is given in **§ *4.4*** below.

4. Additional factors to be considered

4.1 Adjustment factors (AF)

Four distinct cases of interference to a station of the television service from stations of the fixed or land mobile services can be identified; these are dealt with separately below.

4.1.1 Interference from stations of the fixed service or base stations of the land mobile service which are orthogonally polarized with respect to a station of the television service

In this case, the adjustment factor is equal to the antenna discrimination which has a value of 16 dB for 50% of locations and 10 dB for 90% of locations.

4.1.2 Interference from stations of the fixed service or base stations of the land mobile service which have the same polarization as a station of the television service

In this case, the adjustment factor is equal to the relevant receiving antenna directivity discrimination value given in Recommendation ITU-R BT.419. For television Band II, the values as given for Band I should be used.

4.1.3 Interference from a land mobile station operating at more than 40 km outside the coverage area of a station of the television service

No polarization discrimination can be taken into account because:

- the mobile transmitter system, consisting of an antenna and the body of a vehicle, cannot be assumed to radiate with only horizontal or vertical polarization;
- the effect of environmental clutter near the mobile transmitter can be expected to introduce a degree of depolarization.

It would be impracticable to carry out calculations for all possible geographical locations for any mobile station, taking account of propagation losses and receiving antenna directivity discrimination. A reasonable simplification of the problem is to carry out interference calculations for the e.r.p. of the mobile station assuming this to be situated at the base station site with an effective antenna height of 75 m. It is then appropriate to use an adjustment factor of 15 dB (see Note 1) to allow for the effect of clutter loss and ground reflection effects near the mobile station.

In some cases, it may be possible to include an additional adjustment to allow for the directivity of the television receiving antenna, as given in Recommendation ITU-R BT.419. For television in Band II, the values given for Band I should be used.

Note 1 – See Final Acts of the Second Session of the Regional Administrative Conference for the planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (RARC AFBC(2)).

4.1.4 Interference from a land mobile station operating less than 40 km from a receiving site of a station of the television service

In this case, it is necessary to carry out detailed calculations for individual, worst-case paths. No polarization discrimination can be taken into account, for the same reasons as are explained in § 4.1.3 above.

4.2 Multiple interference from co-sited sources

The interference arising from multiple co-sited sources should be combined by means of the power-sum method:

Error!

where:

E_i: value (dB(μV/m)), of ($NF + AF$) for each individual co-sited source. As indicated in § 3 above, NF is expressed in dB(μV/m) and AF in dB

Note I – The value of E represents one of the terms to be included in the procedure given in $4.3 below.

4.3 Multiple interference from non co-sited sources

The interference arising from multiple non co-sited sources should be combined by using the simplified multiplication method given in Annex II of the Final Acts of the RARC AFBC(2), 1989, reproduced herein as Appendix 1 to Annex 1.

4.4 Effective transmitting antenna heights

The effective transmitting antenna height is determined according to Recommendation ITU-R PN.370.

When the effective transmitting antenna height is less than 37.5 m or more than 1200 m, the field-strength values are calculated using the method described in the Final Acts of the RARC AFBC(2), reproduced herein as Appendix 2 to Annex 1.

5. Interference assessments

Interference assessments should normally be made for several reception points within the service area of the television transmitter. These points should be those which are considered to be most likely to suffer from interference.

Moreover, for rebroadcasting stations, it is necessary to ensure that the received television signal is also protected against interference. In this case, the protection ratios given in Recommendation ITU-R BT.655 for the limit of perceptibility are normally used.

PART II

TO ANNEX 1

Sound broadcasting services

1. Minimum field strengths to be protected

The minimum values of field strength which require protection from the fixed and mobile service as given in Recommendation ITU-R BS.412, are:

The minimum values of field strength which require protection from the fixed and mobile service as given in Recommendation ITU-R BS.412, are:

37 dB(μV/m) at an antenna height of 10 m above ground for monophonic reception

48 dB(μV/m) at an antenna height of 10 m above ground for stereophonic reception.

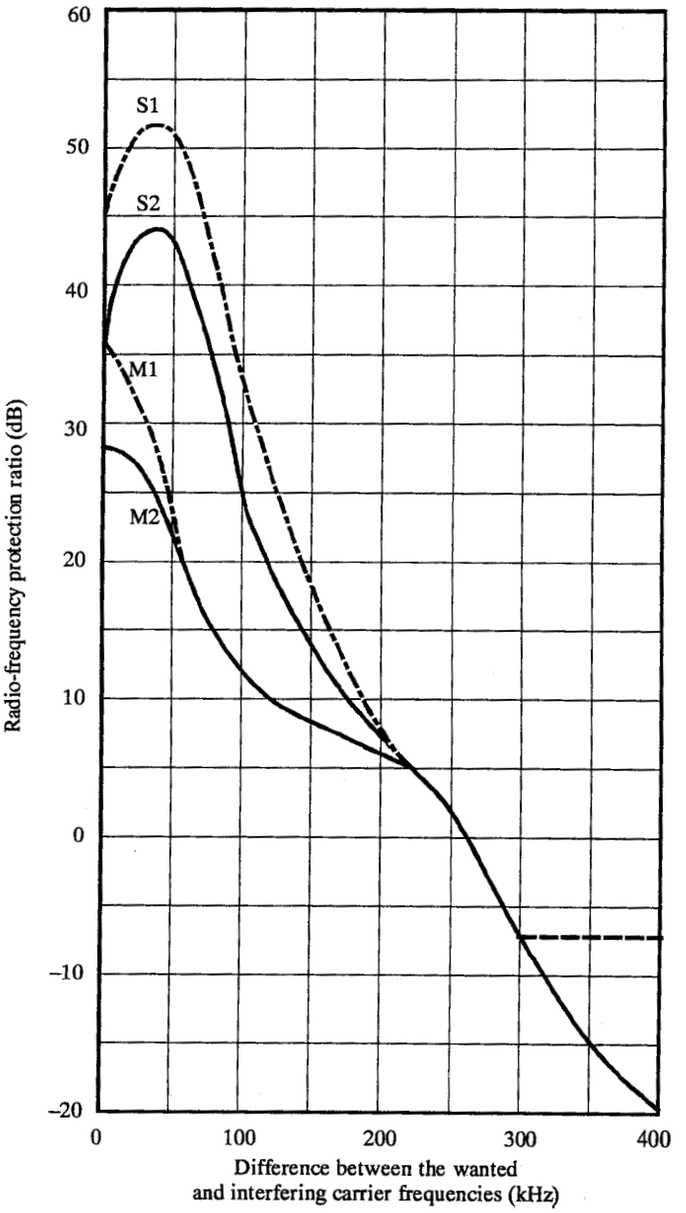
2. Protection ratios

The protection ratios for a wanted FM sound broadcasting station and an unwanted AM or FM fixed or mobile station are given in Figs. 8 and **9,** and Tables 12 and 13 (for a maximum frequency deviation of ± 75 and ± 50 kHz respectively).

In the case of a very narrow-band FM interfering system, some relaxation may be possible (see also Report ITU-R SM.659).

FIGURE! 8

Radio-frequency protection ratios required by broadcasting services in band 8 (VHF) at frequencies between 87.5 MHz and 108 MHz using a maximum frequency deviation of ± 75 kHz

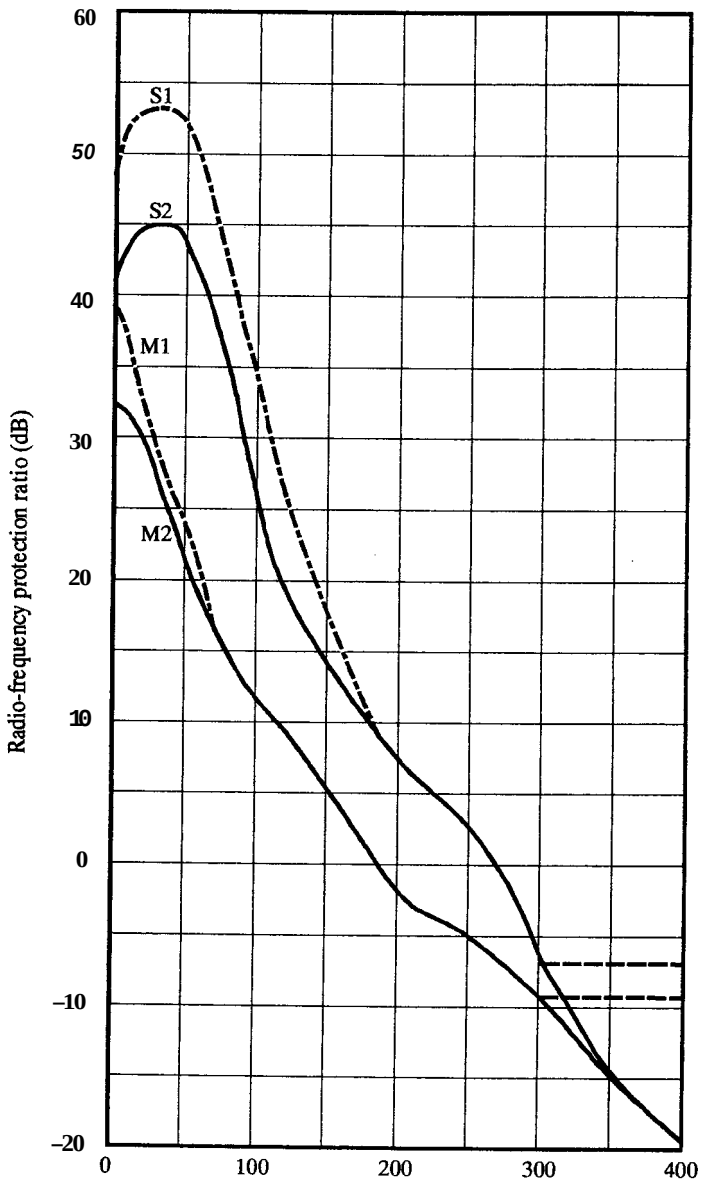


Curves MI: monophonic broadcasting; steady interference
M2: monophonic broadcasting; tropospheric interference (protection for 99% of the time)
S1; stereophonic broadcasting; steady interference
S2: stereophonic broadcasting; tropospheric interference (protection for 99% of the time)
– – – – – – Estimated values for AM interfering stations

am

FIGURE 9

Radio-frequency protection ratios required by broadcasting services in band 8 (VHF) using a maximum frequency deviation of ± 50 kHz



Curves M1: monophonic broadcasting; steady interference

M2: monophonic broadcasting; tropospheric interference (protection for 99% of the time)

S1: stereophonic broadcasting; steady interference

S2 stereophonic broadcasting; tropospheric interference (protection for 99% of the time)

The values of curves S1 and S2 apply equally to the pilot-tone system and the polar-modulation system

– – – – – Estimated values for *AM* interfering stations

D11

TABLE 12

Protection ratios required by broadcasting services in band 8 (VHF) using a maximum frequency deviation of ± 75 kHz

Frequency spacing (kHz)	Protection ratio (dB)							
	Monophonic				Stereophonic			
	Steady interference		Tropospheric interference		Steady interference		Tropospheric interference	
	FM	AM	FM	AM	FM	AM	FM	AM
0	36.0	36.0	28.0	28.0	45.0	45.0	37.0	37.0
25	31.0	31.0	27.0	27.0	51.0	51.0	43.0	43.0
50	24.0	24.0	22.0	22.0	51.0	51.0	43.0	43.0
75	16.0	16.0	16.0	16.0	45.0	45.0	37.0	37.0
100	12.0	12.0	12.0	12.0	33.0	33.0	25.0	25.0
125	9.5	9.5	9.5	9.5	24.5	24.5	18.0	18.0
150	8.0	8.0	8.0	8.0	18.0	18.0	14.0	14.0
175	7.0	7.0	7.0	7.0	11.0	11.0	10.0	10.0
200	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
225	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
250	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
275	–2.0	–2.0	–2.0	–2.0	–2.0	–2.0	–2.0	–2.0
300	–7.0	–7.0	–7.0	–7.0	–7.0	–7.0	–7.0	–7.0
325	–11.5	–7.0	–11.5	–7.0	–11.5	–7.0	–11.5	–7.0
350	–15.0	–7.0	–15.0	–7.0	–15.0	–7.0	–15.0	–7.0
375	–17.5	–7.0	–17.5	–7.0	–17.5	–7.0	–17.5	–7.0
400	–20.0	–7.0	–20.0	–7.0	–20.0	–7.0	–20.0	–7.0

TABLE 13

Protection ratios required by broadcasting services in band 8 (VHF) using a maximum frequency deviation of ± 50 kHz

Frequency (kHz)	Protection ratio (dB)							
	Monophonic				Stereophonic			
			Tropospheric interference		Steady interference		Tropospheric interference	
	FM	AM	FM	AM	FM	AM	FM	AM
0	39.0	39.0	32.0	32.0	49.0	49.0	41.0	41.0
25	32.0	32.0	28.0	28.0	53.0	53.0	45.0	45.0
50	24.0	24.0	22.0	22.0	51.0	51.0	43.0	43.0
75	15.0	15.0	15.0	15.0	45.0	45.0	37.0	37.0
100	12.0	12.0	12.0	12.0	33.0	33.0	25.0	25.0
125	7.5	7.5	7.5	7.5	25.0	25.0	18.0	18.0
150	6.0	6.0	6.0	6.0	18.0	18.0	14.0	14.0
175	2.0	2.0	2.0	2.0	12.0	12.0	11.0	11.0
200	–2.5	–2.5	–2.5	–2.5	7.0	7.0	7.0	7.0
225	–3.5	–3.5	–3.5	–3.5	5.0	5.0	5.0	5.0
250	–6.0	–6.0	–6.0	–6.0	2.0	2.0	2.0	2.0
275	–7.5	–7.5	–7.5	–7.5	0.0	0.0	0.0	0.0
300	–10.0	–10.0	–10.0	–10.0	–7.0	–7.0	–7.0	–7.0
325	–12.0	–10.0	–12.0	–10.0	–10.0	–7.0	–10.0	–7.0
350	–15.0	–10.0	–15.0	–10.0	–15.0	–7.0	–15.0	–7.0
375	–17.5	–10.0	–17.5	–10.0	–17.5	–7.0	–17.5	–7.0
400	–20.0	–10.0	–20.0	–10.0	–20.0	–7.0	–20.0	–7.0

3. Protection margin for sound broadcasting services

The protection margin (PM) is given (dB) by:

$PM = FS$ – combined value of (NF + AF) for all interfering sources

where:

FS : relevant field-strength value (dB(μV/m)) given in § 1 above

AF : adjustment factor (dB), intended to deal with antenna discrimination and clutter loss (see § 4.1 below)

NF : nuisance field and the larger of E_C and E_T given below (dB(μV/m).

For continuous interference:

$$E_C = E_{(50,50)} + P + A_C$$

For tropospheric interference:

$$E_T = E_{(50,t)} + P + A_T$$

where:

$E_{(50,t)}$: field strength (dB(μV/m)) of the interfering transmitter, normalized to 1 kW, and exceeded during t% of the time, determined using Recommendation ITU-R PN.370.

For tropospheric interference the value of t is between 1 and 10 (the precise value should be specified by each administration)

P : e.r.p. (dB(kW)) of the interfering transmitter

A : protection ratio (dB)

and where the indices C and T indicate continuous and tropospheric interference respectively,

The protection ratio for continuous interference is applicable when the resulting nuisance field is stronger than that resulting from tropospheric interference, that is, when:

$$E_C > E_T$$

This means that E_C should be used in all cases when:

$$E_{(50,50)} + A_C > E_{(50,t)} + A_T$$

The calculated protection margin should be positive at all locations where a sound broadcasting service is required.

The combination of multiple interference from co-sited and non co-sited sources is discussed in § 4.2 and 4.3 below.

Information regarding fixed services or base stations of the mobile service with effective antenna heights of less than 37.5 m is given in § 4.4 below.

4. Additional factors to be considered

4.1 Adjustment factors (AF)

Because of the variety of receiving sound broadcasting installations (fixed, portable, car reception, etc.), no antenna discrimination can be taken into account.

4.1.1 Interference from a land mobile station operating at more than 40 km outside the coverage contour of a station of the sound broadcasting service

It would be impracticable to carry out calculations for all possible geographical locations for any mobile station, taking account of propagation losses. A reasonable simplification of the problem is to carry out interference calculations for the e.r.p. of the mobile station assuming this to be situated at the base station site with an effective antenna height of 75 m. It is then appropriate to use an adjustment factor of –15 dB (see Note 1) to allow for the effect of clutter loss and ground reflection effects near the mobile station.

Note 1 – See Final Acts of the RARC AFBC(2).

4.1.2 Interference from a land mobile station operating less than 40 km from a receiving site of a station of the sound broadcasting service

In this case, it is necessary to carry out detailed calculations for individual, worst-case paths.

4.2 Multiple interference from co-sited sources

The interference arising from multiple co-sited sources should be combined by means of the power-sum method:

Error!

where:

E_i : value (dB(μV/m)), of ($NF + AF$) for each individual co-sited source. As indicated in § 3 above, NF is expressed in dB(μV/m) and AF in dB

n : number of co-sited sources

E : effective interference (dB(μV/m)).

Note 1 – The value of E represents one of the terms to be included in the procedure given in § 4.3 below.

4.3 Multiple interference from non co-sited sources

The interference arising from multiple non co-sited sources should be combined by using the simplified multiplication method given in Annex II of the Final Acts of the RARC AFBC(2), 1989, reproduced herein as Appendix 1 to Annex 1.

4.4 Effective transmitting antenna heights

The effective transmitting antenna height is determined according to Recommendation ITU-R PN.370.

When the effective transmitting antenna height is less than 37.5 m or more than 1200 m, the field-strength values are calculated using the method described in the Final 'Acts of the RARC AFBC(2), reproduced herein as Appendix 2 to Annex 1.

5. Interference assessments

Interference assessments should normally be made for several reception points within the service area of the sound broadcasting transmitter. These points should be those which are considered to be most likely to suffer from interference. At these points, interference calculations should be made for monophonic and stereophonic reception. The most critical values shall be used in assessing compatibility.

Moreover, for rebroadcasting stations, it is necessary to ensure that the received sound broadcasting signal is also protected against interference.

APPENDIX 1

TO ANNEX 1

Reproduced from the Final Acts of the Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (Geneva 1989) (RARC AFBC(2)), Annex 2, Chapter 4 (edited to include technical corrections).

"Determination of the usable field strength by the simplified multiplication method

4.1 The concept of usable field strength

The usable field strength, E_u, a quantity characterizing the coverage situation. To calculate the usable field strength, it is necessary to identify all the transmitters:

- which lie within a definite range of the wanted transmitter (according to experience: up to 800 km);
- which might cause interference in relation to the required protection ratio ***(Ai)***.

For the n interfering transmitters identified, the resulting nuisance field, E_{si}, is:

$$E_{si} = P_i + E_{ni}(50, T) + A_i + B_i \qquad (1)$$

where:

$E_{ni}(50, T)$: field strength in dB(μV/m) of the unwanted signal normalized to 1kW effective radiated power (e.r.p) at 50% locations for T% time (value derived from field strength curves of Recommendation ITU-R PN.370);

P_i: e.r.p. in dB(kW) of the interfering transmitter in the direction of the wanted transmitter;

A_i: protection ratio (dB);

B_i: receiving antenna discrimination (dB).

The usable field strength, E_u, is a function of the n nuisance fields, E_{si}, and is calculated by way of the formula:

Error! (2)

in which:

p_c: the coverage probability. To initiate the iterative calculation of E_u a predetermined value, P_{cp}, of the coverage probability is taken, e.g. $p_{cp} = 0.5$. With the value of E, obtained at the end of the iterative process, the coverage probability isp, = $p_{cp} = 0.5$, i.e. 50% of locations[1];

L : the probability integral for a normal distribution:

---

[1] $p\chi$ χαν βε σετ το ανψ οτηερ ωαλυε οφ χοωεραγε προβαβιλιτψ (ε.γ.€45% → p_c = 0.45).

Error! (3)

In this function x is the differencebetween the levels of the usable field-strength, E_u, and the nuisance field E_{si}, referred to σ, the standard deviation (with location) of the resulting difference in level.

Identical values are assumed for the standard deviations (with location) of the wanted and interfering field-strength levels: $\sigma_n = \sigma_s$. Thus, the standard deviation of the resulting level difference is:

$$\sigma = \sqrt{\sigma^{2;n} + \sigma^{2;s}} = \sigma_n\sqrt{2}$$

The value $\sigma_n = 8.3$ dB is assumed for the frequency Bands I to III. For Band IV/V this value is dependent on the terrain attenuation, g. σ is then calculated using the formula $\sigma_n = 9.5 + 0.405$ g. The attenuation correction factor g (in dB) can be derived from Ah (see Recommendation ITU-R PN.370).

4.2 Calculation of the probability integral

4.2.1 Tabular evaluation

The probability integral is as follows:

Error! (4)

Its numerical values are given in Table 4.1.

Since

Error!

and

Error!

it follows that:

Error!

4.2.2 Evaluation using the Hastings approximation

If the calculations are to be done by computer (or programmable pocket or table calculator), the following rational approximation is very useful:

Error! (5)

$$x < 0: L(x) = 1 - L(-x)$$

with:

$$H(y) = C_5y^5 + C_4y^4 + C_3y^3 + C_2y^2 + C_1y^1$$

and:

$y = [1 + 0.2\,316\,419\,|x|]^{-1}$

$C_5 = 1.330274429$

$C_4 = -1.821255978$

$C_3 = 1.781477937$

$C_2 = -0.356563782$

$C_1 = 0.319381530$

By means of approximation (5), one can avoid the integration in formula (3) and avoid using tables to evaluate the probability integral. The error involved by using this approximation is less than 10^{-7}.

4.3 Practical calculation procedures to determine the usable field strength

Since it is impossible to calculate formula (2) explicitly for E_u for a predetermined value p_{cp} (e.g. $p_{cp} = 0.5$), it must be calculated iteratively. Begin with an initial value for E_u, which, according to experience, should be some 6 dB greater than the largest of the E_{si}, and determine, successively, for each value of E_{si} :

$$z_i = E_u - E_{si} = \Delta_i$$

Error!

$\varphi(x_i)$ from Table 4.I.

Error!

Since for the standard deviation a value $\sigma_n = 8.3$ dB is assumed to apply for Bands I to III, it is appropriate to use Table 4.11 where $L(x_i)$ is presented as a function of Δ_i for $\sigma_n = 8.3$ dB. In Bands IV and V, where

$\sigma_n = 9.5 + 0.405\,g$, Table 4.11 may also be used once the Δ_i values have been corrected using:

Error!

p_c is then determined by means of formula (2). If p_c is different from p_{cp} (e.g. $p_{cp} = 0.5$), the value obtained is used as a basis to correct, as a part of the iterative process, the initial E_u value. From experience, the correction may be assumed to correspond approximately to:

Error!

TABLE 4.

x	$\varphi(x)$	x	$\varphi(x)$	x	$\varphi(x)$	x	$\varphi(x)$
0.00	0.0000	0.60	0.4515	1.20	0.7699	1.80	0.9281
01	0.0080	61	0.4581	21	0.7737	81	0.9297
02	0.0160	62	0.4647	22	0.7775	82	0.9312
03	0.0239	63	0.4713	23	0.7813	83	0.9328
04	0.0319	64	0.4778	24	0.7850	84	0.9342
0.05	0.0399	0.65	0.4843	1.25	0.7887	1.85	0.9357
06	0.0478	66	0.4907	26	0.7923	86	0.9371
07	0.0558	67	0.4971	27	0.7959	87	0.9385
08	0.0638	68	0.5035	28	0.7995	88	0.9399
09	0.0717	69	0.5098	29	0.8029	89	0.9412
0.10	0.0797	0.70	0.5161	1.30	0.8064	1.90	0.9426
11	0.0876	71	0.5223	31	0.8098	91	0.9439
12	0.0955	72	0.5285	32	0.8132	92	0.9451
13	0.1034	73	0.5346	33	0.8165	93	0.9464
14	0.1113	74	0.5407	34	0.8198	94	0.9476
0.15	0.1192	0.75	0.5467	1.35	0.8230	1.95	0.9488
16	0.1271	76	0.5527	36	0.8262	96	0.9500
17	0.1350	77	0.5587	37	0.8293	97	0.9512
18	0.1428	78	0.5646	38	0.8324	98	0.9523
19	0.1507	79	0.5705	39	0.8355	99	0.9534
0.20	0.1585	0.80	0.5763	1.40	0.8385	2.00	0.9545
21	0.1663	81	0.5821	41	0.8415	05	0.9596
22	0.1741	82	0.5878	42	0.8444	10	0.9643
23	0.1819	83	0.5935	43	0.8473	15	0.9684
24	0.1897	84	0.5991	44	0.8501	20	0.9722
0.25	0.1974	0.85	0.6047	1.45	0.8529	2.25	0.9756
26	0.2041	86	0.6102	46	0.8557	30	0.9786
27	0.2128	87	0.6157	47	0.8584	35	0.9812
28	0.2205	88	0.6211	48	0.8611	40	0.9836
29	0.2282	89	0.6265	49	0.8638	45	0.9857
0.30	0.2358	0.90	0.6319	1.50	0.8664	2.50	0.9876
31	0.2434	91	0.6372	51	0.8690	55	0.9892
32	0.2510	92	0.6424	52	0.8715	60	0.9907
33	0.2586	93	0.6476	53	0.8740	65	0.9920
34	0.2661	94	0.6528	54	0.8764	70	0.9931
0.35	0.2737	0.95	0.6579	1.55	0.8789	2.75	0.9940
36	0.2812	96	0.6629	56	0.8812	80	0.9949
37	0.2886	97	0.6680	57	0.8836	85	0.9956
38	0.2961	98	0.6729	58	0.8859	90	0.9963
39	0.3035	99	0.6778	59	0.8882	95	0.9968
0.40	0.3108	1.00	0.6827	1.60	0.8904	3.00	0.99730
41	0.3182	01	0.6875	61	0.8926	10	0.99806
42	0.3255	02	0.6923	62	0.8948	20	0.99863
43	0.3328	03	0.6970	63	0.8969	30	0.99903
44	0.3401	04	0.7017	64	0.8990	40	0.99933
0.45	0.3473	1.05	0.7063	1.65	0.9011	3.50	0.99953
46	0.3545	06	0.7109	66	0.9031	60	0.99968
47	0.3616	07	0.7154	67	0.9051	70	0.99978
48	0.3688	08	0.7199	68	0.9070	80	0.99986
49	0.3759	09	0.7243	69	0.9090	90	0.99990
0.50	0.3829	1.10	0.7287	1.70	0.9109	4.00	0.99994
51	0.3899	11	0.7330	71	0.9127		
52	0.3969	12	0.7373	72	0.9146	4.417	$1-10^{-5}$
53	0.4039	13	0.7415	73	0.9164		
54	0.4108	14	0.7457	74	0.9181	4.892	$1-10^{-6}$
0.55	0.4177	1.15	0.7499	1.75	0.9199	5.327	$1-10^{-7}$
56	0.4245	16	0.7540	76	0.9216		
57	0.4313	17	0.7580	77	0.9233		
58	0.4381	18	0.7620	78	0.9249		
59	0.4448	19	0.7660	79	0.9265		
0.60	0.4515	1.20	0.7699	1.80	0.9281		

TABLE 4.11

Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$
0.0	0.50000	7.000	5.0	0.66493	4.121	10.0	0.80288	2.217	15.0	0.89936	1.071	20.0	0.95580	0.457
0.1	0.50340	6.932	5.1	0.66803	4.074	10.1	0.80523	2.188	15.1	0.90085	1.054	20.1	0.95659	**0.448**
0.2	0.50680	6.864	5.2	0.67112	4.028	10.2	0.80757	2.158	15.2	0.90233	1.038	20.2	0.95737	**0.440**
0.3	0.51020	6.796	5.3	0.67419	3.981	10.3	0.80989	2.129	15.3	0.90379	1.022	20.3	0.95813	0.432
0.4	0.51359	6.729	5.4	0.67726	3.936	10.4	0.81219	2.101	15.4	0.90524	1.005	20.4	0.95889	0.424
0.5	0.51699	6.663	5.5	0.68031	3.890	10.5	0.81448	2.072	15.5	0.90667	0.989	20.5	0.95964	0.416
0.6	0.52038	6.5%	5.6	0.68335	3.845	10.6	0.81675	2.044	15.6	0.90808	0.974	20.6	0.96037	0.408
0.7	0.52378	6.531	5.7	0.68638	3.801	10.7	0.81900	2.016	15.7	0.90948	0.958	20.7	0.96109	0.401
0.8	0.52717	6,466	5.8	0.68939	3.756	10.8	0.82124	1.989	15.8	0.91086	0.943	20.8	0.96180	0.393
0.9	0.53056	6.401	5.9	0.69239	3.712	10.9	0.82345	1.962	15.9	0.91222	0.928	20.9	0.96251	0.386
1.0	0.53395	6.337	6.0	0.69538	3.669	11.0	0.82565	1.935	16.0	0.91357	0.913	21.0	0.96320	0.379
1.1	0.53733	6.273	6.1	0.69836	3.626	11.1	0.82784	1.908	16.1	0.91491	0.898	21.1	0.96388	0.372
1.2	0.54071	6.209	6.2	0.70132	3.583	11.2	0.83000	1.882	16.2	0.91623	0.884	21.2	0.96455	0.365
1.3	0.54409	6.147	6.3	0.70427	3.541	11.3	0.83215	1.856	16.3	0.91753	0.869	21.3	0.96521	0.358
1.4	0.54747	6.084	6.4	0.70721	3.499	11.4	0.83428	1.830	16.4	0.91882	0.855	21.4	0.96586	0.351
1.5	0.55084	6.022	6.5	0.71013	3.457	11.5	0.83639	1.804	16.5	0.92009	0.841	21.5	0.96650	0.344
1.6	0.55421	5.960	6.6	0.71304	3.416	11.6	0.83848	1.779	16.6	0.92135	0.827	21.6	0.96713	0.338
1.7	0.55758	5.889	6.7	0.71593	3.375	11.7	0.84056	1.754	16.7	0.92259	0.814	21.7	0.96775	0.331
1.8	0.56094	5.839	6.8	0.71881	3.334	11.8	0.84262	1.729	16.8	0.92382	0.800	21.8	0.96836	0.325
1.9	0.56430	5.778	6.9	0.72168	3.294	11.9	0.84466	1.705	16.9	0.92503	0.787	21.9	0.96896	0.318
2.0	0.56765	5.719	7.0	0.72453	3.254	12.0	0.84669	1.681	17.0	0.92623	0.774	22.0	0.96955	0.312
2.1	0.57099	5.659	7.1	0.72737	3.215	12.1	0.84869	1.657	17.1	0.92741	0.761	22.1	0.97013	0.306
2.2	0.57434	5.600	7.2	0.73019	3.176	12.2	0.85068	1.633	17.2	0.92858	0.748	22.2	0.97071	**0.300**
2.3	0.57767	5.542	7.3	0.73300	3.137	12.3	0.85265	1.610	17.3	0.92974	0.736	22.3	0.97127	0.294
2.4	0.58100	5.484	7.4	0.73579	3.098	12.4	0.85461	1.587	17.4	0.93088	0.723	22.4	0.97183	0.289
2.5	0.58433	5.426	7.5	0.73857	3.060	12.5	0.85634	1.564	17.5	0.93200	0.711	22.5	0.97237	0.283
2.6	0.58765	5.369	7.6	0.74134	3.023	12.6	0.85846	1.541	17.6	0.93312	0.699	22.6	0.97291	0.277
2.7	0.59096	5.312	7.7	0.74408	2.985	12.7	0.86036	1.519	17.7	0.93421	0.687	22.7	0.97344	0.272
2.8	0.59427	5.256	7.8	0.74682	2.948	12.8	0.86225	1.497	17.8	0.93530	0.676	22.8	0.97396	0.266
2.9	0.59757	5.200	7.9	0.74954	2.912	12.9	0.86412	1.475	17.9	0.93637	0.664	22.9	0.97447	0.261
3.0	0.60086	5.144	8.0	0.75224	2.875	13.0	0.86596	1.453	18.0	0.93742	0.653	23.0	0.97497	0.256
3.1	0.60415	5.089	8.1	0.75492	2.839	13.1	0.86780	1.432	18.1	0.93846	0.641	23.1	0.97546	0.251
3.2	0.60743	5.035	8.2	0.75760	2.804	13.2	0.86961	1.411	18.2	0.93949	0.630	23.2	0.97595	0.246
3.3	0.61070	4.980	8.3	0.76025	2.768	13.3	0.87141	1.390	18.3	0.94051	0.619	23.3	0.97643	0.241
3.4	0.61396	4.926	8.4	0.76289	2.733	13.4	0.87319	1.369	18.4	0.94151	0.609	23.4	0.97690	0.236
3.5	0.61722	4.873	8.5	0.76551	2.699	13.5	0.87495	1.349	18.5	0.94250	0.598	23.5	0.97736	0.231
3.6	0.62046	4.820	6.6	0.76812	2.664	13.6	0.87670	1.329	18.6	0.94347	0.588	23.6	0.97781	0.227
3.7	0.62370	4.768	6.7	0.77071	2.630	13.7	0.87843	1.309	18.7	0.94443	0.577	23.7	0.97826	0.222
3.8	0.62693	4.715	5.8	0.77328	2.597	13.8	0.88014	1.289	18.8	0.94538	0.567	23.8	0.97870	0.217
3.9	0.63015	4.664	5.9	0.77584	2.563	13.9	0.88183	1.270	18.9	0.94632	0.557	23.9	0.97913	0.213
4.0	0.63336	4.612	9.0	0.77838	2.530	14.0	0.88351	1.251	19.0	0.94724	0.547	24.0	0.97956	0.209
1.1	0.63657	4.561	3.1	0.78091	2.497	14.1	0.88517	1.232	19.1	0.94815	0.538	24.1	0.97997	0.204
1.2	0.63976	4.511	3.2	0.78342	2.465	14.2	0.88681	1.213	19.2	0.94905	0.528	24.2	0.98038	0.200
4.3	0.64294	4.461	9.3	0.78591	2.433	14.3	0.88844	1.195	19.3	0.94994	0.519	24.3	0.98078	0.196
1.4	0.64611	4.411	3.4	0.78838	2.401	14.4	0.89005	1.176	19.4	0.95081	0.509	24.4	0.98118	0.192
4.5	0.64928	4.362	9.5	0.79084	2.370	14.5	0.89164	1.158	19.5	0.95167	0.500	24.5	0.98157	0.188
46	0.65243	4.313	3.6	0.79328	2.339	14.6	0.89322	1.140	19.6	0.95252	0.491	24.6	0.98195	0.184
4.7	0.65557	4.264	3.7	0.79571	2.308	14.7	0.89478	1.123	19.7	0.95336	0.482	24.7	0.98232	0.180
4.8	0.65870	4.216	9.8	0.79811	2.277	14.8	0.89632	1.105	19.8	0.95418	0.474	24.8	0.98269	0.176
t.9	0.66182	4.168	1.9	0.80050	2.247	14.9	0.89785	1.088	19.9	0.95500	0.465	24.9	0.98305	0.173

TABLE 4.11 (*Cont.*)

Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$	Δ	$L(x)$	$-\log L(x)$
25.0	0.98341	0.169	30.0	0.99470	0.054	35.0	0.99857	0.014	40.0	0.99967	0.003	45.0	0.99994	0.001
25.1	0.98376	0.165	30.1	0.99483	0.052	35.1	0.99861	0.014	40.1	0.99968	0.003	45.1	0.99994	0.001
25.2	0.98410	0.162	30.2	0.99496	0.051	35.2	0.99864	0.014	40.2	0.99969	0.003	45.2	0.99994	0.001
25.3	0.98443	0.158	30.3	0.99508	0.050	35.3	0.99868	0.013	40.3	0.99970	0.003	45.3	0.99994	0.001
25.4	0.98476	0.155	30.4	0.99520	0.049	35.4	0.99872	0.013	40.4	0.99971	0.003	45.4	0.99995	0.001
25.5	0.98509	0.152	30.5	0.99532	0.047	35.5	0.99875	0.013	40.5	0.99972	0.003	45.5	0.99995	0.001
25.6	0.98541	0.148	30.6	0.99543	*0.046*	35.6	0.99879	0.012	40.6	0.99973	0.003	45.6	0.99995	0.001
25.7	0.98572	0.145	30.7	0.99554	0.045	35.7	0.99882	0.012	40.7	0.99974	0.003	45.7	0.99995	0.000
25.8	0.98603	0.142	30.8	0.99565	0.044	35.8	0.99886	0.012	40.8	0.99975	0.003	45.8	0.99995	*0.000*
25.9	0.98633	0.139	30.9	0.99576	0.043	35.9	0.99889	0.011	40.9	0.99975	0.002	45.9	0.99995	*0.000*
26.0	0.98662	0.136	31.0	0.99587	0.042	36.0	0.99892	0.011	41.0	0.99976	0.002	46.0	0.99996	*0.000*
26.1	0.98691	0.133	31.1	0.99597	0.041	36.1	0.99895	0.011	41.1	0.99977	0.002	46.1	0.99996	0.000
26.2	0.98719	0.130	31.2	0.99607	0.040	36.2	0.99898	0.010	41.2	0.99978	0.002	46.2	0.99996	*0.000*
26.3	0.98747	0.127	31.3	0.99617	0.039	36.3	0.99901	0.010	41.3	0.99978	0.002	46.3	0.99996	*0.000*
26.4	0.98775	0.125	31.4	0.99626	0.038	36.4	0.99904	0.010	41.4	0.99979	0.002	46.4	0.99996	*0.000*
26.5	0.98802	0.122	31.5	0.99636	0.037	36.5	0.99906	0.009	41.5	0.99980	0.002	46.5	0.99996	0.000
26.6	0.98828	0.119	31.6	0.99645	0.036	36.6	0.99909	0.009	41.6	0.99980	0.002	46.6	0.99996	***0.000***
26.7	0.98854	0.116	31.7	0.99654	0.035	36.7	0.99912	0.009	41.7	0.99981	0.002	46.7	0.99997	*0.000*
26.8	0.98879	0.114	31.8	0.99663	0.034	36.8	0.99914	0.009	41.8	0.99982	0.002	46.8	0.99997	*0.000*
26.9	0.98904	0.111	31.9	0.99671	0.033	36.9	0.99917	0.008	41.9	0.99982	0.002	46.9	0.99997	*0.000*
27.0	0.98928	0.109	32.0	0.99680	0.032	37.0	0.99919	0.008	42.0	0.99983	0.002	47.0	0.99997	*0.000*
27.1	0.98952	0.106	32.1	0.99688	0.032	37.1	0.99921	0.008	42.1	0.99983	0.002	47.1	0.99997	*0.000*
27.2	0.98976	0.104	32.2	0.99696	0.031	37.2	0.99924	0.008	42.2	0.99984	0.002	47.2	0.99997	0.000
27.3	0.98999	0.102	32.3	0.99704	0.030	37.3	0.99926	0.007	42.3	0.99984	0.002	47.3	0.99997	*0.000*
27.4	0.99021	0.099	32.4	0.99711	0.029	37.4	0.99928	0.007	42.4	0.99985	0.002	47.4	0.99997	*0.000*
27.5	0.99043	0.097	32.5	0.99719	0.028	37.5	0.99930	0.007	42.5	0.99985	0.001	47.5	0.99997	*0.000*
27.6	0.99065	0.095	32.6	0.99726	0.028	37.6	0.99932	0.007	42.6	0.99986	0.001	47.6	0.99997	*0.000*
27.7	0.99086	0.093	32.7	0.99733	0.027	37.7	0.99934	0.007	42.7	0.99986	0.001	47.7	0.99998	0.000
27.8	0.99107	0.091	32.8	0.99740	0.026	37.8	0.99936	0.006	42.8	0.99987	0.001	47.8	0.99998	*0.000*
27.9	0.99127	0.089	32.9	0.99747	0.026	37.9	0.99938	0.006	42.9	0.99987	0.001	47.9	0.99998	*0.000*
28.0	0.99147	0.087	33.0	0.99753	0.025	38.0	0.99940	***0.006***	43.0	0.99988	0.001	48.0	0.99998	0.000
28.1	0.99167	0.085	33.1	0.99760	0.024	38.1	0.99941	0.006	43.1	0.99988	0.001	48.1	0.99998	*0.000*
28.2	0.99186	0.083	33.2	0.99766	0.024	38.2	0.99943	0.006	43.2	0.99988	0.001	48.2	0.99998	***0.000***
28.3	0.99205	0.081	33.3	0.99772	0.023	38.3	0.99945	0.006	43.3	0.99989	0.001	48.3	0.99998	0.000
28.4	0.99223	0.079	33.4	0.99778	0.022	38.4	0.99946	0.005	43.4	0.99989	0.001	48.4	0.99998	*0.000*
28.5	0.99241	0.077	33.5	0.99784	0.022	38.5	0.99948	0.005	43.5	0.99989	0.001	48.5	0.99998	*0.000*
28.6	0.99259	0.075	33.6	0.99790	0.021	38.6	0.99950	0.005	43.6	0.99990	0.001	48.6	0.99998	*0.000*
28.7	0.99276	0.073	33.7	0.99795	0.021	38.7	0.99951	0.005	43.7	0.99990	0.001	48.7	0.99998	*0.000*
28.8	0.99293	0.072	33.8	0.99801	0.020	38.8	0.99953	0.005	43.8	0.99990	0.001	48.8	0.99998	*0.000*
28.9	0.99309	0.070	33.9	0.99806	0.020	38.9	0.99954	0.005	43.9	0.99991	0.001	48.9	0.99998	*0.000*
29.0	0.99326	0.068	34.0	0.99811	0.019	39.0	0.99955	0.005	44.0	0.99991	0.001	49.0	0.99999	*0.000*
29.1	0.99341	0.067	34.1	0.99816	0.019	39.1	0.99957	0.004	44.1	0.99991	0.001	49.1	0.99999	*0.000*
29.2	0.99357	0.065	34.2	0.99821	0.018	39.2	0.99958	0.004	44.2	0.99992	0.001	49.2	0.99999	*0.000*
29.3	0.99372	0.064	34.3	0.99826	0.018	39.3	0.99959	0.004	44.3	0.99992	0.001	49.3	0.99999	0.000
29.4	0.99387	0.062	34.4	0.99831	0.017	39.4	0.99961	*0.004*	44.4	0.99992	0.001	49.4	0.99999	*0.000*
29.5	0.99402	0.061	34.5	0.99835	0.017	39.5	0.99962	*0.004*	44.5	0.99992	0.001	49.5	0.99999	0.000
29.6	0.99416	0.059	34.6	0.99840	0.016	39.6	0.99963	0.004	44.6	0.99993	0.001	49.6	0.99999	*0.000*
29.7	0.99430	0.058	34.7	0.99844	0.016	39.7	0.99964	0.004	44.7	0.99993	0.001	49.7	0.99999	0.000
19.8	0.99444	0.056	34.8	0.99849	0.015	39.8	0.99965	0.004	44.8	0.99993	0.001	49.8	0.99999	*0.000*
29.9	0.99457	0.055	34.9	0.99853	0.015	39.9	0.99966	0.003	44.9	0.99993	0.001	49.9	0.99999	*0.000*

Then the determination of E_u has to be continued by repeating, with the corrected E_u, the calculation of new $\Box_i$ and $L(x_i)$ for each E_{si} and of a new p_c. This procedure has to be carried out until the correction $\Box E_u$ falls below the accuracy limit. Table 4.11.1 gives an example for the iterative determination of E_u in the presence of five nuisance fields ($\Box_n$ = 8.3 dB). The values of $L(x_i)$ are taken from Table 4.11.

TABLE 4.11.1

Approximation		1		2		3	
i	E_{si} (dB)	E_u = 78 dB		E_u = 76.6 dB		E_u = 76.44 dB	
		z_i (dB)	$L(x_i)$	z_i (dB)	$L(x_i)$	z_i (dB)	$L(x_i)$
1	64	14	0.8835	12.6	0.8585	12.44	0.8554
2	72	6	0.6954	4.6	0.6524	4.44	0.6474
3	60	18	0.9374	16.6	0.9214	16.44	0.9193
4	50	28	0.9915	26.6	0.9883	26.44	0.9878
5	45	33	0.9975	31.6	0.9964	31.44	0.9963
			0.5696		0.5082		0.5010
	ΔE_u (dB)		≈ − 1.4		≈ − 0.16		≈ − 0.02

The result of the iterative computation is E_u = 76.42 dB."

In view of the need to carry out numerous multiplications using at least four-digit numbers, the method may be simplified further by substituting the $L(x_i)$ values by the logarithms of their reciprocal value. This reduces the computation work to a summation of the $-\log L(x_i)$ values. To facilitate the computation of ΔE_u further it is appropriate to select a base for these logarithms such that ΔE_u is immediately apparent from a comparison of the sum with $-\log p_{cp}$ (logarithm to the same base), e.g. $-\log 0.5$ (50%). For convenience, the $-\log L(x_i)$ values are included in Table 4.11.1. As an example these logarithms are used in Table 4.IV. The underlying interference problem is identical in Tables 4.III and 4.IV and so are the results.

TABLE 4.IV

Approximation		1		2		3	
i	E_{si} (dB)	E_u = 78 dB		E, = 76.7 dB		E_u = 76.45 dB	
		z_i (dB)	$-\log L(x_i)$	z_i (dB)	$-\log L(x_i)$	z_i (dB)	$-\log L(x_i)$
1	64	14	1.251	12.7	1.519	12.45	1.575
2	72	6	3.669	4.7	4.264	4.45	4.386
3	60	18	0.653	16.7	0.814	16.45	0.848
4	50	28	0.087	26.7	0.116	26.45	0.123
5	45	33	0.025	31.7	0.035	31.45	0.037
–	$-\log p_C$ $-\log 0.5$*		5.685 − 7.000		6.748 − 7.000		6.969 − 7.000
	ΔE_u (dB)		≈ − 1.3		≈ − 0.25		≈ − 0.03

The result of the iterative computation is $E_u = 76.42$ dB."

APPENDIX 2
TO ANNEX 1

Reproduced from the Final Acts of the Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (Geneva, 1989) (**RARC** AFBC(2)), Annex 2, Chapter 2, § 2.1.3.

"2.1.3 Effective transmitting antenna height

The effective transmitting antenna height, h_1, is defined as the antenna height above the average ground level between 3 km and 15 km from the transmitter in the direction of the receiver. The height of the receiving antenna, h_2, is assumed to be 10 m above the ground.

The curves in Figures 2.2 to 2.25 are given for effective transmitting antenna heights between 37.5 m and 1200 m, each value given of the "effectiveheight" being twice that of the previous one. For different values of effective height a linear interpolation between the two curves corresponding to effective heights immediately above and below the true value shall be used.

For an effective transmitting antenna height, h_1, in the range 0 to 37.5 m, the field strength at a distance x from the transmitter is taken as the same as that given on the curve for 37.5 m at a distance of $(x + 25 - 4.1\sqrt{h_1})$ km. An effective antenna height of less than 0 m is replaced by 0 m.

This procedure is valid for distances beyond the radio horizon given by $(4.1\sqrt{h_1})$ km. Field strength values for shorter distances are obtained by:

- calculating the difference between the field strength value at the radio horizon for height h_1 (using the procedure given above) and the value on the 37.5 m curve for the same distance;
- subtracting the absolute value of the difference thus obtained from the field strength value on the 37.5 m curve for the actual distance involved.

This may be expressed as follows:

$$\text{For } x \geq 4.1\sqrt{h_1} \quad F(x, h_1)^{1)} = F((x + 25 - 4.1\sqrt{h_1}), 37.5)$$

$$\text{For } x < 4.1\sqrt{h_1} \quad F(x, h_1) = F(x, 37.5) - F(4.1\sqrt{h_1}, 37.5) + F(25, 37.5)$$

For an effective transmitting antenna height, h_1, greater than 1200 m, the field strength at a distance x from the transmitter is taken as the same as that given on the curve for 1200 m at a distance of $(x + 140 - 4.1\sqrt{h_1})$ km. This procedure is valid for distances beyond the radio horizon, given by $(4.1\sqrt{h_1})$ km. Field strength values for shorter distances are obtained by:

- calculating the difference between the field strength value at the radio horizon for height h_1 (using the procedure given above) and the value on the 1200 m curve for the same distance;
- adding the absolute value of the difference thus obtained to the field strength value on the 1 200 m curve for the actual distance involved.

---

1) Where $F(x, h_1)$ is the field strength (dB(μV/m)) for a distance x (km) and an effective transmitting antenna height h_1 (m).

This may be expressed as follows:

For $x \geq 4.1\sqrt{h_1}$ $F(x, h_1) = F((x + 140 - 4.1\sqrt{h_1}), 1200)$

For $x < 4.1\sqrt{h_1}$ $F(x, h_1) = F(x, 1200) - F(4.1\sqrt{h_1}, 1200) + F(140, 1200)$

This procedure is subject to the limitation that the value obtained does not exceed the free-space value

ANNEX 2

Protection of the land mobile service from the broadcasting service

The criteria specified in this Annex apply only to:

- analogue speech systems and some digital speech systems for the wanted land mobile signal;
- analogue AM vestigial sideband television systems (including the sound carrier) for the interfering broadcasting service (television);
- analogue FM systems for the interfering broadcasting service (sound).

It is noted that some administrations may use different values for any of the following parameters.

1. Minimum field strength values to be protected

11 Protection of analogue speech systems

The minimum median field strength to be protected for analogue land mobile systems, using 25 or 30 kHz channel spacings, is given in Table 14.

TABLE 14

Minimum median field strength to be protected for analogue land mobile systems using 25 or *30* kHz channel spacing

Frequency range (MHz)	Minimum median field strength to be protected (dB(μV/m))	
	Signal quality grade 4	Sound articulation(1) 80%
44-68	19	–
87.5-108	20	–
174-254	21	–
470-582	24	–
582-960	38	36

For channels using diversity reception, the values should be 8 dB lower.

(Signal quality grade 4 refers to a noticeable interfering effect. The best signal quality is grade 5.)

12 Protection of digital speech systems

The minimum median field strength to be protected for digital land mobile systems is given in Table 15.

TABLE 15

Minimum median field strength to be protected for digital land mobile systems

Frequency range (MHz)	Minimum median field strength to be protected (dB(μV/m))	
	π/4 QPSK, 50 kHz channel spacing 3 x 10^{-2} BER	GMSK, BT = 0.3 200 kHz channel spacing
582-960	30 (1)	32

2. Protection ratios

21 Sharing with the broadcasting service (television) when the mobile channel falls within the television channel

In the case of sharing between the broadcasting service (television) and the land-mobile service, the protection ratio, when the carrier frequency falls within □ 0.5 MHz of the vision carrier, is as given in Table 16.

TABLE 16

Protection ratios for the land mobile service when sharing with the broadcasting service (television)

	Analogue speech systems	Digital systems		
		π/4 QPSK, 50 kHz channel spacing 3 x 10^{-2} BER		GMSK, BT = 0.3 200 kHz channel spacing
		Static	Fading (1)	
Protection ratio (dB) (wanted/unwanted)	10	11 (2)	17 (2)	9 (2)

(2) These values are derived from the protection ratios against interfering signals using the same type of modulation as the wanted signal. Correction factors may be required before applying to sharing with the broadcasting service (television).

The curve giving the relative protection ratio values, as a function of the carrier frequency separation from the vision carrier, is given in Fig. 10.

The frequency separation between each of the carriers shown in Fig. 10, depends on the television system in use. The shaded portion of the figure should only be used when the interfering signal contains a NICAM sound carrier

2.2 Sharing with the broadcasting service (sound) when the mobile channel falls within 600 kHz of the broadcasting channel

In the case of **sharing** with the broadcasting service (sound) the protection ratio should be as given in Table 17.

FIGURE 10
Relative values of the radio-frequency protection ratio as a function of the carrier frequency spectrum

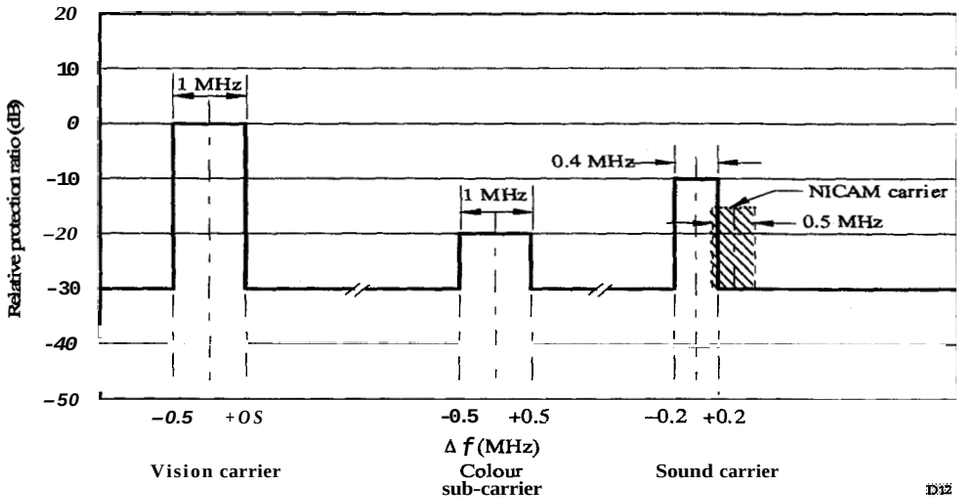


TABLE 17

Protection ratios for the land mobile service when sharing with the broadcasting service (sound)

Frequency separation between carriers of the two services (kHz)	Protection ratio (dB)			
		Digital systems		
	Analogue speech systems (12.5-25 kHz channel spacing)	π/4 QPSK, 50 kHz channel spacing 3×10^{-2} BER		GMSK, BT = 0.3 200 kHz channel spacing
		Static	Fading	
0	10	11 (1)	17 (1)	–9 (1)
15	6	–	–1 (1)	–
50	–5.5	–	–42 (1)	–
75	–17.5	–	–	–
100	–27.5	–	–57 (1)	–
200	–	–	–	–9 (1)
400	–	–	–	–41 (1)
600	–	–	–	–49 (1)

(1) These values are derived from the protection ratios against interfering signals using the same type of modulation as the wanted signal. Correction factors may be required before applying to sharing with the broadcasting service (sound).

2.3 Other interference mechanisms

When the land mobile service attempts to operate near a high power transmitter of the broadcasting service operating at different frequencies in the same band, the effects desensitization, spurious responses or intermodulation product generation can inhibit reception of the wanted land mobile signal.

The figures detailed in the following sections should be used in the calculations described in § 3 of this Annex.

2.3.1 Desensitization

Receivers in the land mobile services can suffer from desensitization in the presence of high power signals occurring outside the mobile channel. The threshold (T) at which desensitization will occur is dependent on the sensitivity of the receiver and the use of out-of-band RF filters. The range for T is typically between *80* and *100* dBμV e.m.f.

In this case, the protection margin (PM) (see § 3) is determined by the following equation:

$$PM = T - R$$

where R is the input voltage to the receiver due to the interfering signal (dBμV).

2.3.2 Intermodulation products

The basic intermodulation phenomena involve the mixing of two or more signals at different frequencies, in a non-linear circuit, which results in the generation of a signal at a different frequency.
In general:

$$f_0 = \pm mf_1 \pm nf_2 \pm pf_3 \pm \ldots$$

where:

f_0 : frequency of the intermodulation product

f_1, f_2, f_3 : frequencies of interfering signals

m, n, p : positive integers.

In this Recommendation, only one form of intermodulation is considered, that due to the dominant effect, i.e. the 2-signal, 3rd order mix, given by:

$$f_0 = 2f_1 - f_2$$

When f_0 falls within the bandwidth of the wanted channel(s), the nuisance field (NF) should be determined using the following parameters.
When applying the procedure of § 3, FI is replaced by:

Error!

where E_1 and $E2$ are the field strengths (dB(μV/m)) of the interfering signals at frequencies f_1 and f_2.

However, there may be an improvement in the calculated nuisance field which results from the response of the receiver front end at frequencies f_1 and/or f_2.

The protection ratio (PR) required for analogue speech systems (12.5-25 kHz channel bandwidth) associated with intermodulation products is:

–70 dB for base stations

–65 dB for mobile stations.

Similar considerations may apply for digital systems.

2.3.3 Spurious responses

Spurious responses to unwanted signals can be expected to occur in receivers at frequencies related to the receiver local oscillator and intermediate frequencies.

The protection margin (PM) is given (dB), by:

$$PM = FS - NF - AF$$

where:

FS : minimum field-strength value (dB(μV/m)) given in § 1 of this Annex

NF: nuisance field determined by:

$NF = FI + PR$

FI : interfering field strength of the broadcasting signal for the carrier frequency of the broadcasting signal for 10% of the time and 50% of locations

PR : protection ratio (dB) given in § 2 of this Annex

AF: adjustment factor (dB) to deal with antenna discrimination (see § 4.1 below).

The calculated protection margin should be positive at all locations where the land mobile service is required.

4. Additional factors to consider

4.1 Receiving antenna discrimination

For base stations, the adjustment factor, AF, resulting from the antenna polarization discrimination for horizontally polarized broadcasting emissions is 18 dB.

Where vertically or mixed polarized broadcasting emissions are used, no antenna polarization discrimination should be taken into account and AF is 0 dB.

For mobile stations, no polarization discrimination is taken into account and AF is 0 dB because:

- the mobile receiving system, consisting of an antenna and the body of a vehicle, cannot be assumed to have any orthogonal polarization discrimination;
- the effect of environmental clutter near the mobile station can be expected to introduce a degree of depolarization,

4.2 Antenna heights

For the purpose of interference assessments, the following typical characteristics for the land mobile service may be assumed:

- base station antenna height = 75 m
- mobile station antenna height = 2 m.

5. Interference assessments

Interference assessments should be made for several points within the service area (i.e. where the minimum field strength can be obtained in 50% of locations for 50% of the time) where interference is most likely and at the location of the base station.

The appropriate propagation curves for 50% of locations and 10% of the time of Recommendation ITU-R PN.370 should be used to determine FI, $E1$ and $E2$.

Appropriate correction factors for frequency, distance, antenna height and terrain should be applied.

To correct values obtained from Recommendation ITU-R PN.370, for receiver antenna heights other than 10 m, but within the range 2 m to 80 m, the following formula or Table 18 should be used:

Error!

where C is the correction factor.

In practice, this factor is also dependent on frequency and local clutter but for purposes of calculating interference levels, the formula is adequate.

TABLE 18

Correction factors applicable to Recommendation **ITU-R PN.370**

Receiving antenna height *h* (m)	Correction factor, *C* (dB)
2	-14
10	0
75	+17.5

ANNEX 3

Protection of the fixed service from the broadcasting service

Introduction

The protection of the fixed service from the broadcasting service in shared or in adjacent VHF and UHF bands should be considered using the methods given below and Recommendation ITU-R F.758.

1. Minimum field strength to be protected

where:

C/N: required carrier-to-noise ratio at the receiver input for a specified performance criteria (dB), see Recommendations ITU-R F.758 and ITU-R F.759

N: receiver thermal noise (dBW)

and:

$$N = 10 \log_{10} kTB + F$$

k Boltzmann's constant (1.38×10^{-23})

T: receiver noise temperature (290 K)

B: receiver IF bandwidth *(Hz)* (system dependent)

F: receiver noise figure (dB) (nominally 5 dB).

If relevant values for receiver IF bandwidth, B, and receiver noise figure, *F*, are not available, the receiver thermal noise may be obtained directly from Recommendation ITU-R F.758.

If the receiver IF bandwidth, *B*, is not available, the following approximation *can* be used.

- For single channel FM systems, the receiver IF bandwidth can be approximated by:

$$B = 2(\beta + BIT)$$

where:

β: peak deviation

BW: baseband bandwidth.

- For frequency division multiplex, frequency modulated (FDM-FM) systems, the receiver IF bandwidth can be approximated by:

$$B = 2(\beta + BW)$$

where:

β: multi-channel peak deviation

BW multi-channel baseband bandwidth.

– For digital systems, the receiver IF bandwidth can be approximated by:

$$B = 1.2R / \log_2 M$$

where:

R: bit rate (bit/s)

M: number of states (e.g., $M = 2$ for PSK, $M = 4$ for QPSK, M = 16 for 16 QAM, etc.).

The nominal receiver input level (dBW) is given by:

$$C_{nrx} = C_{min.} + FM$$

where:

FM: fademargin

The minimum field strength **(FS)** (dB(μV/m)) to be protected is given by:

$$FS = C_{nrx}\,(\text{dBW}) - G_r\,(\text{dBi}) + 20\log_{10} F_O\,(\text{MHz}) + 107.2$$

where:

G_r: receiver antenna gain (dBi)

F_o: receiver-operating frequency (MHz).

2. Protection ratios

In principle, the interference at the receiver input should be more than 6 dB below the receiver thermal noise, *N*. This is equivalent to a fixed system protection ratio (PR) defined in terms of the carrier-to-interference ratio, C_{nrx} / I, given by:

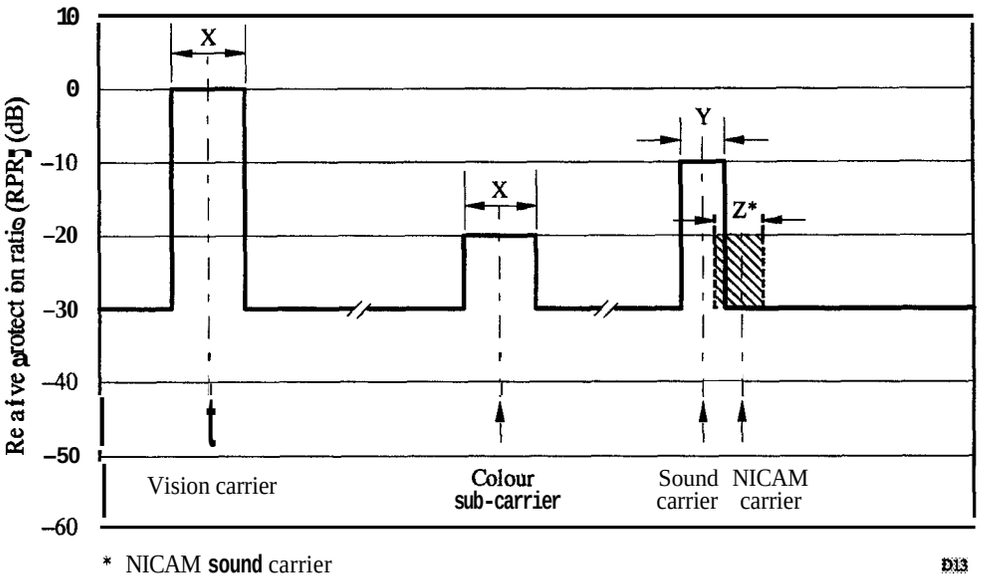
$$PR(\text{dB}) = C_{nrx} / I = C_{nrx} / N + 6 + RPR$$

where I is the interfering signal level (dBW) and RPR is the relative protection ratio normalized to the protection ratio at the vision carrier of the broadcasting signal.

2.1 Sharing in the broadcasting channel (television)

The protection ratio for sharing in the broadcasting channel is a function of the frequency difference between the carrier of the fixed service receiver and the television broadcasting transmitter carrier, the fixed service receiver IF bandwidth (B) and the television broadcasting service emission spectrum characteristics. Figure II should be used to determine the relative protection ratio (RPR) when the desired and undesired signals are within the bandwidth of the same broadcasting channel.

FIGURE 11



Relative values of protection ratio as a function of the frequency difference between the fixed service receiver and the TV broadcasting transmitter carrier, the fixed service receiver IF bandwidth (B) and the TV broadcasting service emission spectrum characteristics.

Note 1 – X = 1 MHz if B < 1 MHz
X = B if B > 1 MHz
Y = 0.4 MHz if B < 0.4 MHz
Y = B if B > 0.4 MHz
Z = 0.5 MHz if B < 0.5 MHz
Z = B if B > 0.5 MHz

2.2 Sharing outside the broadcasting channel (television)

When the fixed service operates outside the broadcasting service television channel and the fixed service receiver operating frequency (F_O) is separated from the television vision or sound carriers by greater than one-half the receiver IF bandwidth (B), the relative protection ratio (RPR), based on available measurements, can be approximated:

$$RPR = 10 \log_{10} (B / 30) - 70$$

where B is the receiver IF bandwidth (kHz).

23 Other interference mechanisms

When the fixed service attempts to operate neat a high power transmitter of the broadcasting service operating at different frequencies in the same band, the effects of desensitization, intermodulation and spurious responses can degrade reception of the wanted fixed signal. These effects may be reduced by the use of RF filters.
The figures detailed in the following sections should be used in the calculations described in § 3 of this Annex.

The figures detailed in the following sections should be used in the calculations described in § 3 of this Annex.

2.3.1 Desensitization

Receivers in the fixed service can suffer from desensitization (front-end-overload) in the presence of high power broadcasting signals occurring outside the fixed receiver channel. Receiver desensitization when the energy from the fundamental frequency (necessary emissions) of an undesired signal saturates the receiver front-end, e.g., low noise amplifier **(LNA)** resulting in gain compression (reduction in signal level) **of** the desired signal sufficient to degrade performance. Receiver front-end overload *can* be mitigated by having adequate RF selectivity prior to the **LNA** by using a diplexer filter.
The threshold (T) at which desensitization occurs **is** a function of the gain and the gain compression level (saturation level) of the **LNA.**

$$T\,(\text{dBW}) = 1\,\text{dB compression gain} - \textbf{LNA gain}$$

A typical 1 dB gain compression level is -20 dBW.

In this case, the protection margin (PM) (see **§ 3)** is determined by the following equation:

$$PM = T - 1$$

2.3.2 Intermodulation products

The basic intermodulation phenomena involve the mixing of two or more signals at different frequencies, in a non-linear circuit, which results in the generation of a signal at a different frequency.

In general:

$$f_0 = \pm mf_1 \pm nf_2 \pm pf_3 \pm \ldots$$

where:

f_0 : frequency **of** the intermodulation product

f_1, f_2, f_3 : frequencies of interfering signals

m, n, p : positive integers

In this Recommendation, only one form **of** intermodulation **is** considered, that due to the dominant effect, i.e. the 2-signal, 3rd order intermodulation product, given by:

$$f_0 = 2f_1 - f_2$$

When f_0 falls within the bandwidth of the wanted channel(s), the nuisance field **(NF)** should be determined using the following parameters.

When applying the procedure of § 3, FI is replaced by:

Error!

where E_1 and E2 are the field strengths (dB(μV/m)) of **the** interfering signals at frequencies f_1 and f_2.
However, there may be an improvement in the calculated nuisance field which results from the response **of** the receiver front end at frequencies f_1 and/or f_2.

The protection ratio (PR) required for the fixed service associated with intermodulation products is typically 70 dB.

2.3.3 Spurious responses

Spurious responses to unwanted signals can be expected to occur in receivers at frequencies related to the receiver local oscillator frequency (f_{lo}) and the receiver intermediate frequencies (f_{IF}).

The frequencies at which spurious responses can occur should be calculated using the following expressions.

$$q f_{sp} = n f_{lo} \pm f_{IF}$$

where:

q: harmonic order of the mixer input signal

f_{sp} : frequency at which a spurious response may occur

n: harmonic order of the local oscillator

f_{lo} : frequency of the local oscillator applied to the mixer stage

The above equation provides the receiver spurious response frequency which produces a signal at the centre of the receiver IF band. Therefore, receiver spurious responses may occur over a frequency range of plus or minus one-half the receiver IF bandwidth.

The protection ratio which applies when the vision or sound carrier of a TV signal occurs at these spurious response frequencies is typically 70 dB. Under these circumstances, the power of the relevant carrier (vision or sound) should be used when calculating the level of the unwanted signal.

3. Protection margin

3.1 Assessment of the protection margin

The protection margin (PM) is given by:

$$PM \text{ (dB)} = FS - NF - AF$$

where:

FS: minimum field-strength value (dB(μV/m)) given in § 1

NF: nuisance field and is determined by:

$NF = FI + PR$

FI: interfering field strength of the broadcasting signal. The appropriate propagation curves for 10% of time and 50% of locations of Recommendation ITU-R PN.370 should be used

PR: protection ratio (dB) given in § 2 of this Annex

AF: adjustment factor (dB) to deal with receiver antenna gain discrimination and polarization discrimination (see § 4 below).

The calculated protection margin should be positive at all locations where the fixed service is required.

4. Additional factors to consider

4.1 Receiving antenna discrimination

The receiving antenna discrimination is determined by taking into account the receiver antenna gain in the direction of the TV broadcasting station. See Recommendation ITU-R F.699 for determination of the receiving antenna discrimination.

4.2 Receiving antenna cross-polarization discrimination

For fixed stations, the value of the antenna discrimination against orthogonal polarization could be up to 15 dB in the mainbeam. Where non-orthogonal or mixed polarization are used, no antenna polarization discrimination should be taken into account.

SECTION 2

COMPATIBILITY BETWEEN DIGITAL BROADCASTING AND OTHER SERVICES

1. This section of the report deals with the sharing of digital broadcasting services and other services within the 470-862MHz band. The Regional Radiocommunication Conference (RRC-06) having realised that the bands 174-230MHz and 470-862MHz are not only used for broadcasting services, addressed the sharing of broadcasting and other services in the band.

It contains technical parameters and protection criteria for the compatibility analysis of other primary services with broadcasting services, which were used in the development of the Plan and shall be used for its implementation. These technical parameters and protection criteria would be used during the coordination process in respect to sharing of the band between broadcasting and non broadcasting services.

2. The chapter deals with protection of digital terrestrial broadcasting services from other services. The chapter also addresses instances where the system of the other service is unknown. This is addressed by using generic cases to ensure that interference between the services is mitigated.

The RRC-06 adopted a sharing criterion that was used to mitigate interference between broadcasting and non broadcasting services. A sharing criterion between broadcasting and fixed and mobile services, and land mobile services in the band 174-230MHz and 470-862MHz, was adopted. It also contained system specific protection criteria for certain systems of other primary services operating in the bands 174-230 MHz and 470-862MHz as well as generic protectioncriteria for the fixed and mobile services operating in the bands 174- 230 MHz and 470-862 MHz.

3. The Authority having carefully studied the recommendations of the criterion of sharing between digital broadcasting services and other services including fixed, mobile and land mobile as outlined in the RRC-06 plan came to the conclusion that the criterion provides sufficient technical conditions under which sharing can occur.

Compatibility with other primary services

4 **Introduction**

This chapter contains technical parameters and protection criteria for the compatibility analysis of other services with broadcasting services. These technical parameters and protection criteria would be used during the coordination process in respect to sharing of broadcasting services and other non broadcasting services in the band.

ANNEX 4.2

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

This annex contains system-specific protection criteria for certain systems of other primary services operating in the band 470-862 MHz as well as generic protection criteria for the fixed and mobile services operating in the band 470-862 MHz. The systems for which protection criteria are provided are listed in Table A.4.2-1.

TABLE A.4.2-1

System type code	Secondary code implemented in the planning software	Type of system	Field strength to be protected (dB(μV/m))	Receiver height (m)	Protection ratio table
AA8	BL8	Aeronautical radionavigation system BL8 (RSBN, 0.7 or 0.8 MHz)	42.0	10 000.0	A.4.2-24
AA8	BN8	Aeronautical radionavigation system BN8 (RSBN, 3 MHz)	42.0	10.0	A.4.2-24
AA8	BY8	Aeronautical radionavigation system BY8 (RSBN, 0.7 MHz)	42.0	10.0	A.4.2-24
AA8	BX8	Aeronautical radionavigation system BX8 (RSBN, 3 MHz)	42.0	10 000.0	A.4.2-24
AB	AB8N	Aeronautical radionavigation system AB8N (RLS 1 Type 1, 6 MHz)	13.0	10.0	k4.2-16
AB	AB8C	Aeronautical radionavigation system AB8C (RLS 1 Type 1, 6 MHz)	13.0	10.0	A.4.2-17
AB	AC8N	Aeronautical radionavigation system AC8N (RLS 1 Type 2, 3 MHz)	13.0	10.0	A.4.2-18
AB	AC8C	Aeronautical radionavigation system AC8C (RLS 1 Type 2, 3 MHz)	13.0	10.0	A.4.2-19
BA	BA8N	Aeronautical radionavigation system BA8N (RLS 2 Type 1)	29.0	10.0	A.4.2-20
BA	BA8C	Aeronautical radionavigation system BA8C (RLS 2 Type 1)	29.0	10.0	A.4.2-21
AA2	BB8N	Aeronautical radionavigation system BB8N (RLS 2 Type 2, airborne transmission, 8 MHz)	24.0	10.0	k4.2-22
AA2	BB8C	Aeronautical radionavigation system BB8C (RLS 2 Type 2, airborne transmission, 8 MHz)	24.0	10.0	k4.2-23
BC	BC8N	Aeronautical radionavigation	73.0	10	A.4.2-18

System type code	Secondary code implemented in the planning software	Type of system	Field strength to be protected (dB(μV/m))	Receiver height (m)	Protection ratio table
		system BC8N (RLS 2 Type 2, ground transmission, 3 MHz)		000.0	
BC	BC8C	Aeronautical radionavigation system BC8C (RLS 2 Type 2, ground transmission, 3 MHz)	73.0	10 000.0	A.4.2-19
BD	BD8N	Aeronautical radionavigation system BD8N (RLS 2 Type 1, ground transmission, 4 MHz)	52.0	10 000.0	A.4.2-20
BD	BD8C	Aeronautical radionavigation system BD8C (RLS 2 Type 1, ground transmission, 4 MHz)	52.0	10 000.0	A.4.2-21
FF	FF7	Fixed system FF7 (transportable, 7 MHz)			
FF	FF8	Fixed system FF8 (transportable, 8 MHz)	J5.0		
FH	FH8	Fixed system FH8 (P-MP)	18.0	10.0	A.4.2-4
FK7	FK7N	Generic fixed non-critical mask	-	10.0	(See Note)
FK7	FK7C	Generic fixed sensitive mask	-	10.0	(See Note)
FK8	FK8N	Generic fixed non-critical mask	-	10.0	(See
FK8	FK8C	Generic fixed sensitive mask	-	10.0	(See Note)
NX**	NX8	Land mobile system NX8	17.0	20.0	A.4.2-7
NR**	NR7	Land mobile system NR7 (radio microphone, 7 MHz)	58.0	1.5	A.4.2-8
NR**	NR8	Land mobile system NR8 (radio microphone, 8 MHz)	58.0	1.5	A.4.2-9
NS**	NS7	Mobile system NS7 (OB link, stereo, non-companded)	$6.0	10.0	A.4.2-10
NS**	NS8	Mobile system NS8 (OB link, stereo, non-companded)	36.0	10.0	A.4.2-11
NT**	NT7	Mobile system NT7 (talkback, non-companded)	31.0	1.5	A.4.2-12
NT**	NT8	Mobile system NT8 (talkback, non-companded)	31.0	1.5	A.4.2-13
NA	NA8N	Digital land mobile system NA8N (non-critical)	3.0	20.0	A.4.2-14
NA	NA8C	Digital land mobile system NA8C (sensitive)	3.0	20.0	A.4.2-15

System type code	Secondary code implemented in the planning software	Type of system	Field strength to be protected (dB(μV/m))	Receiver height (m)	Protection ratio table
NB	NB7N	Generic mobile non-critical mask	–	10.0	(See Note)
NB	NB7C	Generic mobile sensitive mask	–	10.0	(See Note)
NB	NB8N	Generic mobile non-critical mask	–	10.0	(See Note)
NB	NB8C	Generic mobile sensitive mask	–	10.0	(See Note)
PL	PL8	Aeronautical radionavigation system PL8 (radars, artificial values)	0.0	1.5	A.4.2-25
NY	X7N	Land mobile system X7N (VHF)	28.0	1.5	A.4.2-26
NY	X7C	Land mobile system X7C (VHF)	28.0	1.5	A.4.2-27
NY	X8N	Land mobile system X8N (VHF)	28.0	1.5	A.4.2-28
NY	X8C	Land mobile system X8C (VHF)	28.0	1.5	A.4.2-29
NY	Y8N	Land mobile system Y8N at 480 MHz	31.0	1.5	A.4.2-28
NY	Y8C	Land mobile system Y8C at 480 MHz	31.0	1.5	A.4.2-29
NY	Z8N	Land mobile system Z8C at 620 MHz	33.0	1.5	A.4.2-28
NY	Z8C	Land mobile system Z8C at 620 MHz	33.0	1.5	k4.2-29
XA8**	ZA8C	Radio astronomy single dish telescope sensitive DVB-T mask	–39.0	50.0	k4.2-5
XA8**	ZA8N	Radio astronomy single dish telescope non-critical DVB-T mask	–39.0	50.0	A.4.2-6
XB8**	ZB8C	Radio astronomy VLBI sensitive DVB-T mask	2.0	50.0	A.4.2-5
XB8**	ZB8N	Radio astronomy VLBI non-critical DVB-T mask	2.0	50.0	A.4.2-6
	ZC8C**	Radio astronomy interferometry sensitive DVB-T mask	–22.0	50.0	A.4.2-5
	ZC8N**	Radio astronomy interferometry non-critical DVB-T mask	–22.0	50.0	A.4.2-6

TABLE **A.4.2-2**

Transportable 7 MHz system FF7

Δf (MHz)	–5.5	-4.5	–3.5	0	3.5	4.5	5.5
PR (dB)	**-46**	–39	7	11	7	–39	-46

TABLE **A.4.2-3**

Transportable 8 MHz system FF8

Δf (MHz)	-6	-5	-4	0	4	5	6
PR (dB)	-46	–39	7	11	7	–39	**-46**

Δf (MHz)	–6.0	-4.2	–3.9	–3.4	0.0	3.4	3.9	4.2	6.0
PR (dB)	-65.0	–54.0	–4.0	–1.0	–1.0	–1.0	–4.0	–54.0	-65.0

TABLE **A.4.2-5**

Radio astronomy sensitive DVB-T mask ZA8C, ZB8C, ZC8C

Abs(Δf) (MHz)	9.0	8.0	7.0	6.0	5.0	4.0	3.0	2.0	1.0	0.0
PR (dB)	–71.0	-66.0	–41.0	–9.0	–6.0	–4.0	–3.0	–2.0	–1.0	–1.0

TABLE **A.4.2-6**

Radio astronomy non-critical DVB-T mask ZA8N, ZB8N, ZC8N

Abs(Δf) (MHz)	9.0	8.0	7.0	6.0	5.0	4.0	3.0	**2.0**	1.0	0.0
PR (dB)	–61.0	–56.0	–37.0	–9.0	–6.0	–4.0	–3.0	–2.0	–1.0	–1.0

TABLE **A.4.2-7**

Land mobile systems – NX8

Abs(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

TABLE **A.4.2-8**

Radio microphone – *NR7*

Abs(Δf) (MHz)	10.5	8.8	**7.0**	5.2	3.7	3.3	3.2	0.0
PR (dB)	-49.0	-49.0	–44.0	–39.0	–34.0	8.0	13.0	13.0

TABLE A.4.2-9

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

TABLE A.4.2-10

OB link (stereo, non-companded) – NS7

Abs(Δf) (MHz)	10.5	8.8	7.0	5.2	3.7	3.3	3.2	0.0
PR (dB)	–17.0	–16.0	–11.0	–8.0	–4.0	37.0	44.0	44.0

TABLE A.4.2-11

OB link (stereo, non-companded) – NS8

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

TABLE A.4.2-12

Talkback – NT7

Abs(Δf) (MHz)	10.5	8.8	7.0	5.2	3.7	3.3	3.2	0.0
PR (dB)	–96.0	–91.0	–84.0	–79.0	–69.0	–19.0	–13.0	–13.0

TABLE A.4.2-13

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

TABLE A.4.2-14

Digital land mobile NA8N (non-critical)

Abs(Δf) (MHz)	7.5	6.2	5.0	3.8	2.5	1.2	0.0
PR (dB)	–63.0	–57.0	–50.0	–7.0	–5.0	–5.0	–5.0

TABLE? A.4.2-15

Digital land mobile NA8C (sensitive)

Abs(Δf) (MHz)	7.5	6.2	5.0	3.8	2.5	1.2	0.0
PR (dB)	–73.0	–67.0	–60.0	–7.0	–5.0	–5.0	–5.0

TABLE A.4.2-16

RLS 1 Type 1 ABSN (non-critical)

Abs(Δf) (MHz)	17	15	9	7.5	6.5	6	4	1	0
PR 10% (dB)	–80.6	–63.79	-47.1	– 44.4	–11.7	–8.8	-4.1	–1.1	–1

TABLE A.4.2-17

RLS 1 Type 1 AB8C (sensitive)

Abs(Δf) (MHz)	17	15	9	7.5	6.5	6	4	1	0
PR 10% (dB)	–90.66	-63.9	–47.3	– 45.4	–11.8	–8.8	-4.1	–1.1	–1

TABLE! A.4.2-18

RLS 1 Type 2 AC8N (non-critical)
RLS 2 Type 2 BC8N (non-critical)

Abs(Δf) (MHZ)	16	14	8	6.5	6	5	4	2	0
PR 10% (dB)	–82.8	–64	–49.2	-45.8	–45.39	–12.1	–7.25	-4	-4

TABLE A.4.2-19

RLS 1 Type 2 AC8C (sensitive)
RLS 2 Type 2 BC8C (sensitive)

Abs(Δf) (MHz)	16	14	8	6.5	6	5	4	2	0
PR 10% (dB)	–92.4	-64.3	–49.4	-46.28	-46.26	–12.2	–7.27	-4	-4

TABLE A.4.2-20

Abs(Δf)	16	15	6.5	6	5.5	5	4	2.5	0
PR 10% (dB)	–81.3	-66.4	-44.1	–34	–12	–9	–5.9	–3.5	–2.8

TABLE **A.4.2-21**

RLS 2 Type 1 BA8C (sensitive)
RLS 2 Type 1 BD8C (sensitive)

Abs(Δ*f*) (MHz)	16	15	6.5	6	*5.5*	5	**4**	**2.5**	0
PR 10% (dB)	–90.9	-66.5	**-44.9**	–39	–12	**–9**	–6	*–3.5*	**–2.8**

TABLE **A.4.2-22**

RLS 2 Type 2 BBSN (non-critical)

Abs(Δ*f*) (MHz)	17	15	10	**9**	*8.5*	*8*	7	**4**	*0*
PR 10% (dB)	**–79.4**	–61.2	-46.3	-43.2	–43	**–19.9**	-8.7	**–2.9**	*0*

TABLE **A.4.2-23**

RLS 2 Type 2 BBSC (sensitive)

Abs(Δ*f*) (MHz)	17	15	10	**9**	*8.5*	**8**	**7**	**4**	0
PR 10% (dB)	**–89.4**	-61.3	*-46.5*	**-43.4**	-43	*–20.2*	**-8.7**	**–2.9**	0

TABLE **A.4.2-24**

Abs(Δ*f*) (MHz)	12.0	10.0	*8.0*	*6.0*	**4.0**	**2.0**	*0.0*
PR 10% (dB)	–65.0	–50.0	**–27.0**	–16.0	*–5.0*	0.0	*0.0*

TABLE **A.4.2-26**

Land mobile at VHF X7N

Abs(Δ*f*) (MHz)	3.7	3.3	0.0
PR (dB)	–55.0	–17.0	–10.0

TABLE **A.4.2-27**

Land mobile at VHF X7C

Abs(Δ*f*) (MHz)	3.7	3.3	0.0
PR (dB)	-65.0	–17.0	–10.0

TABLE **A.4.2-28**

Land mobile at VHF XSN
Land mobile at 480 MHz YSN
Land mobile at 620 MHz Z8N

Abs(Δ*f*) (MHz)	4.2	3.8	0.0
PR (dB)	–55.0	–17.0	–10.0

TABLE **A.4.2-29**

Land mobile at VHF X8C
Land mobile at 480 MHz YSC
Land mobile at 620 MHz Z8C

Abs(Δ*f*) (MHz)	4.2	3.8	0.0
PR (dB)	-65.0	–17.0	–10.0

APPENDIX
TO ANNEX4.2

Calculation of field strength of the allowed interfering television signal for generic cases of the fixed and mobile services

The field strength, E, of the allowed interfering television signal for generic cases of the fixed and the mobile services is calculated using the formula:

$$E = -37 + F - G_i + L_F + 10\log(B_i) + P_o + 20\log f - K \quad \text{dB}(\mu\text{V/m}) \qquad (1)$$

where:

- F: receiver noise figure land mobile service (LMS) base or mobile station receivers (dB)
- B_i: the bandwidth of the terrestrial broadcasting station (MHz)
- G_i: the receiver antenna gain (dBi)
- L_F: antenna cable feeder loss (dB)
- f: centre frequency of the interfering station (MHz)
- P_o: man-made noise (dB) (typical value is 1dB for VHF band and 0 dB for UHF band)
- K: overlap correction factor (in DVB-T) given in the Tables AP4.2-4 and AP4.2-5 below (dB).

For the generic case of the fixed service, based on the information in Recommendations ITU-R F.758-4, ITU-R F.1670-1 and ITU-R SM.851-1, the following values of F, G_i, L_F and P_o would be used:

TABLE AP4.2-1

Frequency (MHz)	174-230	500	800
F (dB)	5	5	5
G_i (dBi)	9	14	16
L_F (dB)	4	5	5
P_o (dB)	1	0	0
$F - G + L_F + P_o$	1	-4	-6

In the UHF band, the variation of $(F - G + L_F + P_o)$ with frequency relative to the value at 500 MHz is given by using the formula: $10\log(f/500)$.

TABLE AP4.2-2

Frequency (MHz)	174	230	470	790	862
F (dB)	8	8	4	3	3
G_i (dBi)	6	8	12	17	17
L_F (dB)	2	2	2	4	4
P_o (dB)	1	1	0	0	0
$F - G_i + L_F + P_o$	5	3	–6	–10	–10

For the generic case of the land mobile service (mobile stations), the following values of F, G_i, L_F and P_o were used:

TABLE AP4.2-3

Frequency (MHz)	174	230	470	790	862
F (dB)	11	11	7	7	7
G_i (dBi)	0	0	0	0	0
L_F (dB)	**0**	**0**	**0**	**0**	**0**
P_O (dB)	**1**	**1**	**0**	**0**	**0**
$F - G_i + L_F + P_o$	12	12	7	7	7

Calculation of the overlap correction factor K

The overlap correction factor is K (dB). When calculating interference with the victim receiver this factor must be added in equation (1).

In order to calculate the overlap correction factor K:

– Calculate the overlapped bandwidth B_o

$$B_o = \text{Min}\ (B_v, (B_v + B_i)/2 - \Box f)$$

where:

B_v: the bandwidth of the victim receiver

B_i: the bandwidth of the interfering signal

$\Box f$: the difference between the centre frequency of the fixed service system and the centre frequency of the interfering (DVB-T) signal.

TABLE AP4.2-4

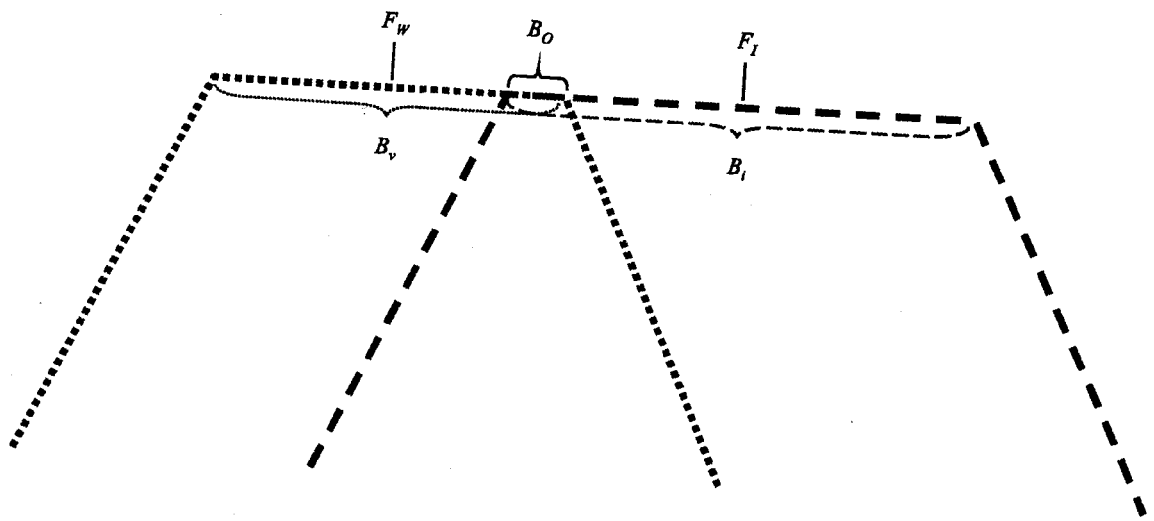
Overlapped bandwidth, B_o	Overlapping factor, K (dB)
$B_o = B_v$	0
$10^{-4} B_v > B_o \geq 10^{-4} B_v$	$10 \log_{10} (B_o/B_v)$
$B_o = -1$	-40
$B_o = -2$	-45
$B_o = -4$	–52
$B_o = -8$	–60
	–77

TABLE *AP4.2-5*

Overlapped bandwidth, B_o	Overlapping factor, K (dB)
$B_o = B_v$	0
$B_v > B_o > 10^{-5} B_v$	$10 \log_{10} (B_o/B_v)$
$10^{-5} B_v > B_o > -0.5$	–50
$B_o = -1$	–55
$B_o = -2$	–62
$B_o = -4$	–70
$B_o = -8$	-87

Where BO,

FIGURE *AP4.2-1*



F_W: centre frequency of the wanted signal
F_I: centre frequency of the interfering signal

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Examples
It is assumed that:
B_v = 0.2 MHz
B_i = 8 MHz

DVB-T case is non-critical

Δf (MHz)	3.8	4.0	4.1	4.8
B_o (MHz)	0.3	0.1	0	-0.7
K (dB)	0	$10 \log(0.1/0.2) = 3$ dB	-40	*See* below $K = -42$

Interpolation example
$F = 4.8$ MHz from example above
Offset = $-B_o = 0.7$ MHz
From non-critical Table AP4.2-4:
0.5 MHz –40 dB
1 MHz –45 dB
$K = ((0.7 - 0.5)/(1.0 - 0.5))*(-45 - (-40)) - 40$
$K = -42$ dB

ANNEX 4.4

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

Protection ratios for DVB-T (64-QAM 2/3 Gaussian channel) interfered with by the other primary services listed in Table A.4.4-1 are available in Tables A.4.4-2 to A.4.4-14 of this annex. They have been derived from Recommendation ITU-R BT.1368-6 (Planning criteria for digital terrestrial television services in the VHF/UHF bands). Information about the values for field strength to be protected for the different DVB-T variants can be found in the above-mentioned Recommendation.

Table k4.4-15 provides correction factors for different DVB-T system variants and reception modes relative to a DVB-T 64-QAM 2/3 Gaussian channel. The values provided in Table A.4.4-15 are to be added to the protection ratios for a DVB-T 64-QAM 2/3 Gaussian channel.

TABLE A.4.4-1

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

System type code (STC)	Secondary code implemented in the planning software	Type of system	Protection ratio for *64-QAM* 2/3 DVB-T Gaussian channel signal: Table
AA2	BB	Aeronautical radionavigation system BB (RLS 2, Type 2, airborne transmission, 8 MHz)	A.4.4-5
AA8	BL	Aeronautical radionavigation system BL (RSBN, ground transmission, 0.7 or 0.8 MHz)	A.44-6
AA8	BN	Aeronautical radionavigation system BN (RSBN, airborne transmission, 3 MHz)	A.4.4-3
AA8	BX	Aeronautical radionavigation system BX (RSBN, ground transmission, 3 MHz)	A.4.4-3
AA8	BY	Aeronautical radionavigation system BY (RSBN, airborne transmission, 0.7 MHz)	A.4.4-6
AB	AB	Aeronautical radionavigation system AB (RLS 1, Type 1 ground transmission. 6 MHz)	A.4.4-2
AB	AC	Aeronautical radionavigation system AC (RLS 1, Type 2 ground transmission, 3 MHz)	A.4.4-3
BA	BA	Aeronautical radionavigation system BA (RLS 2, Type 1 airborne transmission. 4 MHz)	A.4.4-4
BC	BC	Aeronautical radionavigation system BC (RLS2, Type 2 ground transmission, 3 MHz)	A.44.4-3
BD	BD	Aeronautical radionavigation system BD (RLS 2, Type 1 ground transmission, 4 MHz)	A.4.4-4
FF	FF	Fixed system FF (transportable. 1.2 MHz)	A.4.4-9
FI	FI	Fixed system FI (transportable, 2 MHz)	A.4.4-7
FH	FH	Fixed system FH (bandwidth more than 250 kHz)	A.4.4-8, A.4.4-9
FH	FJ	Fixed system FJ (bandwidth up to 250 kHz)	A.4.4-11, A.4.4-12
FK	FK	Generic fixed system FK (bandwidth more than 250 kHz)	A.4.4-8, A.4.4-9
FK	FL	Generic fixed system FL (bandwidth up to 250 kHz)	A.4.4-11, A.4.4-12
NA	NA	Land mobile system NA (digital, 3 MHz)	A.4.4-3
NA	NC	Land mobile system NC (digital, 5 MHz)	A.4.4-10
NA	NC	Land mobile system NC (digital, 5 MHz)	A.4.4-10
NB	NB	Generic mobile system NB	A.4.4-11.A.4.4- 12
NY	OX	Land mobile system OX in VHF band	A.4.4-11, A4.4-12
NY	OY	Land mobile system OY at 480 MHz	A.4.4-12
NY	OZ	Land mobile system OZ at 620 MHz	A.4.4-12
–	–	Land mobile system (CDMA-1X)	A.4.4-13
–	–	Land mobile system (CDMA-3X)	A.4.4-14

TABLE A.4.4-2

Δf (MHz)	–13	–5.5	–4.75	0	4.75	5.5	13
PR (dB)	–40	10	11	16	11	10	–40

TABLE A.4.4-3

Δf (MHz)	–12	–4	–3.25	0	3.25	4	12
PR (dB)	–37	9	14	19	14	9	–37

TABLE A.4.4-4

Δf (MHz)	–12	–4.5	–3.75	0	3.75	4.5	12
PR (dB)	–38	8	13	18	13	8	–38

TABLE A.4.4-5

Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by BB system

Δf (MHz)	–14	–6.5	–5.75	0	5.75	6.5	14
PR (dB)	–41	5	10	15	10	5	–41

TABLE A.4.4-6

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

TABU A.4.4-7

Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by FI system

Δf (MHz)	–12	–4.5	–3.75	0	3.75	4 5	12
PR (dB)	–45	–27	1	4	1	–27	–45

Δf (MHz)	-10.5	-4	-3.25	0	3.25	4	10.5
PR (dB)	–44	–26	1	3	1	–26	–44

TABLE A.4.4-9

Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by FF, FH and FK systems

Δf (MHz)	12	–4.5	–3.9	0	3.9	4.5	12
PR (dB)	–45	–27	0	2	0	–27	–45

Δf (MHz)	–12	–5	–4.25	0	4.25	5	12
PR (dB)	–39	7	12	17	12	7	–39

TABLE A.4.4-11

Protection ratios for DVB-T 7 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by OX, FJ, FL and NB systems

Δf (MHz)	–10.5	–4	–3.4	0	3.4	4	10.5
PR (dB)	–37	–32	–2	–2	–2	–32	–38

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

TABLE A.4.4-13

Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by emissions of CDMA-1X

Δf (MHz)	–12	4 . 5	–3.75	0	3.75	4.5	12
PR (dB)	–38	–20	–3	10	–3	–20	–38

TABLE A.4.4-14

Protection ratios For DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by emissions of CDMA-3X (measured)

Δf (MHz)	–12	-4.5	–3.75	0	3.75	4.5	12

Characteristics of the interfering signal:
Modulation: QPSK
Bandwidth: 4 MHz (99%)

TABLE A.4.4-15

Correction factors for protection ratios (dB) for different system variants relative to 64-QAM 2/3 DVB-T signal and for different reception conditions interfered with by other services

DVB-T system variant	Gaussian channel	Fixed reception	Portable outdoor reception	Portable indoor reception	Mobile reception
QPSK 1/2	–13.5	–12.5	–10.3	–10.3	–7.3
QPSK 2/3	–11.6	–10.5	–8.2	–8.2	–5.2
QPSK 3/4	–10.5	–9.3	–6.9	–6.9	–3.9
QPSK 5/6	–9.4	–8.1	–5.6	–5.6	–2.6
QPSK 7/8	–8.5	–7.1	–4.5	–4.5	–1.5
16-QAM 112	–7.8	–6.8	–3.6	–3.6	–1.6
16-QAM 2/3	–5.4	–4.3	–2.0	–2.0	1.0
16-QAM 3/4	–3.9	–2.7	–0.3	–0.3	2.7
16-QAM 516	–2.8	–1.5	10	1.0	4.0
16-QAM 7/8	–2.3	–0.9	1.7	1.7	4.7
64-QAM 1/2	–2.2	–1.2	1.0	1.0	4.0
64-OAM 2/3	0.0	1.1	3.4	3.4	6.4
64-QAM 314	1.6	2.8	5.2	5.2	8.2
64-QAM 5/6	3.0	4.3	6.8	6.8	9.8
64-QAM 718	3.9	5.3	7.9	7.9	10.9

TABLE AP1.l

Coordination trigger field-strength values to protect systems in the broadcasting service from interference from other services

Broadcasting system modifying the Plan	Trigger field strength (dB(μV/m))			
	Band III (174-230 MHz)	Band IV (470-582 MHz)	Band V (582-718 MHz)	Band V (718-862 MHz)
DVB-T	17	21	23	25
Analogue TV	10	18	20	22

TABLE AP1.3

Coordination trigger field-strength values to protect systems of the mobile service from DVB-T

System to be protected	System type code (see Annex 2, Chapter 4)	Frequency range	Trigger field strength (dB(μV/m))[1]	Height of the receiving antenna (m)
Analogue private mobile radio, 12.5 kHz	NV	Band III	30 (base stations) 38 (mobile stations)	20 (base station) 1.5 (mobile station)
Land mobile system NR (radio microphone)	NR	790-862 MHz/Band III	58 (UHF)/50 (VHF)	1.5
Mobile system NS (OB link, stereo, non-companded)	NS	790-862 MHz/Band III	45 (UHF)/37 (VHF)	10
Mobile system NT (Talk-back)	NT	790-862 MHz/Band III	47 (UHF)/39 (VHF)	1.5
Digital land mobile system NA (e.g. CDMA)	NA	470-862, 790-862 MHz	18 (base station)	20 (base station)
Generic mobile system NB	NB	174-230 MHz/ 470-862 MHz	See equation (AP1.1) and Table AP1.4 (base station) See equation (AP1.1) and Table AP1.5 (mobile station)	20.0 (base station) 1.5 (mobile station)
Land mobile system XN (VHF)	XN	Band III	38	1.5
Land mobile system YN (480 MHz)	YN	480 MHz	41	1.5
Land mobile system ZC (620 MHz)	ZC	620 MHz	43	1.5

[1] The trigger field-strength values are related to the DVB-T bandwidth.

For the generic case (type code NB) in the mobile service, i.e. when there is no value of protection ratio available, the following equation is used:

$$F_{trigger} = -37 + F - G_i + L_F + 10\log(B_i) + P_o + 20\log f + I/N \qquad \text{(AP1.1)}$$

where:

F: receiver noise figure of the mobile service base or mobile station receivers (dB)

B_i: the bandwidth of the terrestrial broadcasting station (MHz)

G_i: the receiver antenna gain of the station in the mobile service (dBi)

L_F: antenna cable feeder loss (dB)

f: centre frequency of the interfering station (MHz)

P_o: man-made noise (dB) (typical value is 1 dB for the VHF band and 0 dB for the UHF band)

I/N: interference to noise ratio, which must not exceed the threshold (margin) applicable when developing the Plan (I/N = –6 dB).

For the generic case of the land mobile service, the following typical values of F, G_i, L_F and P_o to be used (see Recommendation ITU-R M. 1767 as an informative source) are provided in Tables AP1.4 and AP1.5 for the base stations and mobile stations respectively:

TABLE AP1.4

Typical values of the parameters when applying equation (AP1.l) to derive coordination trigger field-strength values to protect the base stations for the generic case (type code NB) of the mobile service from DVB-T

Frequency (MHz)	174	230	470	790	862
F (dB)	8	8	4	3	3
G_i (dBi)	6	8	12	17	17
L_F (dB)	2	2	2	4	4
P_o (dB)	1	1	0	0	0
$F - G_i + L_F + P_o$	5	3	–6	–10	–10

TABLE AP1.5

Typical values of the parameters when applying equation (AP1.l) to derive coordination trigger field-strength values to protect the mobile stations for the generic case (type code NB) of the mobile service from DVB-T

Frequency (MHz)	174	230	470	790	862
F (dB)	11	11	7	7	7
G_i (dBi)	0	0	0	0	0
L_F (dB)	0	0	0	0	0
P_o (dB)	1	1	0	0	0
$F - G_i + L_F + P_o$	12	12	7	7	7

A.4 Coordination trigger field strengths for the fixed service in the band 470-862 MHz

The trigger field-strength levels to protect systems in the fixed service from DVB-T are provided in Table AP1.7 with their corresponding service type codes.

TABLE AP1.7

Service, system to be protected	System type code (see Annex 2, Chapter 4)	Frequency range (MHz)	Trigger field strength (dB(μV/m))	Height of the receiving antenna (m)
Fixed system FF (transportable, 1.2 MHz)	FF	790-862	24(1)	37.5
Fixed system FH	FH	790-862	13(1)	37.5
Generic fixed system FK	FK	174-230 and 470-862	See equation (AP1.2) and Table AP1.8	37.5

(1) The trigger field-strength values are related to the DVB-T bandwidth.

For the generic case (type code FK), i.e. when there is no value of protection ratio available, the following equation should be used:

$$F_{trigger} = -37 + F - G_i + L_F + 10 \log(B_i) + P_o + 20 \log f + I/N \quad \text{(AP1.2)}$$

where:

F: receiver noise figure of the FS station receiver (dB)

B,: the bandwidth of the terrestrial broadcasting station (MHz)

G_i: the FS station receiver antenna gain (dBi)

L_F: antenna cable feeder loss (dB)

f: centre frequency of the interfering broadcasting station (MHz)

P_o: man-made noise (dB) (typical value is 1 dB for VHF band and 0 dB for UHF band)

I/N: interference to noise ratio, which must not exceed the threshold (margin) applicable when developing the plan (*I/N* = –6 dB).

Based on the information in Recommendations ITU-R F.758-4, ITU-R F.1670-1 and ITU-R SM.851-1, the following typical values of F, G_i, L_F and P_o to be used are provided in Table AP1.8:

Frequency (MHz)	174-230	500	800
F (dB)	5	5	5
G_i (dBi)	9	14	16
L_F (dB)	4	5	5
P_o (dB)	1	0	0
$F - G_i + L_F + P_o$	1	–4	–6

For other frequencies in the UHF band, the interpolation should be made by applying a correction of 10 log (f/500).

B Coordination trigger field strengths for the protection of broadcasting services from stations of other terrestrial services

B.1 Derivation of trigger levels

There have been some detailed investigations on protection of DVB-T system against interference from systems in the fixed and mobile services. Their operational frequency range lies either within the bandwidth of the digital television signal or partially overlaps with it. Therefore, a more general case of interference from other services to digital terrestrial broadcasting can be covered by using the trigger criteria for digital broadcasting interfered with by digital broadcasting.
No detailed studies on analogue television interfered with by all systems with which sharing occurs, i.e. ARNS, mobile service, fixed service have been made. Therefore, the same trigger criteria for analogue television interfered with by terrestrial broadcasting will be used for this purpose.

Broadcasting service to be protected	Trigger field strength (dB(μV/m))(1)			
	Band III (174-230 MHz)	Band IV (470-582 MHz)	Band V (582-718 MHz)	Band V (718-862 MHz)
DVB-T	17	21	23	25
T-DAB	27	–	–	–
Analogue TV	10	18	20	22

It is proposed to take the most critical case for the wanted systems, since it is a *priori* not known which system may be used by the affected administration. However, analogue television is expected to be switched off after a transition period. Therefore, two sets of values need to be kept. Table AP1.10 gives the final result of the proposed trigger field strengths to be used in coordination.

Broadcasting system to be protected	Trigger field strength (dB(μV/m))[1]			
	Band III (174 -230 MHz)	Band IV (470-582MHz)	Band V (582-718MHz)	Band V (718-862 MHz)
Analogue and digital[2]	10	18	20	22
Digital	17	21	23	25

Appendix 2

Basis for the determination of the coordination trigger field strengths for the broadcasting service

The purpose of this part is to provide background information on the derivation of the trigger coordination field strengths to protect the broadcasting service.

1 Representative broadcasting systems

This part deals with various broadcasting systems. Therefore, different trigger field-strength values have to be taken into account. However, for determination of the affected transmitting station, the trigger field strengths are evaluated for the following representative system variants of DVB-T and analogue TV, including the respective reception modes and target location probabilities:

- DVB-T: **64-QAM** 3/4, fixed roof-level reception, 95% location probability
- Analogue TV: SECAM L, fixed roof-level reception, 50% location probability.

These variants are regarded as the most sensitive variants which will be used in practice.

2 Determination of the coordination trigger field strengths for the protection of the broadcasting service

The coordination trigger field strength $F_{trigger}$ is calculated as follows:

$$F_{trigger} = F_{med} + f_{corr} - PR - CF \qquad \text{(AP2.1)}$$

where:

F_{med}: minimum median field strength of the relevant (victim) broadcasting system

f_{corr}: frequency correction, as described below

PR: relevant protection ratio provided

CF relevant combined location correction factor

If the protection ratios distinguish between tropospheric and continuous interference, the tropospheric case is to be taken. In order to account for the worst reception case, no receiving antenna discrimination for fixed roof-level reception is taken into account.
The minimum median field strengths for the reference planning configurations were calculated by the ITU for 200 MHz (Band III) and 650 MHz (Bands IV/V) in the RRC-06 Plan. For other frequencies the following interpolation **rule** is used:

- for fixed reception, $f_{corr} = 20 \log_{10} (f/f_r)$, where f is the actual frequency and f_r the reference frequency of the relevant band quoted above;
- for portable reception and mobile reception, $f_{corr} = 30 \log_{10} (f/f_r)$ where f is the actual frequency and f_r the reference frequency of the relevant band quoted above

3 Coordination trigger field strengths for the broadcasting service

Table *AP2.2* give the trigger field strengths for the representative broadcasting systems as described above for the frequency 650 MHz. The most critical trigger field strengths are indicated in bold in Table *AP2.2*.

TABLE *AP2.2*

Coordination trigger field strengths''' for representative broadcasting systems at 650 MHz

	Broadcasting system to be protected	
	DVB-T	**Analogue TV**
Minimum median field strength	$F_{med} = 57$ dB(μV/m)	$F_{med} = 65$ dB(μV/m)
Interfering system		
DVB-T	***PR*** **= 21 dB** $F_{trigger}$ **= 23 dB(μV/m)**	$PR = 35$ **dB** $F_{trigger} = 30$ dB(μV/m)
Analogue TV	$PR = 9$ dB $F_{trigger} = 35$ dB(μV/m)	$PR =$ **45** dB $F_{trigger}$ **= 20 dB(μV/m)**

protected.

It is proposed to distinguish between the analogue and digital broadcasting systems that are to be coordinated but to take the most critical case for the wanted systems, since it is ***a priori*** not known which system may be used by the affected administration.

5. Recommendations

1. The Authority based on the report above has come to the conclusion that sharing by spatial separation is possible, and there is no need to conduct further practical tests.

2. The report will be used as basis for mitigating interference between broadcasting and non-broadcasting services.

3. That the allocation/assignment of non-broadcasting services in the channels 65 (822-830MHz) and 66 (830-838MHz), will be on a secondary basis.

4. That the provisions of Article 4.4 of the Radio Regulations provides for deviations from the Table of Allocations, and therefore the non-broadcasting services in the band will not be limited to only fixed services, but will also include mobile services, and the services other than broadcasting services will be introduced on the basis of Article 4.4 of the Radio Regulations.

5. That there will be no further assignments of broadcasting services on both channel 65 (822-830MHz) and 66 (830-838MHz).

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