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1. Coverage definitions for DVB-T

Digital television service coverages are characterised by a very rapid transition from near perfect reception to no reception and it thus becomes much more critical to be able to define which areas are going to be covered and which are not. However, because of the very rapid transition of the DVB-T system, there is a cost penalty if the coverage target within a small area (say, 100 m by 100 m) is set too high. This occurs because it is necessary either to increase the transmitter powers or to provide a larger number of transmitters in order to guarantee coverage to the last few percent of the worst-served small areas.

For this reason, the coverage definition of “good” has been selected as the case where 95% of the locations within a small area are covered. Similarly, “acceptable” has been defined to be the case where 70% of the locations within a small area are covered.

The definitions do not aim to describe the area where coverage is achieved under worst case conditions. They provide a description of the area where "good" or "acceptable" coverage should be achieved under representative practical conditions.

It should be borne in mind that in a given situation it may be possible to improve reception by:

- finding a better position for the receiving antenna;
- using a (more) directional receiving antenna with a higher gain;
- using a low-noise antenna amplifier (in the case of fixed antenna reception).

1.1 Fixed antenna reception

Fixed antenna reception is defined as ‘reception where a directional receiving antenna mounted at roof level is used’.

In calculating the field strength for fixed antenna reception a receiving antenna height of 10 m above ground level is considered to be representative.

1.2 Portable antenna reception

Portable antenna reception is defined as:

- Class A (outdoor) being reception where a portable receiver with an attached or built-in antenna is used outdoors at no less than 1.5 m above ground level;
- Class B (ground floor, indoor) being reception where a portable receiver with an attached or built-in antenna is used indoors at no less than 1.5 m above floor level in rooms:
    - on the ground floor;
    - with a window in an external wall.

Portable indoor reception at the first or higher floors will be regarded as class B reception with signal level corrections applied, but indoor ground floor reception is likely to be the most common case.

1.3 Coverage area

In defining the coverage area for each reception condition a three level approach is taken.

Level 1: Receiving location

The smallest unit is a receiving location. A receiving location is regarded as being covered if the level of the wanted signal is high enough to overcome noise and interference for a given percentage of the time. A value of 99% of time is recommended.

Level 2: Small area coverage

The second level is a "small area" (typically 100 m by 100 m).
In this small area the percentage of covered locations is indicated.

The coverage of this small area is classified as:

“Good” if at least 95% of receiving locations within it are covered;

“Acceptable” if at least 70% of locations within it are covered.

Level 3: Coverage area

The coverage area of a transmitter, or a group of transmitters, is made up of the sum of the individual small areas in which a given percentage (70% or 95%) of coverage is achieved.

Frequency bands to be used for DVB-T

The frequency bands for implementation of DVB-T in the European Broadcasting Area are 174 to 230 MHz and 470 to 862 MHz. However, the CEPT considers the frequency band 216 to 230 MHz as the core band for T-DAB in VHF.

1.4 Analogue television channel rasters

In Band III, different television channel rasters are used across Europe. In Eastern Europe, France and Ireland, channels are 8 MHz wide, in other countries the channel width is 7 MHz. In addition, there are different channel rasters in countries using 7 MHz channels (e.g. Italy). This means that, in the VHF Bands, there is a number of cases where channels overlap.

Within Bands IV and V, there is a single channel raster of 8 MHz, with the upper and lower edges, and vision carrier, of each channel being the same for all countries in Europe. The only differences are in the use of channels in the upper end of Band V and in the frequency separation between the sound and vision carriers.

2. Field strength prediction model

As a basis, Rec. ITU-R P.370 will be used to predict the field strength values, however:

- no correction will be applied for Δh-values other than 50 meters;
- no use will be made of a terrain clearance angle correction due to the absence of a common European topographical database;
- propagation predictions should include a mixed-path calculation with an agreed land/sea boundary being derived from the ITU-R boundary map files or some other suitable source.

On a bilateral or multilateral agreement, more detailed propagation prediction methods can be used. Such methods do not need to be specified or identified by the CEPT.

3. Signal levels for DVB-T

Due to the very rapid transition from near perfect to no reception, it is necessary that the minimum required signal level is achieved at a high percentage of locations. These percentages have been set at 95 for "good" and 70 for "acceptable" reception. Corresponding minimum median signal levels may be derived, taking account of propagation elements, to ensure that the minimum values are achieved at the specified percentage of locations. The figures are derived assuming a receiver noise figure of 7 dB.

The minimum median signal levels are calculated for:

- 8 MHz channels; for 7 MHz channels, 0.6 dB should be subtracted from the relevant results given in the tables of minimum median equivalent field strength;
- three different receiving conditions:
  - fixed antenna reception;
  - portable outdoor reception (Class A);
  - portable indoor reception at ground floor (Class B);
- frequencies representing Band III, Band IV and Band V: 200, 500 and 800 MHz;
- representative C/N ratios: 2, 8, 14, 20 and 26 dB, including an implementation margin of 3 dB

Representative C/N values are used for these examples. Results for any chosen DVB-T system variant (see Table A1.1) may be obtained by interpolation between relevant representative values. The C/N values in Table A1.1 do not include any implementation margin. Typical C/N results from laboratory tests are about 3 dB higher than the values given in Table A1.1

All minimum median equivalent field strength values are for coverage by a single transmitter only, not for Single Frequency Networks.

Table A1.1

Required C/N (dB) for non-hierarchical transmission to achieve a BER = 2. 10^{-4} after the Viterbi decoder for all combinations of coding rates and modulation types.
The net bit rates after the Reed-Solomon decoder are also listed.

			Required C/N for BER=2. 10^{-4} after Viterbi (quasi error-free after Reed-Solomon, *)			Net bit rate (Mbit/s)			
System variant	Modulation	Code Rate	Gaussian channel	Ricean channel (F_1)	Rayleigh channel (P_1)	D/T_U =1/4	D/T_U =1/8	D/T_U =1/16	D/T_U =1/32
A1	QPSK	1/2	3.1	3.6	5.4	4.98	5.53	5.85	6.03
A2	QPSK	2/3	4.9	5.7	8.4	6.64	7.37	7.81	8.04
A3	QPSK	3/4	5.9	6.8	10.7	7.46	8.29	8.78	9.05
A5	QPSK	5/6	6.9	8.0	13.1	8.29	9.22	9.76	10.05
A7	QPSK	7/8	7.7	8.7	16.3	8.71	9.68	10.25	10.56
B1	16-QAM (M1 **)	1/2	8.8	9.6	11.2	9.95	11.06	11.71	12.06
B2	16-QAM	2/3	11.1	11.6	14.2	13.27	14.75	15.61	16.09
B3	16-QAM	3/4	12.5	13.0	16.7	14.93	16.59	17.56	18.10
B5	16-QAM	5/6	13.5	14.4	19.3	16.59	18.43	19.52	20.11
B7	16-QAM	7/8	13.9	15.0	22.8	17.42	19.35	20.49	21.11
C1	64-QAM (M2 **)	1/2	14.4	14.7	16.0	14.93	16.59	17.56	18.10
C2	64-QAM (M3 **)	2/3	16.5	17.1	19.3	19.91	22.12	23.42	24.13
C3	64-QAM	3/4	18.0	18.6	21.7	22.39	24.88	26.35	27.14
C5	64-QAM	5/6	19.3	20.0	25.3	24.88	27.65	29.27	30.16
C7	64-QAM	7/8	20.1	21.0	27.9	26.13	29.03	30.74	31.67

Notes: (*) Quasi error-free means less than one uncorrected error event per hour, corresponding to BER = 1. 10^{-11} at the input of the MPEG-2 demultiplexer.

(**) System modes adopted by ITU-R as representative for protection ratio assessments

To account for the number of carriers and the guard interval ratio, D/T_u, the designators given in Table A1.2 should be used. See also Table A3.2 (digital television transmitter database structure).

Table A1.2

Designator	Number of carriers	Guard interval ratio
A	2k	1/32
B	2k	1/16
C	2k	1/8
D	2k	1/4
E	8k	1/32
F	8k	1/16
G	8k	1/8
H	8k	1/4

3.1 Location variation of the received signal

Within a small area, say 100 m by 100 m, there will be a more-or-less random variation of the received signal level with location, which is due to terrain irregularities. The statistics of this variation are characterised by a log-normal distribution.

For calculating the location correction factor C_l used when other than 50 % locations are to be considered, a log-normal distribution of the received signal is assumed.

The location correction factor can be calculated by the formula:

$$C_l = \mu * \sigma \ \{dB\}$$

where:

μ is the distribution factor, being 0.52 for 70 % and 1.64 for 95 %;

σ is the standard deviation.

3.2 Calculation of minimum median equivalent field strength

The minimum median equivalent field strength can be calculated using the following formulas:

P_n	$= F + 10 \log_{10} (k T_0 B)$	
$P_{s\,min}$	$= C/N + P_n$	
A_a	$= G + 10 \log_{10} (1.64\lambda^2/4\pi)$	
ϕ_{min}	$= P_{s\,min} - A_a + L_f$	for fixed antenna reception
ϕ_{min}	$= P_{s\,min} - A_a$	for portable reception
E_{min}	$= \phi_{min} + 120 + 10 \log_{10} (120\pi)$	
	$= \phi_{min} + 145.8$	
E_{med}	$= E_{min} + P_{mmn} + C_l$	for fixed antenna reception
E_{med}	$= E_{min} + P_{mmn} + C_l + L_h$	for portable outdoor reception
E_{med}	$= E_{min} + P_{mmn} + C_l + L_h + L_b$	for portable indoor reception

where:

P_n : Receiver noise input power {dBW}

F : Receiver noise figure {dB}

k : Boltzmann's Constant (k= 1.38 10^{-23} {Ws/K})

T_0 : Absolute temperature (T_0 = 290 {K})

B : Receiver noise bandwidth (B=7.61 10^6 {Hz})

$P_{s\,min}$: Minimum receiver input power {dBW}

C/N : RF signal to noise ratio at the receiver input required by the system {dB}

A_a : Effective antenna aperture {dBm^2}

G : Antenna gain related to half dipole {dB}

λ : Wavelength of the signal {m}

ϕ_{min} : Minimum power flux density at receiving place {dBW/m^2}

L_f : Feeder loss {dB}

E_{min} : Equivalent minimum field strength at receiving place {dBμV/m}

E_{med} : Minimum median equivalent field strength, planning value {dBμV/m}

P_{mmn} : Allowance for man made noise {dB}

C_l : Location correction factor {dB}

L_h : Height loss (10 m agl to 1.5 m agl) {dB}

L_b : Building penetration loss {dB}

3.3 Fixed reception

3.3.1 Signal level variation

Measurements of digital signals have shown that the standard deviation of the distribution will be about 5.5 dB. There will be some dependency on the environment surrounding the receiving location, for example for portable reception. The standard deviation for analogue television signals interfering with DVB-T is also taken as 5.5 dB.

3.3.2 Antennas for fixed reception

The antenna diagrams (directivity) to be used for DVB-T planning are given in Rec. ITU-R BT.419. The antenna gains (relative to half wave dipole) used in the derivation of the minimum median wanted signal levels are given in Table A1.3:

Table A1.3

200 MHz	500 MHz	800 MHz
7 dB	10 dB	12 dB

These values are considered as realistic minimum values.

Within Bands IV and V, the variation of antenna gain with frequency may be taken into account by the addition of an empirical correction term:

$$Corr = 10 \log_{10} (F_A/F_R) \text{ \{dB\}}$$

where:

F_A is the actual frequency being considered;
F_R is the relevant reference frequency quoted above.

The associated feeder losses used in the derivation of the minimum wanted signal levels are given in Table A1. 4:

Table A1.4

200 MHz	500 MHz	800 MHz
2 dB	3 dB	5 dB

3.3.3 Minimum median equivalent field strength

The tables below give the minimum median equivalent field strength for 70% and 95% of location probability in Bands III, IV and V.

Within Bands IV and V, the variation of the minimum median equivalent field strength with frequency may be taken into account by the addition of an empirical correction term:

$$Corr = 20 \log_{10} (F_A/F_R) \{dB\}$$

where:

F_A is the actual frequency being considered;
F_R is the relevant reference frequency quoted in the Table.

Table A1.5

Minimum median equivalent field strength in Band III for fixed antenna reception.

Frequency	f {MHz}	200				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\,min}$ {dBμV}	13	19	25	31	37
Feeder loss	L_f {dB}	2				
Antenna gain rel. to half wave dipole	G_D {dB}	7				
Effective antenna aperture	A_a {dBm^2}	1.7				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	20	26	32	38	44
Allowance for man made noise	P_{mmn} {dB}	1				

Location probability: 70%

Location correction factor	C_l {dB}	2.9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	24	30	36	42	48

Location probability: 95%

Location correction factor	C_l {dB}	9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	30	36	42	48	54

For 7 MHz channels, 0.6 dB is to be subtracted from the input signal voltage and field strength values given in Table A1.5.

Table A1.6

Minimum median equivalent field strength in Band IV for fixed antenna reception.

Frequency	f {MHz}	500				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Feeder loss	L_f {dB}	3				
Antenna gain rel. to half wave dipole	G_D {dB}	10				
Effective antenna aperture	A_a {dBm^2}	-3.3				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	26	32	38	44	50
Allowance for man made noise	P_{mmn} {dB}	0				

Location probability: 70%

Location correction factor	C_l {dB}	2.9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	29	35	41	47	53

Location probability: 95%

Location correction factor	C_l {dB}	9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	35	41	47	53	59

Table A1.7

Minimum median equivalent field strength in Band V fixed antenna reception.

Frequency	f {MHz}	800				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Feeder loss	L_f {dB}	5				
Antenna gain rel. to half wave dipole	G_D {dB}	12				
Effective antenna aperture	A_a {dBm^2}	-5.4				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	30	36	42	48	54
Allowance for man made noise	P_{mmn} {dB}	0				

Location probability: 70%

Location correction factor	C_l {dB}	2.9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	33	39	45	51	57

Location probability: 95%

Location correction factor	C_l {dB}	9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	39	45	51	57	63

3.4 Portable reception

3.4.1 General

The conditions for portable reception differ from fixed reception in the:

- absence of receiving antenna gain and directivity;
- reduced feeder loss;
- generally lower reception height;
- building penetration loss in the case of indoor reception.

It has been assumed that a portable receiver and a receiver for fixed reception have the same receiver noise figure, that is, 7 dB.

3.4.2 Antennas for portable reception

It is assumed that the antenna of a portable receiver is omni-directional and that the gain (relative to a $\lambda/2$ dipole) is 0 dB for a UHF antenna and -2.2 dB for a VHF antenna. A portable receiver can be assumed to have 0 dB feeder loss in all bands.

Generally, no polarisation discrimination can be expected from this type of portable reception antenna.

3.4.3 Signal level variations

Field strength variations can be divided into macro-scale and micro-scale variations. Micro-scale variations relate to areas with dimensions in the order of a wavelength and are mainly caused by multipath reflections from nearby objects. As the position of the receiving antenna for portable reception can be optimised within the order of a wavelength, micro-scale variations will not be significant for planning purposes.

The macro-scale variations relate to areas with linear dimensions of 10 m to 100 m or more and are mainly caused by shadowing and multipath reflections from distant objects. Macro-scale variations of the field strength are very important for coverage assessment. In general, a high target percentage for coverage is required to compensate for the rapid failure rate of digital television signals.

3.4.3.1 Macro-scale variations at outdoor locations

Rec. ITU-R P.370 gives a standard deviation for wide band signals of 5.5 dB. This value is used here for determining the location variation at outdoor locations.

This location variation for macro-scale variations is given in Table A1.8:

Table A1.8

Coverage target	Location variation
> 95%	9 dB
> 70%	2.9 dB

3.4.4 Height loss for received signal

For portable reception, the antenna height of 10 m above ground level generally used for planning purposes is not realistic and a correction factor needs to be introduced based on a receiving antenna near ground floor level. For this reason a receiving antenna height of 1.5 m above ground level (outdoor) or above floor level (indoor) has been assumed.

The propagation prediction method of Rec. ITU-R P.370 uses a receiving height of 10 m. To correct the predicted values for a receiving height of 1.5 m above ground level a factor called "height loss” has been introduced. At UHF, a height loss of 12 dB is used, based on measurements in the Netherlands. For VHF, a height loss of 10 dB is used, taken from Rec. ITU-R 1203.

3.4.5 Building penetration loss of the received signal

3.4.5.1 Definition

The mean building penetration loss is the difference in dB between the mean field strength inside a building at a given height above ground level and the mean field strength outside the same building at the same height above ground level. A large spread of building penetration losses is to be expected.

3.4.5.2 Building penetration loss values

Results of measurements carried out at VHF in the UK to investigate in-house reception of T-DAB have been reported in Rep. ITU-R 1203. The results indicate a median value of building penetration loss of 8 dB with a standard deviation of 3 dB.

For UHF measurements have been carried out in the Netherlands and in the UK. Based on these results building penetration loss for planning purposes is given in Table A1.9

Table A1.9

Building Penetration Loss

Band	Median value	Standard deviation
VHF	8 dB	3 dB
UHF	7 dB	6 dB

3.4.5.3 Location distribution indoors

The variation factor at indoor locations is the combined result of the outdoor variation and the variation factor due to building attenuation. These distributions are expected to be uncorrelated. The standard deviation of the indoor field strength distribution can therefore be calculated by taking the root of the sum of the squares of the individual standard deviations. At VHF, where the macro-scale standard deviations are 5.5 dB and 3 dB respectively, the combined value is 6.3 dB. At UHF, where the macro-scale standard deviations are 5.5 dB and 6 dB respectively, the combined value is 8.1 dB.

For planning purposes, the location variation at indoor locations is given in Table A1.10.

Table A1.10

Indoor Location Variation

Coverage target	VHF	UHF
> 95%	10 dB	14 dB
> 70%	3 dB	4 dB

3.4.6 Minimum median equivalent field strength

The tables below give the minimum median equivalent field strength for location probabilities of 70% and 95% in Band III, IV and V.

Table A1.11

Minimum median equivalent field strength in Band III for portable outdoor reception (Class A)

Frequency	f {MHz}	200				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Antenna gain rel. to half wave dipole	G_D {dB}	-2.2				
Effective antenna aperture	A_a {dBm^2}	-7.5				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	27	33	39	45	51
Allowance for man made noise	P_{mmn} {dB}	1				
Height loss	L_h {dB}	10				

Location probability: 70%

Location correction factor	C_l {dB}	2.9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	41	47	53	59	65

Location probability: 95%

Location correction factor	C_l {dB}	9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	47	53	59	65	71

For 7 MHz channels, 0.6 dB is to be subtracted from the input signal voltage and field strength values given in Table A1.11.

Table A1.12

Minimum median equivalent field strength in Band IV for portable outdoor reception (Class A)

Frequency	f {MHz}	500				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Antenna gain rel. to half wave dipole	G_D {dB}	0				
Effective antenna aperture	A_a {dBm^2}	-13,3				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	33	39	45	51	57
Allowance for man made noise	P_{mmn} {dB}	0				
Height loss	L_h {dB}	12				

Location probability: 70%

Location correction factor	C_{lc} {dB}	2.9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	48	54	60	66	72

Location probability: 95%

Location correction factor	C_{lc} {dB}	9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	54	60	66	72	78

Table A1.13
Minimum median equivalent field strength in Band V
for portable outdoor reception (Class A)

Frequency	f {MHz}	800				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Antenna gain rel. to half wave dipole	G_D {dB}	0				
Effective antenna aperture	A_a {dBm^2}	-17.4				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	37	43	49	55	61
Allowance for man made noise	P_{mmn} {dB}	0				
Height loss	L_h {dB}	12				

Location probability: 70%

Location correction factor	C_l {dB}	2.9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	52	58	64	70	76

Location probability: 95%

Location correction factor	C_l {dB}	9				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	58	64	70	76	82

Table A1.14

Minimum median equivalent field strength in Band III for portable indoor reception at ground floor (Class B)

Frequency	f {MHz}	200				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Antenna gain rel. to half wave dipole	G_D {dB}	-2.2				
Effective antenna aperture	A_a {dBm^2}	-7.5				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	27	33	39	45	51
Allowance for man made noise	P_{mmn} {dB}	1				
Height loss	L_h {dB}	10				
Building penetration loss	L_b {dB}	8				

Location probability: 70%

Location correction factor	C_l {dB}	3				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	49	55	61	67	73

Location probability: 95%

Location correction factor	C_l {dB}	10				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	56	62	68	74	80

Note: Minimum median equivalent field strength values at 10 m agl for 50% of time and 50% of locations are estimated to be:

- 5 dB lower than the values shown if reception is required in rooms at the first floor;
- 10 dB lower than the values shown if reception is required in rooms higher than the first floor.

For 7 MHz channels, 0.6 dB is to be subtracted from the input signal voltage and field strength values given in Table A1.14.

Table A1.15

Minimum median equivalent field strength in Band IV for portable indoor reception at ground floor (Class B)

Frequency	f {MHz}	500				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Antenna gain rel. to half wave dipole	G_D {dB}	0				
Effective antenna aperture	A_a {dBm^2}	-13.3				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	33	39	45	51	57
Allowance for man made noise	P_{mmn} {dB}	0				
Height loss	L_h {dB}	12				
Building penetration loss	L_b {dB}	7				

Location probability: 70%

Location correction factor	C_l {dB}	4				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	56	62	68	74	80

Location probability: 95%

Location correction factor	C_l {dB}	14				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	66	72	78	84	90

Note: Minimum median equivalent field strength values at 10 m agl for 50% of time and 50% of locations are estimated to be:

- 6 dB lower than the values shown if reception is required in rooms at the first floor;
- 12 dB lower than the values shown if reception is required in rooms higher than the first floor.

Table A1.16

Minimum median equivalent field strength in Band V for portable indoor reception at ground floor (Class B)

Frequency	f {MHz}	800				
Minimum C/N required by system	**{dB}**	**2**	**8**	**14**	**20**	**26**
Min. equivalent receiver input voltage, 75 Ω	$U_{s\ min}$ {dBμV}	13	19	25	31	37
Antenna gain rel. to half wave dipole	G_D {dB}	0				
Effective antenna aperture	A_a {dBm^2}	-17.4				
Min equivalent field strength at receiving place	E_{min} {dBμV/m}	37	43	49	55	61
Allowance for man made noise	P_{mmn} {dB}	0				
Height loss	L_h {dB}	12				
Building penetration loss	L_b {dB}	7				

Location probability: 70%

Location correction factor	C_l {dB}	4				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	60	66	72	78	84

Location probability: 95%

Location correction factor	C_l {dB}	14				
Minimum median equivalent field strength at 10m a.g.l. 50% of time and 50% of locations	E_{med} {dBμV/m}	70	76	82	88	94

Note: Minimum median equivalent field strength values at 10 m agl for 50% of time and 50% of locations are estimated to be:

- 6 dB lower than the values shown if reception is required in rooms at the first floor;
- 12 dB lower than the values shown if reception is required in rooms higher than the first floor.

4. Protection ratios

The reference power for protection ratio evaluation is:

- for DVB-T, the average signal power (heating) of the COFDM signal measured in the system bandwidth
- for analogue television, generally, the rms power of the vision signal at the sync peak, but in the case of SECAM L, the peak white level.

The protection ratios relevant to a given interference are evaluated without noise or other interference, at the relevant quality target, and are expressed in dB.

For a wanted DVB-T signal the required protection ratios are preferably measured for a BER of $2. 10^{-4}$ after Viterbi decoding, corresponding to a BER of $< 1. 10^{-11}$ at the input of the MPEG-2 demultiplexer, and to approximately one uncorrected error per hour. In case of digital signals as wanted signal, all protection ratio values relate to both tropospheric and continuous interference.

For analogue television wanted signals, tropospheric interference is determined for quality grade 3 and continuous interference for quality grade 4.

For adjacent channel and overlapping channel cases the protection ratio values are related to an out-of-channel spectrum attenuation of 40 dB. This 40 dB figure is only used for protection ratio measurements and is not recommended for real DVB-T transmitters.

The ITU reference document is ITU-R Recommendation: “Planning Criteria for Digital Terrestrial Television Services in the VHF/UHF Television Bands” (at present numbered Rec. ITU-R. XYZ).

4.1 DVB-T interfered with by DVB-T

Table A1.17 gives co-channel Protection Ratios (rounded to the nearest integer), obtained by measurements or by the extrapolation method given below.

Table A1.17

Co-channel protection ratios (dB) for DVB-T interfered with by DVB-T

ITU-Mode	Modulation	Code rate	**PR** (*) **Gaussian**	**PR** (**) **Rice**	**PR** (**) **Rayleigh**
	QPSK	1/2	5	7	8
M1	16-QAM	1/2		13	14
	16-QAM	3/4	14	16	20
M2	64-QAM	1/2		18	19
M3	64-QAM	2/3	19	20	22

(*) Measurement results, IF loop, 2K mode; (**) Extrapolated result

Protection ratios for the various modes and for the various channel types (i.e. Gaussian, Ricean, or Raleigh) can be derived by the required C/N given in Table A1.1, increased by a system implementation loss Δ_1 of 3 dB. For fixed and portable reception, the figures relevant to the Ricean and Rayleigh channels respectively should be adopted.

For **adjacent and image channel interference** a protection ratio of -40 dB is assumed to be an appropriate value due to lack of data.

For **overlapping channels**, in the absence of measurement information, the protection ratio should be extrapolated from the co-channel ratio figure as follows:

$PR = PR(CCI) + 10 \log_{10} (BO / BW)$

PR(CCI) is the co-channel ratio

BO is the bandwidth (in MHz) in which the two DVB-T signals are overlapping

BW is the bandwidth (in MHz) of the wanted signal

PR = -40 dB should be used when the above formula gives PR < -40 dB

4.2 DVB-T interfered with by analogue television

The protection ratios for wanted DVB-T apply to both continuous and tropospheric interference.

In all tables the so-called non-controlled frequency conditions are used. Introducing precisely controlled frequency offsets between the analogue and digital signals, significant lower co-channel required signal to interference ratios have been measured. With precisely controlled frequency position lower protection values can be reached. Further studies of using controlled offset for DVB-T are necessary

4.2.1 Co-channel protection ratios

According to the available measurements the same protection ratio values are applicable for 2k and 8k modes.

Table A1.18

Co-channel protection ratios (dB) for DVB-T 7 and 8 MHz interfered with by analogue television and CW (non-controlled frequency condition)

	Protection Ratio														
Constellation	**QPSK**					**16QAM**					**64 QAM**				
Code Rate	**1/2**	**2/3**	**3/4**	**5/6**	**7/8**	**1/2**	**2/3**	**3/4**	**5/6**	**7/8**	**1/2**	**2/3**	**3/4**	**5/6**	**7/8**
ITU-Mode						**M1**					**M2**	**M3**			
CW and PAL/SECAM with teletext and sound carriers	-12	-8	-5	2	6	-8	-4	0	9	16	-3	4	10	17	24

The PAL/SECAM figures are valid for all sound carrier modes used in Europe, these are:

MONO FM with a single sound carrier at -10 dB referred to the vision carrier;

DUAL FM and FM + NICAM with two sound carriers at -13 dB and -20 dB level;

AM + NICAM with two sound carriers at respectively -10 dB and -27dB.

The values contained in this table represent the present knowledge of behaviour of the DVB-T systems and are derived from a limited number of measurements mainly with 2k systems. There is a general confidence that the final results will not differ by more than 3 dB.

Reference conditions for coordination are given in Annex 1 Section 8

4.2.2 Lower adjacent channel (n - 1)

Table A1.19

Protection ratios (dB) for DVB-T interfered with by analogue television in the lower adjacent channel (n - 1)

Wanted signal			Interfering signal					
System	**BW**	**Mode**	**PAL B**	**PAL G, B1**	**PAL I**	**PAL D,K**	**SECAM L**	**SECAM D,K**
DVB-T	8 MHz	M1			-43			
		M2			-38			
		M3			-34			
DVB-T	7 MHz	M1	-43					
		M2	-40					
		M3	-37					

4.2.3 Upper adjacent channel (n + 1)

Table A1.20

Protection ratios (dB) for DVB-T interfered with by analogue television in the upper adjacent channel (n + 1)

Wanted signal			Interfering signal					
System	**BW**	**Mode**	**PAL B**	**PAL B1, G**	**PAL I**	**PAL D,K**	**SECAM L**	**SECAM D,K**
DVB-T	8 MHz	M1			-46			
		M2			-40			
		M3			-38			
DVB-T	7 MHz	M1	-43					
		M2	-38					
		M3	-36					

4.2.4 Image channel

Table A1.21

Protection ratios (dB) for DVB-T interfered with by analogue television in the image channel

Wanted signal			Interfering signal					
System	**BW**	**Mode**	**PAL B**	**PAL G, B1**	**PAL I**	**PAL D,K**	**SECAM L**	**SECAM D,K**
DVB-T	8 MHz	M1			-58			
		M2			-50			
		M3			-46			

Note: the protection ratios in this table will depend on the intermediate frequency of the receiver.

4.2.5 Overlapping channels*

The frequency difference Δf is the vision carrier frequency of the analogue television signal minus the centre frequency of the DVB-T signal.

Table A1.22

Protection ratios (dB) for DVB-T 8 MHz interfered with by overlapping PAL B

DVB-T 8 MHz (ITU-M3, 64 QAM rate 2/3)													
Δf (MHz)	-9.75	-9.25	-8.75	-8.25	-6.75	-3.95	-3.75	-2.75	-0.75	2.25	3.25	4.75	5.25
PR	-37	-14	-8	-4	-2	1	4	4	4	2	-1	-29	-36

* Protection ratio values for the overlapping channel cases are provisional and will need to be confirmed within the ITU-R.

Table A1.23

Protection ratios (dB) for DVB-T 7 MHz interfered with by overlapping PAL B1, D

DVB-T 7 MHz (ITU-M3, 64 QAM rate 2/3)													
Δf (MHz) for B1	-9.25	-8.75	-8.25	-7.75	-6.25	-3.45	-3.25	-2.25	-1.25	-1.75	2.75	4.25	4.75
Δf (MHz) for D	-10.25	-9.75	-9.25	-8.75	-7.25	-3.45	-3.25	-2.25	-1.25	-1.75	2.75	4.25	4.75
PR	-37	-14	-8	-4	-2	1	4	4	4	2	-1	-29	-36

4.3 Analogue television interfered with by DVB-T

The values of protection ratio quoted apply to interference produced by a single source. In this section the protection ratios for a wanted analogue signal interfered with by an unwanted digital signal apply only to the interference to the vision and colour signals, i.e. excluding sound signals.

The tropospheric interference corresponds to impairment grade 3, that is, acceptable for a small percentage of the time, between 1% and 10%. The continuous interference corresponds to an impairment grade 4, that is, acceptable for 50% of time.

The protection ratio measurements for wanted analogue television signals should be made using the method given in the ANNEX of Rec. ITU-R XYZ. For the co-channel case, the digital interference from a DVB-T signal has a similar effect to Gaussian noise of equal power in the receiver bandwidth.

4.3.1 Co-channel protection ratios

Table A1.24

Protection ratios (dB) for an analogue vision signal interfered with by DVB-T 8 MHz

Wanted analogue system	**Tropospheric interference**	**Continuous interference**
PAL B, B1, G, D, K	34	40
PAL I	37	41
SECAM L	37	42
SECAM D,K	35	41

These figures are taken from Rec. ITU-R XYZ and may be updated as a result of further measurements.
Reference conditions for coordination are given in Annex1 Section 9.

Table A1.25

Protection ratios (dB) for an analogue vision signal interfered with by DVB-T 7 MHz

Wanted analogue system	**Tropospheric interference**	**Continuous interference**
PAL B	35	41

These figures are taken from Rec. ITU-R XYZ and may be updated as a result of further measurements.
Reference conditions for coordination are given in Annex1 Section 9.

4.3.2 Lower adjacent channel (n - 1)

Table A1.26

Protection ratios (dB) for an analogue vision signal interfered with by lower adjacent channel DVB-T 8 MHz

Wanted analogue system	Tropospheric interference	Continuous interference
PAL B1, G, D, K	-7	-4
PAL I	-8	-4
SECAM L	-9	-7
SECAM D,K	-5	-1

Table A1.27

Protection ratios (dB) for an analogue vision signal interfered with by lower adjacent channel DVB-T 7 MHz

Wanted analogue system	Tropospheric interference	Continuous interference
PAL B	-11	-4

4.3.3 Upper adjacent channel (n + 1)

Table A1.28

Protection ratios (dB) for an analogue vision signal interfered with by upper adjacent channel DVB-T 8 MHz

Wanted analogue system	Tropospheric interference	Continuous interference
PAL B1, G	-9	-7
PAL I	-10	-6
SECAM L	-1	-1
SECAM D, K	-8	-5
PAL D, K		

Table A1.29

Protection ratios (dB) for an analogue vision signal interfered with by upper adjacent channel DVB-T 7 MHz

Wanted analogue system	Tropospheric interference	Continuous interference
PAL B	-5	-3

4.3.4 Image channel

Table A1.30

Protection ratios (dB) for an analogue vision signal interfered with by image channel DVB-T 8 MHz

Wanted analogue system	Unwanted DVB-T channel	Tropospheric interference	Continuous interference
PAL B1, G	n + 9	-19	-15
PAL I	n + 9		
SECAM L	n - 9	-25	-22
SECAM D, K	n + 8	-16	-11
SECAM D, K	n + 9	-16	-11
PAL D, K	n + 8		
PAL D, K	n + 9		

4.3.5 Overlapping channels*

Table A1.31

Protection ratios (dB) for a PAL B1, D vision signal interfered with by overlapping channel DVB-T 7 MHz

Frequency Difference (MHz) between DVB-T and PAL signals	Tropospheric interference	Continuous interference
Centre frequency of DVB-T signal minus the vision carrier frequency of the analogue television signal		
-7.75	-13	-8
-4.75 channel n - 1	-10	-4
-4.25	-4	2
-3.75	14	21
-3.25	25	32
-2.75	31	37
-1.75	34	41
-0.75	35	41
2.25 co-channel n	35	41
4.25	35	41
5.25	32	38
7.25	25	34
7.75	20	29
8.25	6	13
8.75	-5	-2
9.25 channel n + 1	-7	-4
12.25	-9	-3

* Protection ratio values for the overlapping channel cases are provisional and will need to be confirmed within the ITU-R.

Table A1.32

Protection ratios (dB) for a PAL B vision signal interfered with by overlapping channel DVB-T 8 MHz

Frequency difference (MHz) between DVB-T and PAL signals Centre frequency of DVB-T signal minus the vision carrier frequency of the analogue television signal	**Tropospheric interference**	**Continuous interference**
-7.25	-11	-6
-5.25	-10	-1
-3.75	13	20
-3.25	24	31
-2.75	30	36
-2.25	33	40
-1.25	34	40
-0.25	34	40
2.75 co-channel n	34	40
4.75	34	40
5.75	33	39
7.75	27	35
8.25	24	33
8.75	19	28
9.25	5	12
10.75	-5	-3
12.75	-7	-2

This table is derived from Table A1.31, relating to an unwanted DVB-T 7 MHz interferer

4.4 Sound signals associated with analogue television, interfered with by DVB-T

In this section, all values quoted refer to the level of the wanted sound carrier.

The reference signal-to-noise ratios (S/N, peak-to-peak weighted) for analogue sound signals are:

- 40 dB for tropospheric interference (approximates to impairment grade 3)
- 48 dB for continuous interference (approximates to impairment grade 4)

The reference bit-error rates for NICAM digital sound signals are:

- $1.\ 10^{-4}$ for tropospheric interference (approximates to impairment grade 3)
- $1.\ 10^{-5}$ for continuous interference (approximates to impairment grade 4)

In the case of a two-sound carrier transmission, each of the two-sound signals must be considered separately.

Table A1.33

Protection ratios (dB) for a sound signal associated with analogue television, interfered with by DVB-T

Protection Ratio in dB		**Interfering signal**	
Wanted sound signal		**DVB-T 7 MHz**	**DVB-T 8 MHz**
FM	Tropospheric	6	5
	Continuous	16	15
AM	Tropospheric		
	Continuous		
NICAM System B, B1, G	Tropospheric		
	Continuous		
NICAM System L	Tropospheric		
	Continuous		
NICAM System I	Tropospheric		
	Continuous		

0 kHz frequency separation between the wanted sound carrier and the centre frequency of the DVB-T signal.

Table A1.34

Protection ratios (dB) for an analogue television FM sound signal interfered with by DVB-T 8 MHz

DVB-T 8 MHz (The frequency difference Δf is the centre frequency of DVB-T signal minus the centre frequency of FM sound signal in MHz)									
Frequency difference Δf	-5*	-4.2*	-4	-3.5	0	3.5	4	4.2	4.5
Tropospheric interference	-1	-1	4	5	5	4	2	-18	-33
Continuous interference	8	8	13	15	15	14	11	-12	-28

* the required higher protection at lower frequencies is caused by intercarrier distortions of the vision carrier

Table A1.35

Protection ratios (dB) for an analogue television FM sound signal interfered with by DVB-T 7 MHz

DVB-T 7 MHz (The frequency difference Δf is the centre frequency of DVB-T signal minus the centre frequency of FM sound signal in MHz)									
Frequency difference Δf	-5*	-3.7*	-3.5	-3	0	3	3.5	3.7	> 4
Tropospheric interference	0	0	5	6	6	5	3	-17	< -32
Continuous interference	9	9	14	16	16	15	12	-11	<-27

* the required higher protection at lower frequencies is caused by intercarrier distortions of the vision carrier

4.5 DVB-T interfered with by T-DAB

Table A1.36

Protection ratios (dB) for a DVB-T 8 MHz interfered with by T-DAB

DVB-T 8 MHz (ITU Mode M3, 64 QAM, 2/3 code rate) **Δf = Centre frequency of T-DAB minus centre frequency of DVB-T**									
Δf (MHz)	-5	-4.2	-4	-3	0	3	4	4.2	5
PR	-30	-6	-5	28	29	28	-5	-6	-30

Table A1.37

Protection ratios (dB) for a DVB-T 7 MHz interfered with by T-DAB

DVB-T 7 MHz (ITU Mode M3, 64 QAM, 2/3 code rate) **Δf = Centre frequency of T-DAB minus centre frequency of DVB-T**									
Δf (MHz)	**-4.5**	**-3.7**	**-3.5**	**-2.5**	**0**	**2.5**	**3.5**	**3.7**	**4.5**
PR	-30	-6	-5	28	29	28	-5	-6	-30

4.6 T-DAB interfered with by DVB-T

Table A1.38

Protection ratios (dB) for T-DAB interfered with by DVB-T 8 MHz

DVB-T 8 MHz (ITU Mode M3, 64 QAM, 2/3 code rate) **Δf = Centre frequency of DVB-T minus centre frequency of T-DAB**									
Δf (MHz)	-5	-4.2	-4	-3	0	3	4	4.2	5
PR	-50	-1	0	1	1	1	0	-1	-50

Table A1.39

Protection ratios (dB) for T-DAB interfered with by DVB-T 7 MHz

DVB-T 7 MHz (ITU Mode M3, 64 QAM, 2/3 code rate) **Δf = Centre frequency of DVB-T minus centre frequency of T-DAB**									
Δf (MHz)	-4.5	-3.7	-3.5	-2.5	0	2.5	3.5	3.7	4.5
PR	-49	0	1	2	2	2	1	0	-49

5. Unwanted emissions

5.1 Spectrum masks for DVB-T in bands shared with analogue television

The masks given in Figure A1.1 and Table A1.40 are considered to cover the minimum protection needed for co-sited analogue and digital television transmitters having equal radiated powers.

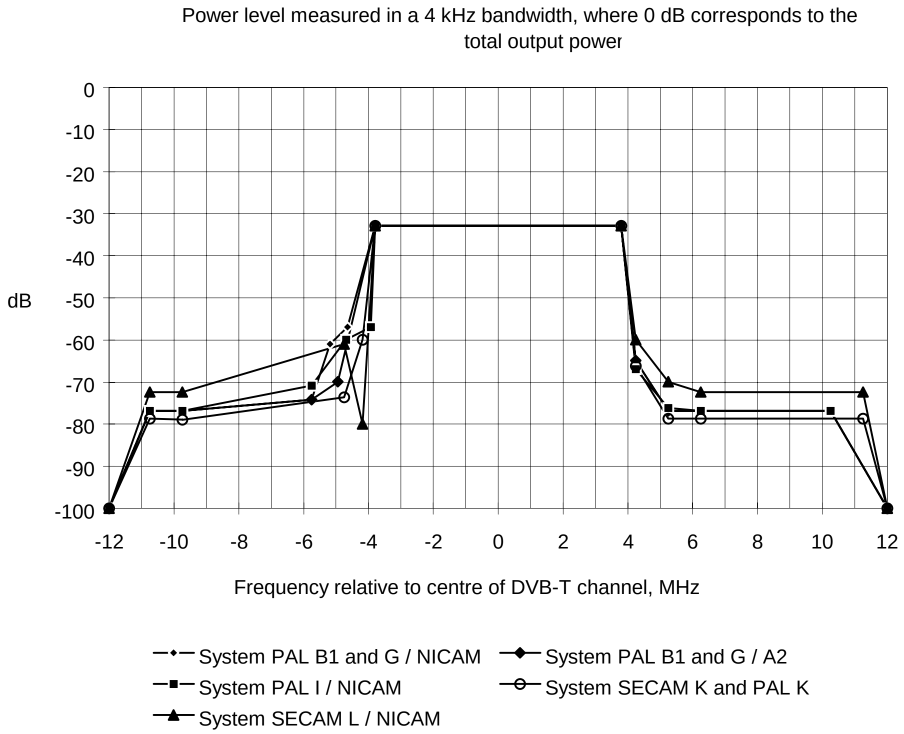


Figure A1.1

Spectrum masks for a digital terrestrial television transmitter operating on a channel adjacent to a co-sited analogue television transmitter (8 MHz channels)

Table A1.40

Breakpoints for spectrum masks in Figure A1.1

Breakpoints									
PAL B1 and G / NICAM		PAL B1 and G / A2		PAL I / NICAM		SECAM K PAL K		SECAM L/ NICAM	
rel. freq. MHz	rel. level dB	rel. freq. MHz	rel. level dB	rel. freq. MHz	rel. level dB	rel. freq. MHz	rel. level dB	rel. freq. MHz	rel. level dB
-12.0	-100.0	-12.0	-100.0	-12.0	-100.0	-12.0	-100.0	-12.0	-100.0
-10.75	-76.9	-10.75	-76.9	-10.75	-76.9	-10.75	-78.7	-10.75	-72.4
-9.75	-76.9	-9.75	-76.9	-9.75	-76.9	-9.75	-78.7	-9.75	-72.4
-5.75	-74.2	-5.75	-74.2	-5.75	-70.9	-4.75	-73.6	-4.75	-60.9
-5.185	-60.9	-5.185	n.a.	-4.685	-59.9	-4.185	-59.9	-4.185	-79.9
n.a.	n.a.	-4.94	-69.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
-4.65	-56.9	n.a.	n.a.	-3.925	-56.9	n.a.	n.a.	n.a.	n.a.
-3.8	-32.8	-3.8	-32.8	-3.8	-32.8	-3.8	-32.8	-3.8	-32.8
+3.8	-32.8	+3.8	-32.8	+3.8	-32.8	+3.8	-32.8	+3.8	-32.8
+4.25	-64.9	+4.25	-64.9	+4.25	-66.9	+4.25	-66.1	+4.25	-59.9
+5.25	-76.9	+5.25	-76.9	+5.25	-76.2	+5.25	-78.7	+5.25	-69.9
+6.25	-76.9	+6.25	-76.9	+6.25	-76.9	+6.25	-78.7	+6.25	-72.4
+10.25	-76.9	+10.25	-76.9	+10.25	-76.9	+11.25	-78.7	+11.25	-72.4
+12.0	-100.0	+12.0	-100.0	+12.0	-100.0	+12.0	-100.0	+12.0	-100.0

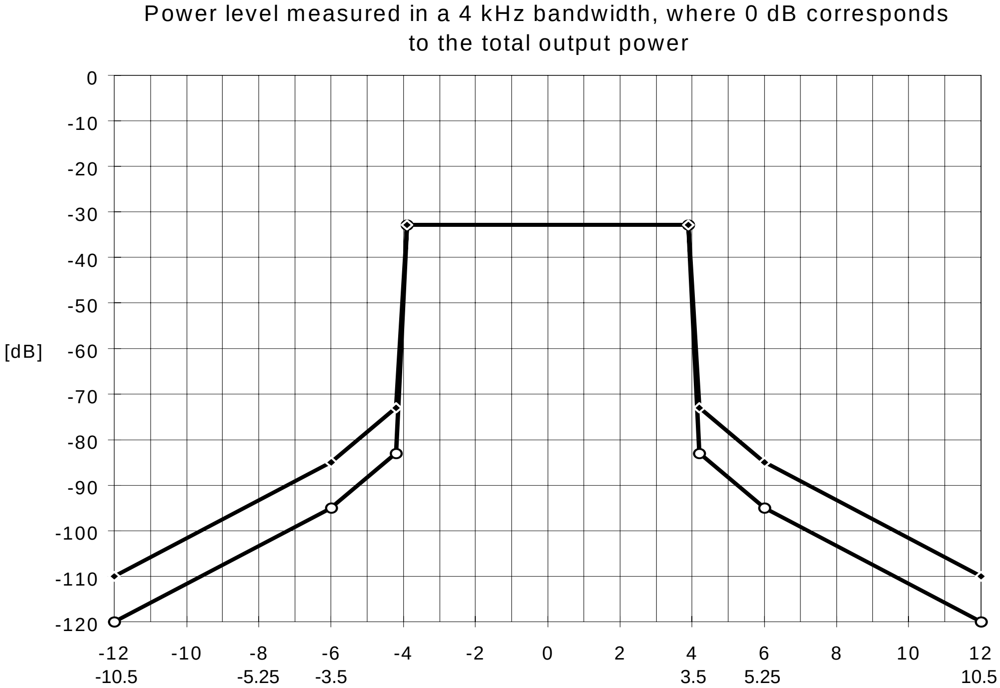
5.2 Spectrum masks for DVB-T in bands shared with other services

The out-of-band radiated signal in any 4 kHz band shall be constrained by one of the two symmetrical spectrum masks given in Figure A1.2 and Table A1.41.

Case 1: the mask having a shoulder attenuation of 40 dB is intended for non-critical cases

Case 2: the mask with a shoulder attenuation of 50 dB is intended for sensitive cases.

The mask for non-critical cases should also be used for measurements of protection ratios for analogue television interfered with by DVB-T.



Frequency relative to centre of DVB-T channel {MHz}
upper scale: 8 MHz channel, lower scale: 7 MHz channel
upper curve: non-critical cases, lower curve: sensitive cases

Figure A1.2

Symmetrical spectrum masks for non-critical and for sensitive cases

Table A1.41

Breakpoints for Figure A1.2

Breakpoints					
8 MHz channels			7 MHz channels		
	Non-critical cases	Sensitive cases		Non-critical cases	Sensitive cases
Relative Frequency MHz	Relative Level dB	Relative Level dB	Relative Frequency MHz	Relative Level dB	Relative Level dB
-12.0	-110.0	-120.0	-10.5	-110.0	-120.0
-6.0	-85.0	-95.0	-5.25	-85.0	-95.0
-4.2	-73.0	-83.0	-3.7	-73.0	-83.0
-3.9	-32.8	-32.8	-3.4	-32.8	-32.8
+3.9	-32.8	-32.8	+3.4	-32.8	-32.8
+4.2	-73.0	-83.0	+3.7	-73.0	-83.0
+6.0	-85.0	-95.0	+5.25	-85.0	-95.0
+12.0	-110.0	-120.0	+10.5	-110.0	-120.0

6. Protection of television services and equitable access

It is necessary to ensure that coordinated analogue television assignments continue to be protected and it will be equally necessary to ensure protection for the digital television services.

It is also necessary to ensure that the principle of equitable access to the limited frequency resources is maintained irrespective of the time of introduction of digital television in individual countries.

The best tool to achieve these protections is the use of test points.

6.1 Definitions of test points

Two categories of test points are needed. One category represents the coverage area for a given station, or SFN, while the other represents country boundaries.

All test points are defined by their geographical coordinates.

6.1.1 Test points representing coverage areas

The transmitter site will normally be inside the contour described by the test points, however, in special cases the transmitter can be located outside of this area.

For small stations, i.e. stations with a coverage area whose width is less than 5 km, only one test point, located at the transmitter site, may be sufficient. However, up to 36 test points can be defined if necessary. If only one test point is given, no receiving antenna directivity is assumed.

For stations with a coverage area whose width is 5 km or more up to 36 test points are used. These test points may be located on radials at 10 degree intervals.

If the contour of the coverage area crosses a country boundary, the test points in this area are located at the crossing points between a radial and the boundary unless otherwise agreed by the concerned administrations.

6.1.2 Test points at the country boundary

A maximum of 499 test points can be used to represent the boundary of a country.

The location of test points at a boundary should be agreed between the countries sharing this boundary and be used as boundary test points by all countries.

The set of test points representing the boundary of a country shall be a complete individual set, as shall a set representing a coverage area.

6.1.3 Availability of test point locations

The location of test points, i.e. their geographical coordinates, shall be commonly available to all CEPT members in order to facilitate calculations of interference into other countries or coverage areas of stations in other countries.

6.2 Calculation of the location for test points representing coverage areas

To calculate the coverage area of a television station on a given channel, two elements are necessary:

- the parameters particular to an individual transmitting station (coordinates, height of the antenna, radiated power, etc.) which are used to calculate the wanted signal;
- the system parameters such as the protection ratios, which are used to calculate the individual nuisance field strengths and the usable field strength, and the minimum median field strength.

These calculations should take into account:

- interference from analogue television assignments;
- interference from digital television assignments.

The individual nuisance field strength En is the field strength of an unwanted signal to which has been added the relevant protection ratio, propagation correction factor and receiving antenna discrimination. It is calculated as follows:

$$En = E + PR + C + A$$

where

E is the field strength of the unwanted signal. The appropriate time percentage according to the wanted signal is to be chosen (see note 1);
PR is the appropriate protection ratio (see note 1);
C is the propagation correction factor (see note 2);
A is the receiving antenna discrimination (taking into account polarisation discrimination), ($A \leq 0$);

and all quantities are expressed in dB or dB(µV/m).

note 1:
In the case of a wanted digital service the 1% time 50% location field strength of the unwanted service is to be chosen. In the case of a wanted analogue service the larger of the 1% time 50% location field strength of the unwanted signal together with the protection ratio for tropospheric interference and the 50% time 50% location field strength of the unwanted signal together with the protection ratio for continuous interference is to be chosen.

note 2:
The propagation correction factor C = (location correction factor in the case of a wanted and an unwanted signal) equals 0 dB in the case of a wanted analogue television service. In the case of a wanted digital television service it equals $\sqrt{2} \times \mu \times \sigma$, where the distribution factor μ and the standard deviation σ (in dB) are given in Annex 1 Sections 3.1 and 3.3.

The usable field strength is the minimum value of the field strength necessary to permit a desired reception quality, under specified receiving conditions, in the presence of natural and man-made noise and interference. The usable field strength is calculated by combining the individual nuisance fields and the minimum median field strength. The combination is done by means of the power sum method, given in Annex 1 Section 6.3, i.e.

$$E_u = 10 \times \log_{10}\left(10^{\frac{E_{\min}}{10}} + \sum_{i=1}^{n} 10^{\frac{En_i}{10}}\right) ,$$

where

E_u is the usable field strength (in dB(µV/m));
E_{min} is the minimum median field strength (in dB(µV/m));
En_i is the nuisance field strength of the i-th unwanted signal (in dB(µV/m));
n is the number of interferers,

and

for analogue television reception, the value of E_{min} is given in Rec. ITU-R BT. 417;
for digital television reception, the value of E_{min} is given in Annex 1 Section 8.

The test points representing a coverage area can thus be determined in three stages:

Stage 1 Calculation of noise limited coverage area

Using Rec. ITU-R P.370, the locations of the noise-limited test points are found, which represent the area that could be served if there were no interference. This area may be approximated on the basis of up to 36 radials, using the e.r.p. and the effective antenna height. For each radial, that location is determined where the field strength of the wanted transmitter equals the minimum median field strength.

Stage 2 **Identification of interferers**

The impact of co-channel, adjacent channel and image channel interference from other transmitters is calculated for each wanted station and each noise-limited test point from Stage 1. First, the sub-set of possible interferers is established. This consists of the stations, which can produce a nuisance field, which is no more than 15 dB below the minimum median field strength at any of the noise-limited test points from Stage 1.

Stage 3 **Calculation of the test points for the interference limited coverage.**

The individual nuisance field strength En caused by each of the interfering stations in this sub-set of interferers is calculated at each of the noise limited test points from Stage 1 (see Figure A1.3). The usable field strength is calculated for each of these test points.

In the case of no interferers the usable field strength at a test point is equal to the minimum median field strength, no further calculation is required, and the coverage radius is that of Stage 1 above (see also Figure A1.3).

If the usable field strength at a test point is greater than the minimum median field strength, it is then necessary to find the new coverage radius on this bearing at which the field strength from the wanted station equals the usable field strength.

Because, in general, the coverage radius thus calculated will not equal the radius previously calculated for the same bearing and thus the nuisance field strengths will change, the process of the previous paragraph is repeated to obtain a close approximation to the required coverage radius on each of the bearings.

It must be noted that a given station will normally have different coverage areas on different channels and that this can be important when considering the relative coverage of digital and analogue services.

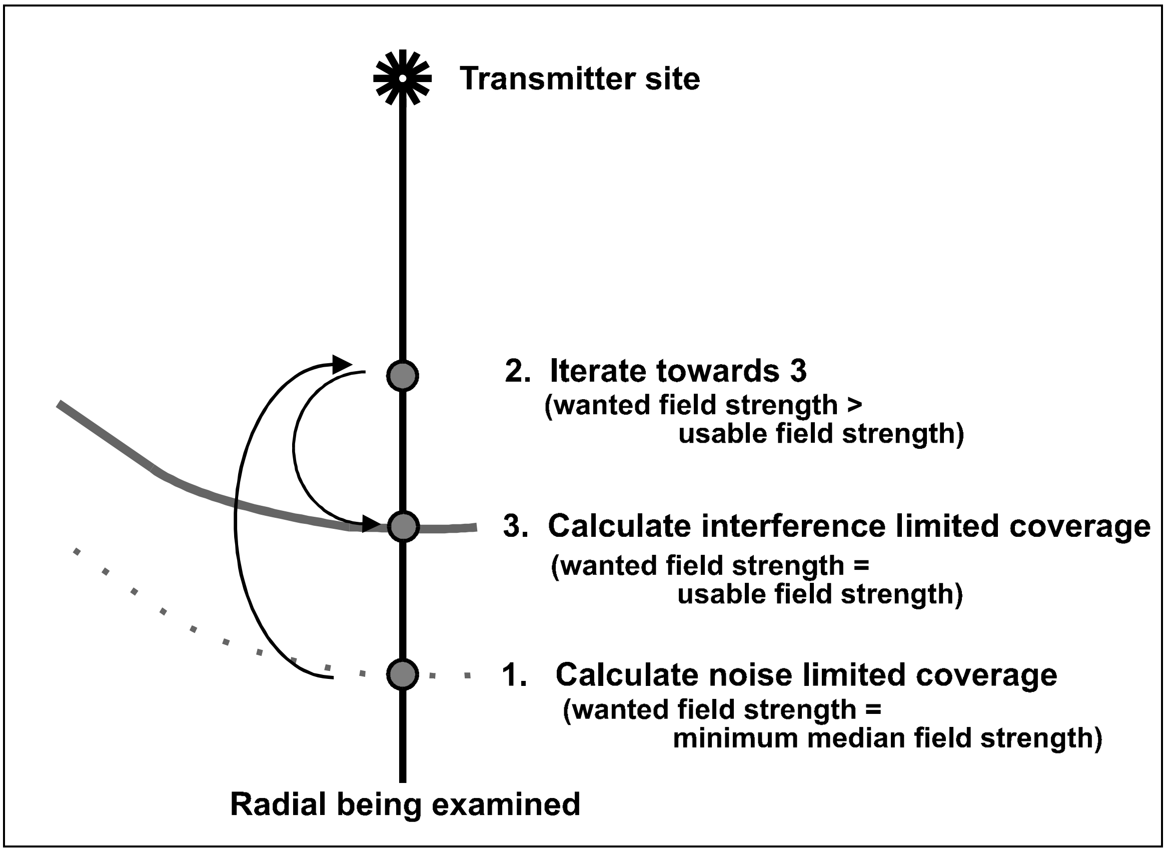


Figure A1.3
Illustration of the calculation of location of test points for the interference limited coverage

6.3 Method for combination of signals (power sum method)

The power sum method is a procedure in which individual field strengths are combined such that the power of the resultant field strength equals the sum of the powers of the individual field strengths. If the (logarithmic) field strength of a single signal is denoted by E_i and is expressed in dB(μV/m), the combined field strength E_Σ is given by:

$$E_\Sigma = 10 \times \log_{10}\left(\sum_{i=1}^{n} 10^{\frac{E_i}{10}}\right)$$

where *n* is the number of individual field strengths.

6.4 Protection of digital television services

Because of the rapid failure of digital reception when the level of the useful signal decreases below its "minimum" value, the target for the percentage of locations nominally covered at any edge – where edge means any transition between a covered area and a non-covered area – of the coverage area has to be much higher for digital systems than the value used for analogue television systems. For coordination, the reference conditions, including the percentage of location value, for digital coverage are given in Annex 1 Section 8.

Since the reception conditions of the **actual** implementation of a digital television service may differ from the **reference** reception conditions given in Annex 1 Section 8, the test points representing a digital assignment do not necessarily lie on the boundary of the actual coverage area of that digital assignment. The test points may lie inside or outside the actual coverage area of the digital assignment.

6.5 Test points representing the digital television coverage area resulting from a conversion

In the case of a digital assignment resulting from the conversion of an analogue assignment (see Annex 6) the location of the test points to be used is that of the test points of the analogue assignment from which the conversion was made.

6.6 Establishment of test points representing an SFN

The locations of the test points representing an SFN are derived by a simplified process, which does not take account of self-interference or network gain.

In this process, a set of up to 36 test points would be derived, using the method described in Annex 1 Sections 6.1 and 6.2, for each of the assignments in the SFN considered individually, that is without taking into account any signal or interference contributions from the other assignments in the SFN.

In bilateral or multilateral co-ordinations, administrations may agree to use more complex methods for deriving the locations of test points representing an SFN, and the interference levels at these test points.

In the case of a digital assignment forming an SFN which results from the conversion of an analogue assignment (see Annex 6) the locations of the test points to be used are those of the test points of the analogue assignment from which the conversion was made.

6.7 Test point locations and usable field strength values to be used during coordination

Two reference scenarios, a mixed-analogue-and-digital and an all-digital scenario, where test point locations and usable field strength values are established, are to be used for the compatibility analysis according to Article 4. The initial sets of test point locations and usable field strength values for both scenarios will be established for the date 25/7/97 by taking into account all coordinated analogue assignments.

The test point locations will be identical for both scenarios whereas the usable field strength values may differ in the two scenarios, as a result of differences, for example, in protection ratio and e.r.p. values.

6.7.1 Mixed-analogue-and-digital reference scenario

The mixed-analogue-and-digital reference scenario reflects the actual coordinated situation and is established in order to facilitate compatibility analyses.

6.7.1.1 Basis for the calculation

All coordinated analogue assignments will be taken into account in establishing the initial set of test point locations and usable field strength values for the mixed-digital-and-analogue reference scenario for the date 25/7/97.

For any new analogue assignment, the reference set of test point locations and usable field strength values will be established when the assignment is entered into the Plan*. The set of test point locations and usable field strength values will be calculated according to the mixed-analogue-and-digital reference scenario.

For any new digital assignment, the reference set of test point locations and usable field strength values will be established when the assignment is entered into the Plan. The set of test point locations (and the usable field strength values for the all-digital reference scenario, see Annex 1 Section 6.7.2.1) will be calculated according to the all-digital reference scenario. The set of usable field strength values will also be calculated according to the mixed-analogue-and-digital reference scenario; however, this set of usable field strength values is not required by the compatibility analysis according to Article 4 and is provided for information only.

When an assignment is converted from analogue to digital, its test point locations will remain those of the analogue assignment from which the conversion was made (and the usable field strength values are calculated for the all-digital reference scenario, see Annex 1 Section 6.7.2.1). The usable field strength values will also be calculated according to the mixed-analogue-and-digital reference scenario; however, this set of usable field strength values is not required by the compatibility analysis according to Article 4 and is provided for information only.

The method given in Annex 1 Sections 6.1 and 6.2 will be used for the calculation of test point locations and usable field strength values.

6.7.1.2 Radiation characteristics to be taken into account

The radiation characteristics, such as e.r.p, polarisation, antenna height and antenna diagram, for all assignments will be those, which have been coordinated at the date of entry into the Plan.

In the case of digital assignments, which result from the conversion of an analogue assignment, the radiation characteristics will be those of the digital assignment as coordinated. For a digital assignment converted from an analogue assignment, temporary restrictions resulting from conversion rule 4a in Annex 6 will not be taken into account.

6.7.1.3 Reception conditions

For digital assignments, reference reception conditions as given in Annex 1 Section 8 will be used. For analogue assignments, reference reception conditions as given in Annex 1 Section 9 will be used.

6.7.2 All-digital reference scenario

The all-digital reference scenario reflects a hypothetical situation. It is established in order to facilitate compatibility analyses and to preserve the rights of the existing digital assignments for protection and the rights of the existing analogue assignments to be converted into digital. The all-digital reference scenario is created by an artificial conversion of all analogue assignments into digital assignments using an automatic process. Thus the actual situation is transformed into an hypothetical all-digital one.

It must be noted that when the real conversion occurs, the radiation characteristics obtained after coordination with the neighbouring countries may differ from the results of the automatic process and the coordinated transmission characteristics will be entered into the Plan.

6.7.2.1 Basis for the calculation

The initial set of test point locations and usable field strength values for the all-digital reference scenario will be established for the date 25/7/97 by automatically converting all analogue assignments into hypothetical digital assignments. The test point locations will remain those of the analogue assignments according to the mixed-analogue-and-digital reference scenario. The usable field strength values will be calculated by applying a reduction of 7 dB to the e.r.p. of all analogue assignments.

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* that is, when published by the ITU-BR in Part B of Special Section ST61 of the weekly circular.

Any new analogue assignment will be automatically converted into a hypothetical digital assignment. The reference set of test point locations and usable field strength values will be established when the assignment is entered into the Plan. The test point locations will remain those of the analogue assignment according to the mixed-analogue-and-digital reference scenario. A reduction of 7 dB of the e.r.p. of the new analogue assignment will be applied. The usable field strength values are calculated according to the all-digital reference scenario.

For any new digital assignment, the reference set of test point locations and usable field strength values will be established when the assignment is entered into the Plan. The set of test point locations and usable field strength values will be calculated according to the all-digital reference scenario.

The test point locations of a digital assignment resulting from the conversion of an analogue assignment according to Annex 6 will remain those of the original analogue assignment; usable field strength values remain those of the hypothetical conversion to the all-digital scenario.

In any case where the conversion of an analogue assignment is not made in accordance with Annex 6, the test point locations remain those of the original analogue assignment according to the mixed-analogue-and-digital reference scenario. However, the usable field strength values will be re-calculated according to the all-digital reference scenario.

The method given in Annex 1 Sections 6.1 and 6.2 will be used for the calculation of test point locations and usable field strength values.

6.7.2.2 Radiation characteristics to be taken into account

The radiation characteristics, such as e.r.p, polarisation, antenna height and antenna diagram, for all assignments will be those which apply to the all-digital scenario at the date of entry into the Plan.

In the case of a digital assignment, which results from the conversion of an analogue assignment according to Annex 6, subsequent to the date of the initial reference conditions, the radiation characteristics used will be those of the digital assignment as coordinated. For a digital assignment, which results from the conversion of an analogue assignment according to Annex 6, temporary restrictions resulting from conversion rule 4a in Annex 6 will not be taken into account.

6.7.2.3 Reception conditions

In the all-digital reference scenario it is only necessary to calculate the test point locations for new digital assignments. The usable field strength values of existing and new digital assignments and of digital assignments resulting from the conversion of an analogue assignment will need to be calculated. Reference reception conditions, as given in Annex 1 Section 8, will be used.

6.7.3 Test point locations and field strength values for assessing compatibility with stations of services other than broadcasting

Test point locations and usable field strength values for analogue and digital assignments are calculated for the assessment of compatibility with services other than broadcasting. Test point locations for the protection of stations other than broadcasting are specified in the data records for the stations of other services.

6.7.3.1 Basis for the calculation

The test point locations for any broadcasting assignment (digital or analogue) will be calculated using the method in Annex 1 Sections 6.1 and 6.2, but taking into consideration only the minimum median field strength value relevant to the broadcasting service (Stage 1 of Annex 1 Section 6.2).

6.7.3.2 Radiation characteristics to be taken into account

The radiation characteristics, such as e.r.p, polarisation, antenna height and antenna diagram, for all assignments will be those, which apply at the date of entry into the Plan. In the case of digital assignments, which result from the conversion of an analogue assignment, which has already been effected, the radiation conditions used will be those of the digital assignment as coordinated. In the case of analogue assignments, which have not yet been converted to digital assignments, the digital radiation characteristics will be established by subtracting 7 dB from the e.r.p. of the analogue assignment.

6.7.3.3 Reception conditions

For digital assignments, reference reception conditions as given in Annex 1 Section 8 will be used. For analogue assignments, reference reception conditions as given in Annex 1 Section 9 will be used.

7. Frequency bands and channels

7.1 Frequencies for implementation of DVB-T

The frequency bands for implementation of DVB-T in the European Broadcasting Area are 174 to 230 MHz and 470 to 862 MHz. However, the CEPT considers the frequency band 216 to 230 MHz as the core band for T-DAB in VHF.

7.2 Analogue television channel rasters

In Band III, different television channel rasters are used across Europe. In Eastern Europe, France and Ireland, channels are 8 MHz wide, in other countries the channel width is 7 MHz. In addition, there are different channel raster in countries using 7 MHz channels (e.g. Italy). This means that in the VHF Bands there is a number of cases where channels overlap.

Within Bands IV and V, there is a single channel raster of 8 MHz, with the upper and lower edges, and vision carrier, of each channel being the same for all countries in Europe.

7.3 Frequencies for television channels in the European Broadcasting Area

Information concerning the frequencies for television channels in Bands III, IV and V, in the European Broadcasting Area are given in Tables A1.42 to A1.49.

Note that following the CEPT T-DAB Planning Meeting (Wiesbaden 1995) the upper part of Band III, above 216 MHz, is now allocated to T-DAB services in many CEPT countries.

Table A1.42

VHF System B

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz	Dual FM Second Sound carrier MHz	NICAM carrier MHz
5	174	181	175.25	180.75	180.99	181.1
6	181	188	182.25	187.75	187.99	188.1
7	188	195	189.25	194.75	194.99	195.1
8	195	202	196.25	201.75	201.99	202.1
9	202	209	203.25	208.75	208.99	209.1
10	209	216	210.25	215.75	215.99	216.1
11	216	223	217.25	222.75	222.99	223.1
12	223	230	224.25	229.75	229.99	230.1

Table A1.43

VHF System B (Italy)

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz	Dual FM Second Sound carrier MHz
D	174.00	181.00	175.25	180.75	180.99
E	182.50	189.50	183.75	189.25	188.49
F	191.00	198.00	192.25	197.75	197.99
G	200.00	207.00	201.25	206.75	206.99
H	209.00	216.00	210.25	215.75	215.99
H1	216.00	223.00	217.25	222.75	222.99
H2	223.00	230.00	224.25	229.75	229.99

Table A1.44

VHF System B (Morocco)

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz
M4	162	169	163.25	168.75
M5	170	177	171.25	176.75
M6	178	185	179.25	184.75
M7	186	193	187.25	192.75
M8	194	201	195.25	200.75
M9	202	209	203.25	208.75
M10	210	217	211.25	216.75
M11	218	225	219.25	224.75

Table A1.45

VHF System B1

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz	Dual FM Second Sound carrier MHz	(NICAM carrier) MHz
R6	174	182	175.25	180.75	180.99	181.1
R7	182	190	183.25	188.75	188.99	189.1
R8	190	198	191.25	196.75	196.99	197.1
R9	198	206	199.25	204.75	204.99	205.1
R10	206	214	207.25	212.75	212.99	213.1
R11	214	222	215.25	220.75	220.99	221.1
R12	222	230	223.25	228.75	228.99	229.1

Table A1.46

VHF System D

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz	(NICAM carrier) MHz
R6	174	182	175.25	181.75	181.10
R7	182	190	183.25	189.75	189.10
R8	190	198	191.25	197.75	197.10
R9	198	206	199.25	205.75	205.10
R10	206	214	207.25	213.75	213.10
R11	214	222	215.25	221.75	221.10
R12	222	230	223.25	229.75	229.10

Table A1.47

VHF System I

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz	NICAM carrier MHz
ID	174	182	175.25	181.25	181.80
IE	182	190	183.25	189.25	189.80
IF	190	198	191.25	197.25	197.80
IG	198	206	199.25	205.25	205.80
IH	206	214	207.25	213.25	213.80
IJ	214	222	215.25	221.25	221.80
IK	222	230	223.25	229.25	229.80

Table A1.48

VHF System L

Channel	Channel boundaries MHz		Vision carrier MHz	Sound carrier MHz	NICAM carrier MHz
L5	174.25	182.75	176.00	182.50	181.85
L6	182.75	190.75	184.00	190.50	189.85
L7	190.75	198.75	192.00	198.50	197.85
L8	198.75	206.75	200.00	206.50	205.85
L9	206.75	214.75	208.00	214.50	213.85
L10	214.75	222.75	216.00	222.50	221.85

Table A1.49

UHF System G, H, I, K, L

Channel	Channel boundaries MHz		Vision carrier MHz	System G System H Sound carrier MHz	System G Dual FM Second Sound carrier MHz	System G System H System L (System K) NICAM carrier MHz	System I Sound carrier MHz	System K System L Sound carrier MHz	System I NICAM carrier MHz
21	470	478	471.25	476.75	476.99	477.1	477.25	477.75	477.8
22	478	486	479.25	484.75	484.99	485.1	485.25	485.75	485.8
23	486	494	487.25	492.75	492.99	493.1	493.25	493.75	493.8
24	494	502	495.25	500.75	500.99	501.1	501.25	501.75	501.8
25	502	510	503.25	508.75	508.99	509.1	509.25	509.75	509.8
26	510	518	511.25	516.75	516.99	517.1	517.25	517.75	517.8
27	518	526	519.25	524.75	524.99	525.1	525.25	525.75	525.8
28	526	534	527.25	532.75	532.99	533.1	533.25	533.75	533.8
29	534	542	535.25	540.75	540.99	541.1	541.25	541.75	541.8
30	542	550	543.25	548.75	548.99	549.1	549.25	549.75	549.8
31	550	558	551.25	556.75	556.99	557.1	557.25	557.75	557.8
32	558	566	559.25	564.75	564.99	565.1	565.25	565.75	565.8
33	566	574	567.25	572.75	572.99	573.1	573.25	573.75	573.8
34	574	582	575.25	580.75	580.99	581.1	581.25	581.75	581.8
35	582	590	583.25	588.75	588.99	589.1	589.25	589.75	589.8
36	590	598	591.25	596.75	596.99	597.1	597.25	597.75	597.8
37	598	606	599.25	604.75	604.99	605.1	605.25	605.75	605.8
38	606	614	607.25	612.75	612.99	613.1	613.25	613.75	613.8
39	614	622	615.25	620.75	620.99	621.1	621.25	621.75	621.8
40	622	630	623.25	628.75	628.99	629.1	629.25	629.75	629.8
41	630	638	631.25	636.75	636.99	637.1	637.25	637.75	637.8
42	638	646	639.25	644.75	644.99	645.1	645.25	645.75	645.8
43	646	654	647.25	652.75	652.99	653.1	653.25	653.75	653.8
44	654	662	655.25	660.75	660.99	661.1	661.25	661.75	661.8
45	662	670	663.25	668.75	668.99	669.1	669.25	669.75	669.8
46	670	678	671.25	676.75	676.99	677.1	677.25	677.75	677.8
47	678	686	679.25	684.75	684.99	685.1	685.25	685.75	685.8
48	686	694	687.25	692.75	692.99	693.1	693.25	693.75	693.8
49	694	702	695.25	700.75	700.99	701.1	701.25	701.75	701.8
50	702	710	703.25	708.75	708.99	709.1	709.25	709.75	709.8
51	710	718	711.25	716.75	716.99	717.1	717.25	717.75	717.8
52	718	726	719.25	724.75	724.99	725.1	725.25	725.75	725.8
53	726	734	727.25	732.75	732.99	733.1	733.25	733.75	733.8
54	734	742	735.25	740.75	740.99	741.1	741.25	741.75	741.8
55	742	750	743.25	748.75	748.99	749.1	749.25	749.75	749.8
56	750	758	751.25	756.75	756.99	757.1	757.25	757.75	757.8
57	758	766	759.25	764.75	764.99	765.1	765.25	765.75	765.8
58	766	774	767.25	772.75	772.99	773.1	773.25	773.75	773.8
59	774	782	775.25	780.75	780.99	781.1	781.25	781.75	781.8
60	782	790	783.25	788.75	788.99	789.1	789.25	789.75	789.8
61	790	798	791.25	796.75	796.99	797.1	797.25	797.75	797.8
62	798	806	799.25	804.75	804.99	805.1	805.25	805.75	805.8
63	806	814	807.25	812.75	812.99	813.1	813.25	813.75	813.8
64	814	822	815.25	820.75	820.99	821.1	821.25	821.75	821.8
65	822	830	823.25	828.75	828.99	829.1	829.25	829.75	829.8
66	830	838	831.25	836.75	836.99	837.1	837.25	837.75	837.8
67	838	846	839.25	844.75	844.99	845.1	845.25	845.75	845.8
68	846	854	847.25	852.75	852.99	853.1	853.25	853.75	853.8
69	854	862	855.25	860.75	860.99	861.1	861.25	861.75	861.8

8. Reference reception conditions for digital television coordination

The reference conditions for analogue television are given implicitly by the systems. Due to the inherent flexibility of DVB-T, which can be selected to meet a given country's requirements, it is likely that various planning criteria will be used throughout the CEPT planning area.

In order to place international coordination on an equitable basis it is necessary to use a representative set of reference conditions.

The values given in Table A1.50 for the reference reception conditions represent a compromise between requirements for fixed reception and portable outdoor reception.

These values can form a basis for the initial implementation of DVB-T. As there is a significant interest in portable reception, including indoor portable reception, the values shall be reviewed at a relevant point in time.

Changes to the values in Table A1.50 should be done on a multilateral basis.

Table A1.50

Reference reception conditions for digital television

Conditions	Value			Notes
	Band III	Band IV	Band V	
Nominal receiving antenna height	10 m agl	10 m agl	10 m agl	1
Receiving antenna directivity discrimination	None	None	None	
Receiving antenna polarisation discrimination	None	None	None	
Required C/N value	20 dB	20 dB	20 dB	2
Co-channel protection ratio for DVB-T interfered with by analogue television.	8 dB	8 dB	8 dB	3
Minimum equivalent field strength at the receiving place	46 dBμV/m	56 dBμV/m at 500 MHz	60 dBμV/m at 800 MHz	4
Location correction factor	9 dB	9 dB	9 dB	5
Minimum median equivalent field strength	55 dBμV/m	65 dBμV/m at 500 MHz	69 dBμV/m at 800 MHz	6

Notes

1. This value does not imply that a receiving antenna must be at 10 m agl, it only sets a (commonly used) reference.
2. Including the implementation margin. This value is also to be used as the co-channel protection ratio value for the case of DVB-T interfering with DVB-T.
3. This value is to be used for coordination and includes the implementation margin.
4. To account for the variation of minimum equivalent field strength with frequency in Bands IV and V, the value to be used is given by 56 + 20 log (f /500) dB μV/m where f is the frequency of the digital assignment in MHz.
5. Corresponding to a target reception location probability of 95 %. For the purpose of interference assessment, a propagation correction factor of 13 dB is required (see Annex 1 Section 6.2).
6. To account for the variation of minimum median equivalent field strength with frequency in Bands IV and V, the value to be used is given by 65 + 20 log (f /500) dB μV/m where f is the frequency of the digital assignment in MHz.

9. Reference reception conditions for analogue television to be used in digital television coordination

Table A1.51

Reference reception conditions for analogue television

Conditions	Value			Notes
	Band III	Band IV	Band V	
Nominal receiving antenna height	10 m agl	10 m agl	10 m agl	1
Receiving antenna directivity and polarisation discrimination	Rec. ITU-R BT.419	Rec. ITU-R BT.419	Rec. ITU-R BT.419	
Protection ratio values for the case of analogue television interfered with by analogue television	Rec. ITU-R BT.655	Rec. ITU-R BT.655	Rec. ITU-R BT.655	
Protection ratio values for the case of analogue television interfered with by DVB-T.	see note 2	see note 2	see note 2	2
Minimum median field strength to be protected in accordance with Rec. ITU-R BT.417	55 dBμV/m	65 dBμV/m	70 dBμV/m	

Notes
1. This value does not imply that a receiving antenna must be at 10 m agl, it only sets a (commonly used) reference.
2. For co-ordination purposes, the following values should be used for co-channel protection ratios for analogue television interfered with by DVB-T and for tropospheric interference:

PAL B, B1, D	35 dB	(DVB-T 7 MHz)
PAL B, B1, G, D, K	34 dB	(DVB-T 8 MHz)
PAL I	35 dB	(DVB-T 8 MHz)
SECAM L	35 dB	(DVB-T 8 MHz)
SECAM D, K	35 dB	(DVB-T 8 MHz)

The protection ratio values in all other cases can be found in Annex 1 Section 4. All of these values should be used in conjunction with an interference increase margin of 0.3 dB (see Annex 2 Section 2d). The values for PAL I and SECAM L are interim values, which need to be confirmed within the ITU-R. A uniform reference method should be used for measurements of co-channel protection ratios for analogue television interfered with by DVB-T.