

APPENDIX G

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

This section contains system-specific protection criteria for certain systems of other primary services operating in the band 470-798 MHz as well as generic protection criteria for the fixed and mobile services operating in the band 470-798 MHz. The systems for which protection criteria are provided are listed in Table 1.1.

TABLE 1.1

System type code	Secondary code implemented in the planning software	Type of system	Field strength to be protected (dB(μ V/m))	Receiver height (m)	Protection ratio table
NX	NX8	Land mobile system NX8	27.0	20.0	1.1.1
NR	NR8	Land mobile system NR8 (radio microphone, 8 MHz)	68.0	1.5	1.1.2
NT	NT7	Mobile system NT7 (talkback, non-companded)	31.0	1.5	1.1.3
NT	NT8	Mobile system NT8 (talkback, non-companded)	31.0	1.5	1.1.4
NA	NA8N	Digital land mobile system NA8N (non-critical)	13.0	20.0	1.1.5
NA	NA8C	Digital land mobile system NA8C (sensitive)	13.0	20.0	1.1.6
NB	NB7N	Generic mobile non-critical mask	-	10.0	
NB	NB7C	Generic mobile sensitive mask	-	10.0	
NB	NB8N	Generic mobile non-critical mask	-	10.0	
NB	NB8C	Generic mobile sensitive mask	-	10.0	
XG	XG8	Aeronautical radionavigation system XG8 (airport radars)	-12.0	7.0	1.1.7
NY	Y8N	Land mobile system Y8N at 480 MHz	31.0	1.5	1.1.8
NY	Y8C	Land mobile system Y8C at 480 MHz	31.0	1.5	1.1.9
NY	Z8N	Land mobile system Z8C at 620 MHz	33.0	1.5	1.1.8
NY	Z8C	Land mobile system Z8C at 620 MHz	33.0	1.5	1.1.9

Table 1.1.1

Land mobile systems – NX8

Abs(Δ f) (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 1.1.2

Radio microphone – NR8

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 1.1.3

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 1.1.4

Talkback – NT8

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 1.1.5

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 1.1.6

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 1.1.7

CH36 airport radars XG8 & Radars (POL) artificial values PL8

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

Table 1.1.8

Land mobile at 480 MHz Y8N & Land mobile at 620 MHz Z8N

Abs(Δf) (MHz)	4.2	3.8	0.0
PR (dB)	-55.0	-17.0	-10.0

Table 1.1.9

Land mobile at 480 MHz Y8C & Land mobile at 620 MHz Z8C

Abs(Δf) (MHz)	4.2	3.8	0.0
PR (dB)	-65.0	-17.0	-10.0

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:

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

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)
- LF: 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 VHF band and 0 dB for UHF band)
- K: overlap correction factor (in DVB-T) given in the Tables 2.4 and 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, LF and P_o were used:

Table 2.1

Frequency (MHz)	500	800
F (dB)	5	5
G _i (dBi)	14	16
LF (dB)	5	5
P _o (dB)	0	0
F - G + LF + P _o	-4	-6

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

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

Table 2.2

Frequency (MHz)	470	790
F (dB)	4	3
Gi (dBi)	12	17
LF (dB)	2	4
Po (dB)	0	0
F - Gi + LF + Po	-6	-10

For the generic case of the land mobile service (mobile stations), the following values of F, Gi, LF and Po were used:

Table 2.3

Frequency (MHz)	470	790
F (dB)	7	7
Gi (dBi)	0	0
LF (dB)	0	0
PO (dB)	0	0
F - Gi + LF + Po	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

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

where:

B_v : the bandwidth of the victim receiver

B_i : the bandwidth of the interfering signal

Δf : the difference between the centre frequency of the fixed service system and the centre frequency of the interfering (DVB-T) signal.

Table 2.4

For the DVB-T mask non-critical cases

Overlapped bandwidth, B_o	Overlapping factor, K (dB)
$B_o = B_v$	0
$B_v > B_o > 10^{-4} B_v$	$10 \log_{10} (B_o/B_v)$
$10^{-4} B_v > B_o > -0.5$	-40
$B_o = -1$	-45

$B_o = -2$	-52
$B_o = -4$	-60
$B_o = -8$	-77

Table 2.5

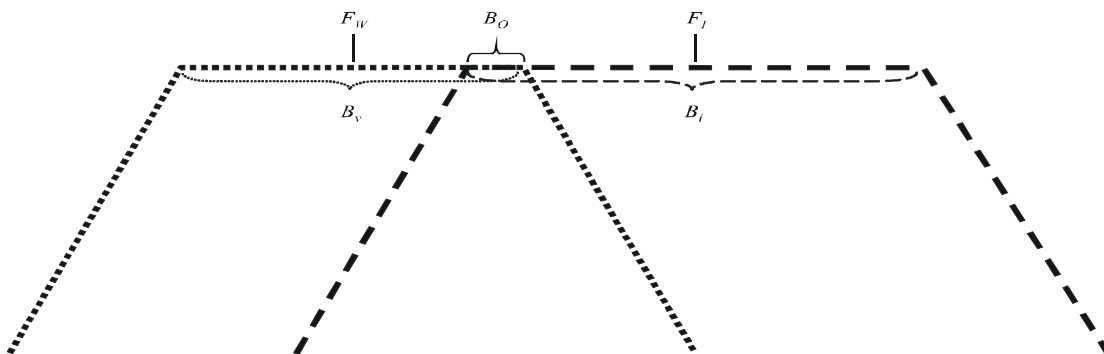
For the DVB-T mask – sensitive cases

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

It should be noted that the overlapping factor, K , is calculated taking into account the break points of the DVB-T mask as defined in Appendix G of this SRSP document.

Where B_o , B_i and B_v are as shown in the figure below.

FIGURE 2.1



RRC06-A2-C4-AP4-2-1

FW: centre frequency of the wanted signal
 FI: centre frequency of the interfering signal

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

3. 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 3.1 are available in Tables 3.2 to 3.14 of this appendix. 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 3.1.8 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 3.1.8 are to be added to the protection ratios for a DVB-T 64-QAM 2/3 Gaussian channel.

Table 3.1
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
NA	NA	Land mobile system NA (digital, 3 MHz)	3.1.1
NA	NC	Land mobile system NC (digital, 5 MHz)	3.1.2

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
NB	NB	Generic mobile system NB	3.1.3, 3.1.4
NY	OX	Land mobile system OX in VHF band	3.1.3, 3.1.4
NY	OY	Land mobile system OY at 480 MHz	3.1.4
NY	OZ	Land mobile system OZ at 620 MHz	3.1.4
XG	XG	Aeronautical radionavigation system XG (Airport Radars)	3.1.5
-	-	Land mobile system (CDMA-1X)	3.1.6
-	-	Land mobile system (CDMA-3X)	3.1.7

Table 3.1.1
Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by NA system

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

Table 3.1.2
Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by NC system

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

Table 3.1.3
Protection ratios for DVB-T 7 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by OX 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

Table 3.1.4
Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by OX, OY and OZ systems

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

Table 3.1.5
Protection ratios for DVB-T 8 MHz 64-QAM code rate 2/3 Gaussian channel signal interfered with by XG system

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

TABLE 3.1.6

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

Δf (MHz)	-12	-4.5	-3.75	0	3.75	4.5	12
PR (dB)	-38	-20	-3	10	-3	-20	-38

Characteristics of the interfering signal:

Modulation: QPSK

Bandwidth: 1.25 MHz (99%)

TABLE 3.1.7

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
PR (dB)	-38	8	13	18	13	8	-38

Characteristics of the interfering signal:

Modulation: QPSK

Bandwidth: 4 MHz (99%)

TABLE 3.1.8

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 primary 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 1/2	-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 5/6	-2.8	-1.5	1.0	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-QAM 2/3	0.0	1.1	3.4	3.4	6.4
64-QAM 3/4	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 7/8	3.9	5.3	7.9	7.9	10.9

4. Working assumptions concerning the other primary terrestrial services used for the development of the DTT Plan

This section is a collection of the working assumptions which were used in the establishment of a DTT plan.

The following assumptions were used during the establishment of the DTT Plan:

- 1 In the absence of notified values of the height above ground level, the following values were assumed as default effective antenna heights for transmitting stations in other primary services:
 - station in the fixed service: 37.5 m;
 - base station in the land mobile service: 37.5 m.
- 2 In the absence of notified values of the effective radiated power, the e.r.p. values were calculated as the sum of the power delivered to the antenna and the antenna gain.
- 3 It was assumed that no directivity discrimination was obtained in the case of receiving antennas, for any angle.
- 4 When the notified beamwidth was narrower than the calculated beamwidth by more than 10°, then the calculated beamwidth was used.
- 5 When the notified azimuth of the maximum radiation was different from the calculated azimuth by more than 3°, then the calculated azimuth was used.
- 6 An antenna was considered as non-directional if the antenna gain was less than 3.7 dB.