RECOMMENDATION ITU-R BS.1660*

Technical basis for planning of terrestrial digital sound broadcasting in the VHF band

(Question ITU-R 56/6)

(2003)

The ITU Radiocommunication Assembly,

considering

a) Recommendations ITU-R BS.774 and ITU-R BS.1114;

b) ITU-R Digital Sound Broadcasting Handbook – Terrestrial and satellite digital sound broadcasting to vehicular, portable and fixed receivers in the VHF/UHF bands,

recommends

1 that the planning criteria as described in Annex 1 could be used for planning of terrestrial digital sound broadcasting in the VHF band.

Annex 1

Technical basis for planning of terrestrial digital sound broadcasting system A (T-DAB) in the VHF band

1 General

This Recommendation contains relevant T-DAB system parameters and network concepts, including a description of single frequency networks (SFNs).

The receiving antenna, which is assumed to be representative for mobile and portable reception, has a height of 1.5 m above ground level, omnidirectional with a gain slightly lower than a dipole.

The field strength prediction method relies on curves for 50% locations, 50% time for the wanted signal and 50% locations, 1% time for the unwanted signal.

For the calculation of tropospheric (1% time) and continuous (50% time) interference, see Recommendation ITU-R BT.655.

The required location percentage for T-DAB services is 99%. Therefore, taking a standard deviation of 5.5 dB, an increase of 13 dB (2.33 × 5.5 dB) shall be applied to the field strength values (50% locations) in order to obtain the 99% location values required for planning a T-DAB service.

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* The Administration of the Syrian Arab Republic is not in a position to accept the content of this Recommendation, nor for it to be used as a technical basis for the planning of sound broadcasting in the VHF band, at the forthcoming regional radiocommunication conferences planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3.

The propagation curves used for planning relate to a receiving antenna height of 10 m above ground, whereas a T-DAB service will be planned primarily for mobile reception, i.e. with an effective receiving antenna height of about 1.5 m. An allowance of 10 dB is necessary to convert the minimum required T-DAB field strength at a vehicle antenna height of 1.5 m to the equivalent value at 10 m.

2 Minimum wanted field strength used for planning

Table 1 contains values for VHF Band III with the inclusion of a correction of 13 dB for location percentage and of 10 dB for height gain. The below given minimum median equivalent field strength represents the minimum wanted field strength used for planning.

The values shown in Table 1 are applied to mobile reception.

TABLE 1

Minimum median equivalent field strength (dB(μV/m))
at an antenna height of 10 m

Frequency band	Band III
Minimum equivalent field strength (dB(μV/m))	35
Location percentage correction factor (50% to 99%) (dB)	+13
Antenna height gain correction (dB)	+10
Minimum median equivalent field strength for planning (dB(μV/m))	58

3 Unwanted emissions

3.1 Spectrum masks for T-DAB out-of-band emissions

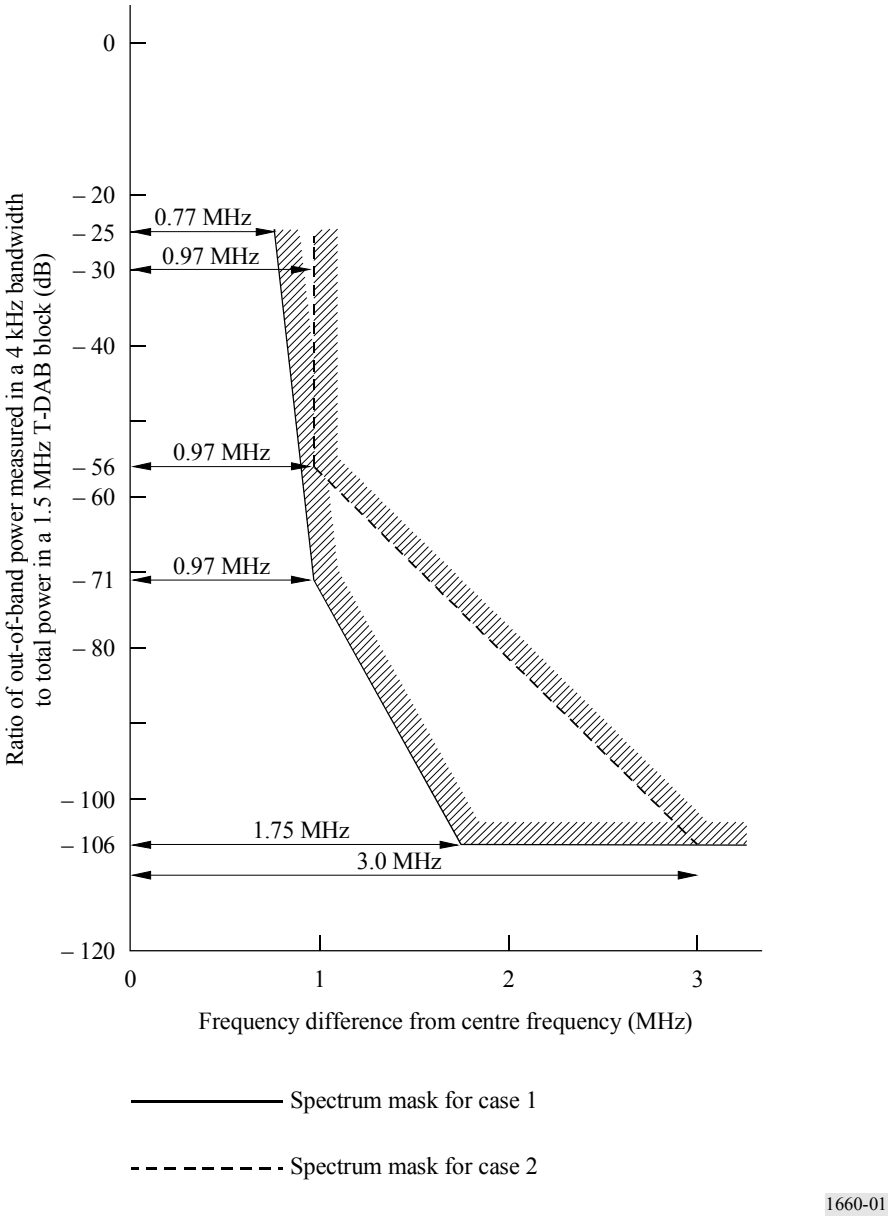
The out-of-band radiated signal in any 4 kHz band shall be constrained by one of the masks defined in Fig. 1.

Case 1: The solid line mask shall apply to T-DAB transmitters operating in areas critical for adjacent channel T-DAB to T-DAB interference, and in any case when it is necessary to protect other services operating on adjacent frequencies on a primary basis.

Case 2: The dashed line mask shall apply to T-DAB transmitters in other cases.

FIGURE 1

Spectrum masks for T-DAB out-of-band emissions



Appendix 1
to Annex 1

Planning criteria as used by a group of countries in the Wiesbaden 1995 Special Arrangement

1 Position of frequency blocks in Band III

Table 2 shows a harmonized channelling plan. This is based on tuning increments of 16 kHz and guardbands of 176 kHz between adjacent T-DAB frequency blocks.

Within each 7 MHz television channel, four T-DAB frequency blocks are accommodated.

In order to enhance compatibility with the sound carrier(s) in 7 MHz TV systems, the guardbands for T-DAB frequency blocks A in Channel N and D in Channel N-1 are 320 kHz or 336 kHz. The position of T-DAB frequency blocks within Channel 12 is shown as an example in Fig. 2.

TABLE 2

T-DAB frequency blocks

T-DAB block number	Centre frequency (MHz)	Frequency range (MHz)	Lower guardband[(1)] (kHz)	Upper guardband[(1)] (kHz)
5A	174.928	174.160-175.696	–	176
5B	176.640	175.872-177.408	176	176
5C	178.352	177.584-179.120	176	176
5D	180.064	179.296-180.832	176	336
6A	181.936	181.168-182.704	336	176
6B	183.648	182.880-184.416	176	176
6C	185.360	184.592-186.128	176	176
6D	187.072	186.304-187.840	176	320
7A	188.928	188.160-189.696	320	176
7B	190.640	189.872-191.408	176	176
7C	192.352	191.584-193.120	176	176
7D	194.064	193.296-194.832	176	336
8A	195.936	195.168-196.704	336	176
8B	197.648	196.880-198.416	176	176
8C	199.360	198.592-200.128	176	176
8D	201.072	200.304-201.840	176	320
9A	202.928	202.160-203.696	320	176
9B	204.640	203.872-205.408	176	176
9C	206.352	205.584-207.120	176	176

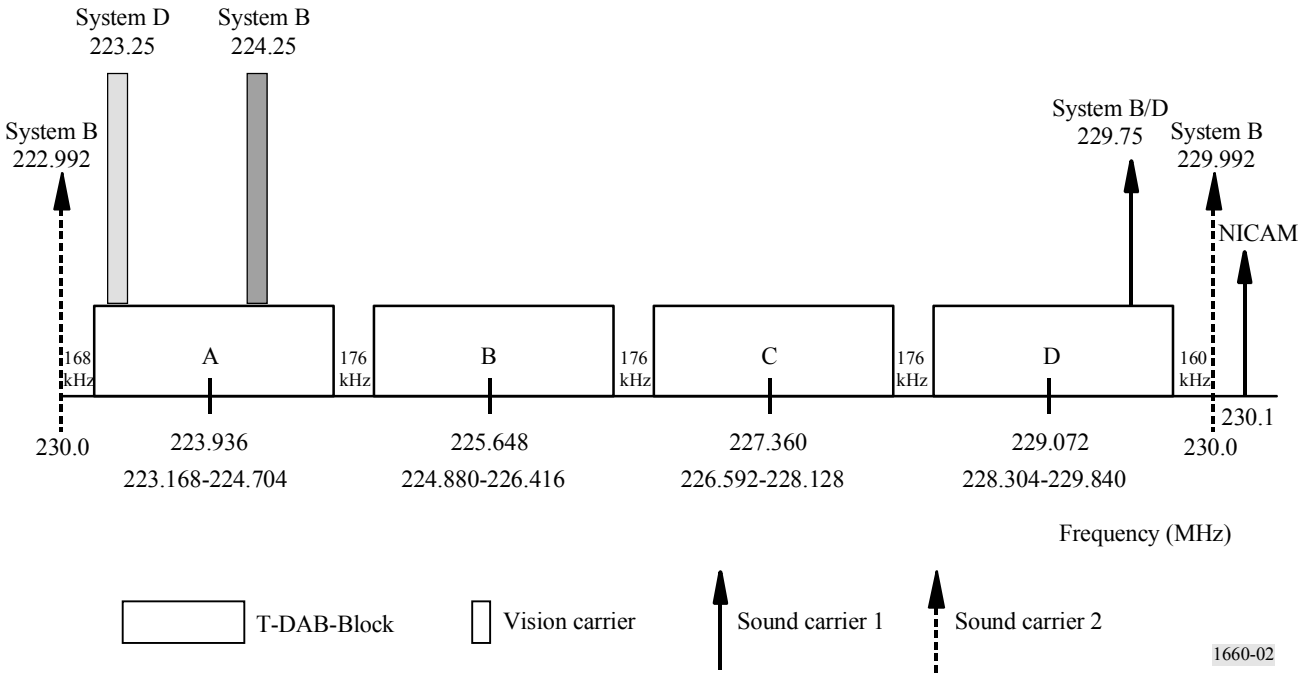
TABLE 2 (*end*)

T-DAB block number	Centre frequency (MHz)	Frequency range (MHz)	Lower guardband[1] (kHz)	Upper guardband[1] (kHz)
9D	208.064	207.296-208.832	176	336
10A	209.936	209.168-210.704	336	176
10B	211.648	210.880-212.416	176	176
10C	213.360	212.592-214.128	176	176
10D	215.072	214.304-215.840	176	320
11A	216.928	216.160-217.696	320	176
11B	218.640	217.872-219.408	176	176
11C	220.352	219.584-221.120	176	176
11D	222.064	221.296-222.832	176	336
12A	223.936	223.168-224.704	336	176
12B	225.648	224.880-226.416	176	176
12C	227.360	226.592-228.128	176	176
12D	229.072	228.304-229.840	176	–

(1) In arriving at these values, it has been assumed that the T-DAB transmitting and receiving equipment must allow for the use of adjacent T-DAB frequency blocks in adjacent areas, i.e. using a 176 kHz guardband.

FIGURE 2

Position of T-DAB blocks in channel 12



2 T-DAB reference network

Reference networks are used for the planning of allotments.

The characteristics of the reference networks represent a reasonable compromise between the density of the transmitters required to support the desired coverage and the potential to reuse the same frequency block with other programme content in other areas.

A reference network is a tool for developing appropriate values for separation distances and for estimating how much interference a typical SFN might produce at a given distance.

2.1 T-DAB transmitter network structures

T-DAB stations or networks consist of one of three basic models or combinations thereof:

– a single transmitter;

– an SFN using non-directional transmitting antennas, also referred to as an "open network";

– an SFN using directional transmitting antennas along the periphery of the coverage area, also referred to as a "closed network".

2.2 Definitions

The reference point is the point on the boundary of a reference network from which outgoing interference is calculated, see also Fig. 4. Incoming interference is calculated at the same point.

In the following text, two distances are defined; see also Fig. 3.

– The separation distance is the distance required between the borders (or peripheries) of two coverage areas served by either T-DAB services or by two different services. There will often be two separation distances, one for each service, because of different field strengths to be protected or because of different protection ratios for the two services. In such cases the longer of these two distances shall be used.

– The transmitter distance is the distance between adjacent transmitter sites in an SFN.

2.3 T-DAB reference SFN

In interfering field strength calculations the contributions from all transmitters of the reference network are added using the power sum method. In the case of mixed land-sea paths, field strengths are first calculated individually for an all-land path and an all-sea path, each of the same distance as the mixed path concerned. A linear interpolation is then performed between the field strengths for all-land and all-sea paths at the required distance from the border of the SFN according to the following formula:

$$E_M = E_L + \frac{d_S}{d_T} (E_S - E_L)$$

where:

E_M: field strength for a mixed land-sea path

E_L: field strength for an all-land path

E_S: field strength for an all-sea path

d_S: length of the sea path

d_T: length of the total path.

All field strengths are in dB(μV/m).

In all-sea path calculations it is assumed that the reference network and its coverage area are on land and that the sea starts from the edge of the coverage area. For land paths a terrain roughness of 50 m is assumed.

FIGURE 3

Definition of distances for different network structures (SFN, single transmitter)

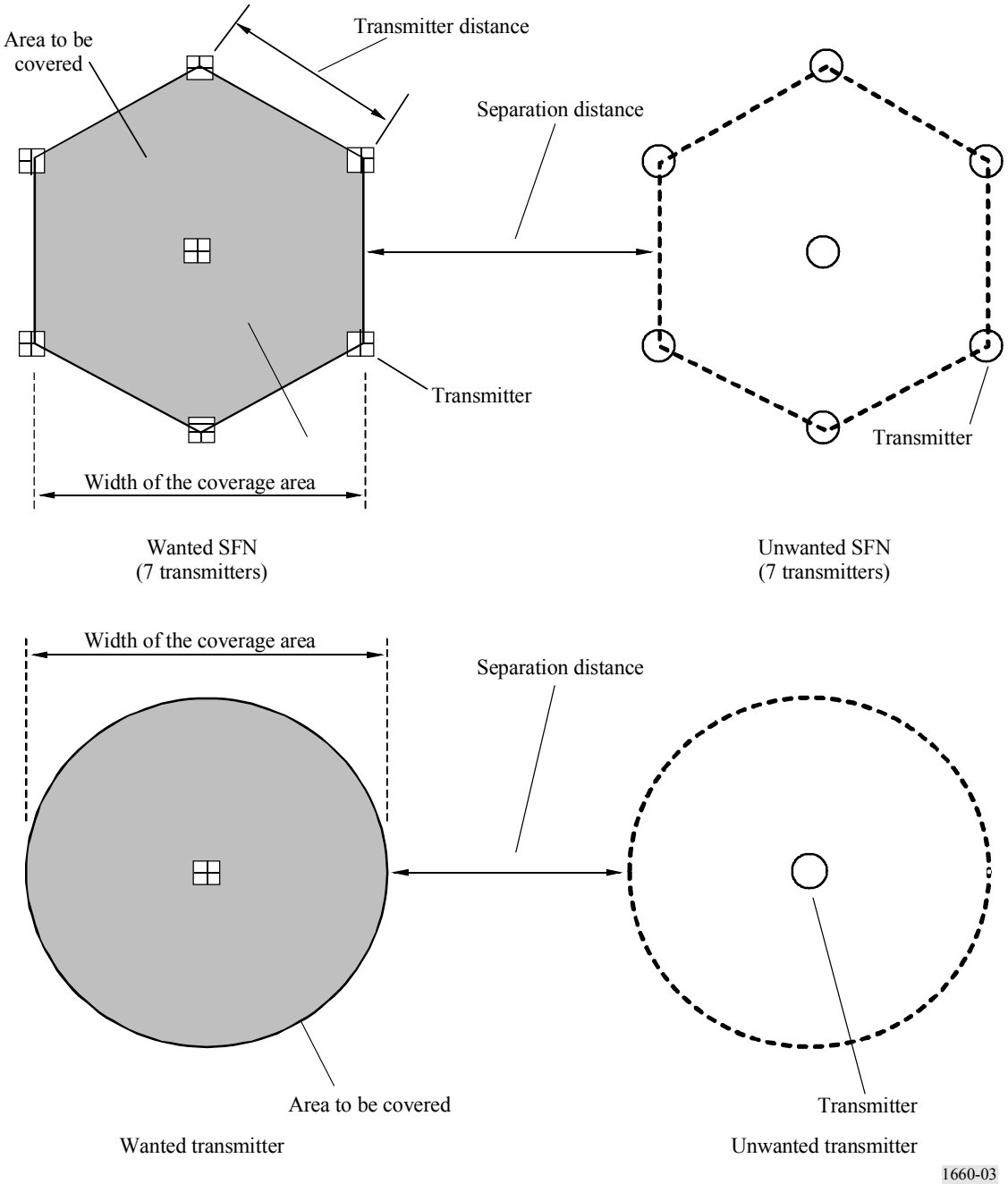
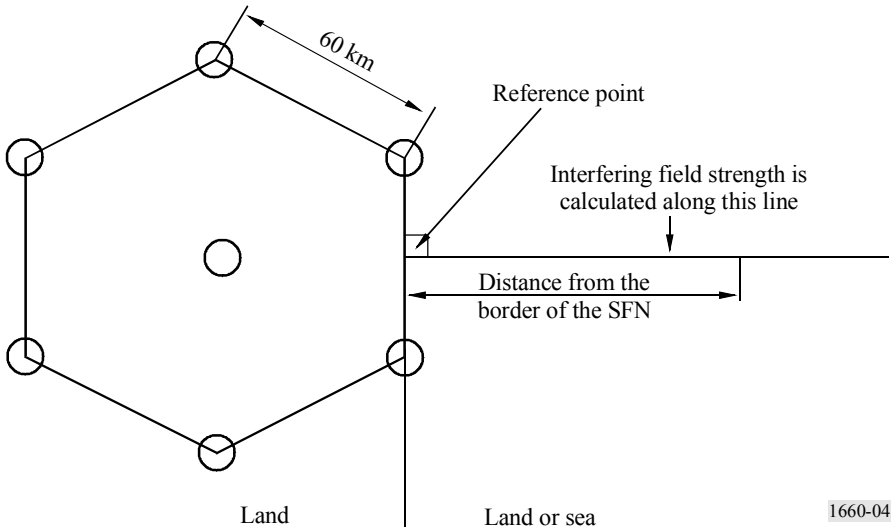


FIGURE 4

Information related to the interfering field strength calculation for the reference network



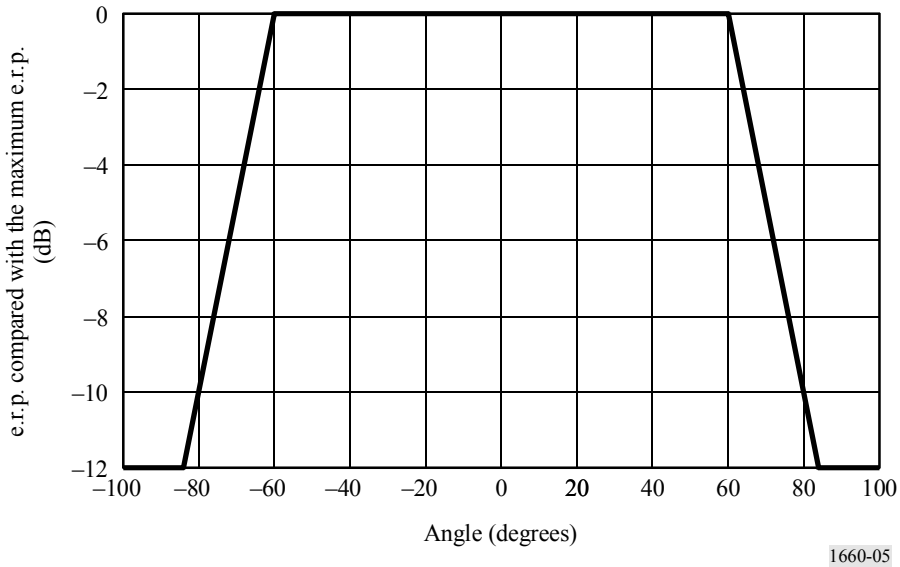
2.3.1 Reference network structure

The reference network suitable for the frequency allotment process is defined as follows (see also Fig. 4):

–	Hexagonal structure:	closed
–	Transmitter distance:	60 km
–	Transmitting antenna height:	150 m
–	Central transmitter effective radiated power (e.r.p.):	100 W
–	Radiation pattern of the central transmitter:	omnidirectional
–	Peripheral transmitter e.r.p.:	1 kW
–	Radiation pattern of peripheral transmitters:	see Fig. 5
–	Main lobe of directional antennas:	in the direction of the central transmitter.

FIGURE 5

Radiation pattern of the peripheral transmitters



When using the field strength prediction method described in this Appendix, the reference network produces the required coverage inside the network. The effective wanted field strength on the border of the reference network is about 3 dB higher than the minimum field strength for planning. This makes it possible to allow 3 dB more interference at the edge of the network.

Thus the maximum interfering field strength from another co-channel T-DAB service on the border of the reference network is:

$$E_I^{Max} = E_W^{Min} - PR - PC + 3$$

where:

E_I^{Max}: maximum interfering field strength on the border of the reference network

E_W^{Min}: minimum median wanted field strength for planning

PR: protection ratio, in this case 10 dB

PC: propagation correction 18 dB (50% to 99% location correction factor).

The additional 3 dB margin is not allowed for the other services because during the frequency block allotment procedure each source of interference is considered separately and their power sum is not calculated.

Thus the maximum interfering field strength from any other service on the border of the reference network is:

$$E_I^{Max} = E_W^{Min} - PR - PC$$

where:

E_I^{Max}: maximum interfering field strength on the border of the reference network

E_W^{Min}: minimum median wanted field strength for planning

PR: protection ratio, depending on service under consideration

PC: propagation correction 18 dB.

The interfering field strengths for land, cold sea and warm sea paths produced by a reference network are shown in Figs. 6a, 6b and 6c. Separation distances for Band III are 81, 142 and 173 km for land, cold sea and warm sea paths respectively.

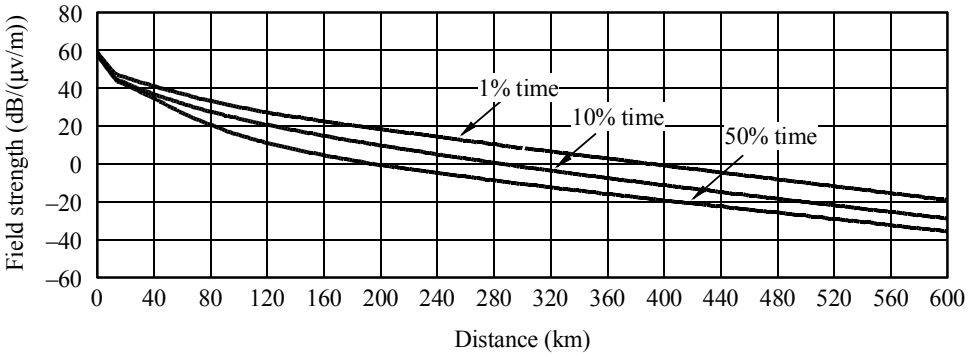
Where the field strength is calculated within 1 km of the transmitter site location, receiving antenna discrimination should not be taken into account.

2.3.2 Nominal transmitter location for the calculation of potential T-DAB interference to the aeronautical mobile service

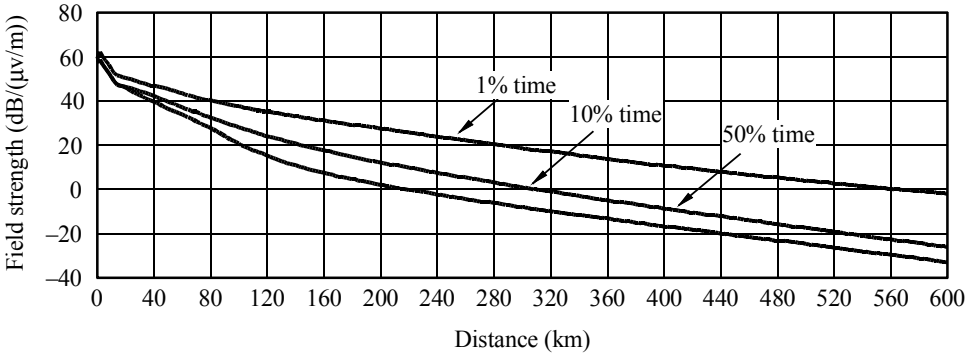
The centre of the reference network shall be used as the nominal location for the network to calculate interference to an aeronautical reception test point. In this case the power used for calculations is 33.8 dBW in Band III.

FIGURE 6

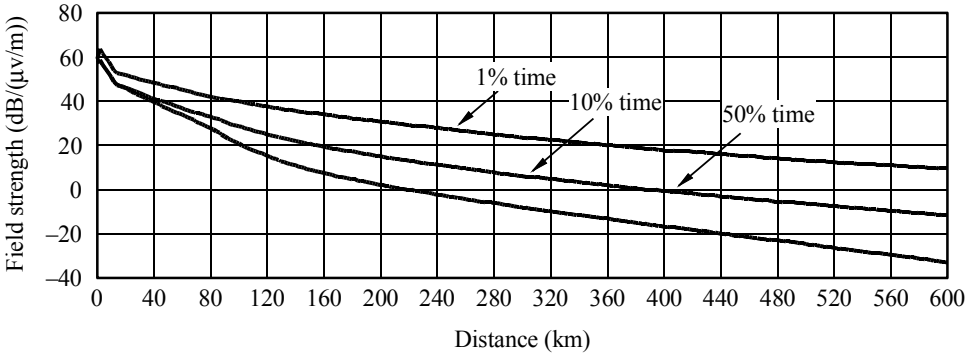
Interfering field strength produced by the reference network



a) Field strength variation with distance: land



b) Field strength variation with distance: cold sea



c) Field strength variation with distance: warm sea

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3 Protection of T-DAB

3.1 T-DAB interfered with by T-DAB

The T-DAB co-block protection ratio is 10 dB.

Table 3 shows the values for the maximum permissible interfering field strength used for planning.

TABLE 3

Maximum permissible interfering field strength (T-DAB to T-DAB)

Frequency band	Minimum wanted field strength (dB(μV/m)) (50% locations, 10 m height)	Protection ratio T-DAB interfered with by T-DAB (dB)	Propagation correction (dB)	Maximum permissible interfering field strength (dB(μV/m))
BAND III	58	10	18	30(1)

(1) In the case of an SFN, this figure shall be increased by 3 dB.

The standard deviation of a location variation of T-DAB signal is 5.5 dB. The field strength values for wanted and unwanted signals are assumed to be uncorrelated. To protect wanted T-DAB signals for 99% of locations against interference from another T-DAB transmission, a propagation correction of $2.33 \times 5.5 \times \sqrt{2} = 18$ dB as well as the T-DAB protection ratio (T-DAB to T-DAB) of 10 dB shall be taken into account.

$$E_I^{Max} = E_W^{Min} - PR - PC + 3$$

where:

E_I^{Max}: maximum permissible interfering field strength

E_W^{Min}: minimum median equivalent field strength

PR: protection ratio

PC: propagation correction.

3.2 T-DAB interfered with by analogue sound broadcasting

Wideband FM sound mono		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
S1	58.0	10.0

Δf (MHz)	–1.3	–1.2	–1.1	–1.0	–0.9	–0.8	–0.8	–0.7	–0.6	–0.5	–0.4
PR (dB)	–45.1	–43.9	–38.4	–37.5	–28.9	–12.9	–4.9	–1.0	2.1	3.5	4.3
Δf (MHz)	–0.3	–0.2	–0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
PR (dB)	4.1	4.4	4.1	4.0	4.1	4.4	4.1	4.3	3.5	2.1	–1.0
Δf (MHz)	0.8	0.8	0.9	1.0	1.1	1.2	1.3				
PR (dB)	–4.9	–12.9	–28.9	–37.5	–38.4	–43.9	–45.1				

Wideband FM sound stereo		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
S2	58.0	10.0

Δf (MHz)	–1.3	–1.2	–1.1	–1.0	–0.9	–0.8	–0.8	–0.7	–0.6	–0.5	–0.4
PR (dB)	–45.1	–43.9	–38.4	–37.5	–28.9	–12.9	–4.9	–1.0	2.1	3.5	4.3
Δf (MHz)	–0.3	–0.2	–0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7
PR (dB)	4.1	4.4	4.1	4.0	4.1	4.4	4.1	4.3	3.5	2.1	–1.0
Δf (MHz)	0.8	0.8	0.9	1.0	1.1	1.2	1.3				
PR (dB)	–4.9	–12.9	–28.9	–37.5	–38.4	–43.9	–45.1				

3.3 T-DAB interfered with by digital terrestrial television broadcasting

Protection ratios for a T-DAB system interfered with by a DVB-T 8 MHz system									
64-MAQ code rate 2/3									
Δf [(1)] (MHz)	–5	–4.2	–4	–3	0	3	4	4.2	5
PR (dB)	–50	–1	0	1	1	1	0	–1	–50

[(1)] Δf: centre frequency of the DVB-T signal minus centre frequency of the T-DAB signal.

Protection ratios for a T-DAB system interfered with by a DVB-T 7 MHz system									
64-QAM code rate 2/3									
Δf [(1)] (MHz)	–4.5	–3.7	–3.5	–2.5	0	2.5	3.5	3.7	4.5
PR (dB)	–49	0	1	2	2	2	1	0	–49

[(1)] Δf: centre frequency of the DVB-T signal minus centre frequency of the T-DAB signal.

The protection ratio tables are related to DVB-T System parameters 64-QAM code rate 2/3 only. The values for the other options have to be added by further measurements.

3.4 T-DAB interfered with by analogue terrestrial television broadcasting

I/PAL (Band III)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T1	58.0	10.0

Δf (MHz)	–8.0	–7.5	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0
PR (dB)	–42.0	–23.5	–10.0	–3.0	–2.0	–3.0	–24.0	–21.0	–23.0	–31.0	–31.5
Δf (MHz)	–2.5	–2.0	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7
PR (dB)	–30.0	–28.5	–25.0	–19.5	–17.5	–11.0	–7.0	–1.5	–1.5	–4.0	–5.5
Δf (MHz)	0.8	0.9	1.0	2.0	3.0						
PR (dB)	–13.5	–17.0	–20.0	–33.0	–47.5						

I/PAL (Band III)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T2	58.0	10.0

Δf (MHz)	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0	–2.5	–2.0
PR (dB)	–47.0	–18.0	–5.0	–3.0	–5.0	–20.0	–22.0	–31.5	–31.5	–29.0	–26.5
Δf (MHz)	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7	0.8	0.9
PR (dB)	–23.0	–18.5	–16.0	–9.0	–5.0	–3.0	–0.5	–3.0	–4.0	–12.0	–16.0
Δf (MHz)	1.0	2.0									
PR (dB)	–19.5	–45.3									

D/SECAM, K/SECAM (Band III)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T3	58.0	10.0

Δf (MHz)	–8.0	–7.5	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0
PR (dB)	–47.0	–42.5	–3.0	–2.5	–3.0	–37.5	–21.5	–18.5	–20.5	–26.5	–33.5
Δf (MHz)	–2.5	–2.0	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7
PR (dB)	–31.5	–29.0	–26.5	–18.5	–16.5	–9.0	–6.0	–3.0	–2.5	–4.0	–4.5
Δf (MHz)	0.8	0.9	1.0	2.0							
PR (dB)	–12.0	–22.0	–25.0	–46.0							

L/SECAM (Band III)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T4	58.0	10.0

Δf (MHz)	–8.0	–7.5	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0
PR (dB)	–46.5	–42.5	–15.5	–13.0	–15.0	–26.5	–18.5	–17.0	–18.0	–23.0	–31.5
Δf (MHz)	–2.5	–2.0	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7
PR (dB)	–30.5	–27.5	–24.5	–18.0	–16.5	–8.0	–5.0	–1.5	1.5	–2.0	–3.5
Δf (MHz)	0.8	0.9	1.0	2.0	3.0						
PR (dB)	–12.5	–18.5	–19.0	–31.0	–46.8						

B/SECAM (Band III). B/PAL (T2) data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T5	58.0	10.0

Δf (MHz)	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0	–2.5	–2.0
PR (dB)	–47.0	–18.0	–5.0	–3.0	–5.0	–20.0	–22.0	–31.5	–31.5	–29.0	–26.5
Δf (MHz)	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7	0.8	0.9
PR (dB)	–23.0	–18.5	–16.0	–9.0	–5.0	–3.0	–0.5	–3.0	–4.0	–12.0	–16.0
Δf (MHz)	1.0	2.0									
PR (dB)	–19.5	–45.3									

D/PAL (Band III)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T6	58.0	10.0

Δf (MHz)	–8.0	–7.5	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0
PR (dB)	–47.0	–42.5	–3.0	–2.5	–3.0	–37.5	–21.5	–20.0	–22.0	–31.5	–31.5
Δf (MHz)	–2.5	–2.0	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7
PR (dB)	–29.0	–26.5	–23.0	–18.5	–16.0	–9.0	–5.0	–3.0	–0.5	–3.0	–4.0
Δf (MHz)	0.8	0.9	1.0	2.0							
PR (dB)	–12.0	–16.0	–19.0	–45.3							

B/PAL (FM+Nicam) (Band III)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
T7	58.0	10.0

Δf (MHz)	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0	–2.5	–2.0
PR (dB)	–47.0	–18.0	–5.0	–3.0	–5.0	–20.0	–22.0	–31.5	–31.5	–29.0	–26.5
Δf (MHz)	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7	0.8	0.9
PR (dB)	–23.0	–18.5	–16.0	–9.0	–5.0	–3.0	–0.5	–3.0	–4.0	–12.0	–16.0
Δf (MHz)	1.0	2.0									
PR (dB)	–19.5	–45.3									

3.5 T-DAB interfered with by services other than broadcasting

The maximum interfering field strength (FS) to avoid interference is calculated as follows:

$$Maximum\ allowable\ FS = (FS_{T\text{-}DAB} - PR - 18) \quad \text{dB}(\mu\text{V/m})$$

As examples the following Table (non-exhaustive list) contains the protection ratio values used for calculations.

The service information is shown as follows, for example:

Aeronautical safety service 1		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
AL	58.0	10 000

where:

AL : service identifier

58.0 : T-DAB field strength to be protected (dB(μV/m)) for Band III

10 000 : other service transmit antenna height (m).

The columns in the Table relating to the above example have the following meaning:

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–66.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–66.0

where:

Δf: frequency difference (MHz), i.e. interfering other service centre frequency minus centre frequency of interfered-with T-DAB block (in the case of an interfering TV signal the vision carrier frequency has to be taken instead of the centre frequency of the TV channel)

PR : required protection ratio (dB).

Table 4 serves to identify other services than broadcasting:

TABLE 4

Service identifier	Radio Regulations provision No.	Service
AL	1.34	aeronautical mobile (OR)
CA	1.20	fixed
DA	1.34	aeronautical mobile (OR)
DB	1.34	aeronautical mobile (OR)
IA	1.20	fixed
MA	1.26	land mobile
ME	1.34	aeronautical mobile (OR)
MF	1.34	aeronautical mobile (OR)
MG	1.34	aeronautical mobile (OR)
MI	1.28	maritime mobile
MJ	1.28	maritime mobile
MK	1.28	maritime mobile
ML	1.20	fixed
MT	1.20	fixed
MU	1.24	mobile
M1	1.24	mobile
M2	1.24	mobile
RA	1.24	mobile
R1	1.26	land mobile
R3	1.24	mobile
R4	1.24	mobile
XA	1.26	land mobile
XB	1.20	fixed
XE	1.34	aeronautical mobile (OR)
XM	1.26	land mobile
YB	1.26	land mobile
YC	1.34	aeronautical mobile (OR)
YD	1.34	aeronautical mobile (OR)
YE	1.28	maritime mobile
YH	1.26	land mobile
YT	1.34	aeronautical mobile (OR)
YW	1.34	aeronautical mobile (OR)
YX	1.38	broadcasting
YY	1.38	broadcasting
YZ	1.38	broadcasting

Aeronautical safety service 1		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
AL	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–66.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–66.0

Service used in Czech Republic. No information, continuous wave (CW) interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
CA	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Aeronautical safety service 2		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
DA	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–66.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–66.0

Aeronautical safety service (Germany), DB. The centre frequency is 235 MHz and the first channel is at 231 MHz. The values used are the same as those for the ME service		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
DB	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Italian service. No information, CW interference data used (224.25 MHz)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
IA	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Land mobile service (173-174 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MA	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military air-ground-air system, analogue minimum separation distance is 1 km. Frequency range is 230 MHz to just above 240 MHz, but channel frequencies are not identical in all countries. No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
ME	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military air-ground-air system, digital (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MF	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military air-ground-air system, frequency hopping (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MG	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile navy service, analogue (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MI	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile navy service, digital (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MJ	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile navy service, frequency hopping (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MK	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military fixed services (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
ML	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military mobile and fixed (tactical) services. No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MT	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile radio – low power devices S2 data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
MU	58.0	10.0

Δf (MHz)	–2.0	–1.9	–1.8	–1.7	–1.6	–1.5	–1.4	–1.3	–1.2	–1.1	–1.0
PR (dB)	–48.0	–47.9	–47.1	–46.7	–46.4	–46.0	–45.4	–45.1	–43.9	–38.4	–37.5
Δf (MHz)	–0.9	–0.8	–0.8	–0.7	–0.6	–0.5	–0.4	–0.3	–0.2	–0.1	0.0
PR (dB)	–28.9	–12.9	–4.9	–1.0	2.1	3.5	4.3	4.1	4.4	4.1	4.0
Δf (MHz)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0
PR (dB)	4.1	4.4	4.1	4.3	3.5	2.1	–1.0	–4.9	–12.9	–28.9	–37.5
Δf (MHz)	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	
PR (dB)	–38.4	–43.9	–45.1	–45.4	–46.0	–46.4	–46.7	–47.1	–47.9	–48.0	

Mobile services – narrow-band (12.5 kHz) FM system. No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
M1	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile services – narrow-band (12.5 kHz) FM system. No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
M2	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile services – narrow-band (12.5 kHz) FM system. No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
RA	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Medical telemetry in Denmark (223-225 MHz). No interference to T-DAB (10 mW e.r.p.)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
R1	58.0	10.0

Δf (MHz)	–0.8	0.0	0.8								
PR (dB)	–66.0	–66.0	–66.0								

Mobile service – remote control (223-225 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
R3	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.94
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile service – remote control (223-225 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
R4	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Professional mobile ratio (PMR) (5 kHz channel spacing). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
XA	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Finnish alarm system (230-231 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
XB	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military air-ground-air system (aeronautical frequencies). No information		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
XE	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Radio microphones (VHF). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
XM	58.0	10.0

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Video link		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YB	58.0	10.0

Δf (MHz)	–8.0	–7.5	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0
PR (dB)	–42.0	–23.5	–10.0	–3.0	–2.0	–3.0	–24.0	–21.0	–23.0	–31.0	–31.5
Δf (MHz)	–2.5	–2.0	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7
PR (dB)	–30.0	–28.5	–25.0	–19.5	–17.5	–11.0	–7.0	–1.5	–1.5	–4.0	–5.5
Δf (MHz)	0.8	0.9	1.0	2.0	3.0						
PR (dB)	–13.5	–17.0	–20.0	–33.0	–47.5						

Military air-ground-air system, frequency hopping (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YC	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military air-ground-air system, frequency hopping (230-243 MHz). No information, CW interference data used		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YD	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Mobile navy (aircraft) service (230-243 MHz). New type		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YE	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–66.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–66.0

Audio link special		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YH	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–66.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–66.0

Military air-ground-air system, frequency hopping (230-243 MHz). No information, CW interference data used (as YC)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YT	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

Military air-ground-air system, frequency hopping (230-243 MHz). No information, CW interference data used (as YC)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YW	58.0	10 000

Δf (MHz)	–0.9	–0.8	–0.6	–0.4	–0.2	0.0	0.2	0.4	0.6	0.8	0.9
PR (dB)	–60.0	–6.6	2.7	3.2	4.1	6.5	4.1	3.2	2.7	–6.6	–60.0

L/SECAM (SNCF)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YX	58.0	10.0

Δf (MHz)	–8.0	–7.5	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0
PR (dB)	–46.5	–42.5	–15.5	–13.0	–15.0	–26.5	–18.5	–17.0	–18.0	–23.0	–31.5
Δf (MHz)	–2.5	–2.0	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7
PR (dB)	–30.5	–27.5	–24.5	–18.0	–16.5	–8.0	–5.0	–1.5	1.5	–2.0	–3.5
Δf (MHz)	0.8	0.9	1.0	2.0	3.0						
PR (dB)	–12.5	–18.5	–19.0	–31.0	–46.8						

New type DGPT		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YY	58.0	10.0

Δf (MHz)	–2.0	–1.5	–1.0	–0.9	–0.8	0.0	0.8	0.9	1.0	1.5	2.0
PR (dB)	–60.0	–46.5	–13.3	–3.8	17.0	17.0	17.0	–3.8	–13.3	–46.5	–60.0

B/PAL (DGPT)		
Service identifier	**Field strength to be protected for Band III (dB(μV/m))**	**Transmit antenna height (m)**
YZ	58.0	10.0

Δf (MHz)	–7.0	–6.5	–6.0	–5.5	–5.0	–4.5	–4.0	–3.5	–3.0	–2.5	–2.0
PR (dB)	–47.0	–18.0	–5.0	–3.0	–5.0	–20.0	–22.0	–31.5	–31.5	–29.0	–26.5
Δf (MHz)	–1.5	–1.0	–0.9	–0.8	–0.7	–0.6	0.0	0.6	0.7	0.8	0.9
PR (dB)	–23.0	–18.5	–16.0	–9.0	–5.0	–3.0	–0.5	–3.0	–4.0	–12.0	–16.0
Δf (MHz)	1.0	2.0									
PR (dB)	–19.5	–45.3									

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

Bibliography

ETSI Specification EN 300 401 – Radio broadcasting systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers.