RECOMMENDATION ITU-R BT.1368-1

**PLANNING CRITERIA FOR DIGITAL TERRESTRIAL TELEVISION SERVICES IN THE VHF/UHF BANDS**

(Question ITU-R 121/11)

(1998)

The ITU Radiocommunication Assembly,

*considering*

a) that systems are being developed for the transmission of digital terrestrial television services in the VHF/UHF bands;

b) that the VHF/UHF television bands are already occupied by analogue television services;

c) that the analogue television services will remain in use for a considerable period of time;

d) that the availability of consistent sets of planning criteria agreed by administrations will facilitate the introduction of digital terrestrial television services,

*recommends*

**1** that the relevant protection ratios given in Annexes 1, 2, 3 and 7, the relevant minimum field strength values given in Annex 4 and the additional information given in Annexes 5 and 6 be used as the basis for frequency planning for digital terrestrial television services.

## Introduction

This Recommendation contains the following seven Annexes:

Annex 1 – Protection ratios for wanted digital terrestrial television systems

Annex 2 – Protection ratios for wanted analogue terrestrial television systems interfered with by unwanted digital terrestrial television systems

Annex 3 – Protection ratios for sound signals of wanted analogue terrestrial television systems interfered with by unwanted digital terrestrial television systems

Annex 4 – Minimum field strengths for digital terrestrial television systems

Annex 5 – Other planning factors

Annex 6 – Subjective comparison method for protection ratio tests for wanted analogue terrestrial television systems

Annex 7 – Protection ratios for wanted terrestrial digital audio broadcasting interfered with by unwanted digital terrestrial television systems

## General

The radio frequency (RF) protection ratio is the minimum value of wanted-to-unwanted signal ratio, usually expressed in decibels at the receiver input.

The reference level of the digital signal is defined as the r.m.s. value of the emitted signal power within the channel bandwidth. It should be preferably measured by thermal power meter.

The reference level of the analogue vision-modulated signal is defined as the r.m.s. value of the vision carrier at peaks of the modulation envelope.

# 1 Wanted digital terrestrial television systems

The protection ratios for digital terrestrial television systems apply to both continuous and tropospheric interference. The protection ratios refer to the centre frequency of the wanted digital terrestrial television system.

Because a digital television receiver needs to operate successfully in the presence of high level analogue signals on nearby channels, a high degree of receiver front-end linearity is required.

The protection ratios for digital terrestrial television systems as the interfering system are those for the case where the wanted and unwanted signals are not synchronized or do not have a common programme source. Results relevant to single frequency networks (SFN) are yet to be developed.

For the digital terrestrial television system ATSC the protection ratios are measured for a $BER = 3 \times 10^{-6}$ at the input of the MPEG-2 demultiplexer.

For digital terrestrial television system DVB-T the protection ratios are measured between the inner and outer codes, before Reed Solomon decoding, for a $BER = 2 \times 10^{-4}$; this corresponds to a $BER < 10^{-11}$ at the input of the MPEG-2 demultiplexer. For domestic receivers it may not be possible to measure the BER for some Reed-Solomon decoding. The BER for such cases is under study.

To reduce the number of measurements and tables, it is proposed that protection ratio measurements for DVB-T systems should preferably be made with the following three modes shown in Table 1. Protection ratio values for the different required operational modes for fixed, portable or mobile reception can be calculated from the given measured values. A formula for calculation is still under study.

TABLE 1

**Proposed preferable DVB-T mode types for measurements on protection ratios**

| Modulation | Code rate | C/N[1)] | Bit rate[2)] |
|---|---|---|---|
| QPSK | 2/3 | 8 dB | ≈7 Mbit/s |
| 16-QAM | 2/3 | 13 dB | ≈12 Mbit/s |
| 64-QAM | 2/3 | 17 dB | ≈20 Mbit/s |

1) $BER < 10^{-11}$ at the input of MPEG-2 demultiplexer for a Gaussian channel with no allowance for implementation margin; typical implementation margins of 2 dB have been measured.

2) For a guard interval of 1/4.

# 2 Wanted analogue terrestrial television systems

Measurements of protection ratios for the vision signal of a wanted analogue terrestrial television system should preferably be made with the subjective comparison method with a sine-wave reference interferer described in Annex 6.

The values of protection ratio quoted apply to interference produced by a single source. Except where otherwise stated, the ratios apply to tropospheric, *T*, interference and correspond closely to a slightly annoying impairment condition. They are considered to be acceptable only if the interference occurs for a small percentage of the time, not precisely defined but generally considered to be between 1% and 10%. For substantially non-fading unwanted signals, it is necessary to provide a higher degree of protection and ratios appropriate to continuous, *C*, interference should be used. Values applicable to the limit of perceptibility, *LP*, are given for information only.

Significantly strong wanted input signals can require higher protection ratio values because of non-linear effects in the receiver.

For 625-line systems, the reference impairment levels are those which correspond to co-channel protection ratios of 30 dB and 40 dB, when third line offset is used, see Recommendation ITU-R BT.655. These conditions approximate to impairment grades 3 (slightly annoying) and 4 (perceptible but not annoying) and apply to tropospheric, *T*, and continuous, *C*, interference, respectively.

ANNEX 1

## Protection ratios for wanted digital terrestrial television systems

The tables in Annex 1 show protection ratios for different wanted digital terrestrial television systems interfered with by digital terrestrial television systems, by analogue terrestrial television systems, by single a single CW and FM carrier and by T-DAB signals, respectively. All protection ratio values in Annex 1 are based upon measurements made with non-consumer receivers.

## 1 Protection of digital terrestrial television interfered with by digital terrestrial television

TABLE 2

**Co-channel protection ratios (dB) for ATSC interfered with by ATSC**

| Wanted signal | Unwanted signal |
|---|---|
| | ATSC 6 MHz |
| ATSC 6 MHz | 15<br>19* |

* Based on equally partitioned noise and interference.

TABLE 3

**Protection ratios (dB) for ATSC interfered with by ATSC in lower adjacent channel (N-1)**

| Wanted signal | Unwanted signal |
|---|---|
| | ATSC 6 MHz |
| ATSC 6 MHz | – 42[1)]<br>–27[2)] |

The protection ratios are given in dB and apply to both continuous and tropospheric interference.

1) Measured using a digital terrestrial television system ATSC interferer with negligible out-of-band emissions.

2) Calculated using a co-channel protection ratio of 19.5 dB and a digital terrestrial television system ATSC interferer with out-of-band emissions measured in a 500 kHz bandwidth relative to the average ATSC transmitted power attenuated by:

– $(46 + 7.5\Delta f)$ dB for $0 \leq \Delta f < 3$ MHz

– $(61 + 2.5\Delta f)$ dB for 3 MHz $\leq \Delta f < 6$ MHz

– 76 dB for $\Delta f \geq 6$ MHz

TABLE 4

**Protection ratios (dB) for ATSC interfered with by ATSC in upper channel (N+1)**

| Wanted signal | Unwanted signal |
|---|---|
| | ATSC 6 MHz |
| ATSC 6 MHz | – 43[1)]<br>–27[2)] |

The protection ratios are given in dB and apply to both continuous and tropospheric interference.

1) Measured using a digital terrestrial television systems ATSC interferer with negligible out-of-band emissions.

2) Calculated using co-channel protection ratio of 19.5 dB and a digital terrestrial television systems ATSC interferer with out-of-band emissions measured in a 500 kHz bandwidth relative to the average digital terrestrial television systems transmitted power attenuated by:

– $(46 + 7.5\Delta f)$ dB for $0 \leq \Delta f < 3$ MHz

– $(61 + 2.5\Delta f)$ dB for 3 MHz $\leq \Delta f < 6$ MHz

– 76 dB for $\Delta f \geq 6$ MHz

TABLE 5

**Protection ratio (dB) for ATSC 6 MHz interfered with by ATSC 6 MHz in the image channel**

| Wanted signal | Unwanted signal |
|---|---|
| | ATSC |
| ATSC | – 63 |

TABLE 6

**Protection ratio (dB) for ATSC 6 MHz interfered with by other ATSC 6 MHz out-of-band channels**

| Wanted signal | Unwanted signal | Unwanted channels | Protection ratio |
|---|---|---|---|
| ATSC | ATSC | N±2 to N±8 | –58 |

TABLE 7

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

| Modulation | Code rate | Gaussian channel | Rice channel | Rayleigh channel |
|---|---|---|---|---|
| QPSK | 1/2 | 5 | 7 | 8 |
| QPSK | 2/3 | | | |
| 16 QAM | 2/3 | | | |
| 16 QAM | 3/4 | 14 | 16 | 20 |
| 64 QAM | 2/3 | 19 | 20 | 22 |

Protection ratios are given for three types of propagation channels (i.e. Gaussian, Ricean and Rayleigh). For fixed and portable reception, the values relevant to the Ricean and Rayleigh channels respectively should be adopted.

The same protection ratios should be applied for DVB-T systems with 6, 7 and 8 MHz bandwidth.

Protection ratios are rounded to the nearest integer.

For adjacent and image channel interference a protection ratio of –30 dB is assumed to be appropriate. Since this assumption is based on only one measurement further studies are required.

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

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

PR(CCI) is the co-channel protection 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 = –30 dB should be used when the above formula gives PR < –30 dB.

## 2 Protection of digital terrestrial television interfered with by analogue terrestrial television

### 2.1 Protection from co-channel interference

TABLE 8

**Co-channel protection ratios (dB) for ATSC interfered with by analogue television**

| Wanted signal | Unwanted signal | Analogue TV system including sound carriers |
|---|---|---|
| | M/NTSC | PAL B |
| ATSC 6 MHz | 2<br>7*) | 9 |

*) Using a comb filter in the digital television receiver and C/N of 19 dB.

TABLE 9

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

| | Protection Ratio | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Constellation | QPSK | | | | | 16QAM | | | | | 64QAM | | | | |
| Code Rate | ½ | 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 |
| PAL/SECAM* | –12 | – 8 | – 4 | 3 | 9 | –8 | –3 | 3 | 9 | 16 | –3 | 3 | 10 | 17 | 24 |

* With teletext and sound carriers.

NOTES:

The PAL/SECAM values are valid for the following sound carrier modes:

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 –13 dB and –20 dB level.

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

In all tables the so-called non-controlled 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. Further studies of using controlled offset for DVB-T are necessary.

Protection ratios for DVB-T 6 MHz are missing due to lack of measurement results.

## 2.2 Protection from lower adjacent channel (N-1) interference

TABLE 10

**Protection ratios (dB) for lower adjacent channel (N-1) interference for ATSC interfered with by an analogue television signal including sound**

| Wanted signal | Unwanted signal<br>Analogue TV system including sound carriers |
|---|---|
| | M/NTSC |
| ATSC 6 MHz | – 48 |

TABLE 11

**Protection ratios (dB) for lower adjacent channel (N-1) interference for DVB-T 7 and 8 MHz interfered with by analogue television signals including sound**

| Wanted signal | | Unwanted signal | | | | | |
|---|---|---|---|---|---|---|---|
| Constellation | Code rate | PAL B | PAL G,B1 | PAL I | PAL D,K | SECAM L | SECAM D,K |
| QPSK | 2/3 | – 44 | | | | | |
| 16QAM | 1/2 | | | – 43 | | | |
| 16QAM | 2/3 | – 42 | | | | | |
| 64QAM | 1/2 | | | –38 | | | |
| 64QAM | 2/3 | –35 | | –34 | | | |

## 2.3 Protection from upper adjacent channel (N+1) interference

TABLE 12

**Protection ratios (dB) for upper adjacent channel (N+1) interference for ATSC interfered with by an analogue television signal**

| Wanted signal | Unwanted signal<br>Analogue TV system including sound carriers |
|---|---|
| | M/NTSC |
| ATSC 6 MHz | – 49 |

TABLE 13

**Protection ratios (dB) for upper adjacent channel (N+1) interference for DVB-T 7 and 8 MHz interfered with by an analogue television signal**

| Wanted signal | | Unwanted signal |
|---|---|---|
| Constellation | Code rate | PAL/SECAM |
| QPSK | 2/3 | – 47 |
| 16QAM | 2/3 | – 43 |
| 64QAM | 2/3 | –38 |

## 2.4 Protection from image channel interference

TABLE 14

**Protection ratios (dB) for ATSC 6 MHz interfered with by an analogue television signal (including sound) in the image channel**

| Wanted signal | Unwanted signal |
|---|---|
| | NTSC M |
| ATSC | –58 |

TABLE 15

**Protection ratios (dB) for DVB-T 7 and 8 MHz interfered with by an analogue television signal (including sound) in the image channel**

| Wanted signal | | Unwanted signal | | | | | |
|---|---|---|---|---|---|---|---|
| | Code rate | PAL B | PAL G,B1 | PAL I | PAL D,K | SECAM L | SECAM D,K |
| QPSK | 2/3 | | | –58* | | | |
| 16QAM | 1/2 | | | –58 | | | |
| 16QAM | 2/3 | | | –48* | | | |
| 64QAM | 1/2 | | | –50 | | | |
| 64QAM | 2/3 | | | –46 | | | |

* Calculated values.

NOTE – The protection ratios in this table will depend on the intermediate frequency of the receiver.

## 2.5 Protection from overlapping channel interference

TABLE 16

**Protection ratios (dB) for DVB-T 8 MHz interfered with by an overlapping PAL B signal including sound**

| DVB-T 8 MHz 64 QAM Code 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 | 3 | 3 | 3 | 2 | –1 | –29 | –36 |

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

TABLE 17

**Protection ratios (dB) for DVB-T 7 MHz interfered with by an overlapping PAL B1, D signal including sound**

| DVB-T 7 MHz 64 QAM Code rate 2/3 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Δf(MHz) for PAL 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 PAL 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 | 3 | 3 | 3 | 2 | –1 | –29 | –36 |

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

## 2.6 Protection from other channel interference

TABLE 18

**Protection ratios (dB) for ATSC 6 MHz interfered with by M/NTSC at other out-of-band channels**

| Wanted signal | Unwanted signal | Unwanted channels | Protection ratio |
|---|---|---|---|
| ATSC | M/NTSC | N±2 to N±8 | –58 |

## 2.7 Protection from CW and FM signals

TABLE 19

**Co-channel protection ratios (dB) for DVB-T 7 and 8 MHz 64QAM Code rate 2/3 interfered with by CW or a FM carrier**

| 64 QAM Code rate 2/3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Δf(MHz) for DVB-T 7 MHz | –10.5 | –4 | –3.4 | 0 | 3.4 | 4 | 10.5 |
| Δf(MHz) for DVB-T 8 MHz | –12 | –4.5 | –3.9 | 0 | 3.9 | 4.5 | 12 |
| PR | –38 | –33 | –3 | –3 | –3 | –33 | –38 |

The given protection ratio tables can be used for interfering signals with narrow bandwidth e.g. analogue sound carriers or non-broadcast services.

TABLE 20

**Co-channel protection ratios (dB) for DVB-T 7 and 8 MHz 16QAM Code rate 1/2 interfered with by CW or a FM carrier**

| 16 QAM Code rate 1/2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Δf(MHz) for DVB-T 7 MHz | –10.5 | – 4 | –3.4 | 0 | 3.4 | 4 | 10.5 |
| Δf(MHz) for DVB-T 8 MHz | –12 | – 4.5 | –3.9 | 0 | 3.9 | 4.5 | 12 |
| PR | – 46 | – 40 | – 6 | – 6 | – 6 | – 40 | – 46 |

The given protection ratio tables can be used for interfering signals with narrow bandwidth e.g. analogue sound carriers or non-broadcast services.

## 2.8 Protection from T-DAB signals

TABLE 21

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

| 64 QAM Code rate 2/3<br>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 22

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

| 64 QAM Code rate 2/3<br>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 |

ANNEX 2

# Protection ratios for wanted analogue terrestrial television systems interfered with by unwanted digital terrestrial television systems

The tables in Annex 2 show protection ratios for different wanted 525– and 625-line analogue television systems interfered with by digital terrestrial television systems.

## Protection ratio for 525-line television systems

## 1 Protection for vision and sound signals interfered with by digital television

### 1.1 Protection for vision signals interfered with by digital television (ATSC)

In this section the protection ratios for an analogue wanted signal interfered by an unwanted digital signal apply only on the interference to vision and colour carrier.

TABLE 23

**Protection ratios for a wanted analogue vision signal (NTSC, 6 MHz) interfered with by unwanted ATSC**

| Unwanted digital channel | Tropospheric interference grade 3 | Continuous interference grade 4 |
|---|---|---|
| N-1 (lower) | –16 | |
| N (co-channel) | 34 | |
| N+1 (upper) | –17 | |
| N+14 (image) | –33 | |
| N+15 (image) | –31 | |
| N±2 | –24 | |
| N±3 | –30 | |
| N±4 | –25 | |
| N±7 | –34 | |
| N±8 | –32 | |

## Protection ratios for 625-line television systems

## 2 Protection of wanted vision signals interfered with by digital terrestrial television

In this section the protection ratios for an analogue wanted signal interfered by an unwanted digital signal relate only to the interference to the vision signal.

The protection ratio values given are related to an out-of-channel spectrum attenuation of the unwanted DVB-T transmitter of 40 dB.

### 2.1 Protection from co-channel interference

TABLE 24

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted DVB-T 8 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B, D, G, H, K/PAL | 34 | 40 | |
| I/PAL | 37 | 41 | 45 |
| B, D, K, L/SECAM* | 34 to 37 | 41 | |

* Provisional values still under study.

TABLE 25

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted DVB-T 7 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B/PAL | 35 | 41 | |
| B/SECAM* | 34 to 37 | 41 | |

* Provisional values still under study.

TABLE 26

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted ATSC 6 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B/PAL | 38 | 45 | 51 |

## 2.2 Protection from lower adjacent channel interference

TABLE 27

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted lower adjacent DVB-T 7 MHz and 8 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B, D, G, H, I, K/PAL | –9 | –5 | 0 |
| B, D, K, L/SECAM | –9 | –5 | |

TABLE 28

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted lower adjacent ATSC 6 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B/PAL | –7 | –1 | 5 |

## 2.3 Protection from upper adjacent channel interference

TABLE 29

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted upper adjacent DVB-T 7 MHz and 8 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B, D, G, H, I, K/PAL | –9 | –5 | |
| L/SECAM* | –1 | –1 | |
| B, D, K/SECAM | –9 | –5 | |

* Provisional values still under study.

TABLE 30

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted upper adjacent ATSC 6 MHz system**

| Wanted analogue system | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|
| B/PAL | –7 | 0 | 5 |

## 2.4 Protection from image channel interference

TABLE 31

**Protection ratios for a wanted analogue vision signals interfered with by an unwanted image channel DVB-T 8 MHz systems**

| Wanted analogue system | Unwanted DVB-T channel | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|---|
| G/PAL | N+9 | –19 | –15 | |
| I/PAL | N+9 | | | |
| L/SECAM* | | –25 | –22 | |
| D, K/SECAM* | N+8 | –16 | –11 | |
| D, K/SECAM* | N+9 | –16 | –11 | |
| D, K/PAL | N+8 | | | |
| D, K/PAL | N+9 | | | |

* Provisional values still under study.

TABLE 32

**Protection ratios for a wanted analogue vision signal interfered with by an unwanted image DVB-T 7 MHz system**

| Wanted analogue system | Unwanted DVB-T channel | Tropospheric interference | Continuous interference | Interference grade 4.5 |
|---|---|---|---|---|
| B/PAL | N+10 | –22 | –18 | |
| B/PAL | N+11 | –21 | –18 | |
| B/SECAM | | | | |

## 2.5 Protection from overlapping interference

TABLE 33

**Protection ratios for analogue B, D, G, H, K/PAL vision signals*) interfered with by an unwanted overlapping DVB-T 7 MHz system**

| Frequency of the centre of unwanted DVB-T minus vision carrier frequency of wanted analogue television signal (MHz) | Protection ratio in dB | |
|---|---|---|
| | Tropospheric interference | Continuous interference |
| –7.75 | –16 | –11 |
| (N-1) – 4.75 | – 9 | –5 |
| – 4.25 | – 4 | 3 |
| –3.75 | 13 | 20 |
| –3.25 | 23 | 30 |
| –2.75 | 30 | 37 |
| –1.75 | 34 | 41 |
| –0.75 | 35 | 41 |
| (N) 2.25 | 35 | 41 |
| 4.25 | 35 | 41 |
| 5.25 | 31 | 38 |
| 6.25 | 26 | 33 |
| 7.25 | 21 | 30 |
| 8.25 | 4 | 9 |
| (N+1) 9.25 | – 9 | –5 |
| 12.25 | – 9 | –5 |

* For all SECAM systems similar values are expected. The values are still under study.

TABLE 34

**Protection ratios for analogue B, D, G, H, K/PAL vision signals*) interfered with by an unwanted overlapping DVB-T 8 MHz system**

| Frequency of the centre of unwanted DVB-T minus vision carrier frequency of wanted analogue television signal (MHz) | Protection ratio in dB | |
|---|---|---|
| | Tropospheric interference** | Continuous interference** |
| – 8.25 | –16 | –11 |
| (N-1) –5.25 | – 9 | –5 |
| – 4.75 | –5 | 2 |
| – 4.25 | 12 | 19 |
| –3.75 | 22 | 29 |
| –3.25 | 29 | 36 |
| –2.25 | 33 | 40 |
| –1.25 | 34 | 40 |
| (N) 2.75 | 34 | 40 |
| 4.75 | 34 | 40 |
| 5.75 | 30 | 37 |
| 6.75 | 25 | 32 |
| 7.75 | 20 | 29 |
| 8.75 | 3 | 8 |
| (N+1) 9.75 | – 9 | –5 |
| 12.75 | – 9 | –5 |

* For all SECAM systems similar values are expected. The values are still under study.

** The values for tropospheric and continuous interference have been arrived at from Table 33 by calculation.

ANNEX 3

# Protection ratios for sound signals of wanted analogue terrestrial television systems interfered with by unwanted digital terrestrial television systems

The tables in Annex 3 show protection ratios for wanted FM, AM and NICAM television sound carriers interfered with by unwanted digital terrestrial television systems.

All protection ratios in this section refer to the level of the wanted television sound carriers. The reference level of the sound carriers is the r.m.s. value of the unmodulated carrier.

The sound quality for tropospheric interference corresponds to grade 3, for continuous interference to grade 4.

The reference signal-to-noise ratios for AM and FM sound signals are:

– 40 dB (approximates to impairment grade 3) – tropospheric case;

– 48 dB (approximates to impairment grade 4) – continuous case

The reference signal-to-noise ratios are measured as S/N peak-to-peak weighted, given in Recommendation ITU-R BS.468 and Recommendation ITU-R BS.412.

The reference FM sound signal level corresponds to a maximum frequency deviation of ±50 kHz.

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

– BER = $10^{-4}$ (approximates to impairment grade 3) – tropospheric case;

– BER = $10^{-5}$ (approximates to impairment grade 4) – continuous case.

In the case of a two-sound carrier transmission, each of the two-sound signals must be considered separately. Multiplex modulated sound signals may require higher protection.

## 1 Protection for NTSC sound signals (BTSC and SAP) interfered with by digital television (ATSC)

In the case of an unwanted upper adjacent digital channel N+1 the audio signals degrade before the vision signal. The protection ratio value for the interference into the BTSC and SAP sound signals was measured with –12 dB. (Vision protection ratio for N+1 is –17 dB.) The –12 dB sound protection ratio figure is related to the wanted NTSC vision carrier level.

## 2 Protection for FM, AM and NICAM sound signals of the analogue television systems interfered with by digital terrestrial television system

TABLE 35

**Co-channel protection ratios for a wanted sound signal interfered with by digital terrestrial television**

| Protection ratio (dB) related to the wanted sound carrier | | Unwanted signal | |
|---|---|---|---|
| Wanted sound signal | | DVB-T 7 MHz | DVB-T 8 MHz |
| FM | Tropospheric case | 6 | 5 |
| | Continuous case | 16 | 15 |
| AM | Tropospheric case | | |
| | Continuous case | | |
| NICAM PAL B/G | Tropospheric case | 5 | 4 |
| | Continuous case | 6 | 5 |
| NICAM System I | Tropospheric case | | |
| | Continuous case | | |

TABLE 36

**Protection ratios for a wanted FM sound signal interfered with by an overlapping DVB-T 7 MHz signal**

| Protection ratio (dB) related to the wanted sound carrier | Frequency of the 3 dB edge of DVB-T minus sound carrier frequency | –500 kHz | –250 kHz | –50 kHz | 0.0 kHz | 50 kHz | 250 kHz | 500 kHz |
|---|---|---|---|---|---|---|---|---|
| Tropospheric case | Upper edge | 0 | 0 | 0 | 5 | 5 | 6 | 6 |
| Continuous case | Upper edge | 9 | 9 | 9 | 14 | 14 | 15 | 16 |
| Tropospheric case | Lower edge | 5 | 5 | 4 | 3 | –9 | –22 | –32 |
| Continuous case | Lower edge | 15 | 15 | 14 | 12 | –6 | –16 | –27 |

NOTE 1 – The protection ratio figures are related to an out-of-channel spectrum attenuation of 40 dB.

NOTE 2 – The protection ratio figures for other television systems in use have to be added.

NOTE 3 – This table is still under study.

ANNEX 4

# Minimum field strengths for terrestrial digital television

Three methods are given for the calculation of minimum field strength values. Each of these methods may be used to give the identical minimum field strength values for a given set of parameters.

TABLE 37

**Derivation by the “voltage method”**

System: DVB-T 8 MHz

| Frequency (MHz) | 65 | | | 200 | | | 550 | | | 700 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| system variant<br>guard interval ¼ | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 |
| noise bandwidth, B (MHz) | | | | | | | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| receiver noise figure, F (dB) | | | | | | | 5 | 5 | 5 | 5 | 5 | 5 |
| receiver noise voltage, $U_n$[1] (dB (µV)) | | | | | | | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 | 8.4 |
| receiver carrier/noise ratio[2] (C/N) (dB) | | | | | | | | | | | | |
| urban noise (dB) | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| minimum receiver input voltage, $U_{Min}$ (dB (µV))[1] | | | | | | | | | | | | |
| conversion factor[1] k (dB) | | | | | | | 20.5 | 20.5 | | 24.5 | 24.5 | |
| feeder loss, $A_f$ (dB) | | | | | | | 3 | 3 | | 5 | 5 | |
| antenna gain, G (dB) | | | | | | | 10 | 10 | | 12 | 12 | |
| minimum field strength for fixed reception, $E_{min}$ (dB (µV/m))[1] | | | | | | | | | | | | |

[1] Formula see Appendix 1.

[2] For noise bandwidth noted above.

TABLE 38

**Derivation by the "power method"**

| Frequency (MHz) | 65 | | | 200 | | | 500 | | | 700 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| system variant<br>guard interval 1/4 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 | QPSK 2/3 | 16-QAM 2/3 | 64-QAM 2/3 |
| equivalent noise bandwidth, B (MHz) | | | | | | | | | | | | |
| receiver noise figure, F (dB) | | | | | | | | | | | | |
| receiver noise power $P_n$[1] (dBW) | | | | | | | | | | | | |
| receiver carrier/noise ratio[2] (C/N) (dB) | | | | | | | | | | | | |
| urban noise (dB) | | | | | | | | | | | | |
| wavelength (m) | | | | | | | | | | | | |
| feeder loss (dB) | | | | | | | | | | | | |
| antenna gain G (dB) | | | | | | | | | | | | |
| effective antenna aperture (dB) [1] | | | | | | | | | | | | |
| power flux-density pfd[1] (dBW) | | | | | | | | | | | | |
| conversion pfd/ field strength (dB) | | | | | | | | | | | | |
| minimum field strength (dB (μV/m)) [1] | | | | | | | | | | | | |

[1] Formula see Appendix 1.

2) For noise bandwidth noted above.

TABLE 39

**Derivation by the "Figure of merit method"**

System: ATSC 6 MHz[1)]

| Planning parameter | Low VHF 54 – 88 MHz | High VHF 174 – 216 MHz | UHF 470 – 806 MHz |
|---|---|---|---|
| Frequency (MHz) | 69 | 194 | 615 |
| C/N (dB) | 19.5 | 19.5 | 19.5 |
| K (dB) | –228.6 | –228.6 | –228.6 |
| B (dB) (6 MHz) | 67.78 | 67.78 | 67.78 |
| $G_l(1m^2)$ (dB) | –1.77 | 7.25 | 17.23 |
| $G_{dipole\ (dB)}$ | 6 | 8 | 10 |
| $G_{isotropic\ (dB)}$ | 8.15 | 10.15 | 12.15 |
| Line loss (dB)<br>$\alpha$ (numeric) | 1.05<br>0.786 | 1.81<br>0.659 | 3.29<br>0.468 |
| Balun 300/75 loss (dB)<br>$\alpha_{balun}$ (numeric) | 0.5<br>0.891 | 0.5<br>0.891 | 0.5<br>0.891 |
| Receiver noise figure (dB) | 5 | 5 | 10 |
| $T_{rx}$ | 627.1 | 627.1 | 2610 |
| $T_{line}$ | 62.1 | 98.9 | 154.3 |
| LNA noise figure (dB) | 5 | 5 | 5 |
| LNA gain (dB) | 20 | 20 | 20 |
| $T_{LNA}$ | 627.1 | 627.1 | 627.1 |
| $T_{balun}$ | 31.6 | 31.6 | 31.6 |
| $T_a$ | 9972.1 | 569.1 | Neg |
| $\alpha_{balun} T_a$ | 8885.1 | 507.1 | Neg |
| $T_{line}/\alpha G$ | 0.79 | 1.5 | 3.3 |
| $T_{rx}/\alpha G$ | 7.98 | 9.52 | 55.8 |
| $T_e$ | 9552.6 | 1176.8 | 717.8 |
| $10\log(T_e)$ | 39.8 | 30.71 | 28.56 |
| $G_{A\ (dB)}$ | 7.65 | 9.65 | 11.65 |
| $E_{reqd\ (dB\mu V/m)}$[2)] | 35 | 33 | 39 |

1) The values in the table were calculated assuming C/N with typical multipath reception impairment and equal partitioning for noise and interference. The receiving system model is a typical receiving installation located near the edge of coverage and consists of an externally mounted antenna, a low noise amplifier (LNA) mounted at the antenna, an interconnecting downlead cable and an ATSC receiver.

2) Formula see Appendix 4.

APPENDIX 1

(to Annex 4)

| | Formulae | in dB |
|---|---|---|
| Derivation by the "voltage method" | $P = \frac{U^2}{R}$ | |
| Thermal noise power | kTB | 10 log (kTB) |
| Receiver noise input power | n kTB | 10 log (kTB) + F |
| Thermal noise voltage | $U_T = \sqrt{kTBR}$ | |
| Receiver noise input voltage | $U_N = \sqrt{nkTBR}$ | 10 log (kTB) + F + 10 log (R) |
| Minimum receiver input voltage | $U_{\min} = U_N \sqrt{C / N}$ | $U_N + \frac{C}{N}$ |

Relationship between voltage and field strength

$$U = \sqrt{\mathrm{PrR}} = \sqrt{\phi \mathrm{AR}} = \sqrt{\frac{\mathrm{E}^2}{120\pi} 1.64\mathrm{go} \frac{\lambda^2}{4\pi} \mathrm{R}}$$

| | | |
|---|---|---|
| Therefore | $U = E\sqrt{\frac{\lambda^2}{480\pi^2} R\, 1.64\, go}$ | |
| Conversion factor | $K = \frac{E}{U} = \sqrt{\frac{480\pi^2}{1.64 go \lambda^2 R}}$ | $K[dB] = 10 \log 480\pi^2$ $- 20 \log \lambda - 10 \log R - 10 \log 1.64$ $- G_D + L$ |
| Conversion factor | $Ko = \frac{E}{U} = \sqrt{\frac{4\pi^2}{go\lambda^2}}$ | $Ko[dB] = 20 \log (2\pi / \lambda)$ $- G_D + L$ |
| | | $E_{\min} = U_{\min} + Ko$ |

(with R = 73 Ohms)

Minimum field strength

APPENDIX 2

(to Annex 4)

| | Formulae | in dB |
|---|---|---|
| Derivation by the "power method" | | |
| Thermal noise | kTB | 10 log (kTB) |
| Receiver noise input power | $P_N$ = n kTB | 10 log (kTB) + F |
| Minimum receiver input power | $P_r = P_N \frac{C}{N}$ | $P_r = P_N + \frac{C}{N}$ |

| | | |
|---|---|---|
| Relationship between power flux-density ($\phi$) and power | $P_r = \phi A$ | $P_r = \phi + A$ |
| | $\phi = \dfrac{P_r}{A}$ | $\phi = P_r - A$ |
| Relationship between power flux-density and field strength | $E = \sqrt{120\,\pi\phi}$ | $E\ (dBV / m) = \phi + 10 \log 120\pi$ $E\ (dB\mu V / m) = \phi + 145.76$ |

APPENDIX 3
(to Annex 4)

Data

| | |
|---|---|
| k | Boltzman constant = $1.38 \times 10^{-23}$ |
| $T_O$: | 290° K |
| F: | receiver noise figure (dB) |
| n: | receiver noise figure (factor) |
| B: | equivalent noise bandwidth (Hz) |
| C/N: | radio-frequency signal/noise ratio (dB) |
| f: | frequency (Hz) |
| $G_D$: | antenna gain related to half-wave dipole (dB) |
| L: | cable loss (dB) |
| $\phi$: | power flux-density |
| go: | gain of receiving antenna system related to half-wave dipole (factor) |
| A: | effective antenna aperture |

Formulae used

| | |
|---|---|
| thermal noise: | $kT_O\ B$ |
| receiver noise temperature: | $Tr = T_O\ (10^{F/10} - 1)$ |
| go: | $10^{\ (G_D - L)/10}$ |
| n: | $10^{F/10}$ |
| A: | $\dfrac{1.64 go \lambda^2}{4\pi}$ |
| $\phi$: | $\dfrac{E^2}{120\,\pi}$ |

APPENDIX 4

(to Annex 4)

# Derivation by the "Figure of merit method"

## Required field strength

$E_{RX}$ (dBV/m) $= \Phi(\text{dBW/m}^2) + 10\log(120\pi)$

C/N $= \Phi - G_{1m2} + G_A/T_e - k - B_{rf}$

$E_{RX}$ (dBμV/m) $= \Phi(\text{dBW/m}^2) + 25.8$ (dB) $+ 120$ (dB)

$= 145.8 + C/N + G_{1m}{}^2 - G_A/T_e + 10\log(k) + 10\log(B_{rf})$

$E_{RX}$ required field strength at the receive system antenna

$\Phi$ power flux-density at the receive system antenna

C/N carrier-to-noise ratio

$G_{1m2}$ gain of 1 metre squared

$G_A/T_e$ figure of merit of the receive system

k Boltzmann's constant

$B_{rf}$ system equivalent noise bandwidth

**Receive system figure of merit**

(for receiving system model with LNA)

$G_A / T_e = (G - L) / (\alpha_{balun}T_a + T_{balun} + T_{LNA} + T_{line}/\alpha_{line}G_{LNA} + T_{rx}/\alpha_{line}G_{LNA})$

**Receiver noise temperature**

$T_{rx} = (10^{NF/10} - 1) \times 290°$

**LNA noise temperature**

$T_{LNA} = (10^{NF/10} - 1) \times 290°$

**Transmission line noise temperature**

$T_{line} = (1 - \alpha_{line}) \times 290°$

**Balun noise temperature**

$T_{balun} = (1 - \alpha_{balun}) \times 290°$

**Antenna noise temperature**

$T_a = 10^{(6.63 - 2.77(\log(f)))} \times 290°$ (for dipole antenna)

**Antenna noise temperature (referred to LNA input)**

$\alpha T_a = T_a(\alpha_{balun})$

**System noise temperature**

$T_e = (\alpha_{balun}T_a + T_{balun} + T_{LNA} + T_{line}/\alpha_{line}G_{LNA} + T_{rx}/\alpha_{line}G_{LNA})$

$T_e$ (dBK) $= 10\log(\alpha_{balun}T_a + T_{balun} + T_{LNA} + T_{line}/\alpha_{line}G_{LNA} + T_{rx}/\alpha_{line}G_{LNA})$

or $= 10\log(T_{balun} + T_{LNA} + T_{line}/\alpha_{line}G_{LNA} + T_{rx}/\alpha_{line}G_{LNA}) + N_{ext}$

when $T_a$ is not known

**Gain of 1 metre squared**

$G_{1m^2} = 10\log(4\pi/\lambda^2)$

**Data**

| | |
|---|---|
| G | Antenna gain (isotropic) (dB) |
| L | Transmission line loss (dB) |
| $\alpha_{line}$ | Transmission line loss (numeric ratio) |
| $T_a$ | Antenna noise temperature (°K) |
| $T_{rx}$ | Receiver noise temperature (°K) |
| nf | Noise factor (numeric ratio) |
| NF | Noise figure (dB) |
| $T_o$ | Reference temperature = 290 °K |
| $\lambda$ | Wavelength of frequency of operation |
| $G_A$ | System gain (dB) |
| $T_e$ | System noise temperature (°K) |
| $N_{ext}$ | dB value representing the contribution due to external noise |
| k | Boltzmann’s constant 1.38 x $10^{-23}$ (–228.6 dB) |
| B | System equivalent noise bandwidth (dB Hz) |
| $\alpha_{balun}$ | Antenna 300/75 Balun loss (numeric ratio) |
| LNA | Low Noise Amplifier |
| TLNA | LNA noise temperature (°K) |

ANNEX 5

# Other planning factors

## Field strength distribution with location

It is to be expected that the distributions of field strength with location for digital television signals will not be the same as those applicable to analogue television signals and given in Figures 5 and 12 of Recommendation ITU-R P.370.

The results of propagation studies for digital systems are given in Figure 1 for the VHF and UHF bands. These results may also be used to derive propagation prediction curves for location percentages other than 50%. Refer to Figures 5 and 12 of Recommendation ITU-R P.370 for the location percentages other than 50% for analogue and digital systems, where the digital system bandwidth is greater than 1.5 MHz.

## Reception using portable television equipment

The methods given in Annex 4 may be used to derive the minimum field strength required in the vicinity of a receiving antenna. By convention, field strength predictions are made for a receiving antenna height of 10 m above ground or roof-top level. In the case of reception using a portable receiver, an estimate will be needed of the difference in field strength between that at 10 m or roof-top level and that at the place where the portable receiver is situated. Representative values, including both indoor and outdoor operation, have yet to be developed. Recommendation ITU-R P.370 notes that by using Equation (5), a correction to the predicted field strengths can be made for various receiving antenna heights ranging from 1.5 to 40 m above ground.

An approximation for the indoor field strength relative to the ground floor outdoor field strength for the VHF and UHF bands in suburban areas is given by:

$$FS(indoor) = FS(outdoor\ at\ ground\ level) + 2N - 10$$

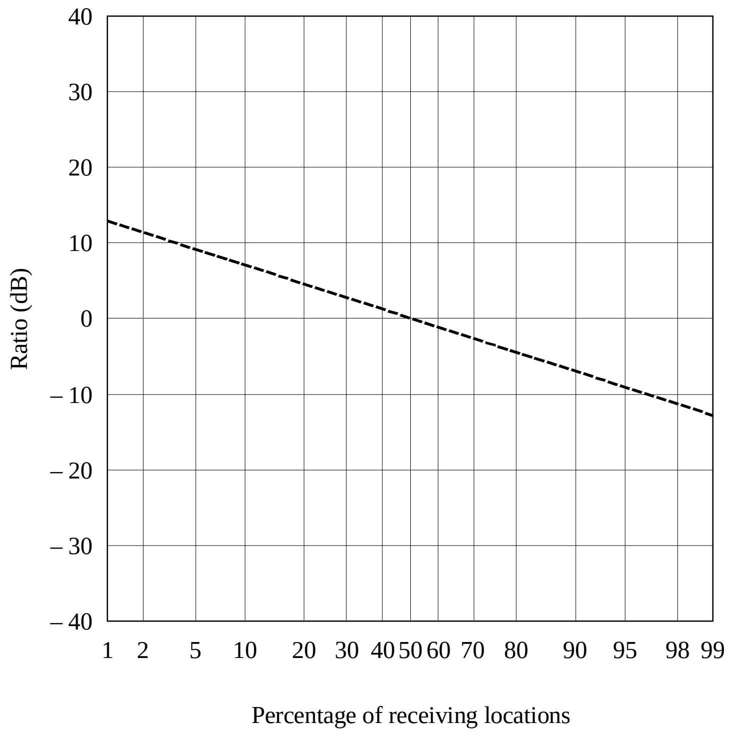
where N is the number of the floor where the indoor receiver is located and for N ranging from 0 to 2.

## Receiving antenna discrimination

Information concerning the directivity and polarization discrimination of domestic receiving antennas is given in Recommendation ITU-R BT.419.

FIGURE 1

**Ratio (dB) of the field strength for a given percentage of the receiving locations to the field strength for 50% of the receiving locations**




Frequency: 30 to 250 MHz (Bands I, II and III) and 470 to 890 MHz (Bands IV and V)

1368-01

ANNEX 6

# Subjective comparison method (SCM) with reference interferer of assessing protection ratios for analogue television systems

## 1 Introduction

This annex gives a method of assessing protection ratios for wanted analogue TV systems based on the subjective comparison of the impairment of an interferer with that of a reference interferer. Usable and reliable results are produced with only a small number of observers and one still picture.

Subjective methods for assessment of impairment grades involve extensive tests, are time consuming, require large numbers of observers and consider the full impairment grade range. For assessing protection ratios only three fixed impairment types are necessary, approximately grade 3 for tropospheric, grade 4 for continuous and grade 4.5 for steady interference, see Table 40. The subjective comparison method is appropriate for the evaluation of interference from any unwanted digital or analogue transmission system into a wanted analogue television channel. The application of a defined fixed reference interferer results in a reproducible set of figures with a low deviation (approximately ±1 dB standard deviation). Only a small number of observers – three to five experts or non-experts – are necessary.

There are two reference interferers which may be used:

– sine-wave interference

  (For the time being the sine-wave reference interferer should be used until an agreement on a common test procedure and an agreement on a harmonized unified noise reference figure have been obtained.)

– Gaussian-noise interferer.

Tests have shown that for unwanted digital television systems a noise reference interferer can improve the assessment decision by the observer. The use of noise reference interferer shows the same results as the defined sine-wave interferer. The disadvantage is that a more complicated test arrangement may be necessary. Further tests are necessary, especially by fixing the equivalent noise reference.

## 2 The subjective comparison method (SCM) of assessing protection ratios using sine-wave reference

### 2.1 General description

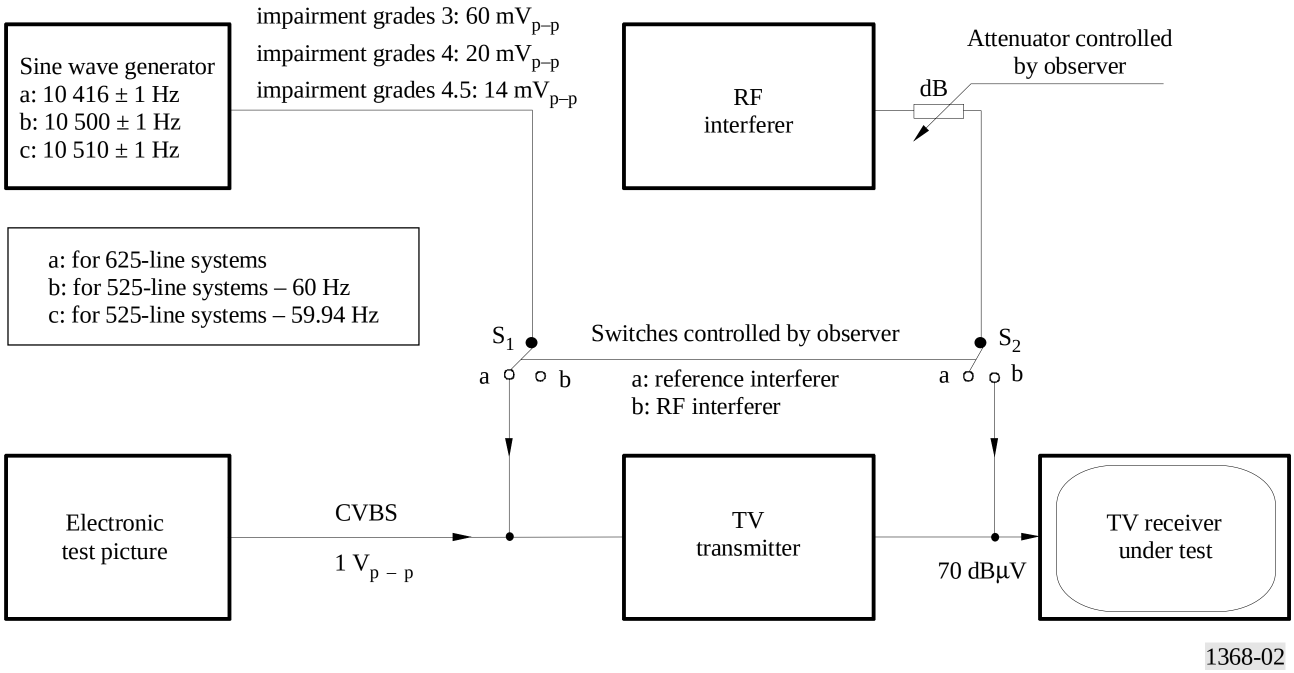
Figure 2 shows the test arrangement for the subjective comparison method with sine-wave interferer. The lower three blocks are the main signal path, the wanted video source, the television transmitter and the TV receiver under test. The reference video interferer is a simple sine-wave signal. The amplitude of the sine-wave generator is switchable between tropospheric interference, continuous interference and steady interferences type. The unwanted RF interferer is added to the wanted signal path. The amplitude and frequency of the interferer are calculated from the RF reference interferer given in Recommendation ITU-R BT.655, Annex 1, § 2.3.

The intensity of the RF interferer can be changed with an attenuator controlled by the observer. The RF interferer is adjusted to produce the same impairment grade as the reference interferer by comparing the interfered pictures on the TV screen.

The RF protection ratio is the difference between the wanted and the unwanted signal levels at the receiver input. The test arrangement can be adjusted in such a way that the value in dB shown at the attenuation box gives directly the protection ratio.

FIGURE 2

**Subjective comparison method (SCM) for assessment of protection ratios**




## 2.2 Realization of the reference interferer

For 625-line systems the reference impairment levels are those which correspond to co-channel protection ratios of 30 dB and 40 dB with a frequency offset between the wanted and unwanted vision carriers close to two-thirds of the line frequency but adjusted for maximum impairment. The precise frequency difference is 10.416 kHz. These conditions approximate impairment grades 3 (slightly annoying) and 4 (perceptible, but not annoying) and apply to tropospheric (1% of time) and continuous interference (50% of time), respectively. The impairment grade of the given video baseband reference interferer is independent from the analogue television system and independent from the RF modulation parameters like modulation polarity, residual carrier etc.

The RF reference interferer can be realized as a simple sine-wave signal at baseband frequency as shown in Figure 2. The sine-wave reference interferer has a fixed frequency of 10.416 kHz for 625-line systems or 10.500 kHz for 525-line systems –60 Hz and 10.510 kHz for 525-line systems –59.94 Hz, an amplitude of either 60 $mV_{p-p}$ or 20 $mV_{p-p}$ referring to a black-to-white level of 700 $mV_{p-p}$ or a CVBS level of 1 $V_{p-p}$. These amplitudes correspond to the RF protection ratios of 30 dB and 40 dB respectively (2/3 line offset). The frequency stability of the sine-wave generator must be within ±1 Hz.

## 2.3 Test conditions

| | |
|---|---|
| Wanted video signal: | Only an electronic test picture is required (e.g. FuBK, Philips or others). |
| Viewing conditions: | As given in Recommendation ITU-R BT.500. |
| Viewing distance: | Five times the picture height. |
| Test receiver: | Up to five different domestic sets, not older than five years. For co-channel measurements a professional receiver can be used. |
| Receiver input signal: | 70 dBμV at 75 Ohms. |
| Observers: | Five observers, experts or non-experts, are necessary. For initial tests less then five observers are possible. Each single test should be made with one observer only. Observers should be introduced to the method of assessment. |

### 2.4 Presentation of the results

The results should be presented together with the following information:

– mean and standard deviation of the statistical distribution of the protection ratio values;
– test configuration, test picture, type of picture source;
– number of observers;
– reference interferer type;
– the spectrum of the unwanted signal (RF interferer), including the out-of-channel range;
– the used RF level for the wanted signal at the receiver input (for domestic receivers an input voltage of 70 dBμV should be used);
– when domestic sets are used, type, display size and year of production.

## 3 Table of important parameters

TABLE 40

**Basic terms and relations for the SCM method**

| Quality impairment | Grade 3 | Grade 4 | Grade 4.5* |
|---|---|---|---|
| Interference type | tropospheric | continuous | steady |
| Time allowance | 1% to 5% of time | 50% of time | 100% of time |
| Subjective impairment | slightly annoying | perceptible, but not annoying | just perceptible limit |
| Reference interferer | 60 mVp-p | 20 mVp-p | 14 mVp-p |
| RF protection ratio | 30 dB | 40 dB | 43 dB |

* Protection ratio for steady interference is not yet defined.

ANNEX 7

# Protection ratios for T-DAB interfered with by an unwanted digital terrestrial television system

## 1 T-DAB interfered with by DVB-T

TABLE 41

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

| 64 QAM Code rate 2/3<br>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 42

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

| 64 QAM Code rate 2/3<br>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 |