

Recommendation ITU-R BT.2036-5

(05/2023)

BT Series: Broadcasting service (television)

Characteristics of a reference receiving system for frequency planning of digital terrestrial television systems

Foreword

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Series	Title
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RA	Radio astronomy
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S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BT.2036-5

Characteristics of a reference receiving system for frequency planning of digital terrestrial television systems

(Questions ITU-R 114/6 and ITU-R 132-3/6)

(2013-2016-2018-2019-2021-2023)

Scope

This Recommendation defines characteristics of reference receiving systems for various digital terrestrial television systems employed as a basis for frequency planning digital terrestrial television services in the VHF/UHF bands.

Keywords

Digital terrestrial television, receiver characteristics, radio frequency, frequency planning, VHF, UHF, protection ratio, adjacent channel selectivity

The ITU Radiocommunication Assembly,

considering

- a) that digital terrestrial television services using a variety of systems are now in widespread use;
- b) that the ITU-R has responsibility for international frequency planning and inter-service sharing to ensure equitable and efficient use of the radio spectrum;
- c) that the error-correction, data framing, modulation and emission methods for first- and second-generation digital terrestrial television broadcasting (DTTB) systems are defined in Recommendations ITU-R BT.1306 and ITU-R BT.1877, respectively;
- d) that the criteria for planning digital terrestrial television services in the VHF/UHF bands are given in Recommendations ITU-R BT.1368 and BT.2033;
- e) that frequency planning parameters for Digital video broadcasting – terrestrial (DVB-T) in Region 1 and the Islamic Republic of Iran are defined by the GE06 Agreement which planned Band III (174-230 MHz) for digital sound and television broadcasting and Bands IV/V (470-862 MHz) for digital television broadcasting. The GE06 Agreement gives the framework for television frequency planning coordination among Region 1 countries and the Islamic Republic of Iran;
- f) that the International Electrotechnical Commission (IEC) has responsibilities relating to television receiver standards and methods of measurement and definitions;
- g) that nominal characteristics of and measurement methods for digital television receivers have been established for the various DTTB systems in the IEC;
- h) that while there is a necessary connection between the receiver characteristics required as limit specifications for manufacturing, efficient spectrum use and frequency planning should take account of the complete receiving system and should be based on a representative reference receive system rather than “worst-case” limit specifications,

recommends

- 1 that the common characteristics of reference television receiving systems given in Annex 1 should be employed as a basis for frequency planning;
- 2 that the characteristics of reference first-generation television receiving systems given in Annex 2 should be employed as a basis for frequency planning¹;
- 3 that the characteristics of reference second-generation television receiving systems given in Annex 3 should be employed as a basis for frequency planning¹.

Annex 1

Digital terrestrial television common receiving system characteristics for frequency planning

Tables 1 to 5 below provide values for common receiver characteristics applicable to any digital terrestrial television systems in frequency planning.

TABLE 1

Receiver antenna height (m)

Reception mode	Fixed roof top reception	Portable outdoor/mobile	Portable indoor
Receiver antenna height above ground	10	1.5	1.5

TABLE 2

Receiving antenna directivity

Receiving antenna directivity	See Rec. ITU-R BT.419
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TABLE 3

Receiver noise figure (dB)

	Band I	Band III	Bands IV/V
Frequency (MHz)	47-68	174-230	470-862
Receiver noise figure	7 to 10	6 to 10	6 to 7

¹ The definitions, methods of measurement and presentation of results used in Annex 1 are consistent with relevant IEC standards/specifications.

TABLE 4
Antenna gain (dBd)

	Band I	Band III	Band IV	Band V
Frequency (MHz)	47-68	174-230	470-582	582-862
Fixed roof top reception	4	5 to 7	8 to 10	9 to 12

TABLE 5
Feeder loss (dB)

	Band I	Band III	Band IV	Band V
Frequency (MHz)	47-68	174-230	470-582	582-862
Fixed roof top reception	1	2	3 to 4	4 to 5

Annex 2

Digital terrestrial television first-generation reference receiving system characteristics for frequency planning ²

1 Introduction

The characteristics of reference first-generation television receiving systems given in this Annex are to be employed as a basis for frequency planning.

1.1 Definitions

Adjacent channel selectivity (ACS): it is a measure of the receiver ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. It is most often defined as the ratio of the receiver filter attenuation on the adjacent channel frequency to the receiver filter attenuation on the assigned channel frequency.

Radio frequency protection ratio (PR): it is the minimum value of the wanted-to-unwanted signal ratio, usually expressed in decibels, at the receiver input, determined under specified conditions such that a specified reception quality of the wanted signal is achieved at the receiver output (see RR (2004), Art. 1 § 1.170). Usually, PR is specified as a function of the frequency offset between the wanted and interfering signals over a wide frequency range.

² As DTTB receive system technology is improving rapidly, administrations are invited to study any improvement of the planning parameters which can result from improved receive system characteristics.

1.2 DVB-T reference receiver characteristics

Reference values for the parameters of a DVB-T reference receiving system are defined for three different reception modes³:

- Reception mode RM1 for fixed roof top reception.
- Reception mode RM2 for portable outdoor reception or mobile reception.
- Reception mode RM3 for portable indoor reception.

Tables 6 and 7 give the reference DVB-T receiver characteristics for all three RMs for Band III, 7 and 8 MHz channel raster, respectively. Table 8 gives the reference DVB-T receiver characteristics for all three RMs for Bands IV/V.

The reference parameters of the RMs that are given in Tables 6, 7 and 8 are not associated with a particular DVB-T system variant or a real DVB-T network implementation; rather, they stand for a large number of different real implementations.

TABLE 6

Reference DVB-T receiver characteristics in Band III, 7 MHz channel raster

Reception mode	RM1	RM2	RM3
Frequency f_r (MHz)	200	200	200
Equivalent noise bandwidth (MHz)	6.66	6.66	6.66
Receiver noise figure (dB)	7	7	7
Receiver noise input power (dBW)	-128.7	-128.7	-128.7
RF signal/noise ratio reference C/N (dB)	21	19	17
Minimum receiver signal input power (dBW)	-107.7	-109.7	-111.7
Minimum equivalent receiver input voltage, 75 Ω (dB(μ V))	31	29	27
Reference minimum field strength $(E_{min})_{ref}$ (dB(μ V/m)) at $f_r = 200$ MHz	38.5	43.5	41.5
ACS (dB)	See Note below		

NOTE – Information on the calculation of adjacent channel selectivity (ACS) values for DVB-T receivers can be found in Recommendation ITU-R BT.1368-10.

³ Those reception modes are equivalent to the Reference Planning Configurations for fixed roof-top, portable outdoor/mobile and portable indoor reception of the GE06 Agreement.

TABLE 7

Reference DVB-T receiver characteristics in Band III, 8 MHz channel raster

Reception mode	RM1	RM2	RM3
Frequency f_r (MHz)	200	200	200
Equivalent noise bandwidth (MHz)	7.61	7.61	7.61
Receiver noise figure (dB)	7	7	7
Receiver noise input power (dBW)	-128.2	-128.2	-128.2
RF signal/noise ratio Reference C/N (dB)	21	19	17
Minimum receiver signal input power (dBW)	-107.2	-109.2	-111.2
Minimum equivalent receiver input voltage, 75 Ω (dB(μ V))	31.5	29.5	27.5
Reference minimum field strength ($E_{min})_{ref}$ (dB(μ V/m)) at $f_r = 200$ MHz	39	44	42
ACS (dB)	See Note below		

NOTE – Information on the calculation of ACS values for DVB-T receivers can be found in Recommendation ITU-R BT.1368-10.

TABLE 8

Reference DVB-T receiver characteristics in Band IV/V, 8 MHz channel raster

Reception mode	RM1	RM2	RM3
Frequency f_r (MHz)	650	650	650
Equivalent noise bandwidth (MHz)	7.61	7.61	7.61
Receiver noise figure (dB)	7	7	7
Receiver noise input power (dBW)	-128.2	-128.2	-128.2
RF signal/noise ratio reference C/N (dB)	21	19	17
Minimum receiver signal input power (dBW)	-107.2	-109.2	-111.2
Minimum equivalent receiver input voltage, 75 Ω (dB(μ V))	31.5	29.5	27.5
Reference Minimum field strength ($E_{min})_{ref}$ (dB(μ V/m)) at $f_r = 650$ MHz	47	52	50
ACS (dB)	See Note below		

NOTE – Information on the calculation of ACS values for DVB-T receivers can be found in Recommendation ITU-R BT.1368-10.

The formula for calculating minimum field strength is given in Attachment 1 to Annex 2 to Recommendation ITU-R BT.1368. For other frequencies, the reference minimum field strength values in Tables 6 and 7 above shall be adjusted by adding the correction factor defined according to the following rule: