PLANNING PARAMETERS FOR

TERRESTRIAL DIGITAL SOUND

BROASDCASTING SYSTEMS IN VHF

BANDS

HD RADIO SYSTEM

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# Introduction

This document describes some parameters that will be very important to close the planning parameters for terrestrial digital sound broadcasting systems in HDRadio.

## Receiver noise input power level

The thermal noise level for HDRadio can be calculated with the formula:

Where,

Pn -> Receiver noise input power level.

F -> Noise Figure.

k -> Boltzmann constant: k = 1.3806504\* 10-23 Ws/K.

T -> Temperature in Kelvin, T= 290◦.

B -> Bandwidth in Hz.

Considering the information[[1]](#footnote-1) at Tabela 1, it is possible to calculate the Receiver noise input power level for each kind of the receiver. For example, the calculation for Portable Indoor Handset receiver:

Tabela – Receiver Noise Figure.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Reception Mode | FX | MO | PO | PI | PO-H | PI-H |
| Antenna type | External fixed | Adapted | External telescopic / ear bud | External telescopic / ear bud | Internal | Internal |
| Receiver System Noise Figure, [dB] | 7 | 7 | 8 | 8 | 25 | 25 |

## Minimum receiver input power level

To determine the Minimum receiver input power level for HDRadio can be use the following formula:

Where,

Ps,min -> Minimum receiver input power level.

C/N -> Carrier / Noise.

Pn -> Receiver noise input power level.

Li -> Implementation loss factor.

**RUSS:** in this point I have doubt about the values for C/N in HD Radio. In page 22 until 24, referent to tables 4-3 to 4-7, there are the values in Cd/No [dB-Hz]. In my point of view this parameters are different in relation to C/N. On the other hand, in page 30 Appendix C, we have IBOC FM Conversion of Cd/No to Digital CNR or SNR Example. In this way am I right to say that C/N is like SNRdB for HDRadio? If not, please could you tell me how can calculate it? Below I am sending you an example, if I am right.

**Example:** considering the table 4-1 in reception mode MO for service MP1, we could calcite the C/N as:

Does it correct?

## Effective antenna aperture

To determine the Effective antenna aperture for HDRadio, considering the central operate frequency at 100 MHz, it can be use the following formula:

Where,

Aa -> Effective antenna aperture (dBm2).

GD -> Antenna gain in dBd.

**Example:** considering the table 3.10 in reception mode MO, the antenna gain correction is 0 dB, then the effective antenna aperture is:

## Minimum power flux-density

Minimum power flux density is the magnitude of the Poynting vector at receiving place. To determine the Minimum power flux density for HDRadio can be use the following formula:

Where,

ϕmin -> Minimum power flux density.

Ps,min -> Minimum receiver input power level.

Aa -> Effective antenna aperture (dBm2).

Lf -> feeder loss (dB).

**Example:** considering a reception mode MO, the minimum power flux density is:

## Calculation of minimum RMS

To determine the minimum RMS field-strength level at the location of the receiving antenna, it is possible to use the following equation:

With:

Resulting in:

**Example:** considering a reception mode MO, the minimum RMS is:

## Calculation of minimum median RMS field-strength level

For the different receiving scenarios the minimum median RMS field strength is calculated as follows:

* For fixed reception:

Where:

Emin -> Minimum RMS.

Pm,m -> Allowance for manmade noise.

Cl -> Location correction factor.

* For portable outdoor and mobile reception:

Where:

Emin -> Minimum RMS.

Pm,m -> Allowance for manmade noise.

Cl -> Location correction factor.

Lh -> Antenna height loss.

* For portable indoor reception:

Where:

Emin -> Minimum RMS.

Pm,m -> Allowance for manmade noise.

Cl -> Location correction factor.

Lh -> Antenna height loss.

Lb -> Building penetration loss.

## Referências

[1] Recommendation ITU-R BS.1660-6, “Technical basis for planning of terrestrial digital sound broadcasting in the VHF band”, 2012.

[2] EBU-TECH 3317, “Planning parameters for hand held reception concerning the use of DVB-H and T-DMB in Bands III, IV, V and the 1.5 GHz band”, 2007.

[3] GE06 , “Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz (RRC-06) Annex3: Technical basis and characteristics”.

[4] Recommendation ITU-R BS.599, “Directivity of antennas for the reception of sound broadcasting in band 8 (VHF)”, 1982.

[5] ETSI TR 101 190, “Digital Video Broadcasting (DVB); Implementation guidelines for DVB terrestrial services; Transmission aspects”.

1. Document: HD RadioTM System Planning Parameters for VHF Band II, table 4.4 at page 20. [↑](#footnote-ref-1)