Digital terrestrial television broadcasting – Transmission system

Televisão digital terrestre – Sistema de transmissão

Televisión digital terrestre — Sistema de transmisión

Digital terrestrial television - Transmission system

地上デジタルテレビジョン放送の伝送方式

Transmission system for digital terrestrial television broadcasting

Foreword

This document is the result of the joint efforts of the ABNT, ARIB and SBTVD Forum under the standardization and technical cooperation activities of the Brazil-Japan Digital Television Joint Working Group.

The Brazilian Association for Standardization (ABNT) is the organism responsible for technical standardization in Brazil, providing essential support for Brazilian technical development. It is a private, non-profit organization, recognized as the only National Standardization Body. It provides Brazilian society with systematic knowledge, through normative documents, enabling the production, commercialization and use of goods and services, in a competitive and sustainable manner, in the internal and external markets, contributing to scientific and technological development, environmental and consumer's protection.

The Association of Radio Industries and Businesses (ARIB) was designated as "the Center for Promotion of Efficient Use of the Radio Spectrum" and "the Designated Frequency Change Support Agency" by the Minister of Internal Affairs and Communications (MIC) of Japan under the provisions of the Radio Law. Under this designation, ARIB conducts studies and R&D, establishes standards, provides consultation services for radio spectrum coordination, cooperates with other overseas organizations and provides frequency change support services for the smooth introduction of digital terrestrial television broadcasting. These activities are carried out in cooperation with and/or participation by telecommunication operators, broadcasters, radio equipment manufacturers and related organizations as well as under the support by MIC.

The Brazilian Digital Terrestrial Television Forum (SBTVD Forum) is a non-profit entity, created with the objective of aiding and stimulating the development and implementation of best practices, with the aim of making systems reality for digital broadcasting of images and sounds in Brazil a success. Since the creation of the SBTVD Forum in February, 2007, its members have endeavored to establish standards of technical quality which permit deployment ofdigital television in Brazil. The Technical Module has contributed to the preparation of standards, with active participation by universities, research centers, related industry organizations and broadcasters.

This document does not describe the industrial property rights mandatory to these standards.

This document has no standardization value. Its purpose is to serve as a reference for characterizing the specificities of Brazilian and Japanese digital terrestrial television standards within the scope of the Brazil-Japan Digital Television Joint Working Group.

This document is drafted in accordance with the rules established in the ISO/IEC Directives, Part 2.

In the Brazilian and Japanese harmonized documents, commonalities are described in Clause 5 where Table 1 includes all references to ABNT and ARIB related documents. Differences are described in Clause 6. In each subclause, a reference to the corresponding Brazilian and Japanese related session is included in separate boxes in *italic text*.

No reference is made to the domestic policies of the countries.

1 Scope

This document addresses the standard for the transmission system for digital terrestrial television broadcasting in Brazil and Japan.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ABNT NBR 15601:2007, *Digital terrestrial television – Transmission system*

3 ARIB STD-B31:V2.2:2014, *Transmission system for digital terrestrial television broadcasting*Terms and definitions

For the purposes of this document, the terms and definitions given in ABNT NBR 15601 and ARIB STD-B31 apply.

4 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ABNT NBR 15601 and ARIB STD-B31 and the following apply.

UHF Ultra High Frequency

VHF Very High Frequency

5 Commonalities of the transmission system

The common parts of ABNT NBR 15601 and ARIB STD-B31 and how they correspond are described in Table 1.

Table 1 — Correspondence between ABNT NBR 15601 and ARIB STD-B31 standards

Description	ABNT NBR reference clause	ARIB STD reference clause
System description	5	2
Channel coding scheme	6	3
Frequency bandwidth	7.1	4.1
Permissible transmission-frequency deviation	7.2	4.2
IFFT sampling frequency	7.4	4.3

6 Differences in the transmission system

6.1 Frequency offset of the OFDM carriers

The frequency of the terrestrial transmission signal shall have a positive offset of 1/7 MHz (142.857 kHz) in relation to the channel central carrier. However the systems differ in the digital signals channel allotment plan

In the Brazilian digital terrestrial television system, according to ABNT NBR 15601, Subclause 7.3: *The frequency of the terrestrial transmission signal shall have a positive offset of 1/7 MHz (142.857 kHz) in relation to the channel central carrier to be used in the current channel allotment plan (see Figure 37).*

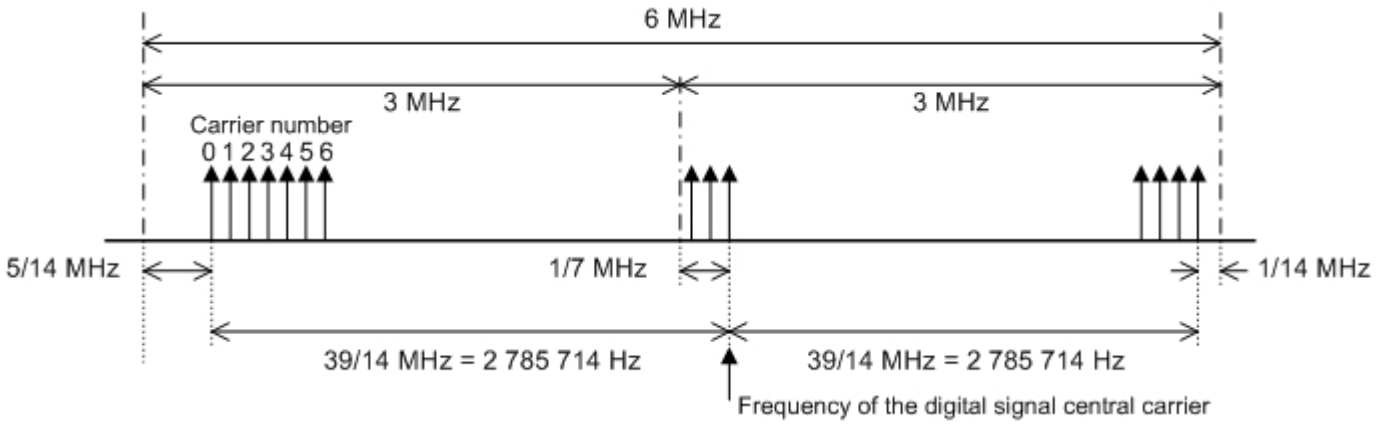

Figure 1 — Example of OFDM signal arrangement

The terrestrial emissions shall comply with Tables 39 and 40 of the channel allocation frequencies.

Table 1 — High VHF channels

Channel	***Initial frequency MHz***	***Final frequency MHz***	***Central frequency MHz***
07	*174*	*180*	*177+ 1/7*
08	*180*	*186*	*183 + 1/7*
09	*186*	*192*	*189 + 1/7*
10	*192*	*198*	*195 + 1/7*
11	*198*	*204*	*201 + 1/7*
12	*204*	*210*	*207 + 1/7*
13	*210*	*216*	*213 + 1/7*

Table 2 — UHF channels

Channel	***Initial frequency MHz***	***Final frequency MHz***	***Central frequency MHz***
14	*470*	*476*	*473 + 1/7*
15	*476*	*482*	*479 + 1/7*
16	*482*	*488*	*485 + 1/7*
17	*488*	*494*	*491 + 1/7*
18	*494*	*500*	*497 + 1/7*
19	*500*	*506*	*503 + 1/7*
20	*506*	*512*	*509 + 1/7*
21	*512*	*518*	*515 + 1/7*
22	*518*	*524*	*521 + 1/7*
23	*524*	*530*	*527 + 1/7*
24	*530*	*536*	*533 + 1/7*
25	*536*	*542*	*539 + 1/7*
26	*542*	*548*	*545 + 1/7*
27	*548*	*554*	*551 + 1/7*
28	*554*	*560*	*557 + 1/7*
29	*560*	*566*	*563 + 1/7*
30	*566*	*572*	*569 + 1/7*
31	*572*	*578*	*575 + 1/7*
32	*578*	*584*	*581 + 1/7*
33	*584*	*590*	*587 + 1/7*
34	*590*	*596*	*593 + 1/7*
35	*596*	*602*	*599 + 1/7*
36	*602*	*608*	*605 + 1/7*
37	*Not used for television*	*Not used for television*	*Not used for television*
38	*614*	*620*	*617 + 1/7*
39	*620*	*626*	*623 + 1/7*
40	*626*	*632*	*629 + 1/7*
41	*632*	*638*	*635 + 1/7*
42	*638*	*644*	*641 + 1/7*
43	*644*	*650*	*647 + 1/7*

44	*650*	*656*	*653 + 1/7*	
45	*656*	*662*	*659 + 1/7*	
46	*662*	*668*	*665 + 1/7*	
47	*668*	*674*	*671 + 1/7*	
48	*674*	*680*	*677 + 1/7*	
49	*680*	*686*	*683 + 1/7*	
50	*686*	*692*	*689 + 1/7*	
51	*692*	*698*	*695 + 1/7*	
52	*698*	*704*	*701 + 1/7*	
53	*704*	*710*	*707 + 1/7*	
54	*710*	*716*	*713 + 1/7*	
55	*716*	*722*	*719 + 1/7*	
56	*722*	*728*	*725 + 1/7*	
57	*728*	*734*	*731 + 1/7*	
58	*734*	*740*	*737 + 1/7*	
59	*740*	*746*	*743 + 1/7*	
60	*746*	*752*	*749 + 1/7*	
61	*752*	*758*	*755 + 1/7*	
62	*758*	*764*	*761 + 1/7*	
63	*764*	*770*	*767 + 1/7*	
64	*770*	*776*	*773 + 1/7*	
65	*776*	*782*	*779 + 1/7*	
66	*782*	*788*	*785 + 1/7*	
67	*788*	*794*	*791 + 1/7*	
68	*794*	*800*	*797 + 1/7*	
69	*800*	*806*	*803 + 1/7*	

In the Japanese digital terrestrial television system, according to ARIB STD-B31, Attachment, Chapter 2, Subclause 2.2:

The ISDB-T program signal carrier wave frequency must be shifted upwards by 1/7 MHz (142,857Hz) from the center frequency used in the current Television channel plan.

Table 2-2 — UHF channels and ISDB-T Program-Signal Carrier-Wave Frequencies

Number of UHF channels	*Channel 13*	*Channel 14*	-----	*Channel 52*
Carrier-wave frequency	*473 + 1/7 MHz = 473.142857 MHz*	*479 + 1/7 MHz = 479.142857 MHz*	-----	*707 + 1/7 MHz = 707.142857 MHz*

6.2 Transmission spectrum mask

The transmission spectrum limit mask is specified according to the spectrum environment of each country.

In the Brazilian digital terrestrial television system, according to ABNT NBR 15601, Subclauses 7.5.1 and 7.5.2:

7.5.1 Characteristics of the transmission spectrum mask

The out-of-band spectrum level allocated for broadcasting the television signal shall be reduced by applying proper filtering. Figure 38 and Table 41 indicate the minimum attenuation and the out-of-band emission in relation to the average transmitter power specified in relation to the spacing of the signal central carrier, for critical, sub-critical and non-critical masks.

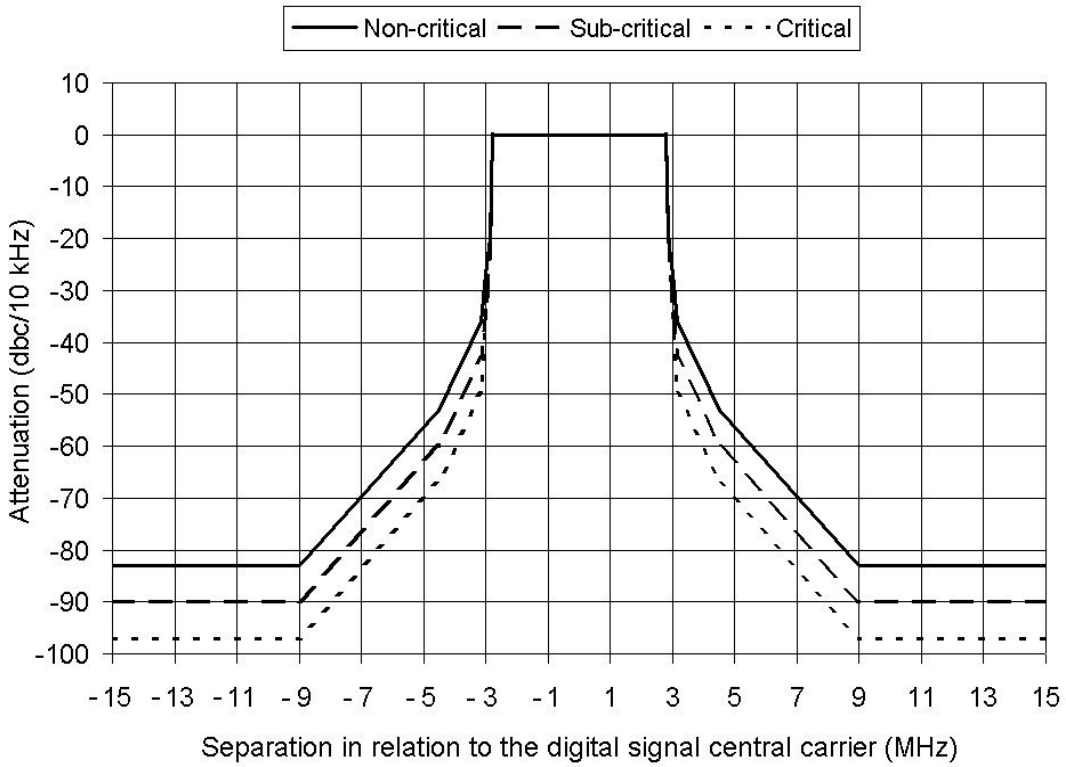

Figure 2 — Transmission-spectrum limit masks for digital terrestrial television broadcasting

Table 3 — Specification of the transmission spectrum mask

Separation in relation to the digital signal central carrier *MHz*	***Minimum attenuation in relation to average power, measured at carrier central frequency***		
	Non-critical mask *dB*	***Sub-critical mask*** *dB*	***Critical mask*** *dB*
- 15	*83.0*	*90.0*	*97.0*
- 9	*83.0*	*90.0*	*97.0*
- 4.5	*53.0*	*60.0*	*67.0*
- 3.15	*36.0*	*43.0*	*50.0*
- 3.00	*27.0*	*34.0*	*34.0*
- 2.86	*20.0*	*20.0*	*20.0*
- 2.79	*0.0*	*0.0*	*0.0*
2.79	*0.0*	*0.0*	*0.0*
2.86	*20.0*	*20.0*	*20.0*
3.00	*27.0*	*34.0*	*34.0*
3.15	*36.0*	*43.0*	*50.0*
4.5	*53.0*	*60.0*	*67.0*
9	*83.0*	*90.0*	*97.0*
15	*83.0*	*90.0*	*97.0*

The values of Table 41 shall be measured using a spectrum analyzer configured according to Table 42.

Table 4 — Spectrum settings for mask measurement

Central frequency	*SPAN*	*RBW*	*VBW*	*Detection mode*
Modulated carrier central frequency	*20 MHz*	*10 kHz*	*300 Hz or lower*	*Positive peak detection*

The cut point shall be measured using a spectrum analyzer adjusted for a 20-MHz span frequency or lower and a 10-kHz bandwidth resolution (RBW). A 300-Hz or lower video bandwidth (VBW) shall be used.

7.5.2 Criteria for applying masks

Application of masks shall take into account the class of the stations and substations.

Digital stations are classified in Special Class, Class A, Class B and Class C. Table 43 indicates maximum values of ERP power for each class of station, taking as reference height 150 m above average terrain level.

Table 5 — Maximum power of each class

Class	*Maximum ERP power (Haat = 150 m) kW*	
	VHF high	*UHF*
Special	*16*	*80*
A	*1.6*	*8*
B	*0.16*	*0.8*
C	*0.016*	*0.08*

Each class is divided into subclasses where the power difference between the various subclasses is of 1 dB.

Two channels shall be taken to be adjacent if, and only if, the difference between the central frequencies of channels involved is 6 MHz.

Criterion for employing non-critical, sub-critical and critical emission masks are indicated on Table 44.

Table 44 — Criteria for the use of the critical, sub-critical and non-critical emission mask

<table>
<tr><td>Digital station class</td><td colspan="4">A, B and C</td><td colspan="2">Special</td></tr>
<tr><td>Distance in relation to the adjacent channel installed in the same location</td><td colspan="2">< 400 m</td><td colspan="2">> 400 m</td><td rowspan="2">Absence of adjacent channel foreseen or installed in the same location</td><td rowspan="2">Presence of adjacent channel foreseen or installed in the same location</td><td rowspan="2">Absence of adjacent channel foreseen or installed in the same location</td></tr>
<tr><td>Type of channel modulation of the adjacent channel foreseen or installed in the same location</td><td>Analogue</td><td>Digital</td><td>Analogue</td><td>Digital</td></tr>
<tr><td>$P_{digital} < P_{adjacente} + 3$ dB</td><td rowspan="2">Critical</td><td>Sub-critical</td><td colspan="2" rowspan="2">Critical</td><td rowspan="2">Non-critical</td><td colspan="2" rowspan="2">Critical</td></tr>
<tr><td>$P_{digital} > P_{adjacente} + 3$ dB</td><td>Critical</td></tr>
<tr><td colspan="7">$P_{digital}$ = ERP Power of the digital station
$P_{adjacente}$ = ERP Power of the adjacent channel station</td></tr>
</table>

In the Japanese digital terrestrial television system, according to ARIB STD-B31, Subclause 4.4:

4.4 Transmission-spectrum mask

The transmission-spectrum limit mask is specified as shown below in Fig. 4-1. The related break points for the

spectrum mask are listed in Table 4-1.

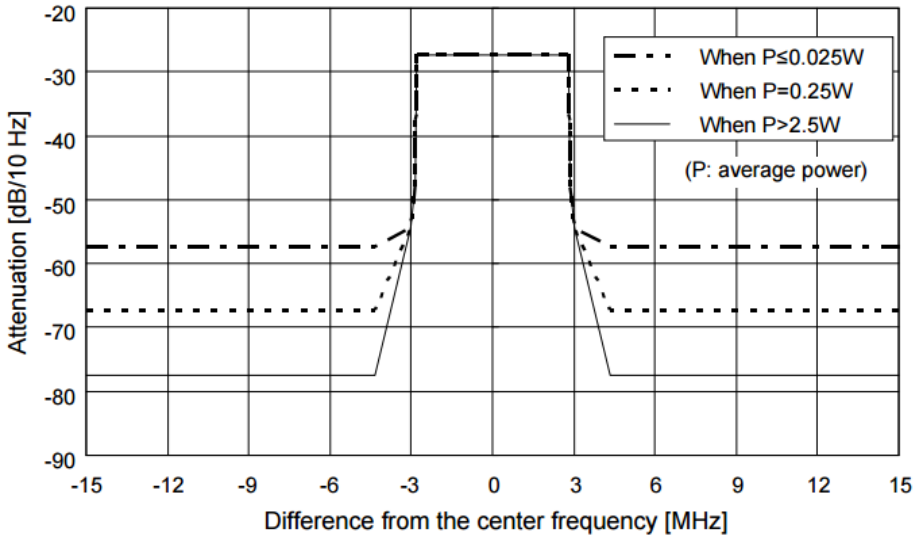

Fig. 4-1 Transmission-spectrum limit mask for digital terrestrial television broadcasting

Table 4-1 Breakpoints for transmission-spectrum mask

Difference from the center frequency (MHz)	*Attenuation relative to average P (dB/10kHz)*	*Type of stipulation*
± 2.79	*-27.4*	*Upper limit*
±2.86	*-47.4*	*Upper limit*
± 3.00	*-54.4*	*Upper limit*
± 4.36	*-77.4**	*Upper limit*

** If the frequency corresponding to an adjacent channel number (the channel number between 13 and 62 that is one number different from the channel number of the television broadcasting corresponding to the allocated frequency in the Plan for the Available Frequencies Allocated to Broadcasting stipulated in item (ii) of paragraph (2) of Article 7 of the Radio Law) is not used for standard television broadcasting (excluding digital broadcasting and restricted to the effective radiation power that is less than ten times the own effective radiation power) within the own broadcasting area, the following specifications should be applied:*

-(73.4+10logP) dB/10 kHz in the case of radio equipment whose transmission power is more than 0.25 W and equal to or less than 2.5 W;

*-67.4 dB/10 kHz in the case of radio equipment whose transmission power (excluding the case of *2) is 0.25 W or less.*

**2 If the frequency corresponding to an adjacent channel number is not used for standard television broadcasting (excluding digital broadcasting) within one's own broadcasting area, the following specifications should be applied: -(73.4+10logP) dB/10kHz in the case of radio equipment whose transmission power is more than 0.025W and less than 0.25W; -57.4 dB/10kHz in the case of radio equipment whose transmission power is 0.025W or less.*

Note: For the adjacent channels of radio equipment that amplifies multiple waves together, an attenuation of -27.4 dB/10 kHz relative to average power P can be set as the upper limit regardless of the above table.

The above specifications are accompanied with transitional measures (supplementary provisions to the Radio Equipment Rules--Ministerial Ordinance No. 119 issued by the MIC (Ministry of Internal affairs and Communications) in 2005).

Explanation

If an adjacent channel is used for standard television broadcasting (excluding digital broadcasting and restricted

to the effective radiation power that is less than ten times the own effective radiation power) within the own broadcasting area, the solid line of Fig. 4-1 (attenuation relative to average power P is -77.4 dB/10 kHz at the frequencies of +/-4.36 MHz from the center frequency) should be applied regardless of the value of P.

6.3 Allowable spurious emission intensity

The allowable spurious emission intensity is specified according to the spectrum environment of each country.

In the Brazilian digital terrestrial television system, according to ABNT NBR 15601, Subclause 7.6:

7.6 Allowable spurious emission intensity

The allowable spurious emission power shall be in accordance with Table 45.

Table 45 — Allowable spurious emission power

Separation in relation to the digital signal central carrier	***Minimum attenuation in relation to the average power measured frequency of the central carrier***
> 15 MHz	*60 dB for P > 25 W, limited to 1 mW in VHF and 20 mW in UHF*
< - 15 MHz	*For P ≤ 25 W, limited to 25 μW in VHF and UHF*

In the Japanese digital terrestrial television system, according to ARIB STD-B31, Subclause 4.5:

4.5 Maximum permitted power level of spurious emission or unwanted emission

The power supplier to antenna transmission on line	*Maximum permitted power level of spurious emission in out-of-band domain*	*Masimum permitted power level or unwanted emission spurious domain*
Above 25W	*20mW or less, and 60dB* lower than the average power of basic frequency*	*12mW or less, and 60dB lower than the average power of basic frequency*
Above 1W, and 25W or less	*25μW or less*	*25 μW or less*
1W or less	*100μW or less*	

** For the maximum permitted power level of spurious emission in the out-of-band region for transmission equipment whose transmission power exceeds 8 kW, the values specified in section 4.4 shall be used.*

The above specifications are accompanied by transitional measures (supplementary provisions to the Radio Equipment Rules--Ministerial Ordinance No. 119 issued by the MIC (Ministry of Internal Affairs and Communications) in 2005).