

ISDB-T Standards of Botswana

Preface

Around the world, countries are converting their analogue terrestrial television platforms to digital technology. Immense benefits can be achieved through digital migration. These benefits include the increase in efficiency in the use of spectrum, a good quality of sound and pictures, and launch of new services for viewers creating opportunities for the convergence with other ICT services and securing the future of the terrestrial television as a viable platform for an advanced information society.

In 2006 Regional Radio Communication Conference (RRC-06), resolved that the transition from analogue to digital broadcasting services should be effected by June 2015 in the African & European Region.

The government of Botswana has made a decision to adopt the Integrated Services Digital Broadcasting - Terrestrial (ISDB-T) Standard as its Digital Terrestrial Television standard after the comparative testing between the two leading international standards, namely Digital Video Broadcasting-Television second generation (DVB-T2) and ISDB-T.

The test revealed that the ISDB-T standard has significant advantages. Of particular note is the ISDB-T system's hierarchical mode of operation, which allows for the simultaneous transmission to fixed, mobile and portable receivers from a single transmitter. In addition, ISDB-T has advantageous functions to provide value added services such as Data broadcasting and Emergency Warning Broadcast System (EWBS).

This document serves to provide technical specifications to manufacture equipment and products, secure the interconnectivity/interoperability by establishing ISDB-T Standards of Botswana. The document is compiled for Botswana by extracting and modifying essential parts from ARIB Standards completed in Japan and the Standards of ABNT (Associação Brasileira de Normas Técnicas) as described in Recommendation ITU-R BT.1306.

A special thanks must be given to Digital Broadcasting Experts Group (DiBEG) under Association of Radio Industries and Businesses (ARIB), who drafts this document with the intention to contribute to the establishment of ISDB-T Standards of Botswana, and

JICA who provides a significant support on this document as one of their Project activities in Botswana.

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ISDB-T Standards

1. General

Currently there are two standard specifications of the ISDB-T System; one is the ARIB Standards, and the other is the Standards of ABNT (Associação Brasileira de Normas Técnicas) as described in Recommendation ITU-R BT.1306, in its Appendix 3 to Annex 1, Bibliography of System C Standard. At first, the ARIB Standards have been completed in Japan where the ISDB-T was originally developed. And then, the ABNT Standards have been completed in Brazil, based on the ARIB Standards yet incorporating the latest technologies which became available at that time. Furthermore, there came out the Harmonization Documents by the ISDB-T International Forum, intending to establish a commonality among the ISDB-T adopting countries on the operation of the EWBS (Emergency Warning Broadcast System) and the specifications of the ISDB-T

receiver products.

With the above history as its background, Botswana ISDB-T standards is basically compiled based on the ABNT standards yet also incorporating the specifications of the ARIB standards as well as the Harmonization Documents.

Furthermore, while the existing ABNT standards specify the transmission parameters for the 6MHz/ch bandwidth, the parameters for the 8MHz/ch bandwidth are not specified. Therefore the transmission parameters and any other related items shall be adjusted for 8MHz/ch bandwidth from the ABNT standards based on Recommendation ITU-R BT.1306.

In the light of the situation above, this technical documentation presents the ISDB-T standards of Botswana;

The Annex, which is the integral part of the standards, covers the details of modifications made to the existing standards; and the Appendix 1 “**Operational Guidelines for ISDB –T in Standards in Botswana**” (separate document), which is not the integral part of but supplementary to the standards, covers the operational guidelines for the general operations at broadcasting stations for digital terrestrial television broadcasting and functional specifications for digital terrestrial television equipment.

2. Transmission

Parameters are given in Table 1c) of ITU-R BT.1306. For details, ABNT NBR 15601 shall be referred as listed in Appendix 3 to Annex 1 of ITU-R BT.1306. Because ABNT NBR 15601 is the standards for 6MHz/ch transmission bandwidth, the transmission parameters have been modified for 8MHz/ch transmission bandwidth as shown here-below. See Annex 1 for details.

- Symbol duration be 6/8 shorter than 6MHz/ch
- Bandwidth be 8/6 wider than 6MHz/ch
- IFFT sample clock be 8/6 faster than 6MHz/ch
- transmission bitrate be 8/6 faster than 6MHz/ch
- Guard interval length be 6/8 shorter than 6MHz/ch
- channels be set by every 8MHz and not be used 1/7MHz frequency shift
- 13 segments in 8MHz

3. Video Coding

All the technical parameters related to video coding shall be in accordance with ABNT NBR 15602-1. However the frame rate of 25 Hz and 50 Hz, and the video

format of 576i and 576p shall be supported and video coding parameters for full-seg services are applied to any layers except for the partial reception layer. See Annex 2 for details.

4. Audio Coding

All the technical parameters related to audio coding shall be in accordance with ABNT NBR 15602-2. However audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

5. Multiplexing

All the technical parameters related to multiplex shall be in accordance with ABNT NBR 15602-3.

6. Service information

Most of all the technical parameters related to service information shall be in accordance with ABNT NBR15603, however there are some modifications. The main points to be modified are shown here-below. See Annex 5 for the details.

- Network ID, Service ID, and Affiliation ID shall be allocated to be respectively unique within Botswana, and Remote Control Key ID shall be allocated to be unique within each of the broadcast service areas.

7. Receiver

While most of all the technical parameters related to receivers shall be in accordance with ABNT NBR15604, there are some modifications required. With respect to the receiver, the technical specification issued by BOCRA shall be referred. The main points to be modified are shown here-below. See Annex 6 for the details.

- In order to adopt BML for data broadcasting, some items that are based on Ginga such as the remote control key and the demodulator for data broadcasting shall be modified.
- As the analog video format of Botswana is of PAL-I, those items of PAL-M format shall be replaced to PAL-I.
- The frame rate of 25 Hz and 50 Hz, and the video format of 576i and 576p shall be supported.
- As for the RF INPUT-TERMINAL of the receivers for Botswana, IEC 61169-2 -type terminal (Belling-Lee) should be recommended.
- The priority parameters of the receiver unit of Annex A are described as the operational guidelines, thus it should be subject to ISDB-T Harmonization Document PART 1: Hardware.
- Since there is no detailed specification of "Accessibility resources (Audio

location)" in ABNT, it is preferable to remove it.

- Since "Accessibility resources (LIBRAS window)" is a specification unique only to Brazil, it is desirable to remove it.
- Silicon-Tuner is mostly adopted in the recent TV-Front-End products, making outputs of Low-IF below 10MHz. Thus Low-IF below 10MHz shall also be acceptable. Accordingly, with respect to the frequency conversion, either upper or lower heterodyne conversion shall be acceptable as long as there is no side-effect.
- As for safety standards, it shall be in reference to actual standards in Botswana.

8. Security issues

All the technical parameters related to security issues shall be in accordance with ABNT NBR 15605-1.

9. Data broadcasting

ISDB-T Standards covers multiple Data broadcasting standards such as BML, Ginga and HTML5.

For the first stage of TV Digitalization, BML, which is proved to work and operationalized, is the most effective standard in terms of providing its service and cost effective receivers for the households..

For the next stage after ASO, HTML5, which is based on two way network standard, can be adopted subject to the development of its service availability. In this document, the specs to localize BML standard for Botswana is described as focusing in the first stage.

All the technical methods and parameters for BML data broadcasting, subtitle and superimposed characters coding shall be in accordance with ARIB STD-B24.

About the localization for Botswana, the main points to be modified are character set and character coding. See Annex 8 for the details.

Data broadcasting standard is referred also in the receiver standard with respect to remote control requirements. See Annex 6 for the details.

10. Interactive channel

All the technical parameters related to interactive channel shall be in accordance with ABNT NBR 15607-1.

11. EWBS

All the technical methods and parameters shall be in accordance with ISDB-T Harmonization Document PART 3: Emergency Warning Broadcast System (EWBS).

Annex Details of modifications made to the existing standards

Annex 1 Transmission

The details of the modifications from ABNT NBR 15601 are shown in Table A1-1.

Table A1-1 Modifications from ABNT NBR 15601

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
6.1 Table 1 — Parameters of the transmission system	6	6000/14 = 428,57 kHz	8000/14 = 571.43 kHz
	2. Segment width	5,575 MHz (mode 1) 5,573 MHz (mode 2) 5,572 MHz (mode 3)	7.433MHz(mode1) 7.431MHz(mode2) 7.429(mode3)
	3. Used bandwidth	252µs (mode 1) 504 µs (mode 2) 1 008 µs (mode 3)	189µs (mode 1) 378 µs (mode 2) 756 µs (mode 3)
	6. Active symbol duration	Bws/108 = 3,968 kHz (mode 1) Bws/216 = 1,984 kHz (mode 2) Bws/432 = 0,992 kHz (mode 3)	Bws/108 = 5.291... kHz Bws/216 = 2.645... kHz Bws/432 = 1.322... kHz
	7. Carrier spacing	63; 31,5; 15,75; 7,875 µs (mode 1) 126; 63; 31,5; 15,75 µs (mode 2) 252; 126; 63; 31,5 µs (mode 3)	47.25, 23.625, 11.8125, 5.90625 µs (mode1) 94.5, 47.25, 23.625, 11.8125 µs (mode2) 189, 94.5, 47.25, 23.625 µs (mode3)
	8. Guard interval duration	315; 283,5; 267,75; 259,875 µs (mode 1) 628; 565; 533,5; 517,75 µs (mode 2) 1.260; 1 134; 1 071; 1.039,5 µs (mode 3)	236.25, 212.625, 200.8125, 194.90625 µs (mode1) 472.5, 425.25, 401.625, 389.8125 µs (mode2) 945, 850.5, 803.25, 779.625 µs(mode3)
9. Overall symbol duration			
6.1 Principal parameters	6	Further, pilot signal shall added to data segment in the OFDM framing section to form an OFDM segment (with a bandwidth of 6/14 MHz).	Further, pilot signal shall be added to data segment in the OFDM framing section to form an OFDM segment (with a bandwidth of 8/14 MHz).
	7	Up to three hierarchical layers may be transmitted in a 6 MHz channel.	Up to three hierarchical layers may be transmitted in an 8 MHz channel.
6.1 Table 2 — OFDM segment parameters	8	Table 2 — OFDM-segment parameters	ARIB STD-B31 Version2.2-E1 Page84 Table A-5: OFDM Segment Parameters (8MHz Bandwidth System)
6.1 Table 3 — Transmission signal parameters	9	Table 3 — Transmission signal parameters	ARIB STD-B31 Version2.2-E1 Page85 Table A- 6: Transmission Signal Parameters (8MHz Bandwidth System)

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
6.1 Table 4 — Data rate of a single segment	10	Table 4 — Data rate of a single segment	ARIB STD-B31 Version2.2-E1 Page86 Table A- 7: Data Rate per a Single Segment (8MHz Bandwidth System)
6.1 Table 5 — Total data rate	11	Table 5 — Total data rate	ARIB STD-B31 Version2.2-E1 Page87 Table A- 8: Total Data Rate*1 (8MHz Bandwidth System)
6.14.4 Table 25 — Examples of transmission capacities for AC carriers (mode1, guard interval of 1/8)	43	Table 25 — Examples of transmission capacities for AC carriers (mode1, guard interval of 1/8)	See Table A1-2 for Examples of transmission capacities for AC carriers (mode1, guard interval of 1/8)
6.15.1 Position of the segments within the 6 MHz spectrum	43	6.15.1 Position of the segments within the 6 MHz spectrum	6.15.1 Position of the segments within the 8 MHz spectrum
7.1 Frequency bandwidth	51	A frequency bandwidth of 5.7 MHz shall be used for digital terrestrial television broadcasting.	A frequency bandwidth of 7.6 MHz shall be used for digital terrestrial television broadcasting.
		The frequency bandwidth shall be 5.7 MHz when the OFDM carrier bandwidth is 5.572 MHz with 4 kHz spacing between carrier frequencies in Mode 1. This bandwidth shall apply regardless of which mode is chosen, and has been selected to ensure that the bandwidth of 5.610 MHz has some margin to determine that each carrier of the uppermost and lowermost in the 5.572..MHz bandwidth includes 99 % of energy.	The frequency bandwidth shall be 7.6 MHz when the OFDM carrier bandwidth is 7. 433 MHz with 5.291 kHz spacing between carrier frequencies in Mode 1. This bandwidth shall apply regardless of which mode is chosen, and has been selected to ensure that the bandwidth of 7. 480 MHz has some margin to determine that each carrier of the uppermost and lowermost in the 7.433..MHz bandwidth includes 99 % of energy.
7.3 Frequency offset of the OFDM carriers	52	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).	Offset not be used.
		Table 39 — High VHF channels	High VHF channels not be used.
	53	Table 40 — UHF channels	See table A1-3 for 8MHz/ch UHF channels

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
7.4 IFFT sampling frequency and permissible deviation	54	The IFFT sampling frequency for use with OFDM for digital terrestrial television broadcasting shall be as follows: $F_s = 512/63 \text{ MHz} = 8\,126\,984 \text{ Hz}$	The IFFT sampling frequency for use with OFDM for digital terrestrial television broadcasting shall be as follows: $F_s = 2048/189 \text{ MHz} = 10\,835\,978 \text{ Hz}$
		The permissible deviation is $\pm 0.3 \text{ Hz/MHz}$.	The permissible deviation is $\pm 0.2 \text{ Hz/MHz}$.
		An IFFT sampling frequency of 512/63 MHz, a theoretical sample frequency, may be used if the permissible deviation requirement is met.	An IFFT sampling frequency of 2048/189 MHz, a theoretical sample frequency, may be used if the permissible deviation requirement is met.
7.5.1 Characteristics of the transmission spectrum mask	54	7.5.1 Characteristics of the transmission spectrum mask The out-of-band spectrum level allocated for broadcasting the television signal shall be reduced applying a proper filtering. Figure 38 and Table 41 indicate the minimum attenuation and the out-of-band emission in relation to the transmitter average power, specified in relation to the spacing of the signal central carrier, for critical, sub-critical and non-critical mask.	7.5.1 Characteristics of the spectrum limit mask The out-of-band spectrum level allocated for broadcasting the television signal shall be reduced applying a proper filtering. Figure A1-1 and Table A1-4 indicate the spectrum limit mask for sensitive and non-critical mask, where the relative power level is defined in a reference bandwidth of 4kHz with the 0dB reference level corresponding to the mean output power measured in the channel bandwidth as described in ITU-R Recommendation BT.1206-1.
	54	Figure 38 — Transmission-spectrum limit masks for digital terrestrial television broadcasting	See Figure A1-1 for 8MHz/ch Spectrum limit masks
	55	Table 41 — Specification of the transmission spectrum mask	See Table A1-4 for 8MHz/ch break points
		The values of Table 41 shall be measured with a spectrum analyzer configured according to Table 42. Table 42 Spectrum settings for mask measurement 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).	Deleted. It is enough to specify the spectrum mask and spurious according to the relevant RR regulations and ITU-R Recommendation, not necessary to specify the method to measure them.

Section, (Table) No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
7.5.2 Criteria for applying masks	55	Application of masks shall take in account the class of the stations and substations. Digital stations are classified in ...	Two spectrum masks are specified in Fig. A1-1 and the associated Table A1-4. The upper curve defines the spectrum mask for the non-critical cases and the lower curve defines the spectrum mask for the sensitive cases as described in ITU-R Recommendation BT.1206-1.
7.6 Table 45 — Allowable spurious emission power	5556	Table 45 — Allowable spurious emission power	See Table A1-5 for Allowable spurious emission power as described in RR Appendix 3 or ITU-R SM.329.

Table A1-2 Examples of transmission capacities for AC carriers
(mode 1, guard interval of 1/8) (See Table A1-1 Column 6.14.4 Table 25)

	Synchronous modulation's segment		Differential modulation's segment	
	1	13	1	13
AC1	9,4 kbps	121,7 kbps	9,4 kbps	121,7 kbps
AC2	-	-	18,7 kbps	243,4 kbps

Table A1-3 8MHz/ch UHF channels
(See Table A1-1 Column 7.3 Frequency offset of the OFDM carriers)

Channel	Start Frequency (MHz)	End Frequency (MHz)	Center Frequency (MHz)
21	470	478	474
22	478	486	482
23	486	494	490
24	494	502	498
25	502	510	506
26	510	518	514
27	518	526	522
28	526	534	530
29	534	542	538
30	542	550	546
31	550	558	554
32	558	566	562
33	566	574	570
34	574	582	578

Channel	Start Frequency (MHz)	End Frequency (MHz)	Center Frequency (MHz)
35	582	590	586
36	590	598	594
37	598	606	602
38	606	614	610
39	614	622	618
40	622	630	626
41	630	638	634
42	638	646	642
43	646	654	650
44	654	662	658
45	662	670	666
46	670	678	674
47	678	686	682
48	686	694	690

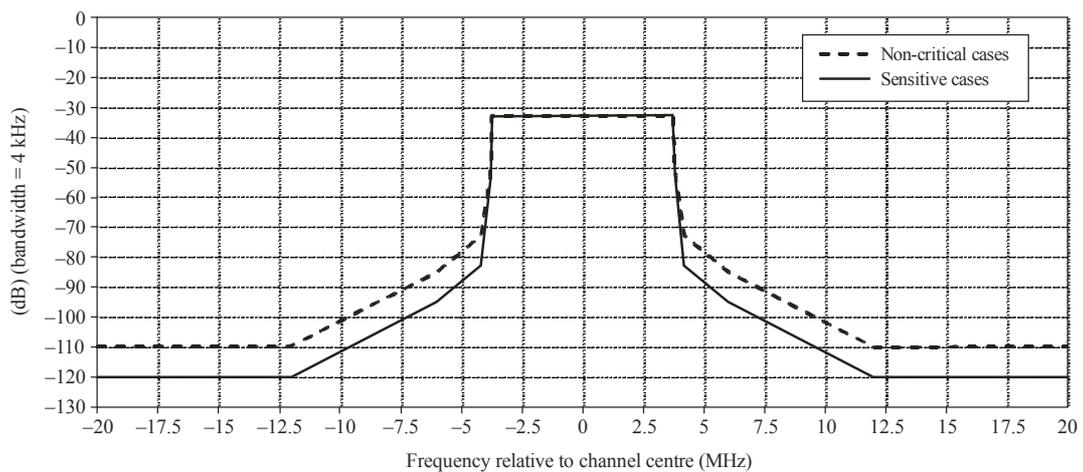


Figure A1-1 Transmission spectrum limit masks for 8 MHz
(See Table A1-1 Column 7.5 Transmission spectrum mask)

Table A1-4 Break points corresponding to Figure A1-1
(See Table A1-1 Column 7.5 Specification of the transmission spectrum mask)

Frequency relative to the center of the 8 MHz channel (MHz)	Relative level in a 4 kHz measurement bandwidth (dB)	
	Non-critical emission mask	Sensitive cases
-20	-110	-120
-12	-110	-120
-6	-85	-95
-4.2	-73	-83
-3.81	-52.7	-52.7

Frequency relative to the center of the 8 MHz channel (MHz)	Relative level in a 4 kHz measurement bandwidth (dB)	
	Non-critical emission mask	Sensitive cases
-3.72	-32.7	-32.7
+3.72	-32.7	-32.7
+3.81	-52.7	-52.7
+4.2	-73	-83
+6	-85	-95
+12	-110	-120
+20	-110	-120

Table A1-5 Allowable spurious emission power

(See Table A1-1 Column 7.6 Table 45 — Allowable spurious emission power)

Separation in relation to the digital signal central carrier	Attenuation (dB) below the power supplied to the antenna transmission line
> 20 MHz	46+10log(P), or 60dBc, whichever is less stringent, without exceeding the absolute mean power level of 12mW for UHF stations.
< - 20 MHz	

Annex 2 Video coding

The details of the modifications from ABNT NBR 15602-1 are shown in Table A2-1. Video coding parameters for full-seg services shown in Table A2-2 are applied to any layers except for the partial reception layer.

Table A2-1 Modifications from ABNT NBR 15602-1

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
5.4 Parameters for video signals	4	NOTE See ITU Recommendation BT.709-5 and ITU Recommendation BT.601-5. for additional information.	NOTE Table 5 to 14 and Figures 1 to 13 are for 60Hz field frequency. See ITU Recommendation BT.709-5 and ITU Recommendation BT.601-5. for 50Hz field frequency. Video coding parameters for Full-Seg services should meet the parameters indicated in Table A2-2.
8.3.1 General specifications	25	5 Hz, 10 Hz, 12Hz, 15 Hz, 24 Hz, 30Hz	5 Hz, 10 Hz, 12 Hz, 15 Hz, 24 Hz, 25 Hz, 30 Hz

Table A2-2 Video coding parameters for Full-Seg services

Number of horizontal pixels	Number of vertical pixels	Frame rate [Hz]	Scanning system	Aspect ratio	Profile and level
720	576	25	Interlaced	4:3 16:9	H.264|MPEG-4 AVC HP@L3
720	576	50	Progressive	16:9	H.264|MPEG-4 AVC HP@L3.1
1280	720	50	Progressive	16:9	H.264|MPEG-4 AVC HP@L4
1920	1080	25	Interlaced	16:9	H.264|MPEG-4 AVC HP@L4
1920	1080	25	Progressive	16:9	H.264|MPEG-4 AVC HP@L4

Annex 3 Audio coding

There is no amendment to ABNT 15602-2. However audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

Annex 4 Multiplexing

There is no amendment to ABNT 15602-3

Annex 5 Service information

The details of the modifications from ABNT NBR 15603-1, 15603-2 and 15603-3 are shown in Table A5-1, A5-2 and A5-3, respectively.

Table A5-1 Modification from ABNT NBR 15603-1

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
6.1 PID used for tables transmission	8	... specified by the Brazilian Ministry of Communications or signal of broadcasters.	... specified by signal of broadcasters.

TableA5-2 Modifications from ABNT NBR 15603-2

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.1 Table 26: Location and requirements of SI descriptors	45	- Carousel ID descriptor - Association tag descriptor - Deferred association tag descriptor	Deleted Deleted Deleted
8.3.4 Component descriptor	49	Table 28	Add video formats described in table A5-4 to Table 28.
8.3.30 Video decode control descriptor	80	Table 66 — Video encoding format	Add video encoding format as described in Table A5-5.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.3.31 Terrestrial delivery system descriptor	80	$(473 + 6 \times (X - 14) + 1/7) \times 7 = (xxx)d$	$(474 + 8 \times (X - 21)) \times 7 = (xxx)d$
Annex E: Area_code specification	116 117	(Whole of Annex E)	Assignment of area_code is in compliance with Appendix 10 in this document
Annex G Specification for tuning physical and logical channel	120	- 6MHz	- 8MHz
Annex H.2: Original_network_id	122	(Whole of Annex H.2)	Refer to Annex A5-1 in this document about the structure of original_network_id.
3.2	3	- Brazilian	- Botswana
8.3.21	61	- Brazil	- Botswana
Annex A	103		
Annex I.1:	124		
Annex I.6	126		
7.2.7.1	28	- Brazil (UTC-3)	- Botswana (UTC+2)
7.2.8	29	- UTC-3	- UTC+2
7.2.9.1	30		
7.2.12	35		
8.3.25	67		
Annex A	103		
8.3.4	48	EXAMPLE Portuguese, Brazilian official language, has 3 coded characters "por", which is coded as: "0111 0000 0110 1111 0111 0010".	EXAMPLE English has 3-character code "eng", which is coded as: "0110 0101 0110 1110 0110 0111", and Setswana has 3-character code "tsn", which is coded as: "0111 0100 0111 0011 0110 1110"
8.3.7	52		
8.3.15	59		
8.3.6	52	EXAMPLE Brazilian country has 3 character code "BRA", which is coded as: "0100 0010 0101 0010 0100 0001"	EXAMPLE Botswana country has 3 character code " BWA", which is coded as: "0100 0010 0101 0111 0100 0001"
8.3.11	55		
8.3.25	67		
8.3.26	69		

Table A5-3 Modifications from ABNT NBR 15603-3

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.2.2	15	- UTC-3	- UTC+2
8.2.6	19		
8.2.6 Table 13	19		
B.1.4.3	30		
B.5	50		
8.2.5 Short node information descriptor	17	EXAMPLE Portuguese, Brazilian official language, has 3 coded characters "por", which is coded as: "0111 0000 0110 1111 0111 0010".	EXAMPLE English has 3-character code "eng", which is coded as: "0110 0101 0110 1110 0110 0111", and Setswana has 3-character code "tsn", which is coded as: "0111 0100 0111 0011 0110 1110"
B.1.4.3	30	- Brazilian	- Botswana
B.2.7	42		

Table A5-4 Stream_content and component_type (additional items)
 (See Table A5-2 Column 8.3.4 Component descriptor)

Stream_content	Component_type	Description
0x05	0x05	H264/AVC video 625i(576i), 4:3 aspect ratio
0x05	0x06	H264/AVC video 625i(576i), 16:9 aspect ratio with pan vectors
0x05	0x07	H264/AVC video 625i(576i), 16:9 aspect ratio without pan vectors
0x05	0x08	H264/AVC video 625i(576i), > 16:9 aspect ratio
0x05	0xA5	H264/AVC video 625p(576p), 4:3 aspect ratio
0x05	0xA6	H264/AVC video 625p(576p), 16:9 aspect ratio with pan vectors
0x05	0xA7	H264/AVC video 625p(576p), 16:9 aspect ratio without pan vectors
0x05	0xA8	H264/AVC video 625p(576p), > 16:9 aspect ratio

Table A5-5 Video encoding format
 (See Table A5-2 Column 8.3.30 Video decode control descriptor)

Video encoding format	Description
0000	1080p
0001	1080i
0010	720p
0011	480p or 576p
0100	480i or 576i
0101	240p
0110	120p
0111	Reserved
1000	180p
1001-1011	Reserved
1100-1111	For video encoding format extension

A5-1 Original_network_id

(See Table A5-2 Column Annex H.2: Original_network_id)

Refer to Figure A5-1 about the structure of original_network_id.

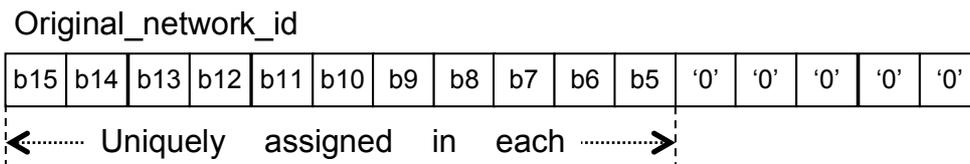


Figure A5-1 Structure of original_network_id

Annex 6 Receiver

The details of the modifications from ABNT NBR 15604 are shown in Table A6-1.

Table A6-1 Modifications from ABNT NBR 15604

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Contents	v, vi	Annex B (normative) Priority parameters of middleware Ginga Annex C (normative) Measurement method C.1 Sensitivity C.2 Selectivity (protection ratio)	Deleted
4 5.2 Figure 2: 7.2.27.7	6 8 22	- PAL-M - Standard: M	- PAL-I - Standard: I
6: Environment and safety conditions	10	Environment and safety conditions	About safety regulations, it shall be in reference to actual standards in Botswana.
7.1: Reception antenna	12	a) the antenna shall allow the reception of digital terrestrial television signals that are comprehended between VHF channels from 07 to 13 and the UHF channels from 14 to 69, for the fixed and mobile (full-seg) receivers and at least the channels comprehended in the UHF band between the channels 14 to 69 for the portable (one-seg) receivers;	a) the antenna shall allow the reception of digital terrestrial television signals that are comprehended between the UHF channels from 21 to 48;
		b) optionally, the antenna may yet allow the reception of analog terrestrial television signals that are comprehended between the VHF channels from 02 to 13 and UHF from 14 to 62;	Deleted
7.2.1.1 7.2.1.2	12	type F	type IEC 61169-2
7.2.2.1: Fixed or mobile (full-seg) reception devices	13	The receiver unit shall be able to tuning television channels limited by the VHF high band, comprehended between the channels 07 to 13 and the receiver unit shall be able to tuning the television channels limited by the UHF band, comprehended between the channels 14 to 69.	The receiver unit shall be able to tuning the television channels limited by the UHF band, comprehended between the channels 21 to 48.
7.2.2.2: Portable devices for partial reception (one-seg)	13	The partial reception unit shall be able to tuning, at least, the television channels limited by the UHF band, comprehended between the channels 14 to 69.	The partial reception unit shall be able to tuning, at least, the television channels limited by the UHF band, comprehended between the channels 21 to 48.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
		The VHF high band channels reception is optional in the portable receivers (one-seg).	Deleted
7.2.3 Channel bandwidth	13	a) fixed or mobile (full-seg) reception devices: 5.7 MHz; b) portable (one-seg) devices: 0.43 MHz.	a) fixed or mobile (full-seg) reception devices: 7.6 MHz; b) portable (one-seg) devices: 0.58 MHz.
7.2.4: Table 3 – Frequencies of channels of UHF band	13	Table 3 – Frequencies of channels of UHF band	See Table A1-3 for 8MHz/ch UHF channels
7.2.5: Sensitivity	16	a) minimum antenna signal input level: - 77 dBm or lower, as shown in Annex C, subclause C.1. b) maximum antenna signal input level: equal or higher than - 20 dBm;	a) minimum antenna signal input level: - 78,4 dBm or lower; b) maximum antenna signal input level: equal or higher than 0 dBm;
7.2.6: Selectivity – Protection ratio	16	The measurement method is demonstrated in Annex C.	Deleted
7.2.7: First intermediate frequency (IF)	16	The central frequency of the IF shall be of 44 MHz, and optionally direct conversion in base band. The local oscillator frequency shall be located at the upper side of the received frequency.	The central frequency of the IF shall be of 36 MHz, and optionally direct conversion in base band. Low-IF under 10MHz is also acceptable such as for Silicon-Tuner use. As for frequency conversion, either upper or lower heterodyne conversion is acceptable as long as there is no side-effect.
7.2.10.1 Figure 5	17	44MHz or base band	36MHz or base band
7.2.10.2 Figure 6	18		
7.2.21: Primary data decoder	20	The porting of middleware Ginga is optional; however when it is embedded in the receiver, the minimum requirements defined in Table B.1 shall necessarily to be implemented (see Clause 9).	All the technical methods and parameters for BML data broadcasting shall be in accordance with ARIB STD-B24.
7.2.24: Accessibility	21	c) locution;	"Locution" specification is not necessary since there is no detail in ABNT.
	21	e) LIBRAS window.	"LIBRAS window" is a unique item to Brazilian standard. So it is not necessary.
7.2.27.1	21	"F" type	"IEC 61169-2" type
7.2.27.1	21		
7.2.27.7: RF Output	22	according to Clause 8, Table 9.	according to Clause 8, Table 10.
7.2.28: Remote control	22	7.2.28 Remote control	See Table A6-2 for remote control keys used for data broadcasting; and Fig A6-1 for examples of remote controllers.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
8.1.4.2: Full-seg receiver	26	The full-seg receivers shall support at least the video decoding in the 525i, 525p, 750p and 1125i formats, according to the specified in the ABNT NBR 15602-1.	The full-seg receivers shall support at least the video decoding in the 576i, 576p, 720p, 1080i and 1080p formats.
8.1.4.4: Full-seg receiver with support to the one-seg exhibition	26	Table 8 – Resolutions which shall be supported	See Table A6-3 for resolutions which shall be supported.
8.1.5.1 Full-seg receivers	26	The full-seg receivers shall at least support the frames rate of 30/1.001 Hz and 60/1.001 Hz.	The full-seg receivers shall at least support the frames rate of 25 Hz and 50 Hz.
8.1.5.2 One-seg receiver	26	The one-seg receivers shall at least support the frames rate 5fps, 10fps, 12fps, 15fps, 24fps and 30fps	The one-seg receivers shall at least support the frames rate 5fps, 10fps, 12fps, 15fps, 24fps, 25fps and 30fps
8.1.6.1: Full-seg receivers type digital converter	27	8.1.6.1 Full-seg receivers type digital converter The digital converter receiver (set-top box) shall have a RCA connector, 75 Ω, for composite video 525i output encoded in PAL-M. The video signal with the specified configuration shall be always present independently of the encoder parameters of a video pertaining to a stream received for decoding. This requirement is optional for integrated receivers with display, fixed or portable.	8.1.6.1 Full-seg receivers type digital converter The digital converter receiver (set-top box) shall have an RCA connector, 75 Ω, for composite video 625i output encoded in PAL-I. The video signal with the specified configuration shall always be present independently of the encoder parameters of a video pertaining to the stream received for decoding. This requirement is optional for integrated receivers with display, fixed or portable.
8.1.7 Analog video output	27-29	8.1.7 Analog video output	Deleted
9: Primary data decoding	34	9 Primary data decoding	About Data broadcasting, all the technical methods and parameters for BML shall be in accordance with ARIB STD-B24. See attached document.
11.3 Semantics for parental rating descriptor	35	EXAMPLE Brazilian country has 3 character code "BRA", which is coded as: "0100 0010 0101 0010 0100 0001"	EXAMPLE Botswana country has 3 character code " BWA", which is coded as: "0100 0010 0101 0111 0100 0001"
11.4 Cases in which the receiver shall not block the event	36	"BRA" (0x425241)	BWA"=0x425741
12: Accessibility resources	39	Portuguese	English and Setswana
	39	c) Audio locution	"Locution" specification is not necessary since there is no detail in ABNT.

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
	39	e) LIBRAS window	"LIBRAS window" is an item unique to Brazilian standard. So it is not necessary.
14.1.2: Full-seg receiver	42	It is optional for the full-seg receivers manufacturers the implementation of the USB port, since such equipment do not have interactivity channel, even if the middleware Ginga is embedded on them.	It is optional for the full-seg receiver manufacturers to provide the USB port.
Annex A: Priority parameters of the receiver unit	47	In Table A.1	In "ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE" (NOTE)
	48-57	Table A.1	Deleted
Annex B: Priority parameters of middleware Ginga	58-62	Annex B Priority parameters of middleware Ginga	Deleted
Annex C(normative) Measurement method	63-64	Annex C(normative) Measurement method	Deleted

(NOTE) The "ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE" doesn't correspond to 8MHz system. Japan is ready to propose the modifications to include 8MHz system for the next ISDB-T International Forum..

Table A6-2 Remote control keys used for data broadcasting
(See Table A6-1 Column 7.2.28: Remote control)

Key type	Guidelines
↑、↓、←、→ (up, down, left, right keys)	To move up, down, left, right.
0 - 9 (number keys)	To input numbers
Confirm	Separator of operation (enter)
Back	Cancel operation
	Back space of user input character (or bulk erase)
	Disconnection of a call to a communication server (*):During connection, receiver units will take the instruction; after connection, instruction is carried out in the contents. (A display to the effect that the connection will be terminated is desirable when the back key is pressed.)
	(*):It is okay to use BML documents for the purpose of going back. However, whether or not there is something after returning should be considered.
Data	Switches display/non-display of multi-media data broadcasting. (*):Separated "Data" button is recommended.

Red, green, yellow, and blue (color keys)	Selection of operation (execution) (*Location of buttons on the remote control should be in order of red, green, yellow, blue from the left.
Bookmark (Optional)	Recording of bookmark.

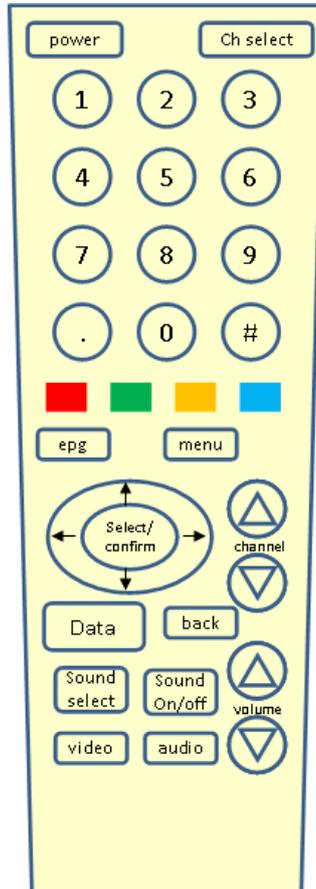


Fig A6-1 Example of Remote Controller
(See Table A6-1 Column 7.2.28: Remote control)

Table A6-3 Resolutions which shall be supported

Output video format	Aspect ratio	Number of lines to be decoded	Aspect ratio info	Output video format	Aspect ratio	Number of lines to be decoded	Aspect ratio idc
SQVGA	4:3	160 x 120	1	576i	4:3	720 x 576	2
SQVGA	16:9	160 x 90	1	576i	16:9	720 x 576	4
QVGA	4:3	320 x 240	1	576p	16:9	720 x 576	4
QVGA	16:9	320 x 180	1	720p	16:9	1280 x 720	1
CIF	4:3	352 x 288	2	1080i	16:9	1920 x 1080	1
				1080p	16:9	1920 x 1080	1

Annex 7 Security issue

There is no amendment to ABNT NBR 15605-1.

Annex 8 Data broadcasting

All the technical methods and parameters for BML data broadcasting, subtitle and superimposed characters coding shall be in accordance with ARIB STD-B24.

ARIB STD-B24 includes the usage of UCS (Universal multi-octet coded character set) and UTF-8 (UCS Transformation Format—8-bit) in it, yet it is intended for the usage in Japan only. Therefore for the usage in Botswana, some modifications are needed.

A8-1 Modifications for BML data broadcasting

The details of the modifications from ARIB STD-B24 necessary for BML data broadcasting in Botswana are shown in Table A8-1-1.

Table A8-1-1 Modifications from ARIB STD-B24 (BML data broadcasting)

Section No. and item		Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Volume 1 Chapter 7	7.1 JIS 8bit character code	34	Whole of section	No use in Botswana.
	7.2 Universal multi-octet coded Character Set (UCS)	102	- Table 7-19 Code Values for Added Symbols Set - Table 7-20 Revision to Table 7-19: Modification of code values of Additional Symbols Set to comply with JIS X0213:2004 - 7.2.1.2 Supplemental characters (Gaiji)	No use in Botswana. For Botswana localized character set. See Table A8-1-2.
		105	7.2.2 Coding of control code The control codes available to this standard are limited to 0x007F (DEL); 0x000D and 0x000A (CR/LF); and 0x0009 (TAB).	See "7.1.2 Coding of control function" and Tables 7-14, 7-15, 7-16, and 7-17.

Section No. and item		Page	Original ISDB-T Standards	Botswana ISDB-T Standards
		105	7.2.3 Character encoding scheme	Adding descriptions about UTF-8. <ul style="list-style-type: none"> - No use "Byte Order Mark". - C0 control codes (0x00 – 0x1F) are 0x0000 – 0x001F in UTF-8. - C1 control codes (0x80 – 0x9F) are 0xC280 – 0xC29F in UTF-8.
	7.3 Shift-JIS Character Codes	105	Whole of section	No use in Botswana.

Table A8-1-2 Character set for Botswana (See Table A8-1-1 Column 7.2 Universal multi-octet coded Character Set (UCS))

U+0021	U+002D	U+0039	U+0045	U+0051	U+005D	U+0069	U+0075	U+00A4	U+00BC	U+201D	U+20A7	U+20B3
!	-	9	E	Q	]	i	u	⊘	¼	”	Pts	Ⓐ
U+0022	U+002E	U+003A	U+0046	U+0052	U+005E	U+006A	U+0076	U+00A5	U+00BD	U+203C	U+20A8	U+20B4
”	.	:	F	R	^	j	v	¥	½	!!	Rs	₣
U+0023	U+002F	U+003B	U+0047	U+0053	U+005F	U+006B	U+0077	U+00A7	U+00BE	U+2047	U+20A9	U+20B5
#	/	;	G	S	_	k	w	§	¾	??	₩	©
U+0024	U+0030	U+003C	U+0048	U+0054	U+0060	U+006C	U+0078	U+00A9	U+00D7	U+2048	U+20AA	U+20B6
\$	0	<	H	T	`	l	x	©	×	!?	℞	tt
U+0025	U+0031	U+003D	U+0049	U+0055	U+0061	U+006D	U+0079	U+00AB	U+00F7	U+2049	U+20AB	U+20B7
%	1	=	I	U	a	m	y	«	÷	!?	đ	
U+0026	U+0032	U+003E	U+004A	U+0056	U+0062	U+006E	U+007A	U+00AE	U+00CA	U+20A0	U+20AC	U+20B8
&	2	>	J	V	b	n	z	®	Ê	£	€	₯
U+0027	U+0033	U+003F	U+004B	U+0057	U+0063	U+006F	U+007B	U+00B0	U+00D4	U+20A1	U+20AD	U+20B9
'	3	?	K	W	c	o	{	°	Ô	¢	₰	₹
U+0028	U+0034	U+0040	U+004C	U+0058	U+0064	U+0070	U+007C	U+00B1	U+00EA	U+20A2	U+20AE	U+20BA
(	4	@	L	X	d	p	|	±	ê	ƒ	₣	₺
U+0029	U+0035	U+0041	U+004D	U+0059	U+0065	U+0071	U+007D	U+00B5	U+00F4	U+20A3	U+20AF	U+2103
)	5	A	M	Y	e	q	}	µ	ô	F	ℓ	°C
U+002A	U+0036	U+0042	U+004E	U+005A	U+0066	U+0072	U+007E	U+00B6	U+2018	U+20A4	U+20B0	U+2109
*	6	B	N	Z	f	r	~	¶	'	£	₰	₣
U+002B	U+0037	U+0043	U+004F	U+005B	U+0067	U+0073	U+00A2	U+00B7	U+2019	U+20A5	U+20B1	U+2116
+	7	C	O	[	g	s	ç	.	'	₰	₰	No.
U+002C	U+0038	U+0044	U+0050	U+005C	U+0068	U+0074	U+00A3	U+00BB	U+201C	U+20A6	U+20B2	U+2121
,	8	D	P	¥	h	t	£	»	“	₰	G	TEL

Table A8-1-2 Character set for Botswana (Cont.)

U+2122	U+215B	U+2168	U+2178	U+2198	U+25B2	U+260F	U+263B	U+266C
™	1/8	IX	ix	↘	▲	☎	☺	♪
U+2150	U+215C	U+2169	U+2179	U+2199	U+25B3	U+2610	U+2660	U+266D
1/7	3/8	X	x	↙	△	□	♠	b
U+2151	U+215D	U+216A	U+217A	U+21D0	U+25BC	U+2611	U+2661	U+266E
1/9	5/8	XI	xi	←	▼	☑	♥	♩
U+2152	U+215E	U+216B	U+217B	U+21D1	U+25BD	U+2612	U+2662	U+266F
1/10	7/8	XII	xii	↑	▽	☒	◇	♯
U+2153	U+2160	U+2170	U+2190	U+21D2	U+2600	U+2613	U+2663	U+26C4
1/3	I	i	←	⇒	☀	✕	♣	
U+2154	U+2161	U+2171	U+2191	U+21D3	U+2601	U+2614	U+2664	U+26C5
2/3	II	ii	↑	↓	☼		♠	
U+2155	U+2162	U+2172	U+2192	U+21D4	U+2602	U+261C	U+2665	U+26C6
1/5	III	iii	→	↔	☂	☞	♥	
U+2156	U+2163	U+2173	U+2193	U+21D5	U+2603	U+261D	U+2666	U+26C7
2/5	IV	iv	↓	↕	☃	☝	♦	
U+2157	U+2164	U+2174	U+2194	U+21D6	U+2604	U+261E	U+2667	U+26C8
3/5	V	v	↔	↗	☂	☞	♣	
U+2158	U+2165	U+2175	U+2195	U+21D7	U+2605	U+261F	U+2669	
4/5	VI	vi	↕	↖	★	☝	♪	
U+2159	U+2166	U+2176	U+2196	U+21D8	U+2606	U+2639	U+266A	
1/6	VII	vii	↖	↘	☆	☹	♪	
U+215A	U+2167	U+2177	U+2197	U+21D9	U+260E	U+263A	U+266B	
5/6	VIII	viii	↗	↙	☎		♪	

A8-2 Modifications for subtitle and superimposed characters

The details of the modifications from ARIB STD-B24 necessary for subtitle and superimposed characters are shown in Table A8-2.

Table A8-2 Modifications from ARIB STD-B24
(Subtitle and superimposed characters)

Section No. and item	Page	Original ISDB-T Standards	Botswana ISDB-T Standards
Volume 1 Part 3 4 Presentation function of caption and superimpose Table 4-1: Presentation function of caption	142	Kanji, hiragana, katakana, symbol, alphanumerical, Greece characters, Russian characters, ruled line, DRCS	Characters defined in UTF-8 character code
Volume 1 Part 3 5.2 Character set	144	Standard character set should be kanji, hiragana, katakana, symbol, alphanumeric, Greece characters, Russian characters, box drawing, and DRCS.	Character set defined in UCS should be used.
Volume 1 Part 3 5.5 Character coding	144	For character coding, 8bitcode shall be used.	For character coding, UTF-8 character code shall be used.
Volume 1 Part 3 5.6 Control code	144	Control code used for caption is in compliance with Volume 1, Part 2 of this standard.	Control code used for caption is in compliance with Annex A8-1 in this document.
Volume 1 Part 3 9.3.1 Table 9-8: Character coding	155	Reserved for UCS	UCS

Annex 9 Interactive channel

There is no amendment to ABNT NBR 15607-1.

Annex 10 EWBS

There is no amendment to ISDB-T Harmonization Document PART 3: Emergency Warning Broadcast System (EWBS).