ISDB-T STANDARDS OF BOTSWANA

ISSUED BY

BOTSWANA COMMUNICATIONS REGULATORY AUTHORITY

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Contents

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Scope

This document serves to provide technical specifications of equipment and products, and to establish secure the interconnectivity/interoperability by defining 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.

Botswana Communications Regulatory Authority shall type-approve all ISDB-T equipment based on the standards defined in this document.

The Annex, which is the integral part of the standards, covers the details of Botswana Standards as modified from the existing standards.

Reference Documents to the Standards

1. The Appendix ***1***, ***Titled*** **"Operational Guidelines for Operating ISDB-T Broadcasting"** is not the integral part of ***the standards but gives*** supplementary information to the standards, and 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. The Appendix 2, "Titled **"Botswana ISDB-T Standards Development Process"** gives full details of how the Botswana ISDB-T standards were developed. The document gives specific details (section and Items) and the rationale of modifications done on the existing ISDB-T standards to derive Botswana ISDB-T standard.

Entry into force

This specification shall enter into force on 10/03/15.

Document History

Description	**Status**	**Date**
Edition 1	Draft	10/03/15

ISDB-T Standards

1. **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. The following transmission parameters would apply;

   - Symbol duration : 6/8 shorter than 6MHz/ch
   - Bandwidth : 8/6 wider than 6MHz/ch
   - IFFT sample clock : 8/6 faster than 6MHz/ch
   - transmission bitrate : 8/6 faster than 6MHz/ch
   - Guard interval length : 6/8 shorter than 6MHz/ch
   - channels : set by every 8MHz
   - 13 segments in 8MHz

   See Annex 1 for details.

2. **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.

3. **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.

4. **Multiplexing**

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

5. **Service information**

   The technical parameters related to service information shall be in accordance with ABNT NBR15603 with the following modifications;

   - 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.

See Annex 4 for the details.

6. **Receiver**

   The technical parameters related to receivers shall be in accordance with ABNT NBR15604. The operational and technical specifications defined in document DTT001 shall apply.

7. **Security issues**

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

8. **Data broadcasting**

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

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

   The character set and character coding shall be as per Annex 6. Annex 6 gives Data broadcasting standard with respect to remote control requirements.

9. **Interactive channel**

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

10. **Emergency Warning Broadcast System (EWBS)**

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

ANNEX

This annex details Botswana Standards as modified from the existing standards.

Annex 1 Transmission

Table A1-1 Transmission Parameters

Item		Botswana ISDB-T Standards
6.1 Table 1 — Parameters of the transmission system	2. Segment width	8000/14 = 571.43 kHz
	3. Used bandwidth	7.433MHz(mode1) 7.431MHz(mode2) 7.429(mode3)
	6. Active symbol duration	189μs (mode 1) 378 μs (mode 2) 756 μs (mode 3)
	7. Carrier spacing	Bws/108 = 5.291… kHz Bws/216 = 2.645… kHz Bws/432 = 1.322… kHz
	8. Guard interval duration	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)
	9. Overall symbol duration	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)
6.1 Principal parameters		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).
		Up to three hierarchical layers may be transmitted in an 8 MHz channel.
OFDM segment parameters		ARIB STD-B31 Version 2.2-E1 Table A-5: ODFM Segment Parameters (8MHz Bandwidth System)

Item	Botswana ISDB-T Standards
Transmission signal parameters	ARIB STD-B31 Version2.2-E1 Table A- 6: Transmission Signal Parameters (8MHz Bandwidth System)
Data rate of a single segment	ARIB STD-B31 Version2.2-E1 Table A- 7: Data Rate per a Single Segment (8MHz Bandwidth System)
Total data rate	ARIB STD-B31 Version2.2-E1 Table A- 8: Total Data Rate*1 (8MHz Bandwidth System)
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	A frequency bandwidth of 7.6 MHz shall be used for digital terrestrial television broadcasting.
	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	Offset not be used.
	High VHF channels not be used.
	See table A1-3 for 8MHz/ch UHF channels

Item	Botswana ISDB-T Standards
7.4 IFFT sampling frequency and permissible deviation	The IFFT sampling frequency for use with OFDM for digital terrestrial television broadcasting shall be as follows: Fs = 2048/189 MHz = 10 835 978 Hz
	The permissible deviation is ± 0.2 Hz/MHz.
	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	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.
	See Figure A1-1 for 8MHz/ch Spectrum limit masks
	See Table A1-4 for 8MHz/ch break points

Item	Botswana ISDB-T Standards
7.5.2 Criteria for applying masks	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	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

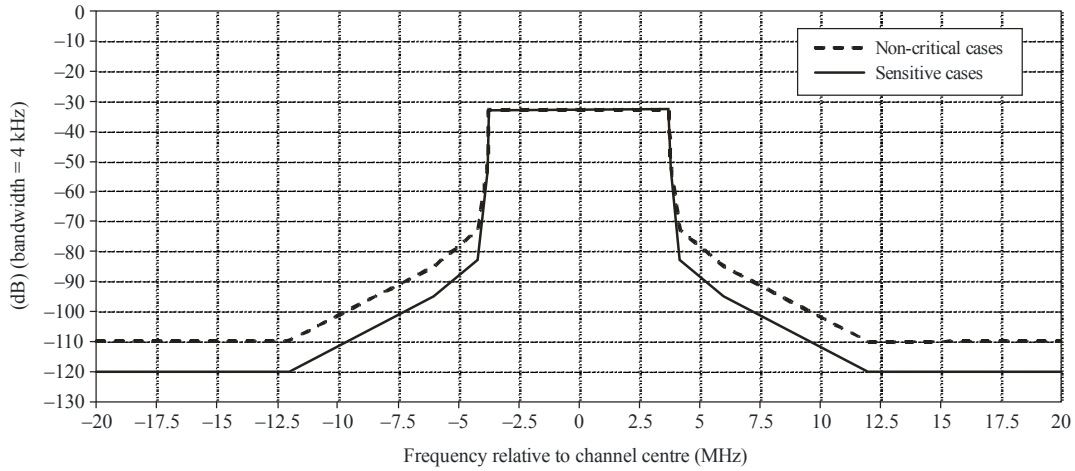

Figure A1-1 Transmission spectrum limit masks for 8 MHz
(See Table A1-1 Column 7.5 Transmission spectrum mask)

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

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 Video Coding

Item	Botswana ISDB-T Standards
5.4 Parameters for video signals	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	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

Audio coding parameters for full-seg services are applied to any layers except for the partial reception layer.

Annex 4 Service information

Table A4-1 Service Information

Item	Botswana ISDB-T Standards
6.1 PID used for tables transmission	specified by signal of broadcasters.

TableA4.2 Service Information

Item	Botswana ISDB-T Standards
8.3.4 Component descriptor	Add video formats described in table A5-4 to Table 28.
8.3.30 Video decode control descriptor	Add video encoding format as described in Table A5-5.
8.3.31 Terrestrial delivery system descriptor	(474 + 8 x (X – 21)) x 7 = (xxx)d
Area_code specification	Assignment of area_code is in compliance with Appendix 1 (reference document)
Specification for tuning physical and logical channel	- 8MHz
Original_network_id	Refer to Annex A4-1 in this document about the structure of original_network_id.

Table A4-3 Modifications from ABNT NBR 15603-3

Item	Botswana ISDB-T Standards
8.2.5 Short node information descriptor	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 B.2.7	- Botswana

Table A4-4 Stream_content and component_type (additional items)
(See Table A4-2 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 A4-5 Video encoding format
(See Table A4-2 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

A4-1 Original_network_id
(See Table A4-2 Column Annex H.2: Original_network_id)

Refer to Figure A4-1 about the structure of original_network_id.

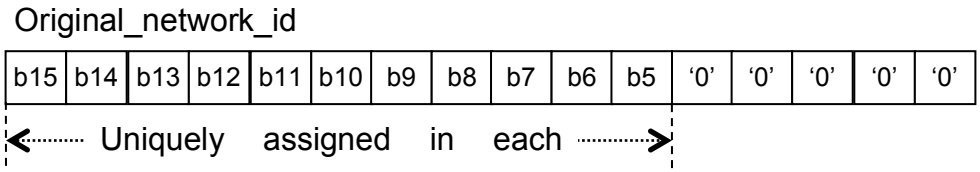

Figure A4-1 Structure of original_network_id

Annex 5 Receiver

Table A5-1 Receiver

Section No. and item	Botswana ISDB-T Standards
Video Output	- PAL-I - Standard: I
6: Environment and safety conditions	Relevant Botswana Standards
7.1: Reception antenna	a) the antenna shall allow the reception of digital terrestrial television signals that are comprehended between the UHF channels from 21 to 48;
Connector	type IEC 61169-2
7.2.2.1: Fixed or mobile (full-seg) reception devices	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)	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.
	Deleted
7.2.3 Channel bandwidth	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	See Table A1-3 for 8MHz/ch UHF channels

Section No. and item	Botswana ISDB-T Standards
7.2.5: Sensitivity	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	Deleted
7.2.7: First intermediate frequency (IF)	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.
7.2.21: Primary data decoder	All the technical methods and parameters for BML data broadcasting shall be in accordance with ARIB STD-B24.
7.2.27.7: RF Output	according to Clause 8, Table 10.
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.
8.1.4.2: Full-seg receiver	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	See Table A6-3 for resolutions which shall be supported.
8.1.5.1 Full-seg receivers	The full-seg receivers shall at least support the frames rate of 25 Hz and 50 Hz.
8.1.5.2 One-seg receiver	The one-seg receivers shall at least support the frames rate 5fps, 10fps, 12fps, 15fps, 24fps, 25fps and 30fps

Section No. and item	Botswana ISDB-T Standards
8.1.6.1: Full-seg receivers type digital converter	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.
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	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	BWA”=0x425741
14.1.2: Full-seg receiver	It is optional for the full-seg receiver manufacturers to provide the USB port.
Annex A: Priority parameters of the receiver unit	In “ISDB-T HARMONIZATION DOCUMENT PART 1: HARDWARE” (NOTE)

Table A5-2 Remote control keys used for data broadcasting
(See Table A5-1 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.

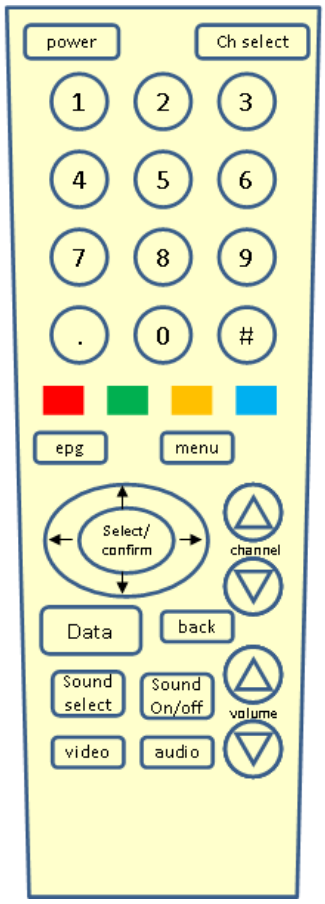

Fig A5-1 Example of Remote Controller
(See Table A5-1 Column 7.2.28: Remote control)

Table A5-3 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 6 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.

A6-1 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 A6-1-1.

Table A6-1-1 BML data broadcasting

Item	Botswana ISDB-T Standards
7.2 Universal multi-octet coded Character Set (UCS)	For Botswana localized character set. See Table A6-1-2.
	See “7.1.2 Coding of control function” and Tables 7-14, 7-15, 7-16, and 7-17.
	Adding descriptions about UTF-8. - 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.

Table A6-1-2 Character set for Botswana (See Table A6-1-1 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	”	₧	₳
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	‼	₨	₴
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	©	×	⁇	₪	₶
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	«	÷	⁉	₫	
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	₢	₮	₺
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	₣	₯	℃
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	¢	·	’	₥	₱	№
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	£	»	“	₦	₲	℡

Table A6-1-2 Character set for Botswana (Cont.)

U+2122	U+215B	U+2168	U+2178	U+2198	U+25B2	U+260F	U+263B	U+266C
™	⅛	Ⅸ	ⅸ	↘	▲	☏	☻	♬
U+2150	U+215C	U+2169	U+2179	U+2199	U+25B3	U+2610	U+2660	U+266D
⅐	⅜	Ⅹ	ⅹ	↙	△	☐	♠	♭
U+2151	U+215D	U+216A	U+217A	U+21D0	U+25BC	U+2611	U+2661	U+266E
⅑	⅝	Ⅺ	ⅺ	⇐	▼	☑	♡	♮
U+2152	U+215E	U+216B	U+217B	U+21D1	U+25BD	U+2612	U+2662	U+266F
⅒	⅞	Ⅻ	ⅻ	⇑	▽	☒	♢	♯
U+2153	U+2160	U+2170	U+2190	U+21D2	U+2600	U+2613	U+2663	U+26C4
⅓	Ⅰ	ⅰ	←	⇒	☀	☓	♣	
U+2154	U+2161	U+2171	U+2191	U+21D3	U+2601	U+2614	U+2664	U+26C5
⅔	Ⅱ	ⅱ	↑	⇓	☁		♤	
U+2155	U+2162	U+2172	U+2192	U+21D4	U+2602	U+261C	U+2665	U+26C6
⅕	Ⅲ	ⅲ	→	⇔	☂	☜	♥	
U+2156	U+2163	U+2173	U+2193	U+21D5	U+2603	U+261D	U+2666	U+26C7
⅖	Ⅳ	ⅳ	↓	⇕	☃	☝	♦	
U+2157	U+2164	U+2174	U+2194	U+21D6	U+2604	U+261E	U+2667	U+26C8
⅗	Ⅴ	ⅴ	↔	⇖	☄	☞	♧	
U+2158	U+2165	U+2175	U+2195	U+21D7	U+2605	U+261F	U+2669	
⅘	Ⅵ	ⅵ	↕	⇗	★	☟	♩	
U+2159	U+2166	U+2176	U+2196	U+21D8	U+2606	U+2639	U+266A	
⅙	Ⅶ	ⅶ	↖	⇘	☆	☹	♪	
U+215A	U+2167	U+2177	U+2197	U+21D9	U+260E	U+263A	U+266B	
⅚	Ⅷ	ⅷ	↗	⇙	☎		♫	

A6-2 Modifications for subtitle and superimposed characters

Table A2-2 Modifications for Subtitle and superimposed characters

Section No. and item	Botswana ISDB-T Standards
4 Presentation function of caption and superimpose Presentation function of caption	Characters defined in UTF-8 character code
5.2 Character set	Character set defined in UCS should be used.
5.5 Character coding	For character coding, UTF-8 character code shall be used.
5.6 Control code	Control code used for caption is in compliance with Annex A8-1 in this document.