ISDB-T HARMONIZATION DOCUMENT

PART 1: HARDWARE

(03/2012)

The documentation herein described is currently presented for revision of the contact points of the Working Group on Harmonization of the ISDB-T International Forum.

FOREWORD

This document is the outcome of the joint efforts of the countries which adopted the ISDB-T standard under the standardization and technical cooperation activities of the ISDB-T International Forum. Participants agree on the relevance of enhancing interoperability and conformity of ISDB-T systems and commit to maximizing the commonality of the technical specifications.

It has no standardization value. Its purpose is to serve as quick a reference for characterizing the specificities of each country digital terrestrial television. It does not describe the industrial property rights mandatory to these standards and no reference is made to the domestic policies of the countries.

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

List of participants

As of March, 2012, the countries participating on ISDB-T International Forum are listed below:

ARGENTINA
BOLIVIA
BRAZIL
COSTA RICA
CHILE
ECUADOR
JAPAN
PARAGUAY
PHILIPPINES
PERU
URUGUAY
VENEZUELA

ISDB-T Harmonization document for digital terrestrial television
Part 1: Hardware

1 Scope

This document summarizes specifications of digital terrestrial television receivers among the participants ISDB-T countries. It defines the essential functionalities set required for the devices to receive signals of digital television of the thirteen segments (full-seg) as well as of one segment (one-seg) designed to receive signals in the modality fixed (indoor), mobile and portable reception.

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 15604:2008, *Digital terrestrial television - Receivers*

ARIB STD-B21:2007, *Receiver for digital broadcasting*

ARIB TR-B14:2006, *Operational guidelines for digital terrestrial television broadcasting*

Harmonization Document between ABNT NBR 15604 and ARIB STD- B21:2009, *Digital terrestrial television broadcasting – Receivers*

RESOLUTIÓN MINISTERIAL N°645-2009-MTC-03, Aprueban especificaciones técnicas mínimas de los receptores de Televisión Digital Terrestre del estándar ISDB-T (Integrated Services Digital Broadcasting – Terrestrial) a ser utilizados en el Peru

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
accessibility
condition for utilization, with security and autonomy, of the services, devices, systems and communication and information means, by person with hearing, visual or intellectual impairment

3.2
audio description
locution in each country language, overlapped to the program's original sound, designed to describe images, sounds, texts and other information that could not be perceived or understood by people with visual impairment

NOTE The information is sent by the content provider in an individual audio PES that, at the user discretion, may be selected.

3.3
built-in
any functionality embedded at the receiver which can be developed by software and/or hardware

3.4
closed-caption
transcription in each country language of dialogs, sound effects, ambient sounds and other information that cannot be perceived or understood by people with hearing impairments

3.5
coding
process of an external signal transformation into bits which represent the original signal

NOTE   The coding is done, as an example, by sampling and the information acquire can yet be compressed.

3.6
decoding
process which is responsible to restore the original signal processing the bits received from the encoder

NOTE   The decoding process can, eventually, also realize the decompression of the received information

3.7
dongle
device typically connected to a data input port of a computer

3.8
downmix
matrix applied to reduce the number of n channels

3.9
dubbing
translation of program originally spoken in foreign language, replacing the original locution by dialogs in Portuguese, synchronized with time, intonation, characters' lips movement, etc

NOTE The sound in the original language, as well as of other languages, is simultaneously transmitted in an independent audio PES or, optionally, in a dual mono audio stream.

3.10
elementary stream
ES
basic bit stream which contain information of video or audio or private data

3.11
front-end
set of components, from the antenna input up to the output interface. This module is responsible for retrieving the transport stream

3.12
full-seg receiver
devices enable to decoder audio, video, data, etc., carried by transport stream layer of the thirteen segments designed to fixed (indoor) and mobile service

NOTE The classification full-seg is applied to the digital converter, also called by set-top box and to the 13 segments receiver integrated with display, but not exclusive to these. This kind of receiver is enabling to receive and to decoder signal from terrestrial digital television in high definition and, by maker criteria, also to receive and to decoder information carried on layer "A" of the transport stream, applied for services recommended to portable receiver, here defined as one-seg.

3.13
integrated receiver
device for digital television signals reception integrated to the display not requiring audio and video signals output interfaces

3.14
LATM/LOAS
transport mechanism defined by MPEG-4 standard, which are constructed in two layer, one of them for multiplexing and another one for synchronization

NOTE The multiplexing layer LATM (low audio overhead MPEG-4 transport multiplex) manages the multiplexing of several payloads of (audio data) and its configuration data in the elements of AudioSpecificConfig. The synchronization layer LOAS (low overhead audio stream) specify a syntax for auto-synchronism of MPEG-4audio transport stream.

3.15
LIBRAS window
space delimited in the video where the information is interpreted in LIBRAS

3.16
one-seg receiver
devices which exclusively decode audio, video, data, etc information transported on layer A that is located at central segment of the thirteen segments

NOTE The classification one-seg is designed to portable receiver, also called by "handheld", specially recommended for small display, normally up to 7 inch. Among the products classified as one-seg are the receivers integrated with cell phone, PDA, dongle and portable television set which generally are powered by an internal battery and, therefore, without the necessary use of an external power source, as well as those designated to vehicle automotive. This kind of receiver is able to receiver and to decode only signal from terrestrial digital television transported on layer "A" and consequently only baseline profile signal designed for portable devices.

3.17
parental rating
classification of informative and pedagogical nature, upset toward to promote the interests of children and adolescents, on democratic way, enabling that all the addressees of the recommendation can participate of the process, and on the objective way, ensuring that the contradiction of interests and arguments promote the correction and the social control of the practiced acts

3.18
profile
specification of capability classes offering different functionalities levels

3.19
return channel or interactive channel
communication mechanism that enables connection between receiver and a remote provider

3.20
set-top box
device for digital television reception and signals decoding that is connected to a television set through cables or any other type of connection and for that needs to provide analog or digital audio and video output interfaces

3.21
threshold
defined as the boundaries of the digital converter to switching to another option of reception according to the quality of digital and analog signal

3.22
transport stream
syntax of MPEG-2 transport stream for packetizing and video, audio, data signal multiplexing at the digital broadcasting system

4   Abbreviations

For the purposes of this document, the following abbreviations apply.

A	Amperes
AAC	Advanced Audio Coding
AES/EBU	Audio Engineering Society (AES) e European Broadcasting Union (EBU)
API	Application Program Interface
AV	Audio and Video
AVC	Advanced Video Coding
BER	Bit Error Ratio
BML	Broadcast Markup Language
C/N	Carrier-to-Noise Ratio
CRC	Cyclic Redundancy Check
CVBS	Composite Video Blanking and Sync
D/A	Digital-to-Analog
dB	Decibel
D/C	Down conversion
DQPSK	Differential Quadrature Phase Shift Keying
DTCP	Digital Transmission Content Protection
EIT	Event Information Table
EPG	Electronic Program Guide
ES	Elementary Stream
FEC	Forward Error Correction
FFT	Fast Fourier Transform
fps	frames per second
HE	High Efficiency
HD	High Definition
HD D/C	High Definition Down Conversion
HDMI	High Definition Multimedia Interface
HDTV	High Definition Television
HE-AAC	High Efficiency Advanced Audio Coding
IEC	International Electrotechnical Commission
IF	Intermediate frequency
I/O	Input/Output
IP	Internet Protocol
IRD	Integrated Receiver Decoder
ISO	International Organization for Standardization
ITU	International Telecommunication Union

LATM	Low Overhead Audio Transport Multiplex
LC	Low Complexity
LFE	Low Frequency Enhancement
LIBRAS	Brazilian Sign Language
LOAS	Low Overhead Audio Stream
MPEG	Motion Picture Experts Group
MHz	Megahertz
NA	Not applicable
OFDM	Orthogonal Frequency Division Multiplexing
PAL-M	Phase Alternation Line – standard M
PDA	Personal Digital Assistant
PES	Packetized Elementary Stream
PID	Packet Identifier
PMT	Program Map Table
PS	Parametric Stereo
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase-Shift Keying
RF	Radio Frequency
RS	Reed-Solomon
SAP	Second Audio Program
SBR	Spectral Band Replication
SD	Standard Definition
SDI	Serial Digital Interface
SP	Scattered Pilot
STB	Set-Top Box
TCP/IP	Transmission Control Protocol/Internet Protocol
TMCC	Transmission and Multiplexing Configuration Control
TS	Transport Stream
UDP/IP	User Datagram Protocol/Internet Protocol
UHF	Ultra High Frequency
USB	Universal Serial Bus
V	Volts
VHF	Very High Frequency
Y/C	Luminance and chrominance

5   Basic receiver configuration

The basic configuration of the receiver shall be according to Figure 1 and shall be composed by the following units:

a) antenna for terrestrial reception;
b) IRD;
c) connection cable between the antenna and the receiver.
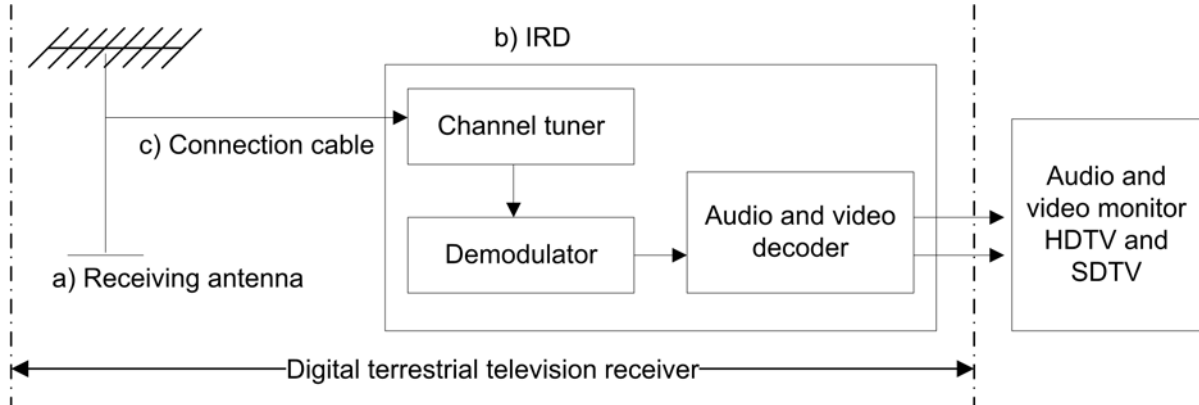

Figure 1 – Basic configuration of receiver

Various types of receivers for receiving digital terrestrial television broadcasts may be designed, that is, receivers intended for fixed stations, for a mobile stations, and for portable reception.

6   Hardware reference model

The hardware components of a basic receiver unit are shown in Figure 2.
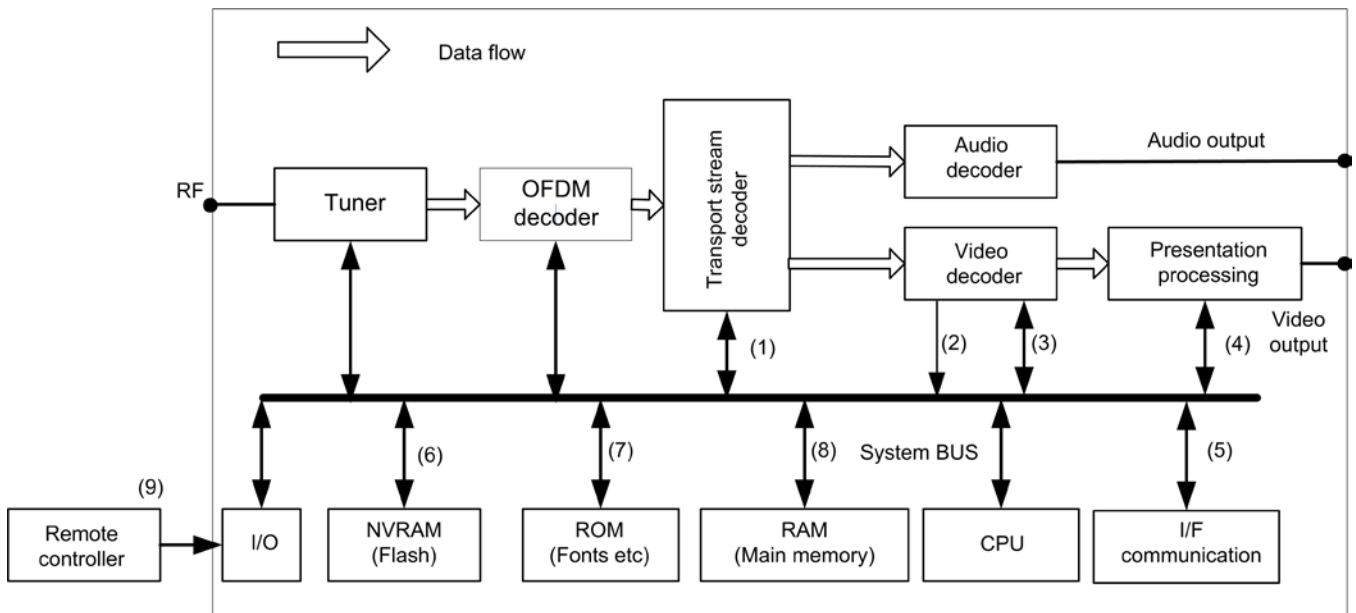
Figure 2- Hardware components of the basic receiver units for the full-seg profile and the one-seg profile

The digital broadcasting input signal in a basic receiver unit is converted into a transport stream (TS) by a tuner in conjunction with a demodulation process. The demodulated transport stream is divided into video, audio and other data through a transport stream decoding process, after which the video stream goes through a video decoding process, and the audio stream goes through an audio decoding process. Through this process, the audio and video are reproduced by the basic receiver units.

When broadcasting data are received, the information shall be transferred to the main memory or nonvolatile memory, since it shall be processed by the CPU. Furthermore, a more interactive performance is expected, when

compared to the traditional process of watching television using an upload connection, etc. From a hardware performance perspective, the following provisions shall be established:

(1) transport decoders capable of receiving data;

(2) reproduction of the stream system and of the stored audio data;

(3) reproduction of the stream system and stored video data;

(4)presentation of video, still pictures, text and graphics, etc.;

(5) function of the interactivity channel using a communication channel;

(6) size of data that can be saved persistently;

(7) storage space reserved on the receiver units (for example, fonts);

(8) sufficient memory capacity to obtain and decode data;

(9) guidelines regarding remote control operations.

In particular, (1) is defined as a TS decoding function; (2), (3), (4) and (7) are defined as presentation functions; (5) is defined as a communication function; (6), (7) and (8) are defined as memory volume; and (9) is defined as a remote control function.

7   Receiver parameters

Table 1 shows parameters for integrated receivers based on their national standards and the normative references listed in the Section 2. Whenever needed parameters for full-seg are categorized separately into integrated receivers and set-top boxes to meet with various needs of manufacturers.

In Table 1, the parameters definite as mandatory are requirements that shall be implemented aim to guarantee the correct decoding of the signals of terrestrial digital television. Therefore, are enclosed in these requisite minimum functions of demodulation of the bit stream, audio and video decoding and applicative that they need to be played by each kind of receiver, being permitted to the manufacturers to exceed any minimum requirements listed. Depending on the planning of products of each manufacturer, functions which are beyond the specified as shall be available can or not be installed. On the other hand, functionalities defined as prohibited are related the requirements which shall not be implemented in the receivers. The broadcasters who transmit services of terrestrial digital television shall necessarily assume that the described functions meet the each country specification.

To guarantee the interoperability between receivers and contents providers in the long run, it is highly recommended to take note of the items specified as recommended, optional, not recommended or not applicable as shown in Table 1.

The parameters identified as recommended, even not a mandatory requirement, it is strongly suggested to analyze the circumstances where this implementation shall be put away.

The parameters identified as optional mean that there are not any recommendation to be part of the receiver's specifications, but if it make part shall following the specifications.

The parameters identified as not recommended mean that it is a practice not recommended. It is strongly suggested that, before to adopt these requirements, to analyze the circumstances where this implementation shall be done and verify and ensure the impact of this specification for the receiver.

Table 1 – Receiver unit parameters

Functionalities		Receiver type		Specification remarks	Countries remarks
		Full- seg	One- seg		
Antenna input and output					
Antenna input		Mandatory	Optional	Terminal F, type 75Ω unbalanced	
Antenna output (*pass through*)		Optional	Optional	Mandatory requirement for set-top-boxes	Japan: Optional for set-top-boxes
Channel reception					
High VHF band		Mandatory	Optional	Channels 07 to 13	Paraguay, Peru and Japan: High VHF not required; Chile: mandatory for one-seg since January 2016
UHF band		Mandatory	Mandatory	Channels 14 to 69	Bolivia and Peru: 14ch to 51ch; Japan:13ch to 62ch
Channel bandwidth					
Full-seg (≈ 5,7 MHz)		Mandatory	Not applicable		African countries of ITU Region 1 might need 8MHz channel bandwidth [a]
One-seg (≈ 0,43 MHz)		Not applicable	Mandatory		
Central carrier frequency					
VHF: 177 + 1/7 to 213 + 1/7 MHz		Mandatory	Optional		Paraguay and Peru: High VHF not required; Ecuador: VHF mandatory for full-seg including 57+1/7 to 69+1/7 MHz and 79+1/7 to 85+1/7 MHz
UHF: 473 + 1/7 to 803 + 1/7 MHZ		Mandatory	Mandatory		Peru and Bolivia: 473 + 1/7 to 695 + 1/7 MHz; Japan: 473+1/7 to 767+1/7
Sensitivity					
Minimum input level: lower than or equal to – 77 dBm		Recommended	Recommended	For one-seg receivers the minimum input level is - 88 dBm	Japan: -75dBm for full-seg; Chile: mandatory
Maximum input level: higher than or equal to - 20 dBm		Recommended	Recommended		Chile: mandatory
Protection ratio (analog television signal)					
Co-channel		Mandatory	Mandatory	+ 18 dB or less	
Lower adjacent channel	UHF	Mandatory	Mandatory	- 33 dB or less	
	VHF	Mandatory	Mandatory	- 26 dB or less	Paraguay, Peru and Japan: NA
Upper adjacent channel	UHF	Mandatory	Mandatory	- 35 dB or less	
	VHF	Mandatory	Mandatory	- 26 dB or less	Paraguay, Peru and Japan: NA
Protection ratio (digital television signal)					
Co-channel		Mandatory	Mandatory	+ 24 dB or less	
Lower adjacent channel	UHF	Mandatory	Mandatory	- 26 dB or less	
	VHF	Mandatory	Mandatory	- 24 dB or less	Paraguay, Peru and Japan: NA
Upper adjacent channel	UHF	Mandatory	Mandatory	- 29 dB or less	
	VHF	Mandatory	Mandatory	- 24 dB or less	Paraguay, Peru and Japan: NA

[a] ISDB-T may support 8MHz in order to assure economy of scale in the production of harmonized hardware and boost the adoption of ISDB-T in African countries.

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	One-seg		
First intermediate frequency (IF)				
Central IF frequency: 44MHz	Mandatory	Mandatory	Optionally the base band conversion can be adopted	Japan: 57 MHz
Local oscillator at upper side of the receiver frequency	Mandatory	Mandatory		
Synchronization range of the received clock	Mandatory	Mandatory	Deviations equal to or higher than 20 ppm	
Synchronization range of the received frequency (catch-up)	Mandatory	Mandatory	Frequency deviations equal to or higher than 30 kHz	
Front-end signal processing				
Synchronism regeneration	Mandatory	Mandatory	OFDM symbol synchronization	
FFT processing	Mandatory	Mandatory	OFDM symbol duration	
Frame extraction	Mandatory	Mandatory	OFDM synchronization signal	
TMCC decoding	Mandatory	Mandatory	TMCC information	
Carrier demodulation	Mandatory	Mandatory	According to TMCC information	
De-interleaving	Mandatory	Mandatory	Time and frequency de-interleaving	
Demapping				
QPSK	Optional	Mandatory		Japan: Mandatory for full-seg
16QAM	Mandatory	Mandatory		
64QAM	Mandatory	Not applicable		
Division into hierarchical levels	Mandatory	Not applicable	Execution indicated on the TMCC	
Bit de-interleaving	Mandatory	Mandatory	Executed in each hierarchical level	
De-puncturing	Mandatory	Mandatory	Executed in each hierarchical level	
Viterbi decoding	Mandatory	Mandatory	Coding rate at ½	
Byte de-interleaving	Mandatory	Mandatory		
Energy inverse dispersal	Mandatory	Mandatory		
TS regeneration	Mandatory	Mandatory		
Reed Solomon decoding	Mandatory	Mandatory	RS decoding (204,188)	
Signal intensity meter	Optional	Optional		Bolivia: Mandatory for full-seg;
Signal quality meter	Optional	Optional		Bolivia: Mandatory for full-seg;

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	**One-seg**		
BER meter	Optional	Optional		
Emergency warning reception	Optional	Optional		Bolivia: Mandatory for full-seg;
Analog TV reception during transition period	Optional	Optional	For integrated receiver the reception of analog and digital TV signals is recommended.	Ecuador: Mandatory for full-seg; Bolivia and Chile: Mandatory for integrated receivers; receivers
One-seg contents exhibitions in full-seg receivers	Optional	Not applicable		
Transport processing				
Section filters	Mandatory	Mandatory		
Section composed by one TS packet	Mandatory	Mandatory		
Multiple sections in a single TS packet	Mandatory	Mandatory	The maximum of sections in one TS packet is limited to ten.	
Maximum PMT section in a single TS packet	Mandatory	Mandatory	Maximum number of PMT sections in a single TS packet is limited to 4	
Sections of two or more TS packets	Mandatory	Mandatory		
Memories				
Minimum of 2MB of volatile memory	Optional	Optional	Mandatory for the receiver with embedded middleware	
Non-volatile memory for program codes	Mandatory	Mandatory	Storage of program codes on the receiver	
Non-volatile memory for data codes	Mandatory	Mandatory	Storage of data codes common to all receivers	
Video decoding and video output interfaces	Mandatory	Mandatory	See ABNT NBR 15604 section 8.1	
Audio decoding and audio output interfaces	Mandatory	Mandatory	See ABNT NBR 15604 section 8.2	
Primary data decoder	Optional	Optional	See ABNT NBR 15604 section 9.1	
EPG function	Optional	Optional	See ABNT NBR 15604 section 10	
Parental rating	Mandatory	Mandatory	See ABNT NBR 15604 section 11. Specific regulation might be applied in each country	Chile, Japan and Peru: Not defined and not applied
Accessibility				
Closed-caption	Optional	Optional		Costa Rica and Ecuador: Mandatory
Audio description	Optional	Optional		

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	**One-seg**		
Locution	Optional	Optional		
Dubbing	Optional	Optional		
LIBRAS window	Optional	Optional		
Storage and channel access				
Virtual channel	Mandatory	Mandatory	Digital channel numbering shall be the same as analogue channel	Chile: Digital channel number not necessarily the same number of the analogue channel.
Digital channel access	Mandatory	Mandatory	Shall be accessed through the virtual channel number	
Sequential channel browsing (up & down)	Mandatory	Mandatory	It shall be exclusively through the primary service	Chile, Ecuador, Uruguay: Browsing including all logical channels
High speed digital interface	Optional	Optional	See ABNT NBR 15604 section 14	
External interfaces				
Antennal input	Mandatory	Optional	Terminal F, type 75Ω unbalanced	Peru: Pass-through required
Interactive communication function	Optional	Optional		
Video output	Optional	Optional	One output is mandatory for Set-top-boxes	Bolivia: Mandatory for full-seg
Digital video output	Optional	Not applicable		Bolivia and Chile: Mandatory for set-top boxes with HD output (HDMI)
Digital audio output	Optional	Not applicable		
RF output	Optional	Not applicable	Analogue modulated in AM/VSB on channels VHF 3 or 4	Brazil: PAL-M modulation Chile: Mandatory for downconverters with SD video output; Bolivia, Costa Rica and Peru: NTSC-M modulation; Paraguay and Uruguay: PAL-N modulation
Remote control functions				
Implementation	Optional	Optional		Costa Rica: mandatory
Power on/off	Recommended	Recommended		Costa Rica: mandatory
Numerical functions (0 to 9)	Recommended	Recommended	Direct access to channels	Costa Rica: mandatory
Sequential channel selection	Recommended	Recommended	Navigation through the stored channels	Costa Rica: mandatory
Volume control	Optional	Optional		
EPG	Optional	Optional	If implemented should be compatible with the EIT table specifications in conformity with Annex 1 of ABNT NBR 15603-2	Japan: optional compliance to the referenced standard

Table 1 (continuation)

Functionalities			Receiver type		Specification remarks	Countries remarks
			Full- seg	One-seg		
Interactive functions						
Confirm			Recommended	Recommended	Mandatory in receivers with embedded midleware	
Exit			Recommended	Recommended		
Back			Recommended	Recommended		
Directional(▲ ▼ ◄ ►)			Recommended	Recommended		
Color			Recommended	Recommended		
Video decoding and output signals						
Video profiles and levels						
H.264/AVC HP @ L4.0			Mandatory	Not applicable		Japan: MPEG-2 video
H.264/AVC BP @ L1.3			Optional	Mandatory	Support to FMO, ASO and RS audio tools is not required	Japan: Level 1.2
Primary service decoding			Mandatory	Mandatory		
Primary service identification			Mandatory	Mandatory		
Designation of component_tag values			Mandatory	Mandatory	According to ABNT NBR 15604, Table 6	
Priority of the secondary ES			Mandatory	Mandatory	Exhibition according to the increasing order of component_tag values	
Multiple services reproduction			Optional	Optional		Chile: mandatory for full-seg receivers
Video output format, aspect ratio and resolution						
Format	Aspect ratio	Resolution				
SQVGA	4:3	160 x 120	Optional	Mandatory		
SQVGA	16:9	160 x 90	Optional	Mandatory		
QVGA	4:3	320 x 240	Optional	Mandatory		
QVGA	16:9	320 x 180	Optional	Mandatory		
CIF	4:3	352 x 288	Optional	Mandatory		
525i(480i)	4:3	720 x 480	Mandatory	Not applicable		
525i(480i)	16:9	720 x 480	Mandatory	Not applicable		
525p(480p)	16:9	720 x 480	Mandatory	Not applicable		
625i(576i)	4:3	720 x 576	Mandatory	Not applicable		
625i(576i)	16:9	720 x 576	Mandatory	Not applicable		
625p(576p)	16:9	720 x 576	Mandatory	Not applicable		
750p(720p)	16:9	1280 x 720	Mandatory	Not applicable		
1125i(1080i)	16:9	1920x1080	Mandatory	Not applicable		Japan: also 1440x1080 for full-seg

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	One-seg		
Frame rate				
5fps	Optional	Mandatory		
10fps	Optional	Mandatory		
12fps	Optional	Mandatory		
15fps	Optional	Mandatory		
25fps	Mandatory	Not applicable		Brazil, Costa Rica and Japan: 24fps optional for full-seg and mandatory for one-seg
30/1,001 Hz or 30fps	Mandatory	Mandatory	30/1,001 Hz required only for full-seg receivers	Japan: One-seg 30fps not applicable
50fps	Mandatory	Not applicable		Brazil and Japan: NA
60/1,001 Hz	Mandatory	Not applicable		
Analog video output				
Composite video output (CVBS)	Optional	Optional	Mandatory requirement for set-top-boxes	
RF audio and video output	Optional	Not applicable		Bolivia: Mandatory for full-seg
Y/C output	Optional	Not applicable		
Analogue component video output	Optional	Not applicable		
Digital video output	Optional	Optional		
Identification of output format	Optional	Optional		
Video seamless switch	Recommended	Recommended		
Pan & Scan	Recommended	Recommended	Defines the video interest area	
Audio processing and audio output signals				
Audio decoding parameters				
MPEG-4 AAC standard	Mandatory	Mandatory		Japan: MPEG-2
Dynamic range control	Mandatory	Not applicable		
Dialogue normalization	Mandatory	Mandatory		
SBR non-backward compatible explicit signaling	Mandatory	Mandatory		
Downmixing	Mandatory	Not applicable		
Sampling frequency 32 kHz, 44,1 kHz, 48 kHz	Mandatory	Mandatory		Japan: also 24kHz, 22.05kHz, 16kHz
Quantization 16 or 20 bits	Mandatory	Mandatory		Japan: 16 bits only

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	**One-seg**		
LATM/LOAS	Mandatory	Mandatory	Audio transport multiplexation and synchronization	
Up to 5.1 audio channels per LATM/LOAS	Mandatory	Not applicable		
Up to 8 streams LATM/LOAS associated to one same program	Mandatory	Not applicable		
Audio decoding mode				
Mono (1/0)	Mandatory	Mandatory		
Stereo (2/0)	Mandatory	Mandatory		
Stereo multichannel (3/2+LFE)	Mandatory	Not applicable		
Allowed decoding modes				
Stereo multichannel (3/0, 2/1, 3/1, 2/2, 3/2)	Optional	Not applicable		
Dual-mono	Optional	Optional		Japan: Mandatory
Audio profile and levels				
LC AAC @ L2	Mandatory	Not applicable		
LC AAC @ L4	Mandatory	Not applicable	The level 4 (L4) does not apply to stereo transmissions	
HE-AAC+SBR v.1 @ L2	Mandatory	Not applicable		
HE-AAC+SBR v.1 @ L4	Mandatory	Not applicable	The level 4 (L4) does not apply to stereo transmissions	
HE-AAC+SBR+PS v.2 @ L2	Optional	Mandatory		
Primary audio stream decoding	Mandatory	Mandatory	Component_tag 0x10	
Load impedance 10 kΩ	Optional	Optional		
Analog audio output interface				
Audio output terminal	Optional	Optional	Set-top boxes shall have at least one stereo output	Japan: Mandatory; Bolivia: Mandatory for full-seg; Peru: Mandatory with RCA connector
Output level 250mVrms ± 3 dB	Optional	Optional	Mandatory specification if the audio output interface is available	
Output impedance ≥ 2.2 kΩ	Optional	Optional		
Load impedance 10 kΩ	Optional	Optional		
RCA output terminal	Optional	Not applicable		
Stereo downmixing	Optional	Optional	Mandatory for receivers without multi-channel output	

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	**One-seg**		
Digital audio output interface	Optional	Not applicable		
Audio interface via bluetooth	Optional	Optional		
Audio mode discrimination	Mandatory	Mandatory		
Audio mode indication	Optional	Optional		
EPG				
H - EIT	Optional	Not applicable		
M – EIT	Optional	Not applicable		
L – EIT	Optional	Optional		
Parental rating				
Blockage by parental rating	Mandatory	Mandatory	User defined	Chile, Japan and Peru: Not defined
Descriptor semantics				
Country code	Mandatory	Mandatory		
Rating	Mandatory	Mandatory		
Receiver shall not block the event				
Missing descriptor	Mandatory	Mandatory	Missing in the 1st loop of the PMT or EIT	
Country code	Mandatory	Mandatory	Argentina: 0x415247 Bolivia: 0x42 4f4c Brazil: 0x425241 Chile: 0x43484c Costa Rica: 0x435249 Ecuador: 0x454355 Japan: 0x6A706E Paraguay: 0x505259 Peru: 0x504552 Uruguay: 0x555259 Venezuela: 0x56454e	
Blocking password	Mandatory	Mandatory		
Temporary unblocking	Optional	Optional		
Receiver configuration				
Blockage exclusively by the age rating	Optional	Optional	The implementation of one from the two blocking modalities shall be present in the receiver.	Chile and Peru: Not defined
Blockage by age and content	Optional	Optional		Chile and Peru: Not defined
Exhibit audio, video and data of the blocked event	Prohibit	Prohibit		Chile and Peru: Not defined
Exhibit information on the blocked event	Optional	Optional	Title, synopsis etc.	Chile and Peru: Not defined
Exhibit message of the blocked event	Recommended	Recommended	Information on age rating and content description	Chile and Peru: Not defined

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remark
	Full- seg	**One-seg**		
Display event rating in the beginning or during the program	Not applicable	Not applicable		
Implementation of the blocking function				
Interface for configuration	Mandatory	Mandatory	Implementation is not specified. It depends on the receiver's manufacturer discretion	
Blocking password	Mandatory	Mandatory		
Temporary unblocking	Optional	Optional		
Accessibility resources				
Closed-caption	Optional	Optional		Costa Rica and Ecuador: Mandatory for full-seg
Audio description	Optional	Optional		
Audio locution	Optional	Optional		
Dubbing (SAP)	Optional	Optional		Bolivia: Recommended for full-seg
LIBRAS window	Optional	Optional		
Channels search and storage				
Automatic channels search	Mandatory	Mandatory	Auto scan e re-scan	Costa Rica and Japan: Recommended
Automatic channel search at first installation	Optional	Optional	When the receiver is energized for the first time	Costa Rica and Japan: Recommended
Manual channels adding	Optional	Optional		Chile, Costa Rica and Ecuador: Recommended for full-seg
Continuous reception	Optional	Recommended	Recommended for receivers in movement	Japan: Optional
Channel re-scan	Recommended	Recommended	Periodicity defined by the receiver's manufacture	Chile: Recommended for one-seg and mobile receivers; Japan: Optional for One-seg
Virtual channel				
Digital numbering (virtual)	Mandatory	Mandatory	The channel should be accessed through the virtual number	
Digital numbers similar to the current analog ones	Mandatory	Mandatory		
Logical channel presentation	Optional	Optional	Defined by receiver manufacture	
Storage form	Mandatory	Mandatory	remote_control_key_id	
Two digits for channel identification	Mandatory	Mandatory	Assumes values between 1 and 99	
Service type (3rd digit)	Optional	Optional		
Service number (4th digit)	Optional	Optional		

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	One-seg		
Analog and digital channels tuner	Optional	Not applicable	Threshold between the option for the digital or analog is not specified	
Switching from digital to analog reception	Optional	Optional	In the automatic mode, the threshold is defined by the manufacturer	Chile: Automatic switching prohibited
Browsing sequentially through channels				
Browsing through the primary logical channels	Mandatory	Mandatory	Default	
Browsing through all the logical channels	Not Recommended	Not Recommended	If implemented, this configuration shall be defined by the user	Chile, Equator and Uruguay: Mandatory
Primary idiom selection	Mandatory	Mandatory	Audio, subtitles, closed caption and primary data	
Secondary idiom selection	Optional	Optional		
USB port				
Transport stream output	Prohibit	Not applicable	This shall not preclude individual fair use in accordance with ABNT NBR 15605-1. Permissions related to the HD video and associated audio are signaled by the content provider.	
USB port	Optional	Not applicable		Ecuador and Uruguay: Recommended
USB interface for built-in modem	Recommended	Not applicable		
USB for receivers with embedded midleware	Mandatory	Not applicable		
Software architecture			Specifications applicable to receivers that have access to the interactivity channel via USB port	
Authentication manager	Mandatory	Not applicable		
Device manager	Mandatory	Not applicable		
Interface IP (Ethernet)	Optional	Not applicable		
RJ-45 8-pin connector	Optional	Not applicable		
Physical interface protocol stack	Optional	Not applicable		
Content output	Prohibit	Not applicable		
Channels tuner	Optional	Not applicable		
Content control	Prohibit	Prohibit		
Interface serial 1394	Optional	Optional		
4- or 6-pin 1394 connector	Optional	Optional		
Transport stream input interface	Optional	Optional		
Transport stream output interface	Prohibit	Prohibit		

Table 1 (continuation)

Functionalities	Receiver type		Specification remarks	Countr ies remarks
	Full- seg	**One-seg**		
Interactivity channel implementation	Optional	Optional		
Receiver software architecture				
Authentication manager	Optional	Not applicable	Specification for receivers with embedded middleware	
External device manager	Optional	Not applicable		
Architecture of the installation software				
Authentication of the application for external device	Optional	Not applicable	Specification for receivers with embedded middleware	
Device-driver	Optional	Not applicable		
Physical layer protocol	Optional	Not applicable		
Configuration file	Optional	Not applicable		
Hardware architecture				
USB Port	Optional	Not applicable	Specification for receivers with embedded middleware	Ecuador: Mandatory for full-seg with interactivity channel
Installation mode	Optional	Not applicable		
Connection type switching	Optional	Not applicable		
Receiver software update				
Download function	Recommended	Recommended		Brazil and Japan: Optional
Software update	Optional	Optional		
Data update	Optional	Optional		
Software certification	Optional	Optional	Management and protection model defined by manufacturer	
Reception method	Optional	Optional	In compliance with ABNT NBR 15608	
Preferable specification of the receiver				
Update functions	Recommended	Recommended	In accordance with ARIB STD-B21:2007, subsection 12.3.1	Brazil and Japan: Optional
Necessary hardware performance	Optional	Optional	In accordance with ARIB STD-B21:2007, subsection 12.3.2	
Memory for common data	Optional	Optional		
Non-volatile memory for software downloading	Optional	Optional		
Receiver signal processing				
Service information	Mandatory	Mandatory		
PIDs simultaneously process	Mandatory	Mandatory	Equal or higher than 12	
Program stream selection	Mandatory	Mandatory		

Table 1 (conclusion)

Functionalities	Receiver type		Specification remarks	Countries remarks
	Full- seg	One-seg		
Criteria for uniqueness				
Receiver architecture	Mandatory	Mandatory	In accordance with ARIB TR-B14:2007, subsection 9.3 and 9.4	
Automatically CUT or skip advertisements	Prohibit	Prohibit		
Insertion of uncorrelated contents	Prohibit	Prohibit		
Spanish Language	Mandatory	Mandatory		Brazil: Portuguese Japan:Japanese
Electrical power: 110V/220V, 50Hz,	Mandatory	Mandatory		Bolivia: AutoVolt, 50Hz; Brazil and Peru:60Hz; Costa Rica and Ecuador: 110V, 60Hz; Chile: 220 V, 50Hz Japan: 100V, 50/60Hz Paraguay: 220V, 50Hz Uruguay: 220V,50Hz

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