

SWAZILAND NATIONAL STANDARD

**DIGITAL TERRESTRIAL TELEVISION RECEIVER
SPECIFICATIONS**

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Table of changes

Clause Changed	Date	Change

NATIONAL FOREWORD

This Public Review Draft Standard was prepared by Technical Committee *SWASA/TC 55 Telecommunications* in accordance with procedures of the Swaziland Standards Authority, in compliance with Annex 3 of the WTO/TBT Agreement. During the development of this Public Review Draft Standard assistance was derived from the International Telecommunication Union, *Receiver specification recommendations for use in terrestrial networks in the kingdom of Swaziland* and SANS 862:2013 *Set-top box decoder for free-to-air digital terrestrial television*.

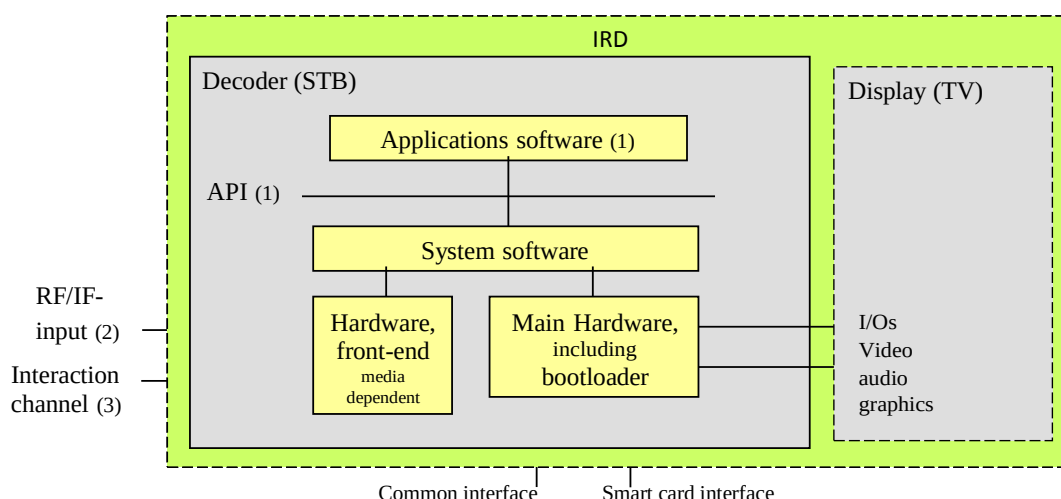
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Introduction

The IRD implements the services by a combination of hardware and software solutions. The IRD may correspond to a decoder (STB) or an integrated digital TV-set (iDTV), including a display. The main functional blocks are shown in Figure 2.1.

The IRD includes a bootloader as firmware. The bootloader can upgrade all resident system-software and application software in the IRD by new software loaded either via the distribution channel or locally.

The software solution is only restricted by the hardware programming interface, i.e. the hardware functionality, capacity and performance.



- 1: Not relevant for Basic Profile
- 2: Not required for IRDs with IP based front-end
- 3: Not relevant for Basic IRDs without IP-based front-end

Figure 1: Basic integrated receiver decider - IRD architecture

Receiver - specifications

1 Scope

This specification covers broadcasting standard DVB-T2, and is applicable for both, SDTV and HDTV level receivers.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from the Swaziland Standards Authority.

EN 300 744, *DVB Framing structure, channel coding and modulation for digital terrestrial television. (ETSI)*

IEC 60169-2, part 2, *Radio-frequency connectors. Part 2: Coaxial unmatched connector*

ETSI TS 101 154, *Digital Video Broadcasting (DVB); Implementation guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications*

ISO/IEC 14496-10, *Information technology - Coding of audio-visual objects - Part 10: Advanced Video Coding*

ISO/IEC 13818-1, *Information technology - Generic coding of moving pictures and associated audio information: Systems*

ISO 639.2, *Code for the representation of names of languages*

ITU-T V.92, *Enhancements to Recommendation V.90*

EN 50049-1, *Domestic and similar electronic equipment interconnection requirements: Peritelevision connector*

EN 50157-2-1, *Domestic and similar equipment interconnection requirements: AV link-Part 2-1: Signal quality matching and automatic selection of source devices*

EN 300 468, *Digital Broadcasting Systems for television, sound and data services; Specification for service information (SI) in Digital Video Broadcasting (DVB) Systems*

ETSI TR 101 211, *Guidelines on Implementation and Usage of Service Information (SI)*

[ETSI TS 102 006, *Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems*

ETS 300 231, *Television systems; Specification of the domestic video, Programme Delivery Control system (PDC)*

ETSI ES 202 130, *Human Factors (HF); User Interfaces; Character repertoires, ordering rules and assignments to the 12-key telephone keypad*

ETSI EN 300 472, *Conveying ITU-R System B Teletext in DVB bitstreams*

ETSI EN 301 775, *Conveying VBI data bitstreams*

ISO/IEC 13818-2, *Information technology - Generic coding of moving pictures and associated audio information - Part 2: Video*

ITU-R BT.653-3, *Teletext systems*

EN 50221, *Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications*

IEC 60958, *Digital Audio Interface*

IEC 61937, *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958*

ETS 300 706, *Enhanced Teletext Specification*

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ETSI TS 102 114, *DTS coherent acoustics; Core and extensions*

IEC 62216-1, *Digital terrestrial television receivers for the DVB-T system – Part 1: Baseline receiver specification*

CEA 770.3, *High Definition TV Analog Component Video Interface*

EN 300 743, *Subtitling systems*

EN 50049-1, *Domestic and similar electronic equipment interconnection requirement: Peritelevision Connector*

HDMI HDMI Licensing, LLC: HDMI, “*High- Definition Multimedia Interface*”, rev. 1.3A, October 10, 2006

CEA 861- D, *Consumer Electronics Association (CEA): A DTV Profile for Uncompressed High Speed Digital Interfaces*, July 18, 2006

EICTA HD extension to IEC 62216-1 “*High Definition*” extensions to the IEC 62216-1 “*Digital Terrestrial Television Receivers for the DVB-T System*”

IEC 60603-14, *Connectors for frequencies below 3 MHz for use with printed boards – Part 14: Detail specification for circular connectors for low-frequency audio and video applications such as audio, video and audio-visual equipment.*

ETSI TS 102 366, *Digital Audio Compression (AC-3, Enhanced AC-3) Standard*

ISO/IEC 14496-3, ISO/IEC: *Information technology -- Coding of audio-visual objects -- Part 3: Audio*

EN 302 755, *Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2).*

ISO/IEC 8859-16, *Information technology — 8-bit single-byte coded graphic character sets — Part 16: Latin alphabet No. 10*

DGTVi D-Book 1.3 (rev.2), *Compatible DTV receivers for the Italian market: baseline requirements*

DGTVi Z-Book 1.3 (rev.2), *Compatible DTV zapper receivers for the Italian market: baseline requirements*

HD Book (final 1.0), *Compatible High Definition receivers for the Italian market: baseline requirements*

NorDig unified requirements for integrated receiver decoders document specifies a set of equipment requirements for reception of DVB-based and related services from cable, satellite and/or terrestrial broadcast networks

NorDig unified test specifications for integrated receiver decoders Common test specifications are established in order to ensure that decoders comply with the common minimum requirements.

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ETSI ES 102 796 V1.2.1, *Hybrid Broadcast Broadband TV (HbbTV)*, (referring to *HbbTV* version 1.5 functionality)

3 Definitions

For the purposes of this standard, the following definitions shall apply:

3.1

basic profile

general requirements for reception of DVB-T2 broadcasted content in standard and high definition, for digital broadcasting, services that do not depend on enhancements by applications or interaction

3.2

hybrid profile

enhanced services dependent on a standardized API, based on the HbbTV v1.5 specification ETSI TS 102 796

3.3

HDTV service

service that includes the MPEG-4 AVC High Definition video stream the surround audio stream and data streams for teletext and subtitling

List of Abbreviations

3DTV	3D television
AAC	Advanced Audio Coding
AC3	Digital audio compression standard, known as Dolby Digital
ASO	Analogue switch-off
AV	Audio Visual
AVC	Advanced Video Coding
CA	Conditional Access
CAT	Conditional Access Table
CBR	Constant Bit Rate
CI	Common Interface
COFDM	Coded Orthogonal Frequency Division Multiplexing
CVBS	Composite Video Baseband Signal
DTT	Digital terrestrial television
DVB-T2	Digital Video Broadcasting – Second Generation Terrestrial
E-AC3	Enhanced AC3, known as Dolby Digital Plus
EIT	Event Information Table
EN	European Norm
EPG	Electronic Programming Guide
ETSI	European Telecommunication Standards Institute
HDMI	High-Definition Multimedia Interface

HDTV	High Definition Television
HE-AAC	High Efficiency AAC
iDTV	Integrated Digital TV set
ISO	International Organization for Standardization
ITU	International Telecommunication Union
MFN	Multi Frequency Network
MHP	Multimedia Home Platform
MPEG	Moving Pictures Expert Group
MUX	Multiplex
NIT	Network Information Table
NF	Noise Figure
PAT	Program Association Table
PCM	Pulse Coded Modulation
PMT	Program Map Table
PSI	Program Specific Information
QAM	Quadrature Amplitude Modulation
QEF	Quasi Error Free
QPSK	Quaternary Phase Shift Keying
RF	Radio Frequency
RGB	Red Green Blue
SDT	Service Description Table
SDTV	Standard Definition Television
SFN	Single Frequency Network
SI	Service Information
STB	Set-top Box
TDT	Time and Date Table
TOT	Time Offset Table
TS	Transport Stream
UHF	Ultra-High Frequency
VBI	Vertical Blanking Information
VBR	Variable Bit Rate
VHF	Very-High Frequency

4 Receiver specifications

4.1 General requirements

4.1.1 The receivers shall comply with all mandatory legal requirements, as specified for Swaziland and by the relevant national authority.

4.1.2 The receivers should be energy efficient and minimize its power consumption during all modes of the operation.

4.2 Hardware requirements

4.2.1 Power supply

4.2.1.1 The receiver should have an external D.C power supply unit.

4.2.1.2 The STB decoder shall be capable of operating in a voltage range of 10.8 V to 14.4 d.c. with a socket for connection to a 12 V d.c. source. Protection against overvoltage and undervoltage and reversed polarity shall be incorporated.

4.2.2 RF part

4.2.2.1 General

4.2.2.1.1 DVB-T2 receiver shall allow in addition reception of signal transmitted in accordance with EN 302 755.

4.2.2.1.2 The receiver shall allow reception of the DVB-T2 signals in Single Frequency Networks (SFN) or Multi Frequency Networks (MFN).

4.2.2.1.3 The receiver shall allow reception of all channels in UHF (Band IV-V with bandwidth 8 MHz) and reception of all channels in VHF (Band III with bandwidth 7 MHz).

4.2.2.1.4 The receiver shall allow reception of the DVB-T2 signal with all allowed combinations of following parameters in table 1 according to EN 302 755.

Table 1: Characteristics of DVB-T2

Characteristic	DVB-T2
Transmission mode	1k, 2k, 4k, 8k, 16k, 32k normal and extended
Modulation	QPSK, 16 QAM, 64 QAM, 256QAM both rotated and non-rotated
Code rate	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 7/8
Guard interval	1/4, 19/256, 1/8, 19/128, 1/16, 1/32, 1/128
Pilot pattern	PP1, PP2, PP3, PP4, PP5, PP6, PP7, PP8
	SISO/MISO
	Input Mode A (single PLP) or Input Mode B (Multiple PLPs – Common PLP, Type 1 and 2 up to the maximum allowed figure 255)
FEC Frame length:	64800, 16200

	Single RF frequency or Time Frequency Slicing (TFS)
	Normal Mode or High Efficiency Mode
	FEF parts ¹
	Auxiliary streams ²

4.2.2.1.5 The receiver shall allow reception of the DVB-T2 signals in environment with echoes according to EN 300 744.

4.2.2.1.6 Within the user interface the receiver shall provide the information of signal level and signal quality.

4.2.2.2 Receiver Signal Input Levels

4.2.2.2.1 For 8 MHz Normal Bandwidth DVB-T2 signal the receiver shall support for QEF operation:

$P_{\min} = -105,2\text{dBm} + \text{NF (dB)} + \text{C/N (dB)}$ input signal level without degradation of decoded picture and audio (QEF reception).

4.2.2.2.2 In VHF III, UHF IV and UHF V band maximum Noise Figure of DVB-T2 receivers shall not exceed 6dB and shall not exceed 10dB in S Band I, S Band II and S Band III.

4.2.2.2.3 Minimum calculated input level of DVB-T2 receivers for QEF reception on 8MHz and Gaussian profile for VHF S Band I&II and UHF S Band III shall therefore be in range from:

- a) -91,6dBm for QPSK CR ½ GI ¼ and
- b) -70,0dBm for 256-QAM CR 5/6 GI 1/8

4.2.2.2.4 For 8MHZ UHF band IV&V the values shall correspond in range from:

- a) -95,6dBm for QPSK CR ½ GI ¼ and
- b) -74,0dBm for 256-QAM CR 5/6 GI 1/8

4.2.2.2.5 Maximum STB input signal level for DVB-T2 shall be -23dBm.

4.2.2.3 RF input connector

4.2.2.3.1 The receiver shall have at least one tuner input connector in accordance with IEC 60169-2, part 2 and shall allow the connection to external antenna with connector type IEC 169-2 male.

4.2.2.3.2 The input impedance shall be 75 Ohm.

¹ The receivers are not required to demodulate or decode the content of FEF parts and auxiliary streams, but existence of FEFs and/or auxiliary streams shall not cause issues to receiver.

² The receivers are not required to demodulate or decode the content of FEF parts and auxiliary streams, but existence of FEFs and/or auxiliary streams shall not cause issues to receiver.

4.2.2.3.3 The receiver should have a looped RF input connector to provide additional connection to the antenna installation.

4.2.2.3.4 The receiver RF input signals should be looped to the RF output connector independently from the status of receiver (operational or stand-by), so that connected equipment (e.g. TV set) can operate even if the receiver is in standby.

4.2.2.3.5 The receiver shall support a DC power to an external antenna with amplifier.

- a) It shall not degrade the RF input characteristic.
- b) The DC power supply should be protected against short circuit.
- c) In the menu system of the receiver shall be an option to turn the DC power supply on/off. The factory default value shall be off.

4.2.2.4 Tuning/Scanning procedures

4.2.2.4.1 The receiver shall, in case of same Transport stream Id and Service Id on two or more different frequencies save all frequencies, or select the frequency with better signal.

4.2.2.4.2 The receiver shall be able to receive and react on tuning parameters in PSI/SI tables (e.g. SDT or NIT information).

4.2.2.4.3 In addition to the automatic search, the receiver shall allow a manual search where Channel Id (or frequency) is entered by the end user.

4.2.2.4.4 The receiver shall;

- a) tune to this channel,
- b) search all available DVB-T2 modes, and
- c) add new services and replace existing services in the service list (without considering any quality criteria).

4.2.2.5 Dynamic channel management

4.2.2.5.1 The receiver should upgrade modulation parameters according to NIT table.

4.2.2.5.2 The receiver should upgrade Services lists according to SDT table.

4.2.2.6 Dynamic PMT

4.2.2.6.1 The receiver shall be able to handle dynamic changes in the Program Map Table (PMT).

Note: A practical use scenario for dynamic PMT changes is for example the requirement to support switching on and off regional variants of programs by a broadcaster.

4.2.2.6.2 The receiver shall handle dynamic PMT changes in correct manner and the following additional restrictions shall be observed:

- a) Dynamic changes in the PMT shall not produce any disturbances in the Audio/Video output.
- b) In case switching of elementary audio and/or video streams is triggered, the maximum switching time (measured from PMT update to clear picture) shall be 3 seconds.

4.2.2.6.3 The maximum switching time shall be met regardless if the elementary streams are scrambled or not.

Note: It is recommended, that the video on the output should freeze (freeze frame), until the new video stream can be decoded and displayed.

4.2.3 Interfaces

4.2.3.1 RCA analogue video output

4.2.3.1.1 As an OPTION HDTV Level STB should provide output of analogue YPbPr video according to CEA 770.3.

4.2.3.1.2 The receiver should have at least one analogue CVBS video interface based on RCA connector, female type IEC 60603-14.

4.2.3.2 Interfaces for Conditional Access

The receiver should support at least one DVB Common Interface (for CA module) for conditional access. CI-slot should comply with EN 50221.

4.2.3.3 Digital Audio Output

The receiver shall have a coaxial or optical S/PDIF interface for digital audio to provide PCM signal according to IEC 60958 [20] or non-linear PCM coded audio stream according to IEC 61937.

4.2.3.4 RCA analogue audio output

The receiver should have at least one analogue audio interface based on two RCA connectors, female type IEC 60603-14.

4.2.3.5 HDMI interface

4.2.3.5.1 The HDTV Level receiver with display (iDTV) shall support requirements specified for high definition video interfaces by EICTA for compliant HD Ready iDTV-sets.

4.2.3.5.2 The HDTV Level receiver without display (STB) shall have at least one High-Definition Multimedia Interface (HDMI) with type A connector, supporting displays that comply with the EICTA HD-Ready requirements.

4.2.4.5.3 The HDTV Level STB shall be able to use the EDID information provided by the display to automatically determine the STB output.

4.2.4.5.4 The HDTV Level STB shall provide “Original Format” option, i.e. to output same format as received if supported by the display, as indicated by the EDID information. If received format is not supported, the STB shall select display mode providing the best possible video quality.

4.2.3.5.5 It shall also be possible to manually set default output format from the HDTV Level STB to a fixed format. Fixed format shall include the following formats:

- a) 1920x1080i@25Hz,
- b) 1280x720p@50Hz,
- c) 720x576p@25Hz,
- d) and optionally
- e) 1920x1080p@25Hz,
- f) 1920x1080p@50Hz.

4.2.3.5.6 The preferred default output shall be stored in the STB.

4.2.3.5.7 The HDMI output shall provide stereo or stereo down mix or multichannel audio, and should be equipped with Auto lip-synch functionality. The HDMI output should be Auto lip-synch aware and should delay audio or video to compensate for latencies in downstream devices. iDTV HDMI input(s) should declare audio/video latency information in their EDIDs.

4.2.4 Processor

4.2.4.1 The receiver shall have a real time clock/calendar running continuously.

4.2.4.2 The clock shall be updated by incoming TDT and TOT from SI.

4.2.4.3 The receiver should have an internal timer for the possibility to automatically switch from standby mode to the operational mode. This timer shall be initiated locally (accepted by the end user).

4.2.5 Demultiplexer

4.2.5.1 The Demultiplexer shall be compliant to the MPEG-2/MPEG-4 transport layer defined in ISO/IEC 13818-1 and ETSI TS 101 154 and shall:

- a) be able to decode an ISO/IEC 13818-1 stream with data rates up to 50,34 Mbit/s for DVB-T2.
- b) support variable bitrate elementary streams within a constant bitrate transport stream.

4.2.6 MPEG VIDEO Decoder

4.2.6.1 General

4.2.6.1.1 The decoder of receiver shall fully comply with standard ISO IEC 14496-10 [4] for decoding MPEG-4 and ISO/IEC 13818-2 for decoding of MPEG-2 coded signal.

4.2.6.1.2 The decoder shall also comply with ETSI TS 101 154 and shall support VBR and CBR.

4.2.6.1.3 The decoder of receiver shall ensure synchronization between AUDIO and VIDEO as follows:

- a) audio shall never lead the video program by more than 20 ms, and
- b) shall never lag the video by more than 45 ms.

4.2.6.1.4 The decoder of receiver shall have processing elements for video format conversion to output the decoded video on its HDMI or other analogue interface.

Note: The display format signaling between the STB and the display device are either LINE23 WSS as defined by IEC 62216-1 [25] or in case of HDMI output comply with EICTA extensions to the IEC 62216-1 (6.4.3.7.4 AFD processing for HDMI output).

4.2.6.1.5 Typically a smaller border region inside each edge of the 720x576 pixels area is not visible due to overscan on the SD display.

Note: For services carrying ISO/IEC 14496-10 video, the broadcaster may use the overscan_info_present and overscan_appropriate flags to indicate whether the receiver should apply this typical overscan or should display the complete broadcasted video image.

Table 2 – Broadcast overscan flags

overscan_info_present_flag	overscan_appropriate_flag	Usage
0x0 or not broadcast	n/a	No preferred display method
0x1	0x0	Important information in entire video region
0x1	0x1	Decoded picture suitable for overscan

4.2.6.1.6 Unless the user requests otherwise, integrated digital TV receivers shall interpret and follow the overscan flags according to Table 3.

Table 3 – Receiver overscan behaviour

overscan_info_present_flag	overscan_appropriate_flag	Behaviour
-----------------------------------	----------------------------------	------------------

0x0 or not broadcast	n/a	Implementation dependent
0x1	0x0	Overscan not applied
0x1	0x1	Overscan applied

4.2.6.1.7 For receivers with HDMI output, the receiver shall pass the video without overscan related reformatting to its output, setting the bits in the AVI Infoframe.

Table 4 – Overscan signaling on HDMI

overscan_info_present_flag	overscan_appropriate_flag	<S1,S0> (in HDMI AVI Infoframe)
0x0 or not broadcast	n/a	<0,0>
0x1	0x0	<1,0>
0x1	0x1	<0,1>

4.2.6.2 Decoding of SDTV services

4.2.6.2.1 The decoder of the receiver shall support profile “MPEG-4 H.264/AVC Main Profile at Level 3” (used for H.264/AVC SDTV) and comply with ETSI TS 101 154 [3] (chapters 5.5 and 5.6; 25 Hz SDTV).

4.2.6.2.2 The decoder of receiver shall decode video in resolution of 720x576 pixels with minimum data rate of 600kbit/s.

4.2.6.2.3 The decoder of receiver shall be able to switch between 4:3 and 16:9 picture aspect ratios.

In case of receiving anamorphic picture and preset 4:3 on TV receiver the DVB-T2 receiver shall perform conversion to »16:9 letterbox«.

Optionally the decoder should perform conversion to »14:9 letterbox«.

The »16:9letterbox« conversion shall be implemented by vertical filtering.

Signal degradation due to the filtering should be subjectively imperceptible.

Line 23 and line 623 should be masked before the letterbox conversion to avoid the irritating half lines.

4.2.6.3 Decoding of HDTV services

4.2.6.3.1 The HDTV Level receiver shall fully support decoding of SDTV services.

4.2.6.3.2 Video decoder shall support “MPEG-4 H.264/AVC High Profile at Level 4” and comply with ETSI TS 101 154 [3].

4.2.6.3.3 In case of SCART, or if any other analogue video output (Y, Pb, Pr or other) is available, the decoded High Definition video shall be down-converted by SD format converter to standard definition (SD) resolution for output via these interfaces.

Picture down-conversion shall be implemented from any of the incoming encoded HD full screen luminance resolution of 1920x1080 and 1280x720 (as an OPTION also from 1440x1080, 1280x1080, 960x1080, 960x720 and 640x720) to 720x576 standard definition (SD) resolution.

Down-converted video shall be displayed as 16:9 letterbox on 4:3 displays. The SD format converter should apply appropriate re-interlacing.

4.2.7 Audio Decoder

4.2.7.1 Requirements for Audio Decoder in SDTV Level RECEIVER

4.2.7.1.1 The receiver shall provide at least one stereo audio decoder that is able to meet minimum decoding requirements based on MPEG 1 Layer II ("Musicam" ISO/IEC 11172-3) and decoder for AC3.

4.2.7.1.2 Audio decoder shall support also MPEG-4 AAC decoding according to ISO/IEC 14496-4 sub part 4., MPEG-4 E-AC 3.

4.2.7.1.3 The Audio decoders shall fully comply with DVB Implementation Guidelines for the use of MPEG- 2 Systems, Video and Audio in satellite, cable and terrestrial Broadcasting Applications ETSI TS 101 154.

4.2.7.2 Additional Audio Decoder requirements for HDTV Level RECEIVER

4.2.7.2.1 General

4.2.7.2.1.1 The HDTV Level receiver shall support reception of multi-channel (up to 5.1) audio in addition to the mandatory audio requirements for SDTV Level receivers.

4.2.7.2.1.2 The HDTV Level receiver shall provide analogue audio outputs for stereo/mono, S/PDIF output and an HDMI output for multi-channel audio. Optionally additional analogue outputs may be provided for additional surround sound or audio components for additional languages and/or impaired people.

4.2.7.2.1.3 An audio output of HDTV level iDTV receiver shall be in sync with the displayed video.

4.2.7.2.1.4 The HDTV level receiver shall be capable of decoding and down-mixing following formats for the analogue outputs:

- a) E-AC3 (5.1 channel downmix to stereo),
- b) MPEG1 layer II (Musicam ISO/IEC 11172-3) (2 channels).

4.2.7.2.1.5 The receiver shall always have the audio signal present on the analogue outputs (stereo out) whenever any of supported two formats is received.

4.2.7.2.1.6 The multi-channel audio may be carried in E-AC3. For receivers on the market both formats shall be mandatory.

4.2.7.2.1.7 HDTV services with multi-channel audio

4.2.7.2.1.7.1 External interfacing equipment (like TV display unit) shall not be required to support more than 2 channel PCM audio within main Video/Audio interface (HDMI).

4.2.7.2.1.7.2 The HD level receiver shall have an internal digital audio reference level equivalent to the Dolby dialogue normalization reference level.

4.2.7.2.1.7.3 The HD level receiver shall adjust the output level of all audio decoders to match the internal reference level so that perceived programme loudness is consistent for all audio coding schemes. For receivers featuring E-AC3, this should be consistent with Dolby Technical Bulletin 11: Requirement Updates for AC3 and E-AC3 in DVB Products.

4.2.7.2.1.7.4 Receivers featuring AC3 or E-AC3 decoding shall include the PCM Level Control feature described therein.

4.2.7.2.2 Audio formats

The HDTV Level receiver shall in addition to the audio requirements for SDTV Level receiver support the formats specified in chapters 7.2.2.1 and 7.2.2.2 of this document.

4.2.7.2.2.1 System with E-AC3 bitstream

4.2.7.2.2.1.1 The HDTV Level receiver shall have capabilities for processing AC3 and E-AC3 streams.

4.2.7.2.2.1.2 The receiver shall be capable of providing the following formats on the HDMI output connector:

- a) Pass-through of native bitstream AC3 and E-AC3
- b) E-AC3 bitstream transcoded to AC3.
- c) PCM stereo from the decoded or down-mixed bitstream.

4.2.7.2.2.1.3 The following formats are optional for the HDMI output connector:

- a) PCM multi-channel from the decoded bitstream.
- b) Pass-through of DTS bitstream.

4.2.7.2.2.1.4 The receiver shall be capable of providing the following formats on the S/PDIF connector:

- a) E-AC3 bitstream transcoded to AC3
- b) PCM stereo from the decoded or down-mixed bitstream
- c) Pass-through of AC3 bitstream
- d) Pass-through of DTS bitstream to the S/PDIF connector is optional.

4.2.7.2.2.1.5 The receiver shall:

- a) Decode AC3 streams at all bit rates and sampling rates listed in ETSI TS 102 366,
- b) (Additionally) decode E-AC3 streams with data rates from 32 kbit/s to 3 024 kbit/s and support all sample rates listed in TS 102 366,
- c) Be capable of transcoding E-AC3 bitstreams to AC3 bitstreams according to ETSI TS 102 366.

4.2.7.2.2.1.6 Transcoding to AC3 audio streams shall be at a fixed bit rate of, at least, 640 kbit/s.

4.2.7.2.2.1.7 The receiver shall support the use of Dolby metadata [33] embedded in the audio stream when decoding AC3 or E-AC3 bitstreams, transcoding E-AC3 bitstreams to AC3, or creating a PCM stereo downmix from a decoded E-AC3 or AC3 bitstream.

4.2.8 Radio mode

4.2.8.1 The STB shall allow basic DVB-T2 RADIO reception and operation (switching between channels) without a TV screen. This can be done with a Radio/TV button on the front plate or on the remote control.

4.2.8.2 In case of an alphanumeric display (optional) on STB the display should be large enough to accommodate the full length of the station name (up to 8 characters).

4.2.8.3 If a DVB stream is labelled as a Radio Service, it should always be shown by the STB in the radio channel list, even if there might be an elementary video stream sent along.

4.2.9 System software upgrade

4.2.9.1 The receiver shall provide at least one mechanism for upgrading system software.

4.2.9.2 HDTV Level receivers shall support and use OTA System Software Update procedure according to the ETSI TS 102 006.

4.2.9.3 The manufacturer shall provide procedure and functions carrying out upgrade in the receiver.

4.2.9.4 The receiver shall provide a mechanism to detect corrupt downloaded system software before it is used to replace current working software.

4.2.9.5 If received system software is corrupt the receiver shall keep current (working) version of system software, thus making the receiver operational again.

4.2.9.6 If so, the failure to download shall be indicated to the user with an error message that can be used in the contact with the customer relations office.

4.2.9.7 It shall be possible for the user to abort the download (in areas of bad reception quality the download may take too long time) and the receiver shall be operational using the current version of system software.

4.2.9.8 The receiver manufacturer shall provide the required MPEG-2 TS binary file (containing only applicable SSU service and all its (PSI/SI) signaling necessary for successful upgrade) intended for cyclic broadcast for each new version intended for system software download.

4.2.9.9 For each new version of system software over-the air download, the manufacturer shall provide all necessary description documents to the network operator required for the transmission of the new software. The manufacturer is responsible for providing and distributing new releases of system software.

4.2.10 Middleware

4.2.10.1 Service information

4.2.10.1.1 The receiver shall have system software for interpretation and handling of the active service information and control of the local hardware/software according to EN 300 468 and ETSI TR 101 211.

4.2.10.1.2 The receiver shall be able to process the PSI/SI tables for both, the ‘Actual’ and the ‘Other’ transport stream.

4.2.10.1.3 The following tables are a mandatory set of tables the receiver shall be able to process:

NIT, CAT, PAT, PMT, SDT, EIT, TDT, TOT

4.2.10.1.3 The receiver shall offer basic functionality of EPG in order to present following:

- a) EIT actual (present/following/scheduled)
- b) EIT other (present/following/scheduled)

4.2.10.2 Navigator (USER INTERFACE)

4.2.10.2.1 The navigator shall be presented in official languages of DIGI.TV region country and shall support characters/letters from code tables defined in group of standards ISO/IEC 8859-x.

4.2.10.2.2 English and siSwati shall be supported so the user can select and store his preference.

4.2.10.2.3 The HDTV Level receiver should be able to up-scale DVB SDTV subtitling and EBU Teletext subtitling for a service with HDTV video, with the target to keep the same relative size as the DVB SDTV subtitling and Teletext subtitling has within a SDTV video grid.

4.2.10.2.4 Up-scaling should be done with a good readable result at the HDTV output.

4.2.10.3 Teletext

4.2.10.3.1 General

4.2.9.3.1.1 The SDTV Level receiver shall offer at least one of following options for presentation of Teletext:

- a) by insertion of the Teletext data in the VBI of the analogue CVBS video output. Insertion shall conform to ITU-R BT.653-3 [18] and to requirements for level 1.5 defined in ETS 300 706 [22];

- b) by presentation of Teletext within the navigator of the receiver.

4.2.10.3.2 Teletext for HDTV Level RECEIVER

HDTV Level receiver shall be able to display (EBU) Teletext (both normal teletext pages and teletext subtitling pages) using the OSD, meeting the requirements for level 1.5 in ETSI EN 300 706 “Enhanced Teletext Specification”.

4.2.10.4 Subtitling

4.2.10.4.1 The receiver shall be capable of decoding and displaying DVB subtitle services which are transmitted in conformance with ETSI EN 300 743 including characters from code table presented for each specific country in clause 4.2.10.2.

4.2.10.4.2 The HDTV Level receiver shall include default font(s) with good readability for all output video resolution modes for SDTV and HDTV.

4.2.10.4.3 The HDTV Level receiver should be able to up-scale DVB SDTV subtitling and EBU Teletext subtitling for a service with HDTV video, with the target to keep the same relative size as the DVB SDTV subtitling and Teletext subtitling has within a SDTV video grid.

4.2.10.5 User settings

4.2.10.5.1 The user shall be able to store preferences in persistent memory.

4.2.10.5.2 The receiver shall provide a function to reset all parameters to factory mode, thus removing all service lists, user preferences, etc. After reset, the receiver shall enter installation state.

4.2.10.5.3 Parental control

The receiver shall provide for setting up passwords in order to ensure parental control.

4.2.11 Remote control

The receiver shall have an easy to use remote control.

4.2.11.1 Infrared receiver frequency

The infrared carrier frequency for the RCU shall be 38 kHz.

4.2.11.2 Keys and layout

By means of the RCU the user shall be able to perform the following:

- a) Enter the channel number by numeric keys
- b) Access and navigate the menu structure
- c) Access the EPG and programme information
- d) Confirm an option selection
- e) Select the next or previous service (P+ and P-)
- f) Increase or decrease the audio level
- g) Mute audio and restore to previous setting
- h) Exit from the menu and information structure
- i) Control the on-screen cursor (up, down, left, right)
- j) Display and suppress subtitles
- k) Toggle between normal and standby operation modes
- l) Provide a shortcut to interactive services and overlay text.

4.2.11.3 Response time

The design of the STB Receiver and the RCU operating system shall ensure maximum 100ms between the release of the key and the commencement of the specified response.

4.2.11.4 Reliability

4.2.11.4.1 Robustness

The RCU shall be designed to withstand frequent usage. It shall have a robust case which is resistant to damage when dropped onto hard surfaces.

4.2.11.5 Packaging

The RCU shall be included in the same shipping carton with the STB Receiver. Batteries shall be provided separately and packaged to prevent accidental short circuiting during transit.

4.2.11.6 Electromagnetic compatibility (EMC)

The STB and all accessories shall comply with the following standards;

- a) Emissions: SANS 213;
- b) Immunity: SANS 2200

4.2.12 Factory presets

For SDTV and HDTV Level receivers following pre-settings shall be enabled (or optional special note should be included on how to set these parameters):

- a) Default language for User interface and subtitling set to one of official languages of DIGI.TV country as defined in clause 4.2.10.2.
- b) Default codepage for language set to one of official languages of DIGI.TV country as defined in clause 4.2.10.2.
- c) Antenna DC power supply off.
- d) Subtitling: ON (enabled)
- e) Analog video output format: 4:3
- f) “16:9 letterbox” conversion: ON
- g) OTA System Software Upgrade: ON (enabled)
- h) Default digital audio output set to PCM Stereo according to IEC 60958.

4.2.13 Conditional Access System (CAS)

The decoder must comply with Nagravision encryption system either card based or cardless system.