HDTV – IRD GUIDELINES AUSTRIA

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1   INTRODUCTION

1.1   Scope

This document outlines a set of minimum requirements for HDTV IRDs (integrated receiver decoders), conditional access modules and TV sets with an integrated HDTV IRD used for receiving SD (Standard Definition) and HD (High Definition) satellite television programs distributed by ORS for the Austrian market.

Exceptions for HDTV IRDs, which are integrated into TV sets, are set out explicitly within the affected clause.

Requirements which apply only to HDTV IRDs with PVR or PVR-ready functionality are explicitly outlined.

This guideline defines only a minimum set of requirements and is not intended to be a complete specification for HDTV IRDs. It lists the minimum requirements for receiving digital audio and/or video in either standard or high definition, and/or data services distributed via satellite.

1.2   Document History

Version	Date	Comments
0.1		Initial version.
0.2	19.11.2007	Draft version.
0.3	22.11.2007	Modifications after 1st review.
0.4	26.11.2007	Modifications after 2nd review.
0.5	07.12.2007	HDCP Specification
1.0	08.01.2008	Changes regarding content protection. Release version.
2.0	02.06.2009	Changes regarding the Irdeto CA system, merging with the SDTV IRD guideline and additional requirements for the smart card agreement
2.1	16.02.2010	Cryptoworks no longer supported. Requirement for channel list management added. General requirements adapted. PVR feature added. AC3 handling defined. Composite interface added.
2.3	09.03.2010	Requirements for TV sets with integrated IRD
2.4	24.03.2010	Additional requirements for CI
2.5	21.05.2010	LCN added
2.6	21.05.2010	DRM & content protection added Middleware
2.7	31.05.2010	HDTV basic requirements Maturity rating Operator pairing DRM & Content protection via Irdeto ECM
2.8	01.06.2010	HDTV mandatory, SDTV-only no more specified
2.9	07.07.2010	DRM, CP, general rules adapted
3.0	23.08.2010	Analogue interfaces not mandatory, final clean version 3
3.1	01.09.2012	Irdeto no longer required for storage encryption Proof-reading
3.4	07.01.2014	Changed requirements for channel lists. HbbTV mandatory for internet connected IRDs.
4.0	09.06.2016	- modified channel lists requirements - Added requirement to support AES CBC scrambled signals to DVB descrambler paragraph - updated Loudness Levels and Downmixing paragraph - added paragraph for Supplementary Audio - updated Digital audio/video interface (HDMI) paragraph - updated DVB common interface paragraph - added requirement to handle component descriptor in EIT - Added requirement to select for "MIS" language code in paragraph Navigator and EPG - modified and further specified requirements for DVB and Teletext subtitling - Changed CA system requirements (cardless and pre-enablement requirement added)

		▪ Modified storage rights for IRDs with non-embedded CA-System paragraph ▪ Updated Hybrid broadcast Television paragraph (HbbTV 2.0.1) ▪ Added requirement for Specific Application Support ▪ Updated System software update paragraph
4.1	01.07.2020	▪ Chapter UHD added ▪ NGA (Dolby AC-4 and MPEG-H optionally added to chapter "audio decoding" ▪ Chapter service information has been updated. ▪ Chapter "SDT" added ▪ Recommendation for Channel list import/export function added ▪ Chapter "zapping operation" added ▪ Chapter "channel list operation" added ▪ Chapter "content protection" ▪ Updated Hybrid broadcast Television paragraph (HbbTV 2.0.2)

1.3   Terminology

Shall (mandatory)   Denotes that the item is mandatory.
Should (recommended)   Denotes that the item is not mandatory, but highly
                          recommended.
May (allowed)   Denotes that the item is allowed.

1.4   Definitions

AAC-HE	Advanced Audio Coding High Efficiency
AC-3	Audio Coding 3 (also known as Dolby Digital)
AD	Audio Description (scene description for visually impaired)
AIT	Application Information Table
API	Application Programming Interface
AVC	Advanced Video Coding
BAT	Bouquet Association Table
CA	Conditional Access
CAM	Conditional Access Module
CAT	Conditional Access Table
CI	Common Interface
CI+	Common Interface Plus
CRC	Cyclic Redundancy Check
CSA	Common Scrambling Algorithm
CVBS	Color, Video, Blank And Sync
DRM	Digital Rights Management
DTS	Digital Theatre Sound
DTT	Digital Terrestrial Television
DVB	Digital Video Broadcasting
DVB SSU	DVB System Software Update.
DVB-T	Digital Video Broadcasting - Terrestrial
DVB-T2	Digital Video Broadcasting – Second Generation Terrestrial
DVR	Digital Video Recorder. An IRD, which is capable of recording content of a DVB Transportstream on the IRD internal data storage or external data storage.
E-AC-3	Enhanced AC-3 (also known as Dolby Digital Plus)
EICTA	European Information & Communications Technology Industry Association
EIT	Event Information Table
EITp/f	Event Information Table, present/following
EITsch	Event Information Table, schedule
EPG	Electronic Program Guide
ETSI	European Telecommunications Standards Institute
H.264	H.264 is a standard for video compression. It is also known as MPEG-4 Part 10, or MPEG-4 AVC (for Advanced Video Coding).
HbbTV	Hybrid broadcast broadband Tele Vision.
HE AAC	MPEG-4 High Efficiency Advanced Audio Coding
HE-AAC V2	MPEG-4 High Efficiency Advanced Audio Coding version 2 (also known as aacPlusv2 and eAAC+)
HD	High Definition
HDCP	High-bandwidth Digital Content Protection
HDTV	High Definition Television

HDMI	High Definition Multi-media Interface
iDTV	Integrated Digital TV set
IRD	Integrated Receiver Decoder:
IRD vendor	The IRD vendor is understood as a distributor who is amended to offer and sell certified IRDs in the Austrian market, according to the defined trade arrangement.
LCN	Logical Channel Number
Mb	Megabit
MFN	Multi-Frequency Network
MPEG	Motion Picture Experts Group
NID	Network ID
NIT	Network Information Table
ONID	Original Network ID
ORF	Österreichischer Rundfunk
ORS	Österreichische Rundfunksender
ORS comm	ORS comm GmbH & Co KG
OSD	On Screen Display
OTA	Over the air
PAT	Programme Association Table
PID	Program Identifier
PIN	Personal Identification Number
PiP	Simultaneous display of the unchanged video content of two independent live video sources on one screen.
PMT	Program Map Table
PVR	Personal Video Recorder, see also DVR
PSI	Program Specific Information
RCA	Radio Corporation of America
RF	Radio Frequency
SCART	Syndicat des Constructeurs d'Appareils Radiorécepteurs et Téléviseurs / Radio and Television Receiver Manufacturers'
SD	Standard Definition
SDT	Service Description Table
SDTV	Standard Definition Television
SFN	Single Frequency Network
SGT	Service Guide Table
SI	Service Information
SID	Service ID
SSU	System Software Update…
TS	Transport Stream
TV Set	The term "TV Set" describes within this document the integrated combination of an IRD and a display. See also iDTV.
UI	User Interface
USB	Universal Serial Bus

1.5 References

[1]	DVB A 011	DVB A 011 Common Scrambling Algorithm. DVB Blue Book A011.
[2]	ETSI EN 300 421 v1.1.2	Digital Video Broadcasting (DVB); Digital broadcasting systems for television, sound and data services: Framing structure, channel coding and modulation for 11/12 GHz Satellite services.
[3]	ETSI EN 302 307 v1.2.1	Digital Video Broadcasting (DVB); Second generation framing structure, channel coding and modulation systems for Broadcasting, Interactive Services, News Gathering and other broadband satellite applications.
[4]	IEC 60169-2	Radio-frequency connectors, Part 2: Coaxial unmatched connector
[5]	ETSI TS 101 154 v2.6.1	Digital Video Broadcasting (DVB); Implementation guidelines for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream
[6]	ISO/IEC 13818-1	Information technology - Generic coding of moving pictures and associated audio information. Part 1: Systems.
[7]	ISO 639-2	Code for the representation of names of languages
[8]	ITU-T V.92	Enhancements to Recommendation V.90
[9]	ETSI EN 50049-1	Domestic and similar electronic equipment interconnection requirements: Peritelevision connector
[10]	ETSI EN 50157-2-1	Domestic and similar equipment interconnection requirements: AV.link-Part 2-1: Signal quality matching and automatic selection of source devices
[11]	ETSI EN 300 468 v1.11.1	Digital Video Broadcasting; Specification for Service Information (SI) in DVB Systems
[12]	ETSI TR 101 211 v1.9.1	Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)
[13]	ETSI TS 102 006	Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems
[14]	ETSI EN 300 472 v1.3.1	Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams
[15]	ETSI ETR 289	Digital Video Broadcasting (DVB); Support for use of scrambling and Conditional Access (CA) within digital broadcasting systems.
[16]	ETSI TS 102 201 v1.2.1	Digital Video Broadcasting (DVB); Interfaces for DVB Integrated Receiver and Decoder (DVB-IRD)
[17]	Universal Serial Bus	Universal Serial Bus (USB) Specification, Revision 2.0, April 27, 2000.
[18]	ITU-R BT.653-3	Teletext systems
[19]	ETSI EN 300 743 v1.3.1	Digital Video Broadcasting (DVB); Subtitling systems
[20]	ETSI EN 50221	Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications
[21]	ETSI TS 102 825	Digital Video Broadcasting Content Protection & Copy Management (DVB-CPCM)
[22]	EBU Tech 3333	EBU HDTV Receiver Requirements, March 2009
[23]	CI Plus Specification	CI Plus Specification v1.4.3 or recent version

[24]	Logical Channel Numbering (LCN) scheme for large DVB-S platforms, v2.1	ASTRA, Logical channel numbering (LCN) scheme for large DVB-S platforms, technical specification v2.1; 22 June 2009
[25]	ETSI TS 102 796 v1.1.1	ETSI TS 102 796 V1.1.1. Hybrid Broadcast Broadband TV (HbbTV)
[26]	Irdeto Cloaked CA Agent	Irdeto Cloaked CA Agent for Secure Chipset based STBs Integration Overview; recent version
[27]	HDMI Specification v1.4b	HDMI Licensing LLC, High-Definition Multimedia Interface Specification Version 1.4b
[28]	ETSI TS 102 796 V1.5.1.	ETSI TS 102 796 V1.5.1. Hybrid Broadcast Broadband TV (HbbTV) Extension for "Version 1.5",
[29]	Ethernet	Fast Ethernet IEEE 802.3u
[30]	IEEE 802.11.a/b/g/n Wi-Fi	IEEE Wireless Communications Protocols
[31]	Irdeto Complementary Specifications	Irdeto Complementary IRD specifications for the Austrian DVB market - version x.x or recent version
[32]	TS 102 366	ETSI TS 102 366 V1.2.1 (2008-08). Technical Specification. Digital Audio Compression (AC-3, Enhanced AC-3) Standard
[33]	NorDig Unified ver 2.5.1	NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks Date: 25 August 2014
[34]	EBU Tech 334	Practical guidelines for distribution systems in accordance with EBU R 128
[35]	HDMI Specification v2.0	HDMI Licensing LLC, High-Definition Multimedia Interface Specification Version 2.0 or higher
[36]	ORS API definition for HBBTV integration	ORS_API_definition_for_HBBTV_integration_V12_final.pdf
[37]	Irdeto Loader 5 Specification	Irdeto Loader 5 Specification
[38]	HbbTV 2.0.2	ETSI TS 102 796 V1.5.1 (2018-09)
[39}	CA-messages ORS HDTV IRD	CA-MESSAGES_ORS_HDTV_IRD_V11_final.pdf
[40]	NorDig Unified ver 3.1	NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks
[41]	CI Plus ECP specification v1.1	CI Plus Specification. Extensions for Enhanced Content Protection
[42]	ETSI TS 103 190-2	Digital Audio Compression (AC-4) Standard
[43]	ETSI TS 103 205	Digital Video Broadcasting (DVB); Extensions to the CI Plus™ Specification V1.4.1 (2019-05)

2 GENERAL REQUIREMENTS

Compliance with general EBU requirements for HDTV receivers as described in EBU Tech 3333 [22] is recommended.

Compliance with the general requirements of applicable European Community directives is mandatory (CE marking).

The user shall be able to store preferences in the persistent memory of the HDTV IRD.

If the HDTV IRD is switched on from standby or deep standby mode, the HDTV IRD shall tune to the last viewed service.

3 HARDWARE REQUIREMENTS

3.1 Satellite tuner and demodulator

3.1.1 General

The HDTV IRD shall at minimum include one tuner/demodulator unit to receive signals from a satellite RF outdoor unit. If more than one tuner is provided an additional CI+ module slot is recommended.

The HDTV IRD should have an RF bypass (RF in - RF out). *(Not required for TV sets)*

3.1.2 RF/IF characteristics

The available transponder bandwidths and transponder powers vary with the different satellites. Consequently, a range of symbol rates and forward error correction rates may be employed.

The HDTV IRD shall accept incoming digital DVB signals which comply with DVB-S, as specified in ETSI EN 300 421 [2], and which comply with DVB-S2, as specified in ETSI EN 302 307 [3] (application area: broadcast services).

The HDTV IRD shall accept symbol rates on the incoming carrier from 7.5Mbd up to 45Mbd in case of DVB-S signals and 5Mbd up to 30Mbd in case of DVB-S2 signals.

3.1.3 Demodulation and error correction

Demodulation and error correction shall be performed for all symbol rates given above and for all error correction rates specified in ETSI EN 300 421 [2] and ETSI EN 302 307 [3] (application area: broadcast services).

The HDTV IRD shall support QPSK and 8PSK Demodulation as specified in ETSI EN 300 421 [2] and ETSI EN 302 307 [3] (application area: broadcast services).

The HDTV IRD shall support DVB-S compliant FEC (Viterbi) and advanced modulation LDPC/BCH FEC as specified in ETSI EN 300 421 [2] and ETSI EN 302 307 [3] (application area: broadcast services).

3.1.4　Input frequency range/tuning range

The input frequency band of the RF unit with antenna may cover the frequency range 10.7GHz to 12.75GHz for each of two polarisations. The RF unit may be configured to select and convert any of the four 1 GHz bands (upper or lower half band for each polarization) to IF.

The IRD shall be able to tune to any DVB carrier located within the IF band 950-2150 MHz with characteristics and symbol rate as specified in section 3.1.2.

3.1.5　Tuning/scanning procedures

3.1.5.1　General

The HDTV IRD shall provide basic information regarding signal strength and reception quality in a submenu of the HDTV IRD configuration menu.

The HDTV IRD shall provide a scanning procedure over the whole frequency range.

The HDTV IRD should use the scanning procedure to access the services available on the network.

3.1.5.2　Channel lists

The HDTV IRD shall have a preinstalled channel list observing the requirements of lit. a). In case an ORF brand cooperation contract is in place which need to be signed separately the requirements in lit. b) shall also apply ("Mandatory Channel list"). This preinstalled channel list shall be the default choice in the overall offer of channel lists.

The HDTV IRD may provide further preinstalled channel lists which do not have to observe the requirements of lit. b) ("Optional Channel list(s)").
For the sake of clarity, the requirements of lit. a), lit. c) and d) have to be observed by all channel lists.

This requirement especially applies to the first-time installation process.

a. ORF channels

The HDTV IRD shall have a channel list which places the ORF services as follows:

The service ORF 1 HD shall be listed on channel number 1.

One of the nine regional ORF2 *<region>* HD services shall be listed on channel number 2 as follows:

During the first-time installation process of the HDTV IRD, the user should be able to select one of the nine ORF 2 HD regional services

ORF2 B HD	<ORF regional service for Burgenland>
ORF2 K HD	<ORF regional service for Kärnten>
ORF2 N HD	<ORF regional service for Niederösterreich>
ORF2 O HD	<ORF regional service for Oberösterreich>
ORF2 S HD	<ORF regional service for Salzburg>
ORF2 St HD	<ORF regional service for Steiermark>
ORF2 T HD	<ORF regional service for Tirol>
ORF2 V HD	<ORF regional service for Vorarlberg>
ORF2 W HD	<ORF regional service for Wien>

The remaining eight or all nine regional ORF 2 HD services as well as Hitradio OE3 and ORF2E service shall be listed under channel number 100 or at the end of the channel list, in subsequent order.

In case the HDTV IRD does not support the selection of the regional ORF 2 HD service as described above, the service ORF 2 W HD shall be listed on channel number 2.

The service ORF III HD shall not be listed above channel number 15.

The service ORF Sport + HD shall not be listed above channel number 20.

ORF reserves the right to change the order of the services as well as to add or remove services. Such changes of the channel list requirement will be communicated to all partners 6 weeks in advance. After this grace period of 6 weeks has ended all new devices applied for certification shall follow the new requirement. For the sake of clarity devices that are already certified or are in the process of certification are not required to implement such new channel list requirement.

b. Other channels

The channel numbers 1 to 99 must not list any service that requires activation from a third party in addition to the basic general activation by ORF-digital.

c. Manual changes to the channel list:

Within the channel list view, users shall be able to manually change the order of channels and insert, replace or delete channels at their discretion and

therefore manually change the mapping of channel numbers to channel names. In such cases however, the HDTV IRD shall provide an option in the HDTV IRD setup menu to reset the mappings to the mandatory or optional channel list.

d. *Automatic update of the channel list:*

The HDTV IRD may provide for an automatic update of the channel list. All requirements of this clause also apply to any automatic update of the channel list.

In case of an automatic update, the user shall receive an on-screen dialog allowing him to accept or refuse such an update of the channel list.

The HDTV IRD shall remember the manual changes made to the channel list view by the user and react accordingly to the current signal.

3.1.5.3   Dynamic NIT and SDT processing

The HDTV IRD should update the modulation parameters according the NIT.

Dynamic changes of service names in SDT shall be supported.

3.1.5.4   Dynamic PMT processing

The HDTV IRD shall be able to handle dynamic changes in the program map table (PMT).

An example of a practical use scenario for dynamic PMT changes is a broadcaster's requirement to make it possible to switch on and off regional variants of programs.

The HDTV IRD shall handle dynamic PMT changes in the correct manner and certain additional restrictions shall also be observed:

- o Dynamic changes in the PMT shall not produce any disturbances in the audio/video output.
- o In cases where 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. The maximum switching time shall be met regardless of whether the elementary streams are scrambled.

It is recommended, that the video stream should freeze until the new video stream can be displayed.

During service regionalization audio/video PIDs are changed but other PIDs within the program will remain unchanged. It is to be ensured that other program elements such as the teletext is not interrupted or disturbed by the regionalization. For sake of clarity the teletext when selected shall not terminate when regionalisation begins or ends.

The HDTV-IRD shall be able to handle a dynamic switchover from an H.264/AVC HDTV elementary stream to an H.264/AVC SDTV elementary stream. The maximum outage shall be less than 3 seconds.

3.1.5.5   Service regionalization (informative)

The service ORF 2 is available in 9 different variants each in SD and HD quality. The regional variants have equal content in central time and are regionalized two times a day.

There are "ORF 2 HD" regional services on TP1005, T1007 and TP1117. On each TP there is an "ORF 2" central service on which the other regional variants point (Audio, Video and Teletext PIDs of regional variant are same as the PIDs from the central service).

For the time of regionalization the regional variants get own dedicated PIDs. Please also note that in regional time there is only one audio track available and the IRD shall select the remaining audio component automatically and should switch back to the audio component that was selected before the regionalization.

Other program components such as HbbTV applications are unaffected by this regionalisation and shall not be disturbed.

3.1.6   Satellite tuner interface and signal levels

3.1.6.1   RF input connector

The HDTV IRD shall include one input connector, type: IEC 60169-2 [4], F-type, female, 75 ohms.

3.1.6.2   RF output connector

The HDTV IRD should include one output connector, type: IEC 60169-2 [4], F-type, female, 75 ohms.

The RF output shall be available independently from the operational status of the HDTV IRD (operational or stand by), so that there is no restriction on the operation of the connected equipment.

3.1.6.3   Signal level

The HDTV IRD shall accept input signals with a level within the range -25dBm to -60dBm.

3.1.6.4   Power supply and control signals of the RF unit

The HDTV IRD shall provide a power supply and control signals to the external RF unit as specified below:

o   Voltage: 13.5/18.5 V +/- 5%

o   Current: at least 400 mA

o   Control tone:

▪   amplitude: 0.65 V +/- 0.25 V

▪   frequency: 22 kHz, duty cycle: 50% +/- 10%

The tuner/demodulator shall be able to select between at least two RF units, upper and lower band as well as polarisation within each unit.

The HDTV IRD should support the DiSEqC 1.0 specification.

3.2 MPEG-2 demultiplexer

3.2.1 General

The HDTV IRD demultiplexer shall be compliant with the MPEG-2 transport layer defined in ISO/IEC 13818-1 [6].

The HDTV IRD shall support ETSI TS 101 154 [5].

Additional requirements:

The HDTV IRD shall interpret the Conditional Access (CA) descriptor as defined in ETSI ETR 289 [15].

The HDTV IRD shall be able to decode an ISO/IEC13818-1 [6] stream with data rates up to 58 Mbps.

The HDTV IRD shall be capable of utilising at least 32 elementary streams simultaneously, which requires 32 PID filters.

The HDTV IRD shall provide at least 32 section filters.

The HDTV IRD shall support variable bit rate elementary streams within a constant bit rate transport stream.

3.2.2 DVB descrambler

The descrambler unit shall be able to handle CSA (as specified by DVB, see DVB A 011 [1]) and AES CBC scrambled signals.

The HDTV IRD shall be able to evaluate the CA descriptor regardless of whether it is inserted in the PMT at programme level or at programme element level.

3.3 Video decoding

The HDTV IRD video decoding subsystem shall comply with ETSI TS 101 154 [5] and shall comply with ETSI EN 302 307 [3]. Still pictures shall be supported in all modes listed below.

3.3.1 SDTV

3.3.1.1 MPEG-2

The HDTV IRD shall comply with ETSI TS 101 154 [5], sub-clause 5.1, "25 Hz MPEG-2 SDTV IRDs and Bitstreams".

The minimum requirements are:

o The HDTV IRD shall support MPEG-2 main profile main level bitstreams (MPEG-2 MP@ML).

- o The HDTV IRD shall support the decoding and display of video material with a frame rate of 25 Hz interlaced.
- o The HDTV IRD shall be able to decode bit-streams with 4:3 and 16:9 aspect ratios.
- o The HDTV IRD shall support a luminance resolution of 352x576 to 720x576.
- o The HDTV IRD decoder shall be able to decode at bit rates down to 1.0 Mbps for video resolutions up to full Standard Definition resolution video (720x576)

3.3.1.2 H.264/AVC

The HDTV IRD shall comply with ETSI TS 101 154 [5], sub-clause 5.6.2, "25 Hz H.264/AVC SDTV IRD and Bitstream".

The minimum requirements are:
- o The HDTV IRD shall support decoding and displaying of H.264/AVC main profile level 3 bitstreams.
- o The HDTV IRD shall support the decoding and display of video material with a frame rate of 25 Hz interlaced or progressive.
- o The HDTV IRD shall be able to decode bitstreams with 4:3 and 16:9 aspect ratios.
- o The HDTV IRD shall be able to decode H.264/AVC video at bitrates down to 250 kbps for all resolutions up to 1920x1080
- o The HDTV IRD shall be able to decode AVC still picture at bitrates down to 100 kbps.

3.3.1.3 16:9 Letterbox conversion

It shall be possible for the user to switch the aspect ratio between 4:3 and 16:9 (adjustable in the user preferences submenu). (Not required for TV sets).

In cases where a 4:3 aspect ratio is preset in the HDTV IRD user preferences settings and video with an aspect ratio of 16:9 is to be displayed, the HDTV IRD shall automatically perform a 16:9 letterbox conversion. (Not required for TV sets).

TV sets shall display the video in the correct aspect ratio by adding pillar box or letterbox spacing.

3.3.2 HDTV

3.3.2.1 H.264/AVC

The HDTV IRD shall comply with ETSI TS 101 154 [5], sub-clause 5.7.2, "25 Hz H.264/AVC HDTV IRD and Bitstream".

The minimum requirements are:

o   The HDTV IRD shall support decoding and displaying of H.264/AVC high profile level 4 bitstreams.

o   The HDTV IRD shall support the decoding and display of video material with a frame rate of 25 Hz interlaced or progressive, or 50 Hz progressive.

o   The HDTV IRD shall be able to decode bitstreams with 16:9 aspect ratio.

o   The HDTV IRD shall support a maximum luminance resolution of 1920x1080.

o   The HDTV IRD shall support H.264/AVC video at bitrates down to 250 kbps for all resolutions up to 1920x1080.

o   The HDTV IRD shall be able to decode AVC still picture at bitrates down to 100 kbps

The following HD video formats shall be supported:

o   1280x720p/50

o   1920x1080i/25

3.3.2.2   Downscaling from HDTV to SDTV

If the HDTV IRD is equipped with analogue video interfaces, the downscaled HDTV signal displayed on the analogue output shall be at least the same quality and resolution as the full resolution for a PAL SDTV signal. The aspect ratio conversion shall be handled as described in clause 3.3.1.2.

The analogue output shall be controlled by the content security system as described in clause 7.5.

3.3.2.3   H.265/HEVC

All IRDs should support HEVC Main10 Level5.1.

3.3.3   UHDTV

If the IRD support UHD than it shall comply with the definitions in this paragraph as well as ETSI TS 101 154 [5], sub-clause 15.14.4 HEVC HDR UHDTV IRDs and Bitstreams.

UHD IRDs shall support HEVC Main10 Level5.1.

3.3.3.1   Compression

HEVC is the expected video compression. A compliant IRD shall at minimum support HEVC Main10 Level 5.1.

It is up to the manufacturer to support additional codecs.

3.3.3.2   HDR

The following High Dynamic Range (HDR) systems shall be supported:
- o   HLG10
- o   PQ10 / HDR10 is considered as optional

Switching between HDR modes and HDR to SDR shall be apparently seamless.

3.3.3.3   Colour

The IRD shall be able to decode all ITU-R BT.2100 colour primaries with appropriate processing and presentation.

Switching between BT.709 and BT.2100 shall be apparently seamless:
- o   ITU-R BT.500 [5], section 2.1.2), artefacts are not noticeable to a viewer.
- o   Format switching occurs at program boundaries (i.e. via black and silence) the viewer should not wait more than 0.25 seconds for the change to occur and a stable output to be achieved

The BT.2100 color primaries are wider than what televisions currently can reproduce. If the IRD display capabilities do not comply to BT.2100 mapping of the signaled colors to the capabilities of the display is required. For the sake of clarity all conversions shall lead to a quality improvement over 'HD SDR' color!

3.3.3.4   Image resolution

The following image resolutions should be supported by the IRD:
- o   3840 x 2160
- o   3200 x 1800
- o   2560 x 1440
- o   1920 x 1080

All resolutions of received video shall internally be scaled to the native resolution of the display.

3.3.3.5   Frame rate (HFR)

The following progressive frame rates shall be supported:
- o   25 frames/second
- o   50 frames/second
- o   60 frames/second (+ fractional) is optional

The Video Decoder of the IRD should also be able to receive and decode a half frame rate (50Hz) component of a dual PID 100Hz HFR bitstream, according to ETSI TS 101 154 [5] section 5.14.5 "HEVC HDR HFR UHDTV IRDs and Bitstreams and HEVC HFR UHDTV Bitstreams", subsection

5.14.5.7 "HEVC encoding structure for HFR Bitstreams using dual PID and temporal scalability".

Support for frame rates other than 25 Hz, 50 Hz and the reception and decoding of a half frame rate (50Hz) component of a dual PID 100Hz HFR bitstream, is optional. For HEVC encoded video, only decoding of progressive scan video is mandatory.

3.3.3.6 Downscaling from UHDTV to SDTV/HDTV

If the UHDTV IRD is equipped with analogue video output interfaces, the downscaled UHDTV signal displayed on the video output shall be at least the same quality and resolution as the full resolution for a PAL SDTV signal. The aspect ratio conversion shall be handled as described in clause 3.3.1.2.

The video output shall be controlled by the content security system as described in clause 7.5.

3.4 Audio decoding

The HDTV IRD audio decoding subsystem shall comply with ETSI TS 101 154 [5] and in particular with sub-clause 6 ("Audio") and its related annexes.

The HDTV IRD shall keep in sync the audio/video streams that are produced in order to achieve adequate lip-synchronization.

The audio decoder shall support the following audio coding systems in compliance with ETSI TS 101 154 [5]:

- o MPEG-1 Audio Layer I and II
- o Dolby Digital (AC-3)

The audio decoder should support the following audio coding systems in compliance with ETSI TS 101 154 [5]:

- o Dolby AC-4
- o MPEG-H

3.4.1 Multichannel audio

3.4.1.1 Digital audio Interface

The HDTV IRD shall be able to output the audio stream in the native incoming audio format of the selected audio component on the digital audio interfaces (see clause 3.5.4.2) in accordance with the requirements of clauses 3.5.2 and 7.5.

The multi-channel audio stream shall be optionally available as a stereo downmix on the digital audio interfaces.

This clause is also valid for TV sets, in cases where a digital multichannel audio interface is available.

3.4.1.2   Analogue audio interface

If present, the multi-channel audio stream shall be decoded to a stereo downmix and shall be fed to the analogue stereo output connectors (see clause 3.5.4.1).

This clause is also valid for TV sets, in cases where analogue audio interfaces are available.

3.4.1.3   Dynamic audio component switching

In cases where the selected audio component is turned off inside the selected service during playback, the audio decoder shall automatically select one of the remaining audio components for digital and analogue output. During the switching period, the interruption should be shorter than 3 seconds.

3.4.2   Loudness Levels and Downmixing

To achieve loudness and dynamic range consistency over codec formats, the device shall follow the following guidelines on audio levelling and dynamic range control.

For decoding and transcoding AC-3 the device shall support the use of a complete set of Dolby Metadata according to TS 102 366 [32]. If metadata is available for an incoming bitstream format, it shall be applied to the audio signal by the device during decoding and/or downmixing.

The IRD shall apply format dependent attenuation to decoded stereo PCM audio, in order to align stereo outputs (-23LUFS) at the same level as multichannel outputs (-31LUFS).

The device shall provide a consistent loudness experience according to NorDig Unified v.3.1, section 6.13 [40] and should be fully compliant to EBU Tech 3344 [34].

For bitstreams, which do not contain metadata, the device shall use default values according TS 101 154 [5], annex C.5.2.8. In accordance with TS 101 154, section 6.4.3 [5] a Program Reference Level of -23dBFS shall be assumed as default.

3.4.3   Supplementary Audio

The device should support supplementary audio services according to NorDig Unified v.3.1, section 6.11 [40], particularly section 6.11.6 and TS 101 154, annex E [5]. Receiver-mixed Supplementary Audio should be supported for all mandatory codecs. Receiver mixing requirement is only applicable if "normal" and Supplementary Audio streams are of the same codec family, sampling rate and on two different PIDs.

If Receiver-Mixing is supported by the device it shall be compliant to supplementary audio settings as specified in NorDig Unified v.3.1, section 6.11.3 [40]. The device shall be able to mix the "normal" audio stream

together with a Supplementary Audio stream according to the receiver-mixing specifications in NorDig Unified v.3.1, section 6.11.6 [40].

The user should be able to enable / disable supplementary audio, change the default Audio Type (stored in the device), temporarily change the audio type and separately adjust the audio mixing level of the receiver mixed audio relative to the "normal" audio via easily accessible remote-control functions.

Devices with head-phones output should additionally offer a separate receiver-mixed Supplementary Audio stream selectable on the head-phones interface as specified in NorDig Unified v.3.1, section 6.11.7 [40] and at the same time presenting the "normal" audio on its own on the other main audio outputs (HDMI, S/PDIF etc.). This should be selectable by the user as an alternative to the ordinary receiver mix.

Devices may optionally support Advanced Clean Audio Services as specified in TS 101 154, section E7.4 [5] or a receiver-side post-processing for Dialogue Enhancement. Devices may optionally support metadata according TS 102 366, Annex H [32].

3.5   HDTV IRD interfaces

3.5.1   SCART interface

The HDTV IRD should have one SCART interface or a Composite interface. (Does not apply to TV sets).

The SCART interface shall comply with ETSI EN 50049-1 [9] and ETSI EN 50157-2 [10].

This clause is also valid for TV sets, in cases where a SCART interface for video output is available.

3.5.2   Digital audio/video interface (HDMI)

The HDTV IRD shall have at least one HDMI output as described in ETSI TS 102 201 [16], sub-clause 4.6. All digital Video Interfaces shall be compliant to the HDMI specification version 1.4b [27] or higher.

The HDTV IRD shall provide digital copy-protection at HDMI output as defined in the HDMI specification. The HDTV IRD shall provide for the user an option in the system menu to disable the HDCP authentication for unprotected content (see EBU Tech 3333 [22], §9.5). The HDMI source (HDTV IRD) shall attempt authentication if the content requires protection. A successful HDCP authentication shall always trigger encrypted transmission of the content.

If the content is signalled as digital copy-protected content and the HDCP authentication handshake is successful, then the HDCP command ENC_EN triggering the encrypted transmission of content shall be sent by the HDCP transmitter. If the content is signalled as digital copy-protected content and

the HDCP authentication handshake fails at any time during the transmission, then unencrypted (clear) content shall not be transmitted.

Clause 3.5.2 is also valid for TV sets, in cases where an HDMI interface for video output is available. At least one HDMI interface shall provide an audio return channel (HDMI-ARC) and shall be compliant as specified in HDMI Specification v1.4b [27]

3.5.3   Component video (YPbPr)

The HDTV IRD should have analogue component video output (YPbPr, RCA connectors). The analogue component video output shall support high-definition resolution.

The clause 3.5.3 is also valid for TV Sets, in cases where a component interface for video output is available.

3.5.4   Audio interfaces

3.5.4.1   Analogue audio

The HDTV IRD should have an analogue audio stereo output (left and right channel RCA connectors).

3.5.4.2   Digital audio

The HDTV IRD shall have a digital audio S/PDIF output (electrical or optical connector).

Digital audio shall be available on at least one HDMI interfaces (HDMI-ARC) an shall be labelled accordingly. Digital audio shall also be available on S/PDIF outputs.

Clause 3.5.4 is also valid for TV sets, in cases where a component interface for video output is available.

3.5.5   Data interface

The HDTV IRD shall support at least one of the following local data interfaces.

- o RS232C as defined in ETSI TS 102 201 [16], sub-clause 4.7.1
- o Universal serial bus port, USB 2.0 [17]
- o LAN: fast Ethernet IEEE 802.3u and/or WLAN 802.11g (or higher)

In cases where the HDTV IRD contains middleware as described in clause 10, a wired or wireless LAN connection shall be supported.

3.5.6 DVB common interface

In cases where the HDTV IRD lacks an embedded Irdeto CA system as required by clause 7.1, the HDTV IRD shall be equipped with at least one DVB common interface slot in compliance with the common interface specification ETSI EN 50221 [20].

In addition to ETSI EN 50221 [20], audio and video streams shall be scrambled at any point in the physical interface between the connected CA module and the HDTV IRD if the incoming stream is also scrambled.

The CA Module shall be capable of signalizing and activating any content protection and DRM functionality to the HDTV IRD as required in clauses 7 and 7.5 in a secure way that is not open to being circumvented. The applied technology for realising this secure content exchange via CI may be based on the common interface plus specification v1.3 or later [23].

HEVC UHD IRDs should have a CI Plus implementation that fully comply with the CI Plus ECP Specification v1.1 (2017-11) [41] available from CI Plus LLP.

4 SERVICE INFORMATION

4.1 General

The HDTV IRD shall be able to process incoming MPEG-2 TS PSI and DVB SI data (descriptors, tables) in accordance with ETSI EN 300 468 v1.7.1 [11] and ETSI TR 101 211 v1.7.1 [12].

The HDTV IRD shall be able to process the DVB-SI tables for 'actual' and 'other' transport streams.

The following tables are a mandatory set of tables that the HDTV IRD shall be able to process: PAT, PMT, CAT, NIT, SDT, EIT, TDT, TOT.

Descriptors or other data structures that are currently undefined or are unknown to the HDTV IRD shall be skipped and shall not cause any harm.

4.2 EIT

The HDTV IRD shall process the following EIT tables:

o   EIT actual (present/following/scheduled)

o   EIT other (present/following/scheduled)

The following descriptors in the EIT shall be processed by the HDTV IRD:

content_descriptor, short_event_descriptor, extented_event_descriptor and component_descriptor.

The HDTV IRD shall process the copy control descriptor as described in clause 7.5.

The HDTV IRD shall support an extended_event_decriptor of up to 1,000 characters per event. A minimum of 200 events per service shall be handled and shall be displayed in the EPG schedule.

4.3 SDT

The IRD should be able to receive and interpret a linkage descriptor (0x4A) in SDTactual and SDTother.

5 NAVIGATOR AND EPG

The HDTV IRD shall implement a Navigator, allowing the user to control the operation of the HDTV IRD, and providing user access to system information (user preferences settings, system settings, facilities to initiate system software updates etc).

The Navigator is by definition part of the system software.

The Navigator shall support the German language in all menus and submenus.

The Navigator shall include a basic electronic programme guide which displays information extracted from relevant DVB-SI tables as described in clause 4.

The HDTV IRD shall be able to read and use ISO 639-2 [7] language descriptors associated with the audio streams in the MPEG-2 transport stream ISO/IEC 13818-1 [6].

The user shall be able to set storable preferences for the default audio language. The IRD should provide the option to select "MIS" language code as defined in ISO 639-2 [7]. If an audio stream for the default audio language is available for the service, the IRD shall automatically choose that audio stream. In addition, the user shall be able to manually select from all audio streams available within the active service by using a function of the user menu or direct "audio" button on the remote control.

The IRD should have a channel list import/export function. The device maker should provide means (e.g PC application) to modify this channel list.

5.1 Zapping operation

When zapping to another service it shall be ensured that audio and video are synchronous after zapping operation is finished. The gap between presenting audio/video should be kept as short as possible.

5.2 Channel list operation

In all channel list views scrambled services should be marked as signalled in the copy control descriptor of the EIT (e.g "key" or "lock" symbol).

It should be possible to:

- sort the EPG or channel list alphabetically
- search for specific service names
- filter the list by predefined criteria (e.g UHD, HD, FTA, Radio etc.)

In the channel list view, it should be easily possible to add service to favourite lists.

Services in the favourite list may come from different DVB sources such as DVB-S, DVB-T2, DVB-IP etc.

6 TELETEXT AND DVB SUBTITLING

6.1 Teletext

During normal operation (decoding of video/audio/data-streams), the HDTV IRD shall be able to demultiplex in parallel the Teletext service transmitted in a packetized format in accordance with ETSI EN 300 472 [14].

The Teletext function shall be easily available via remote control interaction.

6.1.1 Display of Teletext

The HDTV IRD shall be able to insert Teletext via On Screen Display functionality on all available digital and analogue outputs.

TV sets shall display Teletext via On Screen Display functionality. The insertion of Teletext via On Screen Display functionality on available digital and analogue outputs is only recommended for TV sets.

Teletext subtitles shall be displayed synchronous with video. The correct and dynamic display of Teletext subtitles is mandatory.

It is important and therefore mandatory that the IRD keep the TXT alive during regionalization of a service. It shall not be necessary to select TXT subtitles again when regionalization of a service begins or ends.

6.1.2 Teletext data in the VBI

The insertion of the Teletext data in the VBI of the analogue CVBS video output is recommended.

VBI insertion shall conform to ITU-R BT.653-3 [18].

Clause 6.1.2 is also valid for TV sets, in cases where an analogue interface for video output is available.

6.2 DVB subtitling

The HDTV IRD should be capable of decoding and displaying DVB subtitle services which are transmitted in conformance with ETSI EN 300 743 [19].

The user shall be able to enable and disable subtitles through the user interface and to select preferred subtitling language.

The user preference settings for subtitling should be common for EBU Teletext and DVB subtitles. This means when subtitling is enabled the IRD shall try to select the subtitle component which matches with the preferred subtitling language. In case of user has made temporary changes of the subtitling settings (i.e. without changing the IRD's user preference setting), then the IRD should remember this decision.)

If both DVB-subtitling and Teletext subtitling are received simultaneously, the HDTV IRD shall only display the DVB-subtitling stream.

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7   CONDITIONAL ACCESS AND DIGITAL RIGHTS MANAGEMENT

7.1   Conditional access system

The HDTV IRD shall support conditional access (CA) in one of the following ways:

Embedded cardless CA system
or
Embedded cardless CA system and one or more common interface slot(s) for CAMs
or
One or more common interface slot(s) for CAMs

Each CI slot in the HDTV IRD shall be in compliance with the DVB common interface specification ETSI EN 50221 [20] and the additional requirements as described in clause 3.5.6.

The embedded CA system has to be integrated according to the rules of the CA System vendor and product and shall be fully compliant to Irdeto Cloaked CA Agent for Secure Chipset based STBs Integration Overview [26]

All test procedures (e.g mandatory DVT test cases) and licensing terms as defined by CA vendor have to be observed.

The CA system in use for ORF's TV services is Irdeto with the CA system ID "0x06E2" with the Operator Variant ID "0xED".

The Irdeto embedded CA system has to be integrated according to Irdeto CA-System vendor implementation rules [26]) and the test procedure and licensing terms as defined by Irdeto have to be observed. The device shall integrate Irdeto Cloaked CA Version 4.2 or higher (This also applies to and is mandatory for any subsequent updates to the Irdeto CA system) and shall support Irdeto IFCP.

The device manufacturer shall consolidate with Irdeto about the actual used CCA Version.

The HDTV IRD and CAM vendor must provide to ORS a written and certified proof that the device fulfils all requirements as stipulated in Irdeto Cloaked CA Agent for Secure Chipset based STBs Integration Overview [26].

The IRD shall be able to handle Irdeto Unique Announcements and Mail messages as well as Global Announcements and Mail messages.

7.2   PRE-Enablement

The embedded CA System shall support Secure pre-enablement (SPE) as specified in Irdeto Cloaked CA Agent [26].

After successful first HDTV IRD setup, an initial pre entitlement period is running. Period shall be started after switching first time to an encrypted channel and receiving default ECM. This period shall not reset when a factory reset, or software update is performed on the device.

For the sake of clarity for devices with embedded CA-system the channel search procedure within the FTI procedure shall not trigger the SPE.

IRDs with embedded CA System and PVR function shall support recording in the SPE phase (Irdeto uninitialized client PVR)

7.3   CA-System Error&Status messages

Messages generated by the embedded CA-System shall be implemented according to document CA-messages_ORS_HDTV_IRD [39]. This document defines the message text to be used by the IRD instead of the generic messages text defined by the CA-system vendor.

7.4   Maturity rating (Parental rating)

The HDTV IRD shall support maturity rating as provided by the CA system provider listed in clause 7.1.

7.5   Content security for Content delivered via DVB

The IRD shall support all content security features as required by the cardless CA system (as defined in paragraph 7.1) via an embedded CA system or via a CA system residing in a CA Module.

All signalling of copy-protection and DRM information shall be done within the ECMs of the CA system provider defined in clause 7.1.

In the case of encrypted content, the HDTV IRD shall apply the copy-protection and DRM measures to the related service components as signalled in the ECMs accordingly.

In addition to the ECM-contained metadata, DRM and copy-protection information are also available entirely or partly in the copy control descriptor of the EIT according to [11]. The IRD should decode and display this information inside the shown present/following programme information and the EPG schedule.

In case of unencrypted content, the HDTV IRD should support the requirements listed in EBU TECH 3333 [22], §9.7.

7.5.1　　Digital Copy Protection

The activation of digital copy-protection is signalled in ECMs defined by the CA system provider listed in clause 7.1.

If digital copy-protection is signalled as active, then copy-protection shall be enabled on all relevant digital interfaces. Please refer also to clause 3.5.2.

In addition to the signalling of digital copy-protection within ECMs, digital copy-protection is signalled in the EIT/copy control descriptor as active by setting the digital copy-protection bit to 1.

7.5.2　　Analogue Copy Protection

The activation of analogue copy-protection is signalled in ECMs defined by the CA system provider listed in clause 7.1.

If analogue copy-protection is signalled as active, then either all relevant analogue interfaces (see clause 3.5.1) shall be disabled, or appropriate actions to prevent copying shall be taken (e.g. activation of Macrovision or CGSM-A). However, this excludes the analogue video component interface, which is handled separately (see clause 7.5.3).

7.5.3　　Component video control

Restrictions regarding the analogue component video interface (YPbPr) are signalled in ECMs defined by the CA system provider listed in clause 7.1.

7.5.4　　Storage rights

This clause is only valid for PVR enabled IRDs which have an embedded CA System.
For IRDs where the CA System reside on an external CI Plus CA module please refer to 7.5.5.

7.5.4.1　　Basic rules

In cases where the HDTV IRD has an internal or an external storage capability, the storage rights information shall be signalled in ECMs defined by the CA system provider listed in clause 7.1.

The HDTV IRD shall be able to handle and observe the following storage rights:

- No restrictions on storage of content
- Recording allowed but trick mode prohibited
- No recording allowed

These storage rights shall be stored together with the content and shall be observed during subsequent playback of the content.

PVR functionality shall be fully compliant to Irdeto Cloaked CA Agent for Secure Chipset based STBs Integration Overview [26].

7.5.4.2   Storage encryption

In case the HDTV IRD has an internal or an external storage capability, activation of storage encryption shall be signalled in ECMs defined by the CA system provider listed in clause 7.1.

The HDTV IRD shall provide an encryption system for local encryption of content which is stored on an internal or external storage device.

The HDTV IRD shall provide a decryption system for local decryption of content, which was previously stored encrypted on an internal or external storage device.

For the sake of clarity for FTA content or when there is no copy protection signalled in EMMs and URIs respectively the recorded content should be recorded in clear without any encryption applied!

7.5.4.3   Playback Trick mode control

In case the HDTV IRD has an internal or an external storage capability, the restrictions on playback trick modes shall be signalled in ECMs defined by the CA system provider listed in clause 7.1.

7.5.5   Storage Rights for IRDs with non-embedded CA System

In case the CA System resides on an attached CA Module, scrambled services shall be processed and recorded according to the Usage Rule Information signalized by the CA Module (see [23]).

For the sake of clarity for timeshift operation services which are scrambled and which have content protection set by the CA-system shall be stored encrypted to the storage media and shall be removed after expiry.

7.6   General rules on content immutability

The subsequent clauses are required for service providers having additional needs in securing the immutability of their programme signals.

The HDTV IRD shall provide technical means to observe these requirements.

7.6.1   No modification to programme signals

The HDTV IRD shall not allow the modification of the original programme signal by any service provider other than the original one. This is not limited to but includes, for example, insertion or replacement of advertisements.

7.6.2   No graphical overlays

The HDTV IRD shall not allow any graphical overlays on top of the original programme signal by any service provider other than the original one,

regardless of whether the overlays appear on the whole screen or on parts of the screen.

The display of general (neutral) information such as information on the present/following programme and IRD related information displayed as part of the navigator (e.g. menus) are allowed.

This section does not apply to Applications which are directly related to the tuned broadcast signal like HbbTV applications or Teletext which are transported or at least signalized inside the currently decoded and displayed DVB broadcast service.

7.6.3   No concurrent display of programme signals and other content

The HDTV IRD shall not allow the concurrent display of the programme signal and any other content (video, images, text), such as by a split screen mechanism, unless the original service provider issues explicit permission for this or in the case of picture in picture functionality.

The display of general (neutral) information such as information on the present/following programme and IRD related information displayed as part of the navigator (e.g. menus) are allowed.

This section does not apply to Applications which are directly related to the tuned broadcast signal like HbbTV applications or Teletext which are transported or at least signalized inside the currently decoded and displayed DVB broadcast service.

7.6.4   No rescaling of the programme signal

The HDTV IRD shall not allow the rescaling of the programme signal except in non-discriminatory EPGs and/or navigators, or as part of picture in picture functionality.

This section does not apply to Applications which are directly related to the tuned broadcast signal like HbbTV applications or Teletext which are transported or at least signalized inside the currently decoded and displayed DVB broadcast service.

7.6.5   No automatic Ad Zapping

The HDTV IRD shall not allow automatic ad zapping, for example tuning to another service during advert breaks.

This also applies to the playback of recorded content (see clause 9.)

8   CONTENT PROTECTION

8.1   CICAM

IRDs which are equipped with a CI interface shall be in conformance to CI Plus Limited Liability Partnership (LLP) specification and should support the 2nd root of trust and SHA2 certificates. CI+ 1.4 CAMs shall support ECP in

compliance to CI Plus Limited Liability Partnership (LLP) Enhanced Content Protection (ECP) specification.

8.1.1 CICAM Operator profile – Version 2

Operator Profile version 2 profile_type = 1 shall be supported by CI+1.4 CAMs as defined in CI plus LLP [23] and ETSI TS 103 205 [43]. The CICAM shall be able to support multiple profiles. The profile selection mechanism will be defined in separator specification document.

8.2 Embedded DRM based system

IRDs which can connect to internet services should support Common Encryption for ISO Base Media File Format (CENC).

9 DIGITAL VIDEO RECORDER (DVR)

All clauses herein apply only to HDTV IRDs with internal or external storage capabilities (DVR).

9.1 General

The IRD should include all supported components/PIDs for the basic TV viewing listed in the PMT of the recorded service (e.g. video, audio 1, audio 2, EBU Teletext, DVB subtitles, PCR etc) and other relevant metadata from the PSI and SI like parental rating, signal protection/HDCP. HbbTV or other API related streams are optional.

9.2 Content security

The recorded content shall be accessible and decodable at any time. The access and decoding of the recorded content shall follow clause 7.5.

The DVR should display information about content security restrictions inside an EPG and in information concerning the present/following programme based on the EIT Schedule and EIT present/following based on the copy-control descriptor as described in clause 7.5.

All content security restrictions in force at the time of recording shall be observed during playback of the content.

9.3 DVR scheduling

If the recording time is scheduled via an EPG, the recording process of the DVR should be triggered via the information concerning the present/following programme (EIT present/following). Fixed recording times derived from EIT should be avoided as changes in the event duration might be possible (e.g. live sport events).

9.4 Maturity rating

The maturity rating information (see also clause 7.4) shall be stored together with the recorded content and shall be processed during subsequent playback of the content.

10 HYBRID BROADCAST TELEVISION

10.1 General

If the HDTV IRD is able to connect to internet services, the HDTV IRD shall be able to process Hybrid Broadcast Television Applications in compliance with ETSI TS 102 796 V1.5.1 [38] including any errata and in particular shall support all of the mandatory OIPF and DRM features listed in Table A.1 of [38]. All devices shall be able to process Hybrid Broadcast Television Applications in compliance with HbbTV 2.0.2 [38].

If the IRD is capable of processing HbbTV application, it is it mandatory to enable HbbTV application start-up by default. If the device is not connected to the internet it shall process HbbTV applications which are signalled in DSM-CC Type B HbbTV carousel.

The IRD shall have a user menu function to disable HbbTV in general or for a specific service.

The IRD shall support MPEG DASH according to [38] Annex E and especially the parameters (availabilityStartTime, availabilityEndTime and minimumUpdatePeriod).

The IRD shall provide an interface to read out the CAS related ClientID via HbbTV application by using the interface as described in in chapter 10.5

The requirement for HbbTV 2.0.2 does not apply for operator IRDs when there is a native application of ORF TVThek in place. In this specific case HbbTV support is not mandatory but highly recommended.

The following sections are of high importance for service functionality and therefore specific care should be taken when implementing these elements.

10.2 Signalling

The receiver's capabilities shall be returned by the application/oipfCapabilities object as detailed in [38].

The option string "+DRM" shall be returned in ui_profile element's name property of the xmlCapabilities property of the application/oipfCapabilities embedded object.

10.3 Cookies

The STB shall store cookies in persistent memory as described in [38]. If the IRD has an option to disable or enable the storage of cookies, this should be

enabled by default. The receiver shall provide the ability for a user to delete any stored cookies via a UI menu item. Moreover, in order to achieve compliance with the General Data Protection Regulation (GDPR) broadcasters must be able to reliably control the lifecycle of cookies when providing broadcast related HbbTV applications, e.g. for implementing the so-called "right of erasure" aka the "right to be forgotten".

10.4   User agent header

All out-going HTTP requests from an HbbTV application shall include a User-Agent header as per section 7.3.2.4 of [38]. Note that this does not apply to requests made from middleware components invoked as a result of the HbbTV application executing, e.g. DRM system or media player components (e.g. MPEG-DASH segment requests).

10.5   Specific Application Support (SAS)

For IRDs with non-embedded CA-System the device shall support Specific Application Support (SAS) resource as defined in CI Plus specification [23]. This resource offers a transparent pipe that allows an application on the Host to access functionality on the CICAM. The IRD shall support this resource as defined in CI+ Specification – chapter 11.4 [23].

IRDs with embedded CA-system or CAM platform provider needs to provide and implement the corresponding proxy component (according to HBBTV, OIPF, and HTML5), which will be interacting with the HBBTV Application from its northbound, as well as interacting with Irdeto Cloaked CA system from its southbound according to Irdeto Cloaked CA Agent-Device Integration Overview [26] and ORS API definition for HBBTV integration [36].

11   SYSTEM SOFTWARE UPDATE

If the HDTV IRD is able to connect to internet services, the IRD should be able to retrieve software updates from the internet. It is up to the manufacturer to provide adequate infrastructure to roll-out the software update. The manufacturer is responsible for providing a secure download mechanism safe from failure.

The system software update mechanism shall comply with state-of-the-art and approved security mechanisms.

The HDTV IRD software download mechanism shall provide a facility for replacing the existing system software with another.

User preferences settings and channel lists shall be preserved. In cases where this cannot be guaranteed, the user shall be explicitly informed that user settings will be affected during the update process.

Update mechanisms required by the CA system vendor shall be supported. The actual download process should be initiated by the user.

The progress of the update procedure shall be displayed on screen.

The update procedure shall be designed in such a way that the user can interrupt the update procedure any time without corrupting the currently installed IRD system software.

Any security aspects regarding system software updates shall be in the responsibility of the HDTV IRD vendor.

The HDTV IRD vendor and/or its representative in the Austrian market shall be fully responsible for all software updates and guarantees an update if necessary.

The HDTV IRD vendor and/or its representative in the Austrian market will indemnify ORS for all possible claims in regard to downloads to the HDTV IRD.

11.1 SSU over-the-air (broadcast download)

IRDs with embedded CA-System should support OTA updates according to the SSU simple profile (ETSI TS 102 006 [13]). Devices with embedded CAS and CA-Modules shall also be compliant to Irdeto Cloaked CA Agent for Secure Chipset based STBs Integration Overview [26]

In cases where the new system software update is broadcast via ORS transponders, the device manufacturer shall provide:

- o Software update binary (e.g in.CD5 format) according to [37]
- o a TS-File for cyclic broadcast; and
- o the necessary descriptors/parameters that are to be signalled.

11.2 Local download

It shall be possible to make downloads using a local data interface. The HDTV IRD manufacturer shall define the protocol mechanisms. The actual download is in the user's responsibility.

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