DRAFT PROPOSAL

For adding dynamic metadata HDR

* Not mandating dHDR
* IRD not to be disturbed by dHDR not supported
* Where used then it shall be according to DVB specs

**DRAFT NorDig Unified Requirements**for

Integrated Receiver Decoder s

for use in

cable, satellite, terrestrial and managed IPTV based networks

version 3.x.x

Date: DD Month 20yy

Following text is only during drafting and will be removed before final NorDig IRD specification:

DRAFTING GUIDELINES / Explanation from the editors related to DRAFT versions:

This NorDig IRD specification “v3.2” draft document is based on the official NorDig Unified IRD specification v3.1.1.

* Yellow highlight marking marks changes in text compared to NorDig Unified IRD v3.1.1
	+ New modified text: without strikethrough marks new additional text,
	+ ~~Removed text~~: with strikethrough marks old text proposed to be removed
* Green marked text: new proposal and/or highlighting text that under extra scrutiny (not yet agreed).
* Blue marked text: comments or other raw text that will be removed before final version.
* Grey marked text: refers to text that not are relevant to this review/update (e.g. background info, text from RoO etc).

Guide: To improve version handling and readability, old text from NorDig Unified IRD v3.1.1 that is proposed to be deleted in future “v3.2” should not be removed from draft version. Use instead ~~strikethrough~~ and yellow highlighted marking. Microsoft Word function “Track Changes”, will be used in addition to highlight changes, BUT from one draft version to another draft, sometimes all “Track Changes” are *Accepted* to easier read changes in updates of proposals during our work.

When drafting a proposal, cross-references should be manually set and same for proposing correction, i.e. yellow mark and manual reference value. NorDig editor will update cross-references when preparing final draft.

# Introduction

## Scope

This document specifies a set of minimum equipment requirements for reception of DVB-based and related services from cable, satellite and/or terrestrial broadcast networks; in addition, it includes requirements for reception via IP-based networks. This NorDig specified receiver is hereafter denoted as an IRD (Integrated Receiver Decoder) and targets home / domestic usage.

The NorDig IRD technical specifications are established with the aim to ensure that IRDs in the Nordic and Irish market satisfy a common set of minimum requirements, independent of operator/service provider and transmission media.

The specifications cover all kinds of IRD types, such as separate units (set-top-boxes) and as relevant parts of integrated digital TV-sets.

A NorDig IRD may be implemented in different IRD **variants**:

|  |  |
| --- | --- |
| FrontEnd variants | satellite, cable, terrestrial or IPTV IRD, see section 3 |
| Implementation type variants | STB or iDTV (IRD refers both STB and iDTV) |

The NorDig IRD may be implemented with minimum of capability, NorDig **Basic IRD**, or implemented with one or several optional capabilies in addition to the minimum. See section 1.3 for defintions of NorDig variants (IRD, STB, iDTV…).

NorDig has following optional additional IRD **capabilities**:

|  |  |
| --- | --- |
| HEVC | a NorDig IRD with UHDTV HEVC HDR&WCG SFR capability  |
| ~~HEVC HFR~~ | ~~a NorDig IRD with UHDTV HEVC HDR&WCG HFR capability (planned for the future, this profile is not yet specified)~~ |
| HbbTV | a NorDig IRD with HbbTV capability according to section 15. An HbbTV IRD has (Internet access) connectable capability. Observe, HbbTV mandatory for NorDig HEVC iDTVs. |
| PVR | a NorDig IRD with capability for recording services and later playback of them, according to section 14 (also referred to as NorDig PVR).  |

A **NorDig IRD** requirement refers to a requirement that is applicable for all IRD capability and variant types. All NorDig IRDs **shall** support reception of MPEG-2 and MPEG-4/AVC based services, while MPEG-H/HEVC based services at present specification is optional for the basic IRD profile.

HbbTV is optional for NorDig Basic (MPEG4/AVC only) IRDs and NorDig HEVC STBs but is mandatory for NorDig HEVC iDTVs.

Figure 1.1 indicates the relationship between the NorDig basic and additional optional capability building blocks.

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*Figure 1.1 The NorDig IRD main building blocks and examples of configurations.*

NorDig has also specified NorDig Rules of Operation for NorDig compliant networks [[61],](#bm_NorDigRoO) and the Unified NorDig Test Specifications [62], in order to verify compliance with the NorDig Unified Requirements for new IRDs. These Rules of Operation and Test Specifications cover all NorDig profiles.

It should be noted that the **NorDig Rules of Operation** [61] and the **NorDig Test** [62] may provide additional detail to the specified requirements (in this specification), and should be used when additional background is needed in order to interpret the specified requirements.

The specifications of the NorDig IRDs are divided into two parts.

Part A: Hardware and firmware

Part B: The Software system and Application Programming Interfaces (API) as relevant.

The specification parts A and B outline the desired hardware and software architectures. Based on this framework the mandatory interfaces, functionality and performance requirements of the IRD are specified.Part B deals also with requirements to the operating system. Optional requirements are specified for recommended, but not mandatory functions.

The NorDig group represents broadcasters, operators and service providers in the Nordic countries, see Annex A.

The various members of NorDig are independent of each other but intend to transmit to IRDs that satisfy the specified common requirements. In order to ensure compliance with the NorDig requirements, the NorDig IRDs will be subject to a set of verification tests, based on **NorDig Test** [62].

## Document History

## Terminology

##  Definitions

NorDig is using the following terms to refer to a certain combination of capability and variant of IRD (including/excluding): InternetAcess (connectable/non-connectable) + Frontend (T/C/S/IP) + codec (HEVC/basic) + API (HbbTV/basic) + PVR (PVR/basic) + type (IRD/STB/iDTV). (A NorDig PVR IRD is often shortened to NorDig PVR).

Requirements that are only mandatory for NorDig IRDs that support an optional capability are written as for NorDig <capability> IRD, like NorDig HEVC IRD, NorDig PVR IRD or NorDig HbbTV IRD.

Integrated Receiver Decoder (IRD):
Refers to all implementation variants of IRDs like Set-top-box (STB) or relevant parts of integrated digital TV (iDTV)-set. Used for requirement which is applicable for all variants of IRDs.

Set-top-box (STB):
The NorDig STB is a NorDig IRD variant without display and output the decoded selected service to an external display via a video and audio interface (e.g. HDMI). The term NorDig STB is used for requirements which are mandatory only for STBs.

integrated Digital TV set (iDTV):
The NorDig iDTV (also denoted NorDig TV set) is a NorDig IRD variant which includes a display and normally output the decoded selected service to the internal display.

All other IRD variants which are not a STB variant are in NorDig treated as an iDTV. For example, a DVB receiver USB dongle with its associated software together with the display/computer/tablet shall fulfil the requirements for a NorDig iDTV.

The term iDTV (instead of IRD) is used for requirements which are mandatory only for iDTVs.

**NorDig IRD:**

The NorDig IRDs consist of a user terminal, including all possible low to high functionality implementations and its associated peripherals. The term NorDig IRD is used for all common / basic requirements that are applicable for all types of IRDs (STB, iDTV, basic, HEVC, PVR, HbbTV IRDs).

**NorDig Basic IRD (NorDig Basic):**

The NorDig Basic IRDs (NorDig Basic) is specified as a minimum NorDig IRD without any optional capability (e.g. without HEVC, PVR or HbbTV capability).

The NorDig Basic IRD **shall** satisfy all requirements specified for a NorDig IRD, unless stated otherwise. E.g. a requirement specified for NorDig HEVC IRDs is optional (or not applicable) for NorDig Basic IRDs.

**NorDig HEVC IRD (NorDig HEVC):**

The NorDig HEVC IRDs (NorDig HEVC)is a NorDig IRD with capability for reception of HEVC based services as defined by NorDig. The NorDig HEVC IRD **shall** satisfy all requirements specified for a NorDig IRD (unless stated otherwise) plus all additional and specific requirements for the NorDig HEVC.

NorDig HbbTV IRD (NorDig HbbTV):

The NorDig HbbTV IRDs (NorDig HbbTV)is a NorDig IRD with capability for reception of HbbTV services as defined by NorDig. The NorDig HbbTV IRD **shall** satisfy all requirements specified for a NorDig IRD (unless stated otherwise) plus all requirements for NorDig HbbTV.

NorDig PVR IRD (NorDig PVR):

The NorDig PVR IRD (NorDig PVR) is a NorDig IRD with the capability to record to internal media (for example a built-in hard disk drive) or removable media (for example a DVD or Blu-ray disc). The NorDig PVR (Personal Video Recorder) shall satisfy all requirements specified for a NorDig IRD, unless stated otherwise.

NorDig satellite, cable, terrestrial and IPTV IRD:

The satellite/cable/terrestrial/IPTV NorDig IRD refers to an IRD with a front-end that is capable of receiving satellite/cable/terrestrial/IPTV DVB signals according with section 3. For example, theterrestrial NorDig IRD refers to an IRD with a front-end that is capable of receiving DVB-T and DVB-T2 signals.

A NorDig IRD may support multiple Frontend variants (e.g. satellite, cable and terrestrial) and in this case the IRD **shall** support all the relevant requirements for all the supported Frontends as stated in section 3.

Connectable/non-connectable IRD:

An IRD may and in some cases, **shall** include a two-way interface (e.g. WiFi, Ethernet, Eurodocsis etc, see section 8.3) typically with access to Internet, here referred to as a *connectable IRD* type (e.g. NorDig HbbTV IRD (NorDig HbbTV) is a connectable IRD with HbbTV API according to NorDig requirements in section 15, or a “Smart TV” using techniques other than HbbTV). A connectable IRD that has connected and activated the two-way interface is here referred to as *connected IRD* (i.e. a *connected connectable IRD*), while a connectable IRD that has not connected or activated the two-way interface is referred to as *non-connected connectable IRD*.

**Example multiple capabilities:**
*One example of naming for an IRD that supports multiple capabilities is a* ***NorDig terrestrial HbbTV PVR****, which refers to all terrestrial type variants of IRDs (STB and iDTV) that includes HbbTV and PVR capability* *(independently on other additional optional capabilities like HEVC).*

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##

## List of Abbreviations

0b values written in binary (ie with base 2)

0x values written in hexadecimal (ie with base 16)
AAC Advanced Audio Codec

AAC-LC Advanced Audio Codec Low Complexity

AC-3 Audio Codec 3
AC-4 Audio Codec 4, a codec for NGA
ac4\_toc AC-4 Table of Contents

ACE Active Constellation Extension

AD Audio Description

AFC Automatic Frequency Control

AFNOR Association Francaise de Normalisation

APD Audio Preselection Descriptor

API Application Programming Interface
ARC Audio Return Channel (regarding HDMI)

AV Audio (and) Video

AVC Advanced Video Coding (MPEG-4 p.10/H.264)

BAT Bouquet Association Table

BCP Best Current Practice (IETF)

BER Bit Error Ratio

BOOTP Bootstrap Protocol

bslbf bit string, left bit first

C/N Carrier to Noise ratio

CA Conditional Access

CAM Conditional Access Module

CAT Conditional Access Table

CATV Community Antenna Television

CEA Consumer Electronics Association (North American Association)

CENELEC Comité Européen de Normalisation Electrotechnique

CI Common Interface

CI- CAM CA-module that complies with the basic Common Interface specification [7]

CID Content Identifier descriptor

CIF Common Intermediate Format

CIP- CAM CA-module that complies with the Common Interface Plus specification [64]

CRID Content Reference Identifier

CSO Composite Second Order

CTB Composite Triple Beat

CVBS Composite Video Baseband Signal

DAD Default Authority Descriptor

dB decibel

dBFS dB (relative to) Full Scale

DDS Display definition segment

DE Dialog Enhancement

DHCP Dynamic Host Configuration Protocol

DMI Dynamic Mapping Information

DSM-CC Digital Storage Media Command and Control
DTS Digital Theater System (audio codec)

DVB Digital Video Broadcasting

DVB-C Digital Video Broadcasting – Cable
DVB-C2 Digital Video Broadcasting – Cable system, second generation system

DVB-CAM CA-module that complies with the DVB Common Interface specification

DVB-S Digital Video Broadcasting – Satellite
DVB-S2 Digital Video Broadcasting – Satellite system, second generation system

DVB-T Digital Video Broadcasting – Terrestrial system
DVB-T2 Digital Video Broadcasting – Terrestrial system, second generation system
E-AC-3 Enhanced Audio Codec 3

E-EDID Enhanced Extended Display Identification Data (regarding HDMI)

eARC Enhanced Audio Return Channel (regarding HDMI)

EBU European Broadcasting Union

ECCA European Cable Communications Association

EIT Event Information Table

EITp/f Event Information Table, present/following tables

EPT Effective Protection Target

EPG Electronic Program Guide (based on API)

ESG Event Schedule Guide (without any API)

FDD (Mobile communication network) Frequency Division Duplex

FEF Future Extension Frame

FFT Fast Fourier Transform

GOP Group Of Pictures

GS Generic Stream

HbbTV Hybrid Broadcast Broadband TV

HDCP High-bandwidth Digital Content Protection

HDMI High-Definition Multimedia Interface
HDMI ARC HDMI Audio Return Channel
HDMI eARC HDMI enhanced Audio Return Channel

HDR High Dynamic Range

HDTV High Definition Television
HEVC High Efficiency Video Coding (MPEG-H p.2/H.265)

HE-AAC High Efficiency Advanced Audio Coding

HFR High Frame Rate (here >60 frames/s)

HW Hardware

iDTV integrated Digital TV (IRD with display)

IEC International Electrotechnical Commission

IEEE Institute for Electrical and Electronic Engineers

IETF Internet Engineering Task Force

IMI Instant Metadata Identifier

IP Internet Protocol

IRD Integrated Receiver Decoder

ISO International Organisation for Standardisation

JOC Joint Object Coding (extension for E-AC-3)

LCD Logical Channel Descriptor

LCN Logical Channel Number
LTE (Mobile communication network) Long Term Evolution

LUFS Loudness Units (relative to) Full Scale

MAC Medium Access Control

MAT Metadata-enhanced Audio Transmission

MPEG Moving Pictures Expert Group

MPTS Multi Programme Transport Stream

NIT Network Information Table

NGA Next Generation Audio

OSD On Screen Display

PAL Phase Alternating Line

PAPR Peak-toAverage-Power Ratio

PAT Program Association Table
PCM Pulse Code Modulation

PCR Programme Clock Reference
PES Programme Elementary Stream (regarding MPEG)

PLP Physical Layer Pipe

PID Packet Identifier

PMT Program Map Table

PSI Program Specific Information

PTS Presentation Time Stamp

PVR Personal Video Recorder, (same as PDR, Personal Digital Recorder, or DVR)

QAM Quadrature Amplitude Modulation

QEF Quasi Error Free

QPSK Quaternary Phase Shift Keying

RF Radio Frequency

RFC Request For Comments

RMS Root Mean Square

RoO Rules of Operation

RTCP Real-Time Transport Control Protocol

RTP Real-Time Transport Protocol

S/PDIF Sony Philips Digital Interface (for digital audio)
SA Supplementary Audio
SBR Spectral Band Replication (regarding HE-AAC audio)

SCART Syndicat des Constructeurs d'Appareils Radiorécepteurs et Téléviseurs

 (video/audio interface)

SD&S Service Discovery and Selection

SDL (Mobile communication network) Supplemental Downlink

SDR Standard Dynamic Range

SDT Service Description Table

SDTV Standard Definition Television

SEI Supplemental Enhancement Information

SFN Single Frequency Network

SFR Standard Frame Rate (here up to 50 frames/s)

SI Service Information

SL-HDR Single Layer High Dynamic Range

SMATV Satellite Master Antenna Television

SNTP Simple Network Time Protocol
SPTS Single Programme Transport Stream

SpS Spoken Subtitles

STB Set-top box (IRD without display)

SW Software

TDT Time and Date Table

TFS Time Frequency Slicing

TOT Time Offset Table

TPS Transmission Parameter Signalling
TR Tone Reservation

TRS Tip Ring Sleeve

TS Transport Stream

TV Television
TVA TV Anytime

UHDTV Ultra High Definition Television

UHF Ultra-High Frequency

uimsbf unsigned integer most significant bit first

UTC Universal Time, Co-ordinated

VCR Video Cassette Recorder

VHF Very-High Frequency

VSB Vestigial SideBand

XML Extensible Markup Language

# General Features of the NorDig IRD

## General

The NorDig Unified specification relates to all NorDig profiles and type of IRDs unless otherwise specified.

All requirements specified in this document are mandatory unless otherwise specified.

It should be noted that compliance with the NorDig requirements will require full compliance with at least one of the specified NorDig IRD configurations with a capability (Basic, HbbTV, PVR, or HEVC and a variant (frontend: (satellite, cable, terrestrial or IPTV and type: STB or iDTV).

## Introduction

This chapter describes the overall structure of the NorDig IRD specification. The detailed requirements are specified in chapters 3 – 16, except for general product requirements that are specified in section 2.5.

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.



*Figure 2.1 Basic IRD architecture*

The IRD will be provided with an installed front-end, with a cable or satellite or terrestrial Tuner & Demodulator, and/or a front-end for IP-based networks, a Common Interface and/or a Smart Card Interface. The IP-based interface (two-way interface) may be used for reception of broadcast signals (managed network IPTV services) and and as an input/output for the interaction channel for example for HbbTV/OTT broadband services (not necessary for Basic IRDs), these and other external interfaces are shown in Figure 2.2.

The user **shall** be able to access the services from all the tuners by means of the remote control.

## IRD Hardware and Firmware

### Overview

The IRD hardware and firmware consists of a number of functional blocks as outlined in Figure 2.2. The IRD developer is free to decide on the hardware architecture as long as it fulfils the NorDig requirements for the relevant profile.



*Figure 2.2 Functionality of Hardware and Firmware for NorDig IRD*

### RF Interface and Tuner/Demodulator

### Rfin-Rfout Bypass (option)

### Two-way Interface

### Demultiplexer

### Video/Audio Decoding

The audio and video decoding units recover the audio and video signals from the input elementary packet streams. This involves processes like descrambling, de-packetisation, decompression, synchronisation with related services, digital to analogue conversion, etc. The digital signals are output to the HDMI/ S/PDIF interfaces while analogue signals are output to external baseband connectors. See also chapters 5 and 6 and clause 7.3.1 of HbbTV specification ETSI TS 102 796 [27].

### Graphics processor

The graphics processor unit generates graphics and text to be displayed for the user, see chapters 7 and 15.

### IRD Controller Unit and System Software Update (Bootloader)

### Common Interface and Plug-in CA Module

### Smart Card Interface(s) and Smart Card Reader(s)

### Remote Control

### Video/Audio Interfaces

HDMI output/input (1) and SCART (2) interfaces. See section 8.4 and 8.6.

Note 1: HDMI output for STBs/PVRs and HDMI input for iDTV.
Note 2: Optional

###   Audio Output Interfaces (option)

### Main hardware/firmware functions-Overview per configuration

Table 2.1 indicates some of the major hardware/firmware functions in the IRD. A more detailed overview, which also includes the NorDig profiles, is given in Annex J. Detailed requirements are specified in chapters 3-16.

|  |  |  |
| --- | --- | --- |
|  |  | **HEVC IRD** |
| **NorDig IRD** | **STB** | **iDTV** | **STB** | **iDTV** |
| **Video decoding/processing** |  |  |  |  |
|  MPEG-2 MP@ML SDTV video |  M |  M |  M |  M |
|  MPEG-4 AVC HL@L4 SDTV + HDTV video | M | M | M | M |
|  MPEG-H HEVC HDR SFR UHDTV (HLG10 + PQ10)  |  |  | M | M |
| **Audio decoding/processing** |  |  |  |  |
|  MPEG-1 Layer II audio decoding | M | M | M | M |
|  HE-AAC Level 4, including downmix to stereo | Alt (4) | Alt (4) | Alt (4) | Alt (4) |
|  HE-AAC-to-AC-3 or DTS for digital output (1)(6) | Alt (4) | Alt (4) | Alt (4) | Alt (4) |
|  AC-3 (AC-3 pass-through) digital output (1) | Alt (4) | Alt (4) | Alt (4) | Alt (4) |
|  E-AC-3, including downmix to stereo | Alt (4) | Alt (4) | Alt (4) | Alt (4) |
|  E-AC-3 (E-AC-3 to AC-3) digital output (1) (3) | Alt (4) | Alt (4) | Alt (4) | Alt (4) |
| AC-4 Audio, including downmix to stereo | O  | O  | M | M |
| AC-4 Audio-to-E-AC-3 or AC-3 for digital output (1) (7) | O | O  | M | M |
|  |  |  | **HEVC IRD** |
| **NorDig IRD** | **STB** | **iDTV** | **STB** | **iDTV** |
| **Subtitling** |  |  |  |  |
|  DVB Subtitling | M | M | M | M |
|  EBU Teletext subtitling (subtitling pages) | M | M | M | M |
|  TTML subtitling | O | O | M | M |
| **Teletext and API** |  |  |  |  |
|  EBU Teletext (normal pages) | M | M | M | M |
|  HbbTV | O (5) | O (5) | O (5) | M |
| **CA** |  |  |  |  |
|  Embedded CA | (2) | (2) | (2) | (2) |
| **Interfaces** |  |  |  |  |
| DVB-C front-end for cable IRDs | M | M | M | M |
| DVB-S front-end for satellite IRDs | M | M | M | M |
| DVB-S2 front-end for satellite IRDs | M | M | M | M |
| DVB-T front-end for terrestrial IRDs | M | M | M | M |
| DVB-T2 front-end for terrestrial IRDs | M | M | M  | M  |
| Two-way interface for IPTV IRDs | M | M | M | M |
| Analogue SD video output (SCART, component, composite, S-video) | R | O | R | O |
|  HDMI with HDCP | M | M | M | M |
|  Digital Audio Output (e.g. SPDIF, HDMI ARC) (1) (3) | R/O | R/O | R/O | R/O |
| Analogue Audio Output | R/O | R/O | R/O | R/O |
|  Common Interface Plus for CA  | (2) | M(2) | (2) | M(2) |
|  Smartcard Interface for embedded CA (2) | (2) | (2) | (2) | (2) |
| M; Mandatory, R; (Highly) Recommended, O; Optional item to include, Alt; minimum one among several options1) If IRD is equipped with a digital audio output (like S/PDIF), see section 8.5.2) As specified by relevant network/CA-operator, see chapter 9. Common Interface Plus is mandatory for for iDTV-sets with screen diagonal larger than 30 cm and highly recommended for iDTV-sets with smaller screen diagonals, see section 9.2.3) E-AC-3 is not defined for S/PDIF output, instead an ‘E-AC-3 to AC-3’ conversion is expected for the S/PDIF output to ensure interoperability with legacy A/V receivers. For newer A/V receivers supporting E-AC-3, where implemented, HDMI output **shall** be used for STBs, and HDMI ARC (or eARC) output **shall** be used for IDTVs.4) See details in section 6.15) Optional for NorDig Basic IRDs mandatory for NorDig HbbTV IRDs6) HE-AAC is not commonly available in A/V receivers, instead an ‘HE-AAC to AC-3 or DTS’ conversion is expected for the S/PDIF output to ensure interoperability with current A/V receivers. 7) AC-4 is not defined for S/PDIF output, instead an ‘AC-4 to AC-3’ conversion is expected for the S/PDIF output to ensure interoperability with legacy A/V receivers. For newer A/V receivers supporting E-AC-3, an ‘AC-4 to E-AC-3’ conversion is expected and, where implemented, HDMI output **shall** be used for STBs, and HDMI ARC (or eARC) output **shall** be used for iDTVs. |

Table 2.1 Main hardware/firmware functions for the various IRD configurations

### Additional hardware/firmware for the PVR features

## System Software and API

### Introduction

The NorDig software may contain two main parts, system software and applications (later not relevant for NorDig Basic IRDs). The system software **shall** provide two main sets of functions. One set is accessible within the system software only and includes functions for control of hardware/firmware and handling of service information. Another set is available internally and externally for applications, and constitutes the Application Programming Interface, API (not relevant for NorDig Basic IRDs). See also chapter 15.

### Principal Software Architecture

An important feature in this software architecture is the possibility of replacing the whole software, with exception of the bootloader software itself. This allows the exchange or upgrade of the entire software 'over the air' or though the IP-based network according to the need for new functionality or for bug fixing (e.g. drivers).

The download of applications uses an internal function from the API, outside of the bootloader software.



Figure 2.3: Possible software architecture of a NorDig, to the left a NorDig Basic IRD without NorDig API and to the right a NorDig HbbTV IRD with NorDig API (i.e. HbbTV API).

Figure 2.3 illustrates only examples of NorDig IRD software architecture. The IRD manufacturers are free to implement system the way they want as long as it fulfils the NorDig IRD specification.

### System Software

The NorDig IRD includes a System Software in compliance with DVB specifications, i.e. APIs, PSI/SI (1), Navigator, teletext, subtitling and Common Interface. The system software can be completely upgraded via the bootloader (2), see chapter 10.

Note 1: The NorDig IRD with an IP-based front-end will be based on a modified use of the DVB service information (SI), see section 12 and Annex C.

Note 2: The bootloader is by definition a part of the hardware/firmware.

### NorDig APIs

The NorDig HbbTV IRD includes an open API in compliance with the HbbTV APIs (not relevant for NorDig Basic IRDs), see chapter 15.2.

### PVR related software

## General Product Requirement

PART A: Hardware and Firmware

# The Frontend of the NorDig IRD

## Common Features

## Satellite Tuner and Demodulator

## Cable Tuner and Demodulator

## Terrestrial Tuner and Demodulator

## IP-based Front-End

# MPEG-2 Demultiplexer

## General

## DVB Descrambler Performance (for IRD with embedded descrambling)

## System Clock Recovery

# Video

## General requirements

The video decoder of the NorDig IRD **shall** comply with the DVB specification for broadcasting applications regarding “25 Hz MPEG-2 SDTV IRDs and Bitstreams “25 Hz H.264/AVC SDTV IRD and Bitstream “25 Hz H.264/AVC HDTV IRD and Bitstream ETSI TS 101 154 [26].

The video decoder of the NorDig HEVC IRD **shall**, in addition to above, comply with the DVB specification for broadcasting applications regarding “HEVC HDR UHDTV IRD and Bitstream” in ETSI TS 101 154 [26].

Observe that in a future revision of the NorDig Unified Requirements, requirements regarding “HEVC HDR HFR UHDTV IRD and Bitstream” will be added.

The following clauses of ETSI TS 101 154 [26] are relevant to this specification:

* 5.1 “25 Hz MPEG-2 SDTV IRDs and Bitstreams”
* 5.5 “Specifications Common to all H.264/AVC IRDs and Bitstreams”
* 5.6 “H.264/AVC SDTV IRDs and Bitstreams”. The NorDig IRD **shall** support High Profile at Level 3.0 bitstreams.
* 5.7.1 “Specifications common to all H.264/AVC HDTV IRDs and Bitstreams”.
* 5.7.2 “25 Hz H.264/AVC HDTV IRD and Bitstream”. The NorDig IRD **shall** support High Profile at Level 4.0 bitstreams.
* 5.14.1 “Specifications Common to all HEVC IRDs and Bitstreams”.
* 5.14.4 “HEVC HDR UHDTV IRDs and Bitstreams” (1). Support for both PQ10 and HLG10 is required for the NorDig HEVC IRD. Only support of 50 Hz and 25 Hz frame rates are required for the NorDig HEVC IRD. Support for Supplemental Enhancement Information messages carrying one or more DMI formats conforming to sub-section 5.14.4.4.3.3.4 “Optional Supplemental Enhancement Information messages carrying DMI” is optional. Any non DMI cognisant HEVC HDR UHDTV IRD shall be able to decode and present the service, even if DMI is in the bitstream.

Note 1: This implies support for the “HEVC HDR UHDTV Bitstream”, the “HEVC UHDTV Bitstream” and the “HEVC HDTV Bitstream”, excluding non-square pixel aspect ratios and excluding interlace scan.

### Video Decoder Reference Model



Figure 5.1 Video Decoder Reference Model.

The Video Decoder Reference Model is illustrated in Figure 5.1. It is a logical reference model and does not imply any specific implementation of an actual iDTV or STB.

## Supported resolutions

The Video Decoder of the NorDig IRD **shall** be able to receive and decode the resolutions according to ETSI TS 101 154 [26]:

* Section 5.1 “25 Hz MPEG-2 SDTV IRDs and Bitstreams”, sub-section 5.1.4 “Luminance resolution”.
* Section 5.6 “H.264/AVC SDTV IRDs and Bitstreams”, sub-section 5.6.2 “25 Hz H.264/AVC SDTV IRD and Bitstream”, sub-section 5.6.2.3 “Luminance resolution”.
* Section 5.7 “H.264/AVC HDTV IRDs and Bitstreams”, sub-section 5.7.1.4 “Luminance resolution”.

The Video Decoder of the NorDig HEVC IRD **shall**, in addition to the capabilities of the NorDig IRD, be able to receive and decode the resolutions according to ETSI TS 101 154 [26]:

* Section 5.14.4 “HEVC HDR UHDTV IRDs and Bitstreams”, sub-section 5.14.4.3 “Luminance Resolutions”.
* Section 5.14.3 “HEVC UHDTV IRDs and Bitstreams”, sub-section 5.14.3.2 “Luminance resolution” with the exception for non-square pixel aspect ratios.
* Section 5.14.2 “HEVC HDTV IRDs and Bitstreams”, sub-section 5.14.2.2 “Luminance resolution” with the exception for non-square pixel aspect ratios and the exception for interlace scan.

## Supported frame rates

The Video Decoder of the NorDig IRD **shall** be able to receive and decode the frame rates according to ETSI TS 101 154 [26]:

* Section 5.1 “25 Hz MPEG-2 SDTV IRDs and Bitstreams”, sub-section 5.1.2 “Frame rate”.
* Section 5.6 “H.264/AVC SDTV IRDs and Bitstreams”, sub-section 5.6.2 “25 Hz H.264/AVC SDTV IRD and Bitstream”, sub-section 5.6.2.2 “Frame rate”.
* Section 5.7 “H.264/AVC HDTV IRDs and Bitstreams”, sub-section 5.7.2 “25 Hz H.264/AVC HDTV IRD and Bitstream”, sub-section 5.7.2.2 “Frame rate”.

The Video Decoder of the NorDig HEVC IRD **shall**, in addition to the capabilities of the NorDig IRD, be able to receive and decode the frame rates according to ETSI TS 101 154 [26]:

* Section 5.14.1 “Specifications Common to all HEVC IRDs and Bitstreams”, sub-section 5.14.1.7 “Frame rate” (1).
* Section 5.14.4 “HEVC HDR UHDTV IRDs and Bitstreams”, sub-section 5.14.4.5 “Frame Rates” (1).

The Video Decoder of the NorDig HEVC IRD **shall** 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 [26] 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 in the NorDig HEVC IRD. For HEVC encoded video, only decoding of progressive scan video is mandatory.

Note 1: The specifications in section 5.14.1.7 **shall** apply with the restrictions in section 5.14.4.5, i.e. only progressive scan support is mandatory.

## Video resolution scaling Up-sampling/Up-converting

Upscaling of (sub-) resolutions of received video **shall** be made in accordance with ETSI TS 101 154 [26], i.e. (sub-) luminance resolutions in Reference Model Figure 5.1 **shall** be up-scaled by the Decoder Format Converter into the video raster of the Decoder Composition Output.

Regarding the NorDig STB, the video raster **shall** either be a manually chosen raster of 1920x1080, 1280x720 or 720x576 or a raster automatically selected via EDID-information as desired by the HDMI Sink (iDTV/display).

In addition to the raster resolutions above, the NorDig HEVC STB **shall** provide the raster 3840x2160.

Regarding NorDig iDTVs, all resolutions of received video **shall** internally be scaled to the native resolution of the display.

When upscaling video with an encoded luminance resolution of 720x576 or 704x576 to any square pixel aspect ratio format (e.g. 1280x720, 1920x1080 or 3840x2160), only the centred 702 of the horizontal 720 / 704 pixels **shall** be used. Those 702 pixels correspond to the 52 microseconds of an active line, hence preserves correct geometry in the up-conversion process.

When upscaling other 576 line-based input resolutions to any square pixel aspect (output) format (i.e. 1280x720, 1920x1080 or 3840x2160), only the centred horizontal pixels **shall** be used; e.g. when up-converting (received) 544x576 line resolution format to any square pixel aspect ratio (output) format, only the centred 530 pixels of the horizontal 544 **shall** be used.

## Colorimetry

The NorDig IRD Decoder Format Converter **shall** use the VUI (Video Usability Information) parameters (ISO/IEC 14496-10) [54] *colour\_primaries*, *transfer\_characteristics* and *matrix\_coeffecients* in received AVC encoded bitstreams and the Sequence Display Extension parameters (ISO/IEC 13818-2) [51] in MPEG-2 encoded bitstreams.

In addition to the NorDig IRD requirements above, the NorDig HEVC IRD Decoder Format Converter **shall** use the VUI (Video Usability Information) parameters (ISO/IEC 23008-2) [82] *colour\_primaries*, *transfer\_characteristics* and *matrix\_coeffecients* in received HEVC encoded bitstreams.

It **shall** be assumed that bitstreams according to “HEVC HDR UHDTV Bitstreams using PQ10”, section 5.14.4.4.3 in ETSI TS 101 154 [26], will provide the “Mastering Display Colour Volume SEI message”, section 5.14.4.4.3.3.2 in ETSI TS 101 154 [26]. Bitstreams carrying non-live programmes, may also contain the “Content Light Level Information SEI message”, section 5.14.4.4.3.3.3 in ETSI TS 101 154 [82].

Hence, it is highly recommended that the NorDig HEVC IRD Decoder Format Converter makes use of the “Mastering Display Colour Volume SEI message” when adapting to the luminance and chrominance capability of the connected display. It is in addition recommended that the NorDig HEVC IRD makes use of the “Content Light Level Information SEI message” when available in the bitstream.

Note: In the case that DMI messages are included in the bitstream, the NorDig Rules of Operation [61] require broadcasters to provide video quality from that bitstream to NorDig HEVC IRDs that do not support DMI at the level that can be expected from a bitstream that does not include DMI messages. DMI enables further enhancement of the video quality.

### NorDig HEVC STB colorimetry

The Decoder Composition Output in NorDig’s Video Decoder Reference Model (see chapter 5.1.1) **shall** be advanced enough to perform all video format conversions (luminance-wise and chrominance-wise) needed to target legacy HDMI-sinks, as well as EDID-enabled adaption to the capability of the connected display, including HDR capability, described in ANSI/CTA-861-G [92]. The complete ANSI/CTA-861-G [92] **shall** be taken into account, ~~except the~~ ~~“6.10 Extended InfoFrame” and “6.10.1 HDR Dynamic Metadata Extended InfoFrame”. (1)~~

When connected to a Sink (iDTV/display) of any HDMI version, the HDMI 2.0b or higher interface in-line with ANSI/CTA-861-G [92] will give the STB’s Video Format Converter necessary information regarding the desired colorimetry via EDID handshake. The EDID-information shall be used by the Decoder Format Converter of the NorDig HEVC STB to determine any applicable ~~convert~~ colorimetry conversion, display mapping (if supported) or DMI message pass-through (if supported).

However, legacy SDR displays will signal their supported SDR video formats in priority without specifically signalling "Desired Content Max Luminance data" (see 7.5.13 “HDR Static Metadata Data Block” in ANSI/CTA-861-G [92]). Hence, the Decoder Format Converter of the NorDig HEVC STB shall output SDR video formats based on the HDR to SDR conversion methods described by the ITU (e.g. ITU-R BT.2390 [90] and operational practises in HDR television production ITU-R BT.2408 [95]) or based on DMI (if supported).

Note: In the case of the High Dynamic Range (HDR) video format ITU-R BT. 2100/PQ [89], it is anticipated that the capabilities of professional reference monitors and consumer displays will evolve differently over time. Consumer displays may have lower luminance and chrominance capabilities than professional reference monitors. Hence, there is a need for both an initial display adaption and a subsequent consumer viewing environment adaption. The latter for example via user control of overall brightness and contrast. The initial display adaptation can be done by using DMI (if supported) ~~Leads on how to best perform the initial display adaption is~~ or by applying processing derived from the conversion methods described by the ITU, e.g. ITU-R BT.2390 [90] and Operational practises in HDR television production ITU-R BT.2408 [95].

~~Note 1: “HDR Dynamic Metadata” in general will be discussed in a future revision of the NorDig Unified Requirements, at the same time as requirements regarding the “HEVC HDR HFR UHDTV IRD and Bitstream” will be added.~~

### Programme production colorimetry – informative

Table 5.1 below gives the reference to the standards regarding programme production where to find appropriate chromaticity co-ordinates, opto-electronic transfer characteristics and matrix coefficients to be used for example when deriving luminance and chrominance signals from the red, green and blue primaries (or vice versa, i.e. YCbCr to RGB):

|  |  |  |
| --- | --- | --- |
| **Active composition resolution in the “Decoder Composition Output” (equal to the production resolution)(Horizontal x Vertical)** | **Standards regarding programme production colour parameters** | **Comments** |
| 720x576 | ITU-R BT.1700 [85] (replaces ITU-R BT.470 System B, G)and ITU-R BT.601 [83] | Note that 576 lines in both interlaced scan (576i) and progressive scan (576p) **shall** be processed and output with equal colour parameters.Standard Dynamic Range production parameters. |
| 1280x720 | ITU-R BT.1847 [86](SMPTE 296M) | The colour parameters in SMPTE 296M are the same as in ITU-R BT.709 [84].Standard Dynamic Range production parameters. |
| 1920x1080 | ITU-R BT.709 [84](SMPTE 274M) | The colour parameters in SMPTE 274M are the same as in ITU-R BT.709 [84].Standard Dynamic Range production parameters. |
| 3840x2160 | ITU-R BT.2020 [88] | Standard Dynamic Range production parameters. |
| 3840x2160 | ITU-R BT.2100 [89] | High Dynamic Range production parameters used for PQ10 and HLG10 by DVB (1). |

Table 5.1 Standards for production colour parameters

Note 1: In ITU-R BT.2100 [89] TABLE 9 “Digital 10- and 12-bit integer representation”, both "Narrow range" and "Full range" are defined. DVB is however only specifying the use of 10-bit "Narrow range" in its TS 101 154 [26].

## Dynamic changes in the video stream

The NorDig IRD **shall** be able to handle dynamic changes of either the video codec or the video format that may occur dynamically within the transmitted stream.

After a change of video codec, the IRD should automatically resume decoding and output of valid video within five seconds.

The NorDig IRD **shall** be able to handle dynamic changes in transmission between different video formats and frame rates (e.g. 720p50 to 1080i25/1080p25 and 576i25 to 720p50), including changes in encoded sub resolution (e.g. 720x576 to 544x576) within one second after receiving Random Access Point. (Random Access Point equals H.264/AVC RAP for H.264/AVC and Sequence header for H.262/MPEG-2).

The NorDig IRD **shall** adapt to changes in transmitted aspect ratio (e.g. 16:9 / 4:3) within one second after the reception. The transition **shall** cause minimal disturbance of the decoded service.

The NorDig HEVC IRD **shall**, regarding HEVC encoded bitstreams, in addition be able to handle dynamic changes in transmission between encoded (sub-) resolutions (i.e. 3840x2160 in steps down to 960x540) within one second after receiving Random Access Point, ideally without interruption. (Random Access Point equals HEVC DVB\_RAP for H.265/HEVC).

For NorDig HEVC IRD supporting one or more of the optional DMI formats, dynamic switching should be handled as described in ETSI TS 101 154 [26] sub-section 5.14.4.4.3.3.4.2 “Dynamic switching between bitstreams with and without DMI”.

## MPEG-2 Minimum video bandwidth

For MPEG-2 video the NorDig 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).

## Frame Cropping

The NorDig IRD **shall** support frame cropping for H.264/AVC encoded video. Frame cropping signalling is used to indicate which area of the encoded video that should be displayed.

For 1080 line formats, the video is encoded with 1088 lines. To indicate which area of the encoded video that should be displayed, frame cropping signalling may be used. If frame cropping information is included in the encoded video, this **shall** be used to decide which 8 lines should be hidden in the Decoder Composition Output. If no frame cropping signalling is available, the IRD **shall** crop the bottom 8 lines.

The NorDig HEVC IRD **shall** support “conformance cropping window” for H.265/HEVC encoded video according to ETSI TS 101 154 [26] section 5.14.1 “Specifications Common to all HEVC IRDs and Bitstreams”, sub-sections 5.14.1.3 “Sequence Parameter Set” and 5.14.1.5.1 “Aspect Ratio and Overscan Information”.

## Overscan

For services carrying H.264/AVC video, the broadcaster may use the *overscan\_info\_present* and *overscan\_appropriate* flags to indicate whether the IRD (NorDig IRD and NorDig HEVC IRD) should apply overscan (e.g. by masking with black pixels or by additional cropping plus scaling), or should display the complete broadcast video image (after appropriate Frame Cropping, see Chapter 5.8 Frame Cropping). The flags will be encoded according to Table 5.2.

|  |  |  |
| --- | --- | --- |
| overscan\_info\_present\_flag | Overscan\_appropriate\_flag | Usage |
| 0x0 or not broadcasted | n/a | No preferred display method |
| 0x1 | 0x0 | Important information in entire video frame |
| 0x1 | 0x1 | Decoded picture suitable for applied overscan |

Table 5.2 Broadcast overscan flag

Unless the user requests otherwise, NorDig IRDs **shall** interpret and follow the overscan flags according to Table 5.3.

|  |  |  |
| --- | --- | --- |
| overscan\_info\_present\_flag | overscan\_appropriate\_flag | Behaviour |
| 0x0 or not broadcasted | n/a | Implementation dependent |
| 0x1 | 0x0 | Overscan not applied |
| 0x1 | 0x1 | Overscan applied |

Table 5.3 NorDig IRD and NorDig HEVC overscan behaviour.

NorDig STBs **shall** pass the video unaltered, i. e. without overscan related reformatting to its HDMI output, setting the bits in the AVI Infoframe (see CTA 861 [92]) in accordance with Table 5.4 below.

|  |  |  |
| --- | --- | --- |
| overscan\_info\_present\_flag | overscan\_appropriate\_flag | <S1,S0> (in HDMI AVI Infoframe) |
| 0x0 or not broadcasted | n/a | <0,0> |
| 0x1 | 0x0 | <1,0> |
| 0x1 | 0x1 | <0,1> |

Table 5.4 Overscan signalling on the HDMI.

Most displays have a user option where it will display the full frame of 1080 line based video formats without any overscan applied. It is recommended that the NorDig iDTVs support such user option to achieve one-to-one pixel mapping on 1920 x 1080 resolution displays. Note that the user, if overriding the received overscan flags, may not see a clean aperture as content producers cannot promise artefact free areas outside the Action Safe Area described in “EBU R 095 Safe areas for 16:9 television production” [71].

For the NorDig HEVC IRD, in addition to above, regarding Overscan Information via Video Usability Information for services carrying H.265/HEVC video, see ETSI TS 101 154 [26] section 5.14.1 “Specifications Common to all HEVC IRDs and Bitstreams”, sub-sections 5.14.1.5.0 “General” and 5.14.1.5.1 “Aspect Ratio and Overscan Information”.

### Safe area for overscan

The amount of applied overscan **shall** not be in conflict with the broadcasted Action Safe Areas. Please refer to “EBU R 095, Safe areas for 16:9 television production” [71], for appropriate guidelines.

## Video Output and Display

The NorDig STB **shall** use the HDMI EDID information provided by the Sink (iDTV/display) to automatically determine the STB output as specified in section 5.4 and 5.5, and as an alternative enable manual setting of the STB output as specified in section 8.6.

The NorDig STB **shall** ensure that it can always present video (where available) for all services in the installed service list, regardless of the capabilities of the connected display.

## Restrictions on analogue video output

Down-conversion of High Definition Video for Standard Definition output.

If SCART, or any other analogue video output (Y, Pb, Pr, RF-PAL or CVBS) is available (1), decoded video with a resolution higher than Standard Definition (576i/25), **shall** always be down-converted to interlaced Standard Definition resolution before output via these interfaces.

The down-conversion **shall** be implemented from any received resolution, see section 5.2

When down-converting any square pixel aspect ratio format (e.g. 1280x720) to 720x576 resolution, the target **shall** be 702x576 pixels to be centred in the 720x576 grid with nine black pixels inserted as the start of the 720 pixel active line and nine black pixels inserted as the end of the 720 pixel active line.

Down-converted HD or UHD (2) video **shall** be displayed as 16:9 letterbox on 4:3 displays. 4:3 centre-cut is *not* an allowed display option, since this would limit the Action Safe AreainHD program production.

The conversion should apply appropriate re-interlacing (field mode integration re-interlacing). It **shall** process and output 720x576i25 in 4:3 frame aspect ratio or 16:9 frame aspect ratio video with colours according to section 5.5.

Note 1: The NorDig IRD is not required to be equipped with any analogue video output.

Note 2: UHD video resolution is only applicable for the NorDig HEVC IRD, not the NorDig IRD.

## Display of 4:3 aspect ratio content

The NorDig IRD **shall** have methods to display 4:3 transmitted SDTV content on a 16:9 monitor (with any resolution and colorimetry capability). The NorDig IRD **shall** be able to maintain full height 4:3 picture aspect ratio (pillar box) on a 16:9 display. Other display modes for 4:3 content are optional.

If SCART is available (1), the user **shall** have the ability to select appropriate aspect ratio, see section 8.4.

Note 1: The NorDig IRD is not required to be equipped with any analogue video output.

## Rescaling for HbbTV application

A NorDig HbbTV IRD **shall** support rescaling as defined in HbbTV under “video scaling” minimum requirements in clause 10.2.1 of ETSI TS 102 796 [27]. These **shall** be supported for any of the valid incoming encoded full screen luminance resolutions (see 5.2 for full screen luminance resolution values). The video **shall** be scaled, preserving the aspect ratio, and when applicable converted colorimetry-wise, such that all of the decoded video is visible within the area of the AV Control object or HTML5 video object. (See HbbTV requirements in ETSI TS 102 796 [27] Appendix E4).

## Graphic compositing with HDR video - informative

When compositing graphic components (e.g. subtitling, HbbTV) with an HDR-based TV service, these graphics may typically utilise a small, perhaps undefined, legacy SDR-based colour volume. Hence ambiguity may occur, primarily luminance-wise, to which HDR-based video colours to map the SDR-based colours of the graphics in the composition, see the Video Decoder Reference Model in section 5.1.1.

The SDR to HDR conversion methods (and vice versa) for video described by the ITU, e.g. ITU-R BT.2390 [90] and ITU-R’s operational practises in HDR television production ITU-R BT.2408 [95], should be studied as guidance regarding colour volume conversion (both luminance and chrominance) of graphics.

# Audio

# Teletext and Subtitling

# Interfaces and Signal Levels

##  Introduction

## RF- bypass (option)

## Two-way Interface

## Analogue Video Interfaces (Option)

Video signals output via any type of analogue interface **shall** be of maximum 720x576 (SDTV) resolution, see section 5.11.

### SCART Interface (Option)

The NorDig STB should have one SCART Interface in accordance with EN 50049-1 [4] and EN 50157-2-1 [6].

The following table summarises the input/output signals available at all SCART interfaces:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SCART** | **requirement** | **CVBS/AUDIO** | **RGB**  | **PIN 8** | **PIN 16** |
| 1 TV | Mandatory\* | Out | Out | out (1) | out (2) |
| 2 VCR | Optional  | in and out (3) | In | In | In (4) |

Table 8.1 SCART requirements

\* Not relevant for iDTV

(1): the voltage **shall** be forwarded from in to out (12V or 6V)

(2): the voltage **shall** be forwarded from in to out (0V or 1 - 3V)

(3): the OSD graphics should not be present on the VCR SCART output except for DVB subtitling
 (if present and chosen)

(4): the voltage should be forwarded from in to out (0V or 1 - 3V)

Control signal definitions:

 PIN 8: nom. 0 Volt/DC: internal source of the TV set

 nom. 6 Volt: external source, 16:9 format

 nom. 12 Volt: external source, 4:3 format

 PIN 16: nom.0 Volt/DC: CVBS active

 1-3 Volt/DC: RGB active

## Audio Output Interfaces (Option)

## HDMI (High Definition Multimedia Interface)

### General

#### NorDig iDTV

A NorDig iDTV is, by definition, capable of receiving and decoding the relevant NorDig broadcast signals. Whilst NorDig recognises that specifying the HDMI input connector requirements on iDTVs is generally beyond its scope, for the avoidance of doubt the NorDig (non-HEVC) iDTV **shall** include at least one HDMI 1.4b [36] or later version input while a NorDig HEVC iDTV **shall** include at least one HDMI 2.0b [93]or later version input.

Note: A NorDig iDTV may have several other HDMI inputs with HDMI-versions selected at the manufacturer’s own discretion.

#### NorDig STB

A NorDig STB **shall** have at least one High-Definition Multimedia Interface (HDMI) output connector. STBs not using type A connector should provide an adapter to type A. For the (non-HEVC) NorDig STB the HDMI **shall** be compliant with HDMI v1.4b or later [36] and for the NorDig HEVC STB be compliant with HDMI v2.0b [93] or later.

### Video Output and Display

#### NorDig STB

The NorDig STB **shall** recognise E-EDID information provided by the display and subsequently follow the below requirements.

 The NorDig STB **shall** use 1920x1080p@50 Hz as the default output format, if supported by the display.

If 1920x1080p@50 Hz is not supported by the display, the NorDig STB should use 1280x720p@50Hz, rather than 1920x1080i@25Hz, as the output format – although this priority requirement may not comply with the specified priority order in the HDMI specifications regarding E-EDID information exchange.

The user **shall** be able to override the above behaviour in two different ways:

1. By choosing an “Original Format” option, i.e. to output the same format as received, if supported by the display. If the received format is not supported, the STB **shall** select the display mode providing the best possible video quality, as indicated by the E-EDID information. This is to avoid the STB output to go black, if there is a mismatch between received format and display capability.

Note: In the case of received 1080p@25Hz, and if the display does not accept this, the STB shouldperform 2:2 pulldown (a.k.a. frame-doubling) to reach 50 Hz and subsequently retry with the E-EDID information exchange.

2. By choosing a “Fixed Format” option, i.e. to manually set, preferably with a dedicated knob on the remote control, the default output format from the NorDig STB to a fixed video format. The video format options **shall** include 1920x1080p@50Hz, 1280x720p@50Hz and 1920x1080i@25Hz.

#### NorDig HEVC STB

The NorDig HEVC STB **shall** recognise E-EDID information provided by the display and subsequently follow the below requirements.

The NorDig HEVC STB **shall** use 3840x2160p@50 Hz as the default output format, if supported by the display.

If 3840x2160p@50Hz PQ10 (including all decimated sub-resolutions) is not supported by the display, the NorDig HEVC STB should primarily convert to 3840x2160p@50Hz HLG10 and secondarily 3840x2160p@50Hz WCG+SDR (i.e. ETSI/ITU-R BT.2020 [88]).

If 3840x2160p@50Hz HLG10 (including all decimated sub-resolutions) is not supported by the display, the NorDig HEVC STB should primarily convert to 3840x2160p@50Hz PQ10 and secondarily 3840x2160p@50Hz WCG+SDR (i.e. ETSI/ITU-R BT.2020 [88]).

If 3840x2160p@50 Hz, no matter colorimetry, is not supported by the display, the NorDig HEVC STB should primarily convert to BT.709-based 1920x1080p@50Hz and secondarily BT.1847-based 1280x720p@50Hz, rather than BT.709-based 1920x1080i@25Hz, as the output format – although this priority requirement may not comply with the specified priority order in the HDMI specifications regarding E-EDID information exchange.

The user **shall** be able to override the above behaviour in two different ways:

1. By choosing an “Original Format” option, i.e. to output the same format as received, if supported by the display.

If the received format is not supported, the STB shall select the display mode providing the best possible video quality, as indicated by the E-EDID information, and perform colorimetry conversion if needed because of display capability. This is to avoid the STB output to go black, if there is a mismatch between received format and display capability.

Note: In the case of received 25 Hz progressive scan, and if the display does not accept this, the STB shouldperform 2:2 pulldown (a.k.a. frame-doubling) to reach 50 Hz and subsequently retry with the E-EDID information exchange.

2. By choosing a “Fixed Format” option, i.e. to manually set, preferably with a dedicated knob on the remote control, the default output format from the NorDig HEVC STB to a fixed video format. The video format options **shall** include 3840x2160p@50Hz PQ10, 3840x2160p@50Hz HLG10, 3840x2160p@50Hz WCG+SDR (i.e. ETSI/ITU-R BT.2020 [88]), 1920x1080p@50Hz, 1280x720p@50Hz and 1920x1080i@25Hz.

### Audio Output

The HDMI Audio Output is specified in section 6.6 (Audio Output Formats). For IRDs integrated in IDTVs, an HDMI ARC (or eARC output) should be implemented.

### Signal protection

The NorDig IRD’s HDMI interface (output or input) used to transport audio & video content **shall** support the High-bandwidth Digital Content Protection (HDCP) rev. 1.4 or higher [35].

The NorDig HEVC IRD’s HDMI interface (output or input) used to transport audio & video content **shall** support High-bandwidth Digital Content Protection (HDCP) rev. 2.2 or higher [91].

NorDig HEVC STB **shall** only fall back to HDCP rev. 1.4 when connected to an HDMI sink that doesn’t support HDCP rev. 2.2 or higher [91].

Broadcast received services may be flagged with a need for content protection or not (CP “ON” or “OFF”) via the CA-system or similar, as specified by the relevant network/CA-operator. Signals that the IRD is entitled to receive **shall** be sent to the HDMI-sink (display) in accordance with the following conditions:

A. In case the received service is flagged with no need for content protection, the signal may be sent to the sink with HDCP disabled (1).

B. In case the received service is flagged with content protection required via the CA-system, the signal **shall** only be sent to the sink with the HDCP enabled, i.e. when the HDMI sink satisfies the HDCP requirements and HDCP protection is established on the HDMI-link.

If the NorDig IRD has an HDMI output (ie: is an HDMI source) it should (2) provide an option for setting the preferred HDCP-state, (“HDCP-user setting”), that can be set between following modes:

* ON (where ON refers to ‘always on’) and~~or~~
* OFF and/or AUTO mode, (where OFF refers to ‘always off’ and AUTO refers to ‘automatic; on when required and off when not required’).

The HDCP-user setting **shall** apply to all services receivable by the IRD. Changes to this setting **shall** survive channel change, standby and power on/off.

Note 1: Disabling of HDCP is optional.

Note 2: This option – when available- **shall** be available via the IRD’s menu system, unless otherwise specified by the relevant network/CA-operator.

Table 8.2 defines the required actions of the IRD, based on the required content protection for the received service and the selected HDCP-user setting. The required content protection level and the required HDCP-state may be flagged via the CA-system (as specified by the relevant network/CA-operator).

|  |  |  |  |
| --- | --- | --- | --- |
| **mode** | **Signalled Content Protection level incoming service, CA-system (1)** | **STB’s HDCP-user preference setting (optional)** | **Description(STB actions)** |
| 1 | CP Not needed | ON  | HDCP active and service content is presented on the HDMI output  |
| 2 | CPRequired | ON or ‘AUTO’ | HDCP active and service content is presented on the HDMI output |
| 3 | CP Not needed | OFF (2) or ‘AUTO’ | HDCP is inactive/disabled and service content is presented in the clear on the HDMI ouput. |
| 4 | CPRequired | OFF (2) | HDCP is inactive and service content **shall** **not** be presented on the HDMI ouput, instead STB **shall** display a message that inform the end user that the HDCP user setting must be turned ON in order to view protected content. |
| Note 1: The specified modes may be omitted or redefined by the relevant network/CA-operator. Note 2: “HDCP OFF” is not recommended for the HDCP user setting in networks where some programmes will require “HDCP ON”, because it may lead to excessive zapping times. |

Table 8.2 IRD actions versus required (signalled) Content Protection level and HDCP user setting

## User Control functions (Remote Control)

### General

The functions described in the below tables consist of those operations which are considered to be necessary to implement a fully operational IRD (dependant on the class of device like: Basic IRD, HbbTV IRD or PVR). These operations may be implemented as logical functions, as physical buttons on a remote control or a combination of the two.

NorDig strongly recommends that the mandatory functions defined here are implemented in a manner which makes them easily accessible for a user.

Where these functions are implemented as dedicated physical buttons they will implicitly be accessible.

Where the functions are implemented as logical functions, NorDig strongly recommends that the User Interface renders these functions at a high enough menu level that a user will be able to easily locate and select them. Ideally this would be at the first or second level menu structure.

### Handling of Persistent and Temporary settings

### Accessibility

### Grouping of User Control settings

NorDig recommends device manufacturers to use good practice when considering the layout of core remote control functions. This applies whether the implementation is as a set of physical buttons or rendered as an on-screen display. Good practice would typically dictate that common functions are grouped in reasonable, useable proximity to each other. This recommendation would, for example, include:

* Number buttons being grouped
* PVR buttons being grouped
* Colour buttons being grouped
* Arrow buttons, OK/select, Back and Exit being grouped

All buttons within a group should be presented in equal way for the user to select between all buttons in the group (for example during an IRD status mode of presenting EBU Teletext page all colour buttons should be presented and not just one colour button at the time).

For clarity, this recommendation does not mean all the above functions need to be grouped.

### User Control, basic functions

| Basic Functions | STB | iDTV | Recommen­dation for Temporary/ Persistent |
| --- | --- | --- | --- |
| Power On/Off Turns the IRD on and off | M | M | - |
| Programme Up/Down Function to switch between programmes. It is recommended to start at the same channel after a power off/on. | M | M | P |
| Volume Up/DownFunction to adjust the volume output level. Optional for receivers without display. It is recommended to keep the volume level when changing channels and power off/on. | O | M | P |
| TV/ Radio If this function is provided this is what it should do: Function that puts the IRD directly into conventional television state, i.e. only audio, video and subtitling or radio state (i.e. toggle between TV and Radio category list of services). | O | O | - |
| SubtitlesOptions for subtitling (On/Off/Hard of hearing, Languages) | M | M | P |
| Audio Description/Spoken Subtitles | M | M | Tp |
| Audio Selection of audio language and/or audio stream | M | M | Tp |
| MuteMutes audio | O | O | T |
| Program GuideThis function displays an Electronic Programme Guide.  | M | M | - |
| InfoProvides additional event information | M | M | - |
| TeletextThis function launches the EBU Teletext or HbbTV Digital Teletext if present, see section 7.1.6. | M | M | - |
| Numerals 0-9 | M | M | - |
| Menu This function starts the main menu for all the persistent settings (ref chapter 16) and the navigator (ref chapter 13) functionality. | M | M | - |
| Navigation (e.g. Arrow keys)A navigation or pointing system for navigation on the OSD | M | M | - |
| OK or SelectA function that selects or confirms current choice or statement | M | M | - |
| BackThis function exits from the current menu or “page” and returns to the previous state. In TV/Teletext it should return to previous channel/page. | O | O | - |
| ExitExits the current menu/info/program guide (back to TV screen) | O | O | - |
| Colours Four color-coded controls for non-dedicated functions. The colours **shall** be red, green, yellow and blue (in that order) | M | M | - |
| High Contrast User Interface This function enhances the contrast of the User Interface menus over the video. | O | O | P |
| Talking Menussee section 13.6.2 | O | O | - |
| Key: M = Mandatory, O = Optional, T = temporary change, P = persistent change, - = not applicable,  Tp = Temporary change of a persistent system setting |

Table 8.3 User Control, basic functions.

### User Control, NorDig HbbTV functions

|  |  |
| --- | --- |
| NorDig HbbTV Functions in addition to basic functionality | HbbTV |
| HbbTV function activationPlease refer to the HbbTV specification. This function activates the HbbTV Digital Teletext application. Typically this function is covered by the Teletext or Red control. | M |
| BackPlease refer to the HbbTV specification. This function is always available to applications once an HbbTV application is active | M |
| Exit This function terminates the currently running HbbTV application. It does not disable the HbbTV feature, therefore if the current service has an auto-start application then it **shall** be re-launched and broadcast video **shall** be reset to its default position. | M |
| Key: M = Mandatory, O = Optional, T = temporary change, P = persistent change, - = not applicable,  Tp = Temporary change of a persistent system setting |

Table 8.4 User Control, NorDig HbbTV functions

### User Control, PVR functions

### User Control, other optional functions

Other functions are left to the discretion of manufacturers.

It is expected that a production IRD will include additional functions not described here which may be implemented entirely at the device manufacturer discretion. See table below.

|  |
| --- |
| Other Optional Functions |
| Display resolutionToggles through all available display resolutions (original format, 720p, 1080i and more) |
| Aspect ratio Normally find on TVs. Toggles through different aspect ratios, 16:9, 4:3, Zoom,  |
| Option / short menuA way of accessing menu functions that are used more often than the set-up menu, but not as often to need separate function. |
| User manualIf the IRD has an interactive on-screen user manual |
| HelpShows help about where You are in the menu |
| 3DToggles through different 3D functions |
| Smart TV / InternetGives access to smart TV functions and/or Internet web browsing functions |
| Channel listGives access to a list of available services. Often combined with OK-button. |
| SearchSearch for content, web search etc.  |
| Other Teletext functionsMix modes, next/prep page, enlarge Teletext, show hidden text, etc. |
| Digital / AnalogueToggles between digital and analogue services |

Table 8.6 User Control, other optional functions

### Design and Labelling for physical Remote Control

The manufacturer is responsible for the design of the remote control and the labelling of the remote control functions.

Manufacturers should consider the needs of visually impaired users when designing remote control handsets.  Items to consider include the size/texture/tactile response of buttons and the colour/typeface/size of labelling. Frequently used remote control functions such as Volume Up/Down, Programme Up/Down should be placed in an easy accessible manner.

### Mapping of Key Events for NorDig HbbTV IRD profile

The NorDig HbbTV IRD **shall** generate (HbbTV) events according to Table 8.7 in response to user control functions, (e.g. when a key is pressed on the NorDig IRD remote-control).

|  |  |
| --- | --- |
| **User Control functions** | **HbbTV Key event** |
| Numerals 0-9 | VK\_0 to VK\_9 |
| Navigation Up | VK\_UP |
| Navigation Down | VK\_DOWN |
| Navigation Left | VK\_LEFT |
| Navigation Right | VK\_RIGHT |
| OK | VK\_ENTER |
| Back | VK\_BACK |
| Colour Red | VK\_RED |
| Colour Green | VK\_GREEN |
| Colour Yellow | VK\_YELLOW |
| Colour Blue | VK\_BLUE |
| Stop | VK\_STOP  |
| Play | VK\_PLAY or VK\_PLAY\_PAUSE (1) |
| Pause | VK\_PAUSE or VK\_PLAY\_PAUSE (1) |
| Fast Forward | VK\_FAST\_FWD |
| Fast Rewind | VK\_REWIND |

Table 8.7 Mapping of NorDig HbbTV IRD Key Events to HbbTV.

Note 1: VK\_PLAY and VK\_PAUSE is used for PVRs with separate remote control keys for these two functions, while VK\_PLAY\_PAUSE is used for PVRs with one common toggling multifunctional key for these two functions.

|  |  |
| --- | --- |
| **User Control functions** | **Key Event** |
| Power On/Off  | Not available to HbbTV applications |
| Programme Up | Not available to HbbTV applications |
| Programme Down | Not available to HbbTV applications |
| Volume Up | Not available to HbbTV applications |
| Volume Down | Not available to HbbTV applications |
| Teletext | Not available to HbbTV applications |
| Subtitling/Option  | Not available to HbbTV applications |
| Guide | Not available to HbbTV applications |
| Info | Not available to HbbTV applications |
| TV/Radio | Not available to HbbTV applications |

Table 8.8 User Control functions that are not available to HbbTV applications.

# Interfaces for Conditional Access

# The System Software Update

# Performance

## Introduction

In this chapter the performance of decoded digital video and audio signals are specified (only relevant for IDTV in case of external interfaces). It also includes zapping performance regarding the time to recover when changing services. The performance for demodulated analogue video and audio signals (optional for NorDig IRD with embedded analogue cable front-end) is also specified.

Other performance issues are treated in other chapters.

## Video Performance of RGB and PAL Signals

The RGB- and CVBS-signals at the appropriate interfaces of the NorDig IRD **shall** meet the characteristics given in ITU report 624-4 [59].

## Audio Performance of the Decoded Digital Signal

Reference for the performance of all audio measurement is full scale minus 12 dB and the measurement **shall** be made at a sampling rate of 48 kHz.

The NorDig IRD **shall** at least satisfy the performance as stated below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Measurement item** | **Min** | **Typical** | **Max.** |
| Output impedance (Ohm) |  | 600 | 1000 |
| Output level for sine wave at 1kHz of 0 dBTP (mV RMS) | 1590 (i.e. -1 dB)  | 2000 (note 1) | 2520 (i.e. +1 dB)  |
| Output level for sine wave at 1kHz of -12 dBTP (mV RMS) | 397 (i.e. -1 dB)  | 500 | 630 (i.e. +1 dB)  |
| Flatness of amplitude response: (dB) (at 40 Hz to 80 Hz)80 Hz to 13,5 kHz13,5 kHz to 20 kHz | -2-1-2 |  | +2+1+2 |
| Dynamic range (dB) | 80 |  |  |
| Harmonic distortion ratio (%) |  |  | 0.1 |
| Cross-talk between channels (dB, at 20 Hz to 20 kHz) |  |  | -60 |
| Hum suppression (dB) | 60 |  |  |
| S/N (dB, weighted, quasi peak, ITU/R rec. 468)  | 66 |  |  |
| Phase difference between channels (°), 40 Hz to 13,5 kHz13,5 kHz to 15 kHz |  |  | 1015 |
| Amplitude difference between channels (dB, 20 Hz to 20 kHz) |  |  | ±1  |
| Volume control (affected steps with 3 dB/step) |  | 6 |  |
| Signal attenuation at mute (dB) | 70 |  |  |

Table 11.1 Audio performance

Note: Full scale is defined, for a digital signal, as the maximum signal in accordance with the encoding system specification. Full scale amplitude is defined after pre-emphasis and is the same for all frequencies after encoding.

## Zapping Time for TV Services

The NorDig IRD’s zapping time for the services **shall** satisfy the requirements given in Table 11.2.

The figures in Table 11.2 **shall** be met for an input signal which has:

* video GOP length of around half a second (i.e. 12 frames for interlaced 50Hz video, 24 frames for progressive 50 Hz/fps video).
* a repetition rate of ECM of 2 per second (for scrambled services)
* repetition rate of PAT and PMT of 10 times per second and
* maximum PTS-to-PCR relative delay **shall** be 700ms.

The picture on the display during the zapping time **shall** be either frozen or black and the sound **shall** be muted until the new session has been stabilised.

The figures in the table are valid for two services on one multiplex as well as for two multiplexes and for both scrambled and unscrambled (FTA) services.

|  |  |
| --- | --- |
| IRD Type | Average max zapping time |
| IRD with embedded CAS | 2.5 seconds |
| IRD with CI and using a CAM | 3.5 seconds |

Table 11.2 Maximum zapping time

Note: An IRD may have several methods of changing selected service to be decoded (zapping), for example via P+/P-, service list, numeric keys, from EPG/ESG menu etc. The different methods of zapping may have slightly different zapping time, for example due to response time, time-out for keying etc. Figures above are for the IRD’s fastest method, other method should not introduce more than 1s of extra zapping time. Observe that CAMs from different vendors can have different performance and this can have an impact on the zapping time. Figures above are for CAMs with well proven performance. Different CAS broadcast settings (e.g. CI+ messages) can also impact on the zapping time, which must be taken into account when evaluating the result. Figures above are for CAS broadcast settings with fastest zapping time.

Part B: The system software with application

# Service Information

## General

### General Requirements

The NorDig IRD **shall** be able to process, i.e. sort out, store and make available through the Man-Machine Interface (NorDig Basic IRD) the incoming SI data (descriptors) as tabulated in sections 12.1.8-12.8, i.e. these are (minimum) mandatory descriptors for the receiver to decode and interpret, (see also Table 12.2 for an overview over minimum broadcast and receiver requirements). The processing **shall** be compliant with ETSI EN 300 468 [13] and ETSI TR 101 211 [25].

Descriptors or other data structures that are currently undefined or are unknown to NorDig IRD **shall** be skipped and **shall** not cause any harm. This means for example that NorDig IRD **shall** ignore/skip the complete text string that is using DVB character tables that the IRD does not support.

The NorDig IRD **shall** be able to process the PSI/SI tables, both for the ‘Actual’ and for ‘Other’ transport streams. SI tables for the ‘Other’ transport streams, SIother, should be seen as informative and **shall** always be double checked with the corresponding SI tables for the ‘Actual’ transport stream, SIactual.

The NorDig IRD **shall** at least start updating for any changes in the received “quasi-static” SI data after it returns to active from standby mode. “Quasi static“ SI-data includes NIT and SDT, i.e. SI that is typically stored in the flash memory for service navigations, such as service name, service\_ID, number of services. (The ‘running status’ is not included in the quasi-static SI data. As a guideline for the implementation, this updating may be performed in the background, to shorten the start-up of the basic video and audio).

The NorDig IRD **shall** at least start action for any changes in the received “dynamic” PSI and SI data, (PMT, EIT, TDT/TOT, running status and CA mode) within 1 second. (As a guideline for the implementation, the trigger for changes in received tables can be based on comparing the ‘version id’ in the tables).

NorDig IRDs with IP-based front-end **shall** support “TS Full SI” and should support “TS Optional SI”, as specified in ETSI TS 102 034 [29]. With respect to DVB SI as specified in ETSI EN 300 468 [13], the following general requirements and comments apply:

* + 1. The NorDig IRD with IP-based front-end **shall** process the following DVB SI tables if present in the transport stream (see also Table 12.1):
* Service Description Table (table\_id = 0x42 – Actual transport stream)
* Event Information Table, Present/Following and Schedule
* Time and Date Table/Time Offset Table
See section 12.5 for complete procedure to retrieve network time.
* Conditional Access Table (CAT)
* Programme Map Table (PMT)
	+ 1. For NorDig IRDs with IP-based front-ends the NIT is not used. Instead the IRDs **shall** (1) look for the Service Provider Discovery Information as defined in ETSI TS 102 034 [29]. The entry point(s) for Service Provider Discovery Information **shall** be according to the mechanisms defined in ETSI TS 102 034 [29]. A service list **shall** be built based on the information in the Service Provider Discovery Information. See also Annex C.
		2. In order to locate possible bootloader streams retransmitted from e.g. satellite, the NorDig IP IRD **shall** (1) look in the Broadcast Discovery Record (according to ETSI TS 102 034 [29]). A bootloader service **shall** be signalled as a particular service with service\_type set to 0x81.

Note 1: Use of ETSI TS 102 034 is suspended, as it is currently not used in most IP-based networks. For information about required performance related to this item, contact the relevant network operator.

As the NorDig IRD needs information like manufacturer, HW version, SW version etc., the NorDig private Linkage Descriptor **shall** be included in the Broadcast Discovery Records. The XML scheme of the private Linkage Descriptor is given in section 13.4.

### PSI/SI classification

Static PSI/SI data is defined as the PSI/SI data that must be updated by the IRD in Installation mode (channel search or first time initialization).

Quasi static PSI/SI data is defined as the PSI/SI data that must be updated by the IRD in (automatic) Update mode (i.e. when it is toggled between standby mode and active mode or vice versa).

Dynamic PSI/SI data is defined as the PSI/SI data that must be updated by the IRD in active/TV viewing mode (i.e. within 1s after a change in the data occurs).

### Private data specifier value

NorDig defined private descriptors and data inside PSI and/or SI tables are recognised with private\_data\_specifier\_value set to 0x00000029, used according to ETSI TR 101 211 [25] and ETSI ETR 162 [21].

### Service Types

The NorDig IRD **shall** minimum handle the service types listed in Table 12.1 below.

Service types that are not supported by the NorDig IRD should be ignored.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Service** | **Component**  | **Status** | **Category** | **Priority** |
| **Class of service** (description of service type) | **type** **(SDT)** | **descriptor****(SDT)** |  | **type** | **within category** |
| **TV service** (mainly MPEG-2/H.262 based SDTV) | 0x01 | Ob Or | M | TV | 5 |
| **Radio service** (mainly MPEG-1 Layer II based) | 0x02 | Ob Or | M | Radio | 2 |
| **Teletext service** | 0x03 | Ob Or | M | others |  |
| Advanced codecbased **Radio service**(MPEG-4 HE-AAC, AC-3/E-AC-3, AC-4 (1)) | 0x0A | Ob Or | M | Radio | 1 |
| **Data broadcast service** (e.g. for SSU service) and HbbTV standalone services | 0x0C | Ob Or | M | others |  |
| AVC/H.264 based **SDTV service**  | 0x16 | Ob Or | M | TV | 4 |
| AVC/H.264 based **HDTV service**  | 0x19 | Ob Or | M | TV | 3 |
| HEVC/H.265 based TV service (up to UHD, SFR and SDR compatible, incl HDR/HLG10)  | 0x1F | Mb Mr (2) | M (1) | TV | 2 |
| HEVC/H.265 based TV service with PQ10 HDR (up to UHD, SFR/HFR)  | 0x20 | Mb Mr (2) | M (1) | TV | 1 |
| Others | others |  | O | Others | lowest |
| M; Mandatory, R; (Highly) Recommended, O; Optional item to support, Alt; minimum one among several options.Priority; lower value refers to higher priority.Note 1: Mandatory for NorDig HEVC IRDs, optional for IRDs not supporting HEVC.Note 2: Used in addition to service\_type to identify components’ complexity for a service. See section 12.3.6 for mandatory types for the NorDig HEVC IRD.  |

Table 12.1 Overview of service types, service category groups and priority between the service types

*Informative: During migration period simulcasting of the content in (MPEG2) SDTV and in (MPEG4 AVC) HDTV may occur. Simulcasting may be under the same service (service\_id) or on separate services (separate service\_ids).*

*For service simulcasting on separate service\_ids a linkage ‘NorDig Simulcast replacement service’ (linkage type 0x82) will be broadcasted from the SDTV version pointing to the HDTV version of the same service, in order to help the IRD to know that these services are two versions of the “same” service/content,*

*The service types ‘Advanced codec based Radio service’ (0x0A), ‘advanced codec based SDTV service’ (0x16) and ‘advanced codec based HDTV service’ (0x19) will be used for services where the main component is an advanced codec stream. For TV services the main component is the video stream while for Radio services the main component is the audio stream. These service types will be used when it is not desirable that an old MPEG2 only IRD install and list a MPEG4 service.*

*The service type ‘digital TV service’‘(0x01) will be used for services including MPEG-2 video stream. It may also be used for service simulcasting MPEG2 and MPEG4 AVC video and for services only including MPEG-4 AVC video. All IRDs will install service type ‘digital TV service’ (0x01). This service type (0x01) may be used for a service that only includes MPEG-4 AVC video when it is desirable that an old MPEG2 only IRD installs and lists a service (even if old MPEG2 only IRD cannot decode the video, used for promotion purpose).*

*The logical channel number* ***shall****, as far as possible, be unique within each original network id for each service type category (TV, Radio and Others).*

### Service Categories

The services are grouped inside the IRD into three service type categories; TV (1), Radio (2) and Others/data (3) services:

1. TV category includes services with service type: 0x01 digital (MPEG-2) TV service, 0x16 AVC/H.264 SDTV service,0x19 AVC/H.264 HDTV service, 0x1F HEVC/H.265 based HD/UHDTV service and 0x20 HEVC/H.265 based UHDTV HDR service.
2. Radio category includes services with service type: 0x02 digital radio sound service and 0x0A advanced codec digital radio sound service.
3. Others/(data) category includes all other service types that are not included in TV (1) and Radio (2) categories.

The NorDig IRD **shall** during installation of services create a common service list for each category (i.e. all 0x01, 0x16, 0x19, 0x1F and 0x20 within same TV category list and so on for the Radio and Other/data categories).

*Informative: These categories enable the IRD to create a common TV category service list for all TV service types (0x01, 0x16, 0x19, 0x1F and 0x20) and similar for Radio and Other/data service lists.*

### Used PSI/SI descriptors

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Descriptor** | **Tag value** | **NIT (3)** | **BAT** | **SDT** | **EIT** | **TOT/ TDT** | **CAT** | **PMT** |
| audio\_stream\_descriptor | 0x03 | - | - | - | - | - | - | mb Or |
| target\_background\_grid\_descriptor | 0x07 | - | - | - | - | - | - | Ob Or |
| video\_window\_descriptor | 0x08 | - | - | - | - | - | - | Ob Or |
| CA\_descriptor | 0x09 | - | - | - | - | - | mb Mr | mb Mr |
| ISO\_639\_language\_descriptor | 0x0A | - | - | - | - | - | - | mb Mr |
| carousel\_identifier\_descriptor | 0x13 | - | - | - | - | - | - | mb Mr (1) |
| Metadata\_pointer\_descriptor | 0x25 | Ob Or (3) | - | Ob Or (3)  | - | - | - | - |
| Metadata\_descriptor | 0x26 | - | - | - | - | - | - | Ob Or (3) |
| [MPEG] Extension\_descriptor (7) | 0x3F | - | - | - | - | - | - | Ob Mr |
| network\_name\_descriptor (2) | 0x40 | Mb Mr | - | - | - | - | - | - |
| service\_list\_descriptor (2) | 0x41 | Ob Mr | - | - | - | - | - | - |
| satellite\_delivery\_system\_descriptor (2) | 0x43 | mb Mr | - | - | - | - | - | - |
| cable\_delivery\_system\_descriptor (2) | 0x44 | mb Mr | - | - | - | - | - | - |
| service\_descriptor | 0x48 | - | - | Mb Mr | - | - | - | - |
| linkage\_descriptor (2) | 0x4A | mb Mr | - | Ob Mr | \* | - | - | - |
| short\_event\_descriptor | 0x4D | - | - | - | mb Mr | - | - | - |
| extended\_event\_descriptor | 0x4E | - | - | - | Ob Mr | - | - | - |
| component\_descriptor (6) | 0x50 | - | - | Mb Mr | Ob Mr | - | - | - |
| stream\_identifier\_descriptor | 0x52 | - | - | - | - | - | - | Ob Mr |
| CA\_identifier\_descriptor | 0x53 | - | - | Ob Mr | Ob Mr\* | - | - | - |
| content\_descriptor | 0x54 | - | - | - | mb Mr | - | - | - |
| parental\_rating\_descriptor | 0x55 | - | - | - | Ob Mr | - | - | - |
| teletext\_descriptor | 0x56 | - | - | - | - | - | - | mb Mr |
| local\_time\_offset\_descriptor | 0x58 | - | - | - | - | Mb Mr | - | - |
| subtitling\_descriptor | 0x59 | - | - | - | - | - | - | mb Mr |
| terrestrial\_delivery\_system\_descriptor (2) | 0x5A | mb Mr | - | - | - | - | - | - |
| private\_data\_specifier\_descriptor (2) | 0x5F | mb Mr | - | mb Or | mb Or | - | - | mb Mr |
| frequency\_list\_descriptor (2) | 0x62 | Ob Mr | - | - | - | - | - | - |
| data\_broadcast\_id\_descriptor  | 0x66 | - | - | - | - | - | - | mb Mr |
| AC-3 descriptor (6) | 0x6A | - | - | - | - | - | - | mb Mr |
| application\_signalling\_descriptor | 0x6F | - | - | - | - | - | - | mb Mr (1) |
| default\_authority\_descriptor (3) | 0x73 | Ob Mr (3) | - | Ob Mr (3) | - | - | - | - |
| Related\_content\_descriptor (3) | 0x74 |  |  |  |  |  |  | Ob,Or (3) |
| content\_identifier\_descriptor (3) | 0x76 | - | - | - | Ob Mr (3) | - | - | - |
| S2\_satellite\_delivery\_system\_descriptor (2) | 0x79 | mb Mr | - | - | - | - | - | - |
| Enhanced\_AC-3\_descriptor (6) | 0x7A |  |  |  |  |  |  | mb Mr |
| AAC\_audio\_descriptor (6) | 0x7C |  |  |  |  |  |  | mb Mr |
| [DVB] extension descriptor (7) | 0x7F | mb Mr | - | mb Mr | mb Mr | - | - | mb Mr |
| user defined | 0x80-0xFE | - | - | - | - | - | - | - |
| NorDig private: logical\_channel\_descriptor (Version 1) (3) | 0x83 | Ob Mr  | - | - | - | - | - | - |
| NorDig private: logical\_channel\_descriptor (Version 2) (3) | 0x87 | Ob Mr | - | - | - | - | - | - |
| CI\_protection\_descriptor | 0xCE |  |  | Mr(5) |  |  |  |  |
| Forbidden | 0xFF | Fb | Fb | Fb | Fb | Fb | Fb | Fb |
| * *Descriptor not applicable or not yet used as minimum within NorDig*

Mb Mandatory to broadcast, always/all timemb Mandatory to broadcast if applicable, i.e. if certain criteria is met (e.g. if scrambling is used)Ob Optional to broadcast, but recommended (if applicable)Fb Forbidden to broadcast (may cause misinterpretation)Mr Mandatory to receive and interpret if broadcastOr Optional to receive and interpret (if broadcast) |
| Note 1: Only mandatory for IRD with HbbTV capabilityNote 2: Descriptors carried in the NIT are not relevant for IRDs with IP-based Front-end, See Annex C. Delivery descriptors requirements depends of which tuning and demodulation the IRD supports, see table 12.7. Note 3: Only applicable for NorDig PVR IRDs only. Note 4: Only applicable for NorDig IRD-T2Note 5: Mandatory to receive from SDT-actual for IRDs that support use of CIP-CAMs, See section 9.2.Note 6: The value of component\_type to be used within the component\_descriptor **shall** be equal to the value of component\_type held in the AC-3\_descriptor or Enhanced\_AC-3\_descriptor or AAC\_descriptor.Note 7: The DVB extension\_descriptor is defined in DVB-SI (EN 300468) [13]Comment: Descriptors used for the UNT of the DVB SSU Enhanced profile are given in table 12.30 Descriptors used for the RCT (only applicable for PVRs) are given in table 12.21 |

*Table 12.2 Overview over minimum used descriptors in NorDig broadcast and receivers*

| **DVB] Extension Descriptor** | **Tag extension value** | **NIT (1)** | **BAT** | **SDT** | **EIT** | **TOT/ TDT** | **CAT** | **PMT** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| T2\_delivery\_system\_descriptor | 0x04 | mb Mr | - | - | - | - | - | - |
| Supplementary\_audio\_descriptor | 0x06 | - | - | - | - | - | - | mb Mr |
| AC-4 Descriptor | 0x15 | - | - | - | - | - | - | mb Mr(1) |
| S2X\_satellite\_delivery\_system descriptor | 0x17 | Mb Mr (2) | - | - | - | - | - | - |
| audio\_preselection\_descriptor (3) | 0x19 | - | - | - | - | - | - | mb Or |
| TTML\_subtitling\_descriptor | 0x20 | - | - | - | - | - | - | mb Mr (1) |
| reserved for future use | 0x09-0x7F | - | - | - | - | - | - | - |
| user defined | 0x80-0xFF | - | - | - | - | - | - | - |
| - Descriptor not applicable or not yet used as minimum within NorDigMb Mandatory to broadcast, always/all timemb Mandatory to broadcast if applicable, i.e. if certain criteria are met (e.g. if scrambling is used)Mr Mandatory to receive and interpret if broadcastOr Optional to receive and interpret (if broadcast) |
| Note 1: Only mandatory for NorDig HEVC IRDNote 2: Only mandatory for NorDig Satellite HEVC IRD supporting DVB-S2X. Note 3: The processing of audio\_preselection\_descriptor is highly recommended in the NGA capable Nordig HEVC IRD, and should be supported in new IRDs. It is expected that audio\_preselection\_descriptor processing, especially languages, will become mandatory in future versions of this specification.  |

Table 12.3 Overview over minimum used descriptors in the extension\_descriptor (as defined in DVB SI EN 300 468 [13], Tag value 0x7F) in NorDig broadcast and receivers

### Character sets in text strings

### Country and Language Codes within PSI/SI

### NorDig common EPG/Event metadata exchange format (informative)

## Network Information Table (NIT)

### The Network Information Table Descriptors

|  |  |  |  |
| --- | --- | --- | --- |
| **NIT descriptors** | **Cable IRD** | **Satellite IRD** | **Terrestrial IRD** |
| Metadata\_pointer\_descriptor (3) | Optional  | Optional | Optional |
| Network\_name\_descriptor | Mandatory | Mandatory | Mandatory |
| Service\_list\_descriptor | Mandatory | Mandatory | Mandatory |
| Satellite\_delivery\_system\_descriptor  | n/a | Mandatory | n/a |
| S2\_satellite\_delivery\_system\_descriptor | n/a | Mandatory | n/a |
| S2X\_satellite\_delivery\_system\_descriptor  | n/a | Mandatory (4) | n/a |
| Cable\_delivery\_system\_descriptor | Mandatory | n/a | n/a |
| Terrestrial\_delivery\_system\_descriptor  | n/a | n/a | Mandatory |
| T2\_Terrestrial\_delivery\_system\_descriptor (2)  | n/a | n/a | Mandatory (2) |
| Linkage\_descriptor | Mandatory | Mandatory | Mandatory |
| Private\_data\_specifier\_descriptor  | Mandatory | Mandatory | Mandatory |
| Frequency\_list\_descriptor | Optional | Optional | Mandatory |
| default\_authority\_descriptor (3) | Mandatory (3) | Mandatory (3) | Mandatory (3) |
| (NorDig) logical\_channel\_descriptor (Version 1) | Mandatory | Mandatory | Mandatory |
| (NorDig) logical\_channel\_descriptor (Version 2) | Mandatory | Mandatory | Mandatory |

Table 12.7 NIT descriptors

Note 1: The NIT is not used with NorDig IRDs with IP-based front-ends. Hence if NIT is transmitted,
 the NorDig IP IRDs **shall** ignore this table. Instead, the information provided by the NIT will be
 replaced by the Service Discovery and Selection mechanisms, specified in Section 13.4.

Note 2: Descriptor is signalled in the extension\_descriptor.

Note 3: NorDig PVR only.

Note 4: only mandatory for satellite NorDig HEVC IRDs that support DVB-S2X.

### Metadata Pointer Descriptor (NorDig PVR only, Broadcast Record Lists)

### Cable Delivery System Descriptor

### Terrestrial Delivery System Descriptor

### T2 Delivery System Descriptor

### Linkage Descriptor

The following linkage\_type values **shall** be interpreted by a NorDig IRD, when used inside the NIT

0x01, linkage to a service that contain information about the network

0x02, linkage to an EPG service (1)

0x04, linkage to transport stream which carries EIT schedule information for all of the services in the network (i.e. “barker channel” service).

0x09, linkage to DVB System Software Update service (bootloader), see section 10

Note 1: Not relevant for NorDig Basic IRD.

### Frequency List Descriptor

### Default authority descriptor (in NIT) (NorDig PVR only)

### NorDig private; Logical\_Channel\_descriptor (LCD)

## Service Description Table (SDT)

### The Service Descriptor Table Descriptors

|  |
| --- |
| **SDT descriptors** |
| metadata\_pointer\_descriptor (1) |
| service\_descriptor |
| CA\_identifier\_descriptor |
| component\_descriptor  |
| linkage\_descriptor |
| service\_identifier\_descriptor |
| default\_authority\_descriptor (1) |
| CI\_protection \_descriptor (2) |
| message descriptor |

Table 12.21 SDT descriptors

Note : NorDig IRDs with IP-based front-end: SDT is only used for actual transport stream (table\_id = 0x42).

Note 1: Mandatory for NorDig PVR IRD.

Note 2: Mandatory for NorDig IRDs that support use of CIP-CAMs, see section 9.2

#### Metadata Pointer Descriptor (NorDig PVR only, Broadcast Record Lists)

### Service Descriptor

The service\_type (under the service\_descriptor) value 0x81 is reserved for the NorDig legacy bootloader use (see section 12.2.9.2).

### CA Identifier Descriptor

### Linkage Descriptor

The following linkage\_type value **shall** be interpreted by a NorDig IRD when used inside the SDT:

0x05, linkage to a service replacement service. When present, the NorDig IRD should automatically switch to the replacement service if the ‘running\_status’ is set to “1” (not running) and if the NorDig IRD are able to receive the SDT containing the original service during the replacement, also switch back when ‘running\_status” is set to “4” (running).

0x82, NorDig Simulcast replacement service, linkage from one TV based service to another TV replacement service with the same content, typical usage it to hide/not include the “old” version of the service and only list the “new” version in the IRD’s service list. For example, it may be used during simulcasting of a service in both an (MPEG2/H.262) SDTV and an (AVC/H.264) HDTV version on separate service ids with same content within the same original network id, or during simulcasting an (AVC/H.264) HDTV and an (HEVC/H.265) UHDTV version with the same content. The linkage will be included in the SDT for the “old” TV service that is intended to be replaced (hidden) and pointing to the “new” replacement service. Whenever it is used, it will be used quasi-static.

For NorDig IRDs that are able to receive both the “old” TV service that is intended to be replaced (hidden) and the “new” replacement service, they **shall** only include the “new” replacement TV version/(service) of the two services within its TV service list. The “old” TV service that is intended to be replaced (hidden) may be omitted or hidden at the end of the list, dependant of IRD implementation. The method **shall** be service type independent (1).

Clarification: If no ‘NorDig Simulcast replacement service’ linkage is included, both services **shall** be included. If only the “old” TV service that is intended to be replaced (hidden) is possible to receive and decode and not the new replacing service (due to e.g. reception problems or codec/service type limitations), then then NorDig IRD **shall** include and display the “old” TV service that is intended to be replaced in the service list even if it carries this linkage ‘NorDig simulcast replacement service’.

Note 1: NorDig IRDs that are launched before 1 July 2019 are allowed to support this only for MPEG2/H.262 SDTV services that are pointing to AVC/H.264 HDTV or HEVC/H.265 replacement services.

Note 2: Broadcasters should not use this replacement from a higher service\_type value (e.g. AVC/H.264) point to replacement service with a lower service\_type value (e.g. MPEG2/H.262).

### Default authority descriptor (in SDT) (NorDig PVR only)

### Component Descriptor

Zero or several Component descriptor(s) may be present in the SDT (according to DVB SI specification, ETSI EN 300 468 [13]), used in combination with the service\_type in the Service descriptor to specify sub-type of service, especially used for HEVC based TV services. It signalises the decoding complexity of the components for the service and Services that are not supported by the NorDig IRD should not be visible in the service list.

If no Component descriptor is included in SDT for a HEVC service, the NorDig HEVC IRD **shall** interpret a HEVC service with service\_type 0x1F as an UHD SFR compatible SDR service and a HEVC service with service\_type 0x20 as an UHD SFR compatible PQ10 HDR service.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component description** **in SDT** | **Values {stream\_content, stream\_content\_ext, component\_type}**  | **Used in** service types  | **in SDT** | **Component category** |
| HEVC/H.265 Main Profile 1080p HD video, 50 Hz  | 0x9,0x0,0x00 | 0x1F | mb Mr (1) | Video |
| HEVC/H.265 Main 10 Profile 1080p HD video, 50 Hz | 0x9,0x0,0x01 | 0x1F | mb Mr (1) | Video |
| HEVC/H.265 UHD 2160p video, 50Hz compatible  | 0x9,0x0,0x04 | 0x1F | mb Mr (1) | Video |
| HEVC/H.265 UHD 2160p video with PQ10 HDR | 0x9,0x0,0x05 | 0x20 | mb Mr (1)  | Video |
| HLG10 HDR | 0xB,0xF,0x04 | 0x1F | Ob Mr (1) | Video |
| HEVC temporal video subset for a frame rate of 100 Hz (dual PID backward compatible HFR)  | 0xB,0xF,0x05 | 0x1F, 0x20 | Ob Mr (1, 2) | Video |
| HEVC/H.265 UHD 2160p video with PQ10 HDR with SMPTE ST 2094-10 SEI messages | 0xB,0xF,0x06 | 0x20 | Ob Or | Video |
| HEVC/H.265 UHD 2160p video with PQ10 HDR with SL-HDR2 SEI messages | 0xB,0xF,0x07 | 0x20 | Ob Or | Video |
| HEVC/H.265 UHD 2160p video with PQ10 HDR with SMPTE ST 2094-40 SEI messages | 0xB,0xF,0x08 | 0x20 | Ob Or | Video |
| *Others* |  | others | Ob Or |  |
| Mb Mandatory to Broadcast, always/all timemb Mandatory to Broadcast if applicable, i.e. if certain criteria is met (e.g. if scrambling is used)Ob Optional to broadcast, but recommended (if applicable)Mr Mandatory to receive and interpret if broadcastOr Optional to receive and interpret (if broadcasted)Note 1: Mandatory for NorDig HEVC IRDs, optional IRDs not supporting HEVC.Note 2: According with section 5.3 the NorDig HEVC IRD shall be able to receive and decode the first video PID as SFR (50Hz) for a dual PID 100Hz HFR video service.  |

Table 12.14 Component description in SDT

Note 1: At the time of writing (November 2017) there is already a significant and increasing legacy of IRDs which can fully support HEVC video but may not fully support TTML subtitles.
These IRDs which meet DVB specifications, will consequently display any HEVC services which the video decoder can support in the service list even if the Audio and Subtitle capabilities are not met.
It is expected that IRDs will inform consumers when there is no audio/subtitle service available, it is strongly recommended that when delivering HEVC services NorDig broadcasters simulcast/carry the legacy audio and subtitle services matching those delivered on NorDig HD services (i.e.MPEG-4 HE-AAC and DVB Subtitles respectively) to ensure maximum uptake of any new HEVC services.

## Event Information Table

### General

The NorDig IRD **shall** support EIT present/following (p/f) for both actual and other tables (1).

The NorDig IRD **shall** support EIT schedule (sch) for both actual and other tables (1) up to at least 8 days of schedules.

Note 1: DVB SI ‘Other’ tables are optional/not applicable for NorDig IRDs with IP-based Front-end.

### The Event Information Table Descriptors

|  |  |  |
| --- | --- | --- |
| **Event descriptors** | **EIT p/f** | **EIT sch** |
| Short\_event\_descriptor | M | M (1) |
| Extended\_event\_descriptor | M | M (1) |
| Component\_descriptor | M | O |
| Content\_descriptor | M | M (1) |
| Parental\_rating\_descriptor | M | M (1) |
| CA\_identifier\_descriptor (optional) | O | O |
| Content\_identifier\_descriptor  | M (2) | M (2) |

Table 12.23 EIT descriptors

Note 1: EIT schedule is recommended (optional) for NorDig IRDs with IP-based Front-end

Note 2: NorDig PVR only.

### CA Identifier Descriptor

### Content Descriptor

The NorDig IRD should handle all content nibbles listed in the DVB SI specification (ETSI EN 300 468 [13]), but **shall** at least be able to handle all content nibble level 1 classes. If there is no content coding in conformance with table present for an event, the default content description ”unclassified” **shall** be assumed by the receiver.

### Content Identifier Descriptor (NorDig PVR only)

### CRID encoding and reuse (NorDig PVR only)

The CRID **shall** be according to ETSI TS 102 822-4 [34], Section 8. The use of abbreviated CRIDs **shall** follow the rules set out in ETSI TS 102 323 [32] Section 6.3.1.

The NorDig PVR **shall** support CRIDs that is encoded according to the following rules:

* The CRID is further restricted to only contain characters encoded over the range from ISO 6937 0x20 to 0x7F.

The length of the CRID plus IMI (if any) **shall** not exceed 64 characters as a combined total for the crid’s authority, data and instance metadata identifier (including the separator ‘#’).

The CRIDs are not intended to be human readable and **shall** not be displayed on-screen. The CRID is simply an identifier.

The authority part of a CRID **shall** be a registered internet domain name and therefore globally unique. The data part of a CRID is only unique within the scope of the associated CRID authority. An IMI is only unique within the scope of the complete CRID.

Broadcasters **shall** endeavour to use the same CRID whenever a programme is repeated. However, this cannot be guaranteed. A repeat of any content by a different service provider may result in a different CRID being assigned.

CRIDs and IMIs may be reused to refer to different programme concepts with the following restrictions:

**Series CRIDs** **shall** not be re-used for 91 days after the scheduled end-time of the last event that referenced this CRID.

**Programme CRIDs** **shall** “never” be reused for different programme content, (i.e. Broadcasters **shall** do their outmost to keep the CRID unique for all time).

**IMI** **shall** not be reused for a different instance of the same CRID within 3 hours of the scheduled end time (start\_time plus duration). Two events greater than or equal to 3 hours apart but with the same CRID & IMI **shall** not be considered to be split parts of the same instance.

#### CRID type 0x01 – programme CRID (NorDig PVR only)

Programme CRIDs are used to identify two or more EIT events as being the same programme. This prevents duplicate programmes being recorded from within the same series and also allows alternative programme instances to be recorded (or offered for recording) if a booking clash occurs.

It is not necessary for all EIT events to have a programme CRID. An event may only include a maximum of one programme CRID. In the current context they are only useful where alternative instances or split programmes are being identified.

#### CRID type 0x02 – series CRID (NorDig PVR only)

Where a series CRID is conveyed in a CID according to the signalling outlined, it is to be used to only refer to an editorial concept of a series.

An event may be associated with more than one series, i.e. an event may include several series CRIDs. Where an event is associated with more than one series, an invitation to record ‘programmes in the same series as this event’ would book to record all events in all series associated with the selected event (see more section 14.3.3).

#### CRID type 0x03 – recommendation CRID (NorDig PVR only)

This identifies a looser linkage to another programme or series. A recommendation may point to a single event (programme CRID) or a series (series CRID).

A CRID in the CID **shall** be marked as [crid type 0x03](#CRID0x33) (recommendation) and be a programme or series CRID.

It is not required that the recommendation CRID be present in the current scope of EIT. If the event referenced by the recommendation CRID is not present in the current scope of EIT, the recommendation may be presented to the user when it appears in EIT. If a recommendation CRID does not appear in EIT within 91 days of the referencing event, it **shall** be discarded.

A recommendation may reference an event earlier in the EIT schedule than the linked-from event, e.g. to link to a preview programme.

#### Split programme (split content) (NorDig PVR only)

A programme may consist of multiple EIT events within the same service or over several services. For example, a film might be divided into two parts (blocks) interrupted by a news programme in the middle or a longer sport event might be split into several parts over several services.

To be able to signal a split content programme the events **shall** include a CRID in the Content Identifier Descriptor (CID) that includes a programme CRID (crid type 0x01) with an Instance Metadata Identifier (IMI) extension. A “split programme” is defined as several events which have the same programme CRID and IMI value and the gap between each event is less than 3 hours (measured from the end of the preceding event to the start of the next event). Such events **shall** be considered to be segments of a single item of content. An item of content may be split across more than two events as long as the gap between each event remains less than 3 hours.

Where a broadcaster changes a single programme into a split programme (using IMIs) the broadcaster should ensure that one of the events of the new split programme maintains the event\_id of the original single event. Failure to do this will result in lost or incomplete recordings.

### Event Information Table Schedule

## Time and Date Table and Time Offset Table

## Conditional Access and Program Map Tables

### Conditional Access Table Descriptors

|  |
| --- |
| **Conditional Access Table** |
| CA\_descriptor |

Table 12.25 CAT descriptors

### Program Map Table Descriptors

|  |
| --- |
| **Program map Table** |
| metadata\_descriptor (3) |
| teletext\_descriptor |
| Subtitling\_descriptor |
| stream\_identifier\_descriptor |
| video\_stream\_descriptor |
| CA\_descriptor |
| ISO\_639\_language\_descriptor |
| AC-3\_descriptor |
| Enhanced\_AC-3\_descriptor |
| AC-4\_descriptor (4) |
| AAC\_descriptor |
| Supplementary\_audio\_descriptor |
| audio\_preselection\_descriptor (5) |
| Private\_data\_specifier\_descriptor |
| data\_broadcast\_id\_descriptor (1) |
| application\_signalling\_descriptor (2) |
| carousel\_id\_descriptor (1) |
| related\_content\_descriptor (3) |
| TTML\_subtitling\_descriptor (4) |

 Table 12.26 PMT descriptors

Note 1: Use of the data\_broadcast\_id\_descriptor and the carousel\_identifier\_descriptor for signalling relevant for the SSU is specified in ref ETSI TS 102 006 [28], see also section 12.7.

Note 2: Only mandatory for the NorDig HbbTV IRDs

Note 3: Only mandatory for NorDig PVR IRDs.

Note 4: Only mandatory for NorDig HEVC IRDs.

Note 5: The processing of audio\_preselection\_descriptor is highly recommended in the NGA capable Nordig HEVC IRD, and should be supported in new IRDs. It is expected that audio\_preselection\_descriptor processing, especially languages, will become mandatory in future versions of this specification.

### Component priority multiple video or audio streams

Component priority when multiple video or audio streams are received

The following applies for services that transmit in parallel more than one type of video/audio stream under the same service\_id (e.g. simulcasting within the same service):

For video decoding, NorDig IRDs **shall** select the service’s video component, and set the default setting in accordance with the priority list in Table 12..

|  |  |  |
| --- | --- | --- |
| **Video codec** | **Stream\_type** | **Priority** |
| HEVC/H.265 up to UHD HDR SFR video stream (incl first PID in dual PID HFR) (1)  | 0x24 | 1 (highest) |
| AVC/H264 HP@L4 / L3 HD or SD video stream | 0x1B | 2 |
| MPEG-2/H264 MP@ML video stream (or MPEG1) | 0x02 (0x01) | 3 (lowest) |

Table 12.27 Default priority order for the IRD between different video streams

For Audio decoding, NorDig IRDs **shall** prioritise the service´s components according to chapter 6.5, Audio prioritisation.

NorDig IRDs **shall** ignore advanced audio streams when it does not support decoding those streams. For example, an IRD that do not include any AC-3 (downmix) decoder, (maybe only supports pass-through of AC-3 to the digital audio output), **shall** not choose the AC-3 audio stream as default. Instead it **shall** choose among the IRDs supported audio stream types according to chapter 6.5, Audio Prioritisation.

When several audio streams of the same type are received, the primary stream **shall** be selected in accordance with the definitions in section 6.5 (Audio ).

Note 1: Only mandatory for the NorDig HEVC IRD.

### ISO 639 language descriptor

### AC-3 descriptor

### Enhanced AC-3 descriptor

### AAC descriptor

### Supplementary\_audio\_descriptor

### Metadata descriptor (NorDig PVR only, Broadcast Record Lists)

### Related Content Descriptor (NorDig PVR only)

### Audio Preselection Descriptor (NGA services only)

### AC-4 Descriptor

## SSU UNT Descriptors

## Related Content Table (NorDig PVR only)

## NorDig Broadcast Record List syntax (NorDig PVR only)

# Navigator

## General

The NorDig IRD **shall** implement a basic Navigator, which provides user access to system information, and allows the user to control the operation of the IRD. The Navigator is by definition part of the system software. A minimum functionality is required as specified below.

The Navigator **shall** include a service list function and a basic Event Schedule Guide (ESG), see ETSI EN 300 468 [13]. The Navigator **shall** also initiate bootloading, as described in chapter 10.

The Navigator **shall** support the Nordic and English languages.

## Service List

### Service List Requirements

#### Service List Requirements for IRDs, except for IP-based front-end

The NorDig IRD **shall** maintain a service list based on SI-information. The NorDig IRD identifies a service uniquely through the combination of original\_network\_id, transport\_stream\_id and service\_id. (The broadcaster however **shall** make services uniquely identified in the broadcast through the combination of only original\_network\_id and service\_id).

The service list **shall** include the services and should also include the corresponding network names. The service list can be completely updated by the user by initiating the tuning/scanning procedure(s) for the connected tuners (see section 3.1.2). The corresponding part of the service list **shall** be updated within 1 second after reception of an updated SI table; updates should be made each time the NorDig IRD is switched from active to standby and **shall** be made each time the NorDig IRD is switched from standby to active.

The IRD **shall** build up different sections inside one common service list (recommended) or build up several service lists, one for each different service category as the default IRD service list(s). Minimum three different sections/lists **shall** be supported for three different categories of service\_types and they are ‘TV’, ‘Radio’ and ‘Data’/’other’ services, (see 12.1.5 for service categories).

Whenever two or more services within same category are allocated to the same logical\_channel\_number, the NorDig HD IRD **shall** first prioritise the advanced codec services as stated in Table 12.1 above (see chapter 12.1.4 for priority between different services within same service category).

The service list **shall** be displayed to the user. The user **shall** be able to select a service from the displayed service list. The selected service **shall** appear immediately (see section 11.4).

 The IRD should provide functionality for the viewer to build up additional personal service lists with the viewer’s own preferred services (like mixed service\_type) and own preferred order or manually re-order the default service list(s). If any network operator makes changes in his part of the service list, the NorDig should place new entries at the end of the corresponding part of the user service list.

The information in the descriptors specified in Table 13.1 and Table 13.2 **shall** be displayed. The original network operator name may be omitted in case only one network is available.

####  Service List Requirements for IRDs with IP-based front-end

NorDig IRDs with IP-based front-end **shall** support the Service Discovery mechanism specified in ETSI TS 102 034 [29] and the additions specified in section 13.4.

Based upon this mechanism, NorDig IRDs with IP-based front-end **shall** be able to generate and maintain a service list of all available services at any time.

### Service list functions for the Network Information Table (NIT)

The NorDig IRD **shall** (1) make use of the descriptors listed in Table 13.1 in all NIT\_actual (the transport stream the NorDig IRD is tuned to) and NIT\_other (other transport stream) tables available in order to update the service list (system delivery data, number of transport streams, logic channel number etc).

Note 1: NorDig IRDs with a terrestrial front-end **shall** be able to install and update the service list components even if the transport stream does not contain the terrestrial\_ delivery\_ system\_descriptor in the NIT\_actual and the NIT\_other streams (NIT\_actual: the transport stream the IRD is tuned to. NIT\_other: other transport stream).

NorDig IRDs with a terrestrial front-end dedicated for stationary reception may receive TS including NIT\_actual and NIT\_other tables. Due to the nature of the terrestrial networks all the transport streams listed in the NIT\_other can be impossible to be received. Therefore, before using the information in NIT\_other tables, carefulness **shall** be taken.

NorDig IRDs with a terrestrial front-end dedicated for mobile and portable reception may also receive TS including NIT\_actual and NIT\_other tables. In that case information in NIT\_other tables may have informative background use for faster service acquisition when receiver is moved from one coverage area to another coverage area.

NorDig IRDs with a IP-based front-end: Not relevant. See Annex C

A cable NorDig IRD should provide functionality for fast installation of services by typing the network\_ID into the receiver. In such a case, the IRD **shall** process only that specific NIT (actual and other) table (with corresponding network\_ID) from current/actual transport stream and only install/display services listed in that table’s service\_list\_descriptors.

A Navigator **shall** never display services that the IRD is not able to receive or decode except for de-scrambling (i.e. a pure satellite IRD **shall** not display services which are described in NIT\_other tables for secondary cable networks).

A NorDig IRD **shall** not install, be able to reach or display services or networks with original\_network\_ID and/or network\_ID which are marked as ‘private\_temporary\_use’ as defined in ETSI ETR 162 [21] (i.e. an original\_network\_ID 0xFF00 – 0xFFFF and/or network\_ID 0xFF01 – 0xFFFF). (This descriptor may be used by broadcasters to avoid confusing consumers with (shorter) test and demonstration transmissions).

Services that are not listed in NorDig Logic\_channel\_descriptor, **shall** be displayed in the service list(s) and **shall** be located last in the list (for that service\_type).

|  |
| --- |
| **NIT descriptors** |
| Network\_name\_descriptor |
| Satellite\_delivery\_system\_descriptor |
| S2\_satellite\_delivery\_system\_descriptor |
| S2X\_satellite\_delivery\_system\_descriptor (1) |
| Cable\_delivery\_system\_descriptor |
| Terrestrial\_delivery\_system\_descriptor |
| T2\_delivery\_system\_descriptor |
| Service\_list\_descriptor  |
| (NorDig) Logic\_channel\_descriptor |
| Note 1: Only mandatory for satellite NorDig HEVC IRDs that support DVB-S2X |

Table 13.1 NIT descriptors

### Service List functions for the Service Description Table (SDT)

The IRD **shall** (1) use the descriptors listed in table 13.2 from both SDT\_actual and SDT\_other tables to update the service list (service names etc.).

Note 1: Not relevant for NorDig IP IRD. See Annex C

|  |
| --- |
| **SDT descriptors** |
| Service\_descriptor |
| CA\_identifier\_descriptor |

Table 13.2 SDT descriptors

### Network Evolution and Service Changes

## Event Schedule Guide (ESG)

The Event Schedule Guide (ESG) is part of the Navigator in the IRD and presents program event information for the user about its installed services via a Graphical User Interface (GUI) as defined by the IRD manufacturer.

### ESG Requirements

#### ESG and length

The NorDig IRD **shall** be able to display an ESG for the user with a minimum of eight days (1) of schedule data, defined as whole days from present day and ahead according to ETSI EN 300 468 [13]. The ESG **shall** be based on the information from the EIT tables, see section 12.4 and TSI EN 300 468 [13].

Comment: Eight days of schedule data for the services within one NorDig network (original network) consists of typically of up to 2-4 MB of data per language.

Note 1: Support for EIT schedule is recommended (optional) for NorDig IRDs with IP-based Front-end

#### Proper handling of EIT data

The NorDig IRD **shall** maintain proper behaviour in case of the incoming event information data for the services exceeds the available free memory for the ESG and not affect the IRD’s basic service decoding and navigation.

If the NorDig IRD’s memory for the ESG is exceeded, then the NorDig IRD **shall** prioritize the event information nearest in time and first reduce the data most far ahead in time for all service, for example via using EIT table filtering (instead of reducing service by service). (If the user has made personalized favourite service list consisting of a subset of available services, then the NorDig IRD should first priorities favourite services and then events most nearest in time).

The NorDig IRD **shall** be able to handle situations when the EIT is not present.

#### ESG performance

The NorDig IRD **shall** maintain the full ESG up to date and be able to display the ESG within 10 seconds after selection, even if not all EIT sections have been received (in which case gaps may occur in timeline for some services). The NorDig PVR **shall** be able to present the ESG regardless of recording status (i.e. while recording or timeshifting an event, it **shall** be possible to present the ESG).

The NorDig IRD should cache EIT data during normal service viewing to speed up time to present a full ESG after selection.

The ESG **shall** be non-discriminatory and display all services on an equal basis.

The ESG **shall** process and display the relevant content of the following tables (including start-time, end-time/duration and content of all descriptors specified below in 13.3.2 and 13.3.3).

### Event Information Table (EIT)

NorDig IRD **shall** make use of the EIT p/f and schedules tables from both EIT\_actual and EIT\_other tables.

|  |  |  |
| --- | --- | --- |
| **Event descriptors** | **EIT p/f** | **EIT sch** |
| Short\_event\_descriptor | M | M (1) |
| Extended\_event\_descriptor | M | M (1) |
| Component\_descriptor | M | O |
| Content\_descriptor | M | M (1) |
| Parental\_rating\_descriptor | M | M (1) |
| CA\_identifier\_descriptor (optional) | O | O |
| Content\_identifier\_descriptor | M (2) | M (2) |

Table 13.3 EIT descriptors

Note 1: EIT schedule is optional for NorDig IRDs with IP-based Front-end.
Note 2: NorDig PVR only.

#### Dynamic update of EIT data

The EIT data **shall** be treated as dynamic information which means that the EIT data is often updated by the broadcaster several times during a day, for example

* The description of events may be changed/updated from when the event was first “published”/broadcasted,
* Some events may be re-scheduled,
* Past events from current day may be removed from broadcast etc.

As factory default, the NorDig IRD **shall** continuously monitor and update the ESG without user request to update (for example by monitoring the tables’ version ids). Information in the ESG **shall** be updated within 10 second after reception of the updated tables.

#### Multiple languages in EIT data

#### Time periods with no EIT data or missing EIT data

#### Parental Control from EIT data

#### ESG presentation filtering of EIT data

The NorDig IRD should provide a function which allows the user to filter events in the ESG with the same content type (from content descriptor), events belonging to the same series (from content identifier descriptor), recommended events referred to by an event and to search events using keywords (from description).

### Time and Date Table (TDT) and Time Offset Table (TOT)

## Service Discovery and Selection for IRDs with IP-based front-end

## User Information (UI) about service components (audio and subtitling)

### UI for Audio information

For services with multiple audio streams (PIDs), or in case of multiple NGA Preselections (1), the NorDig IRD **shall** be able to display information about available incoming audio streams / NGA Preselections (1), for the user to temporarily select one audio stream / NGA Preselection (1), (see section 6.5 and 6.11.3.4 and 6.14.2).

The NorDig IRD **shall** display at least the following information about the currently available audiostreams as (listed in the PMT for the currently selected service):

* Audio Language (if available)
* Audio Type:
	+ it **shall** be possible for the user to differentiate available supplementary audio stream(s) from Normal audio stream(s) even when these have the same language
	+ in case of NGA (1): it shall be possible for the user to differentiate available preselections even when these have the same language; this includes preselections for accessibility services (audio description, spoken subtitles and/or dialogue enhancement)
* Incoming Audio format (stereo/multichannel)

This can for example be done via wordings and/or symbols etc. (As stated in section 6.11.6 ‘Receiver mixing’ audio **shall** not be decoded on its own).

The NorDig IRD should also display information about:

* Incoming audio stream type (audio codec)

The NorDig IRD should for currently selected audio also display information about:

* Outgoing audio format (stereo/multichannel) Outgoing Audio stream type (uncompressed or bitstream, e.g. DTS, Dolby Digital (AC-3), etc.)

Note 1: Only applicable/mandatory for Nordig HEVC IRD.

### UI for Subtitling information

*The NorDig IRD first automatically selects subtitling stream/PID if several subtitling streams are available (DVB Subtitling stream/PID prior over EBU Teletext subtitling, see section 7.1).*

The NorDig IRD **shall** be able to display information about different incoming subtitling pages within the selected subtitle stream/PID, for the user to be able to temporary select subtitling page or disable displaying subtitling. Then NorDig IRD **shall** be able to display following information about the subtitling:

* Subtitle language
* Subtitling type (it **shall** be possible for the user to differentiate available hearing impaired/hard of hearing subtitling pages from subtitling page(s) even when these have same language)

## Accessibility menus and settings

# NorDig PVR feature requirements (NorDig PVR only)

## Introduction - PVR

This chapter (together with PVR-related requirements specified in chapter 12 and section 13.3) specifies the minimum requirements for a NorDig PVR, which may record live services (TV, radio etc) in persistent memory (like HDD) for later playback, (even if the IRD has been completely powered off between the recording and the playback).

A NorDig PVR is a recordable IRD that fulfils all mandatory requirements specified in this chapter 14 (and relevant part in chapter 12 and 13), which among other things includes support for series recording, accurate recording, split recording etc. *(A NorDig IRD with some recording capability but which do not meet all mandatory NorDig PVR requirements is just a “NorDig IRD with recording capability”).*

NorDig recordable iDTVs that can not fulfil the requirements for Simultaneous Recording (section 14.3.8), is anyway recommended to support the other NorDig PVR requirements (like series recording, accurate recording, split recording, playback features etc).

Programming a recording (or booking) in the PVR refers to the user action of making a booking to record a live event, series and/or other broadcast content, either to be scheduled in the future or for immediately recording.

## General - PVR

### Recording File System

The NorDig PVR **shall** at all times keep a file system of the PVR’s recordings and make them available upon request for the user to select and playback.

The user **shall** be able to list the recordings as:

* all recordings, as ordered by date&time

The user should be able to list the recordings as:

* all series (where all episodes of a series are group into same item in the list) and all non-series recordings
* all episodes of a specific series

For all recordings that have been programmed via the ESG or EPG, each recorded item in the NorDig PVR’s list of recordings **shall** display for the user at least information about the recorded event’s date of recording and event\_name extracted from EIT data during the recording. If no event information is available for a specific recording, then the service\_name **shall** be used. For manual recording that span several events (excluding split events, see below), it is recommended to use the service\_name instead.

In addition, the NorDig PVR’s list of recordings should display information about the item’s time and duration of the recording and the description taken from the EIT (preferably all EIT data for the event, like short and extended description, etc). The description of the event (preferably from the EIT p/f data) could typically be presented when highlighting the recorded item in the list of recordings.

Due to the latency within all transmission of EIT data, it is recommended to wait 1 minute after the event’s start\_time or until the event’s running status has become ‘running’ before acquire the event’s EIT data (if EIT p/f is used).

The time and date in the list of recordings **shall** use the local time offset (based on the user’s preferences settings), as applicable at the time of recording.

A NorDig PVR with IP front-end may use equivalent data to EIT data to display information about recorded items, if no EIT data is available inside the IP Network (as specified by the Operator).

### Recording capacity

### Deletion of recordings

### Failed and incomplete recordings

The NorDig PVR **shall** have a mechanism for informing the user of failed or incomplete (partial) recordings. For incomplete (partial) recordings it should inform the user how much of the booked event has not been successfully recorded.

### Save only the last number of episodes

The NorDig PVR should be able to let the user set the PVR to save/keep a configurable number of the latest events (episodes) within a Series. If the user has set the NorDig PVR to keep a specific number of events in a series and the NorDig PVR has recorded more, then the NorDig PVR **shall** automatically remove the “oldest” event (without any additional user confirmation).

The criteria to decide which event is the “oldest” within a Series, **shall** be based on which event has the lowest TVA programme CRID value. If the NorDig PVR can not easily decide which event that has the lowest TVA programme CRID value (for example due to lack of digits inside the TVA programme CRID), then the PVR **shall** keep all recordings from that Series.

### File system intact after update

### Limitations in local storage, interfaces, extraction and removable media for recordings

Some of the broadcasted content is signalled as protected, for example via the CA-system, copyright and/or copy protection signalling as specified by the relevant network/CA operator.

The requirements for external interfaces of recordings, internal storage, limitation for extraction of protected content and for removable media for the NorDig PVR and other NorDig recordable IRDs are specified by the relevant network/CA operator.

For protected content (unless otherwise specified by the relevant network/Operator), it **shall** not be possible to extract or output content from the NorDig PVR and other NorDig recordable IRDs in un-protected format, therefore all recordings **shall** be stored in a protected format.

Some networks and operators require local scrambling for all recording, some other allows either local scrambling or original DVB scrambling etc.

NorDig PVRs’ and other NorDig recordable IRDs using standardised removable media, such as DVD or Blu-ray for recording of protected content **shall** downscale any content with higher resolution than SD (i.e. higher than 720x576i25 or 960x540p50) to SD resolution (maximum 720x576 or 960x540) before storing it to the removable media. Content with HD resolution or higher may be recorded in its original resolution if the recording retains the original broadcast scrambling or any other local device scrambling approved by the Network/Operator. The downscaling should be made as specified in 5.11.

### Disk management / de-fragmentation

### Safe margins

### NorDig Record Lists functionality

## PVR Recording

### General PVR recording

The NorDig PVR **shall** as a minimum support recording up to 20 Mbps per (SD/576i) service and **shall** as a minimum support recording up to 30 Mbps per (HD/1080i/720p) service. The NorDig HEVC PVR **shall** in addition as a minimum support recording up to 25 Mbps per (Full HD/1080p) service and **shall** as a minimum support recording up to 45 Mbps per (UHD/2160p) service.

The NorDig PVR **shall** be able to record all supported service types (TV, radio etc) and its components (as described in 14.3.9).

On-screen informational messages or menus generated by the NorDig PVR **shall** not be recorded with the programme content.

### ESG/EPG recording programming

### Series recording

### Split recordings

### Recommended events

### Alternative instance

When scheduled recordings overlap, the NorDig PVR should use the alternate instance information (1), when provided, to record one or more of the programmes at their alternate times thereby minimising the conflict, subject to any device limitations (e.g. available space).

Where a programme is repeated in its entirety a broadcaster may assign the same programme CRID to both EIT events. The NorDig PVR should detect an alternative instance of a programme (as when two events have same programme CRID). This can be used to assist in resolution of booking conflicts. Where alternate instances belong to the same series this allows the NorDig PVR to only record a single showing of each episode, usually the first.

### Accurate Recording

### Simultaneous recording

### Full service recording

The NorDig PVR **shall** be able (factory default) for all recordings to 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 etc), excluding any HbbTV or other API related streams (Any HbbTV related streams are optional to be included in the recording).

Note: For a NorDig PVR using removable media formats (such as DVD or Blu-ray) for recordings, such devices **shall** include all supported components/PIDs for that format and any subtitling **shall** (according to the user preference settings) be burnt in to the video or converted into a supported subtitling format. Observe the limitation specified above for removable media.

### Trailer booking/Promotional Linking (optional)

### Back-to-back recording

### Timeshift recording

### Late Recording

### Manual recording

### One touch recording (OTR)

### Automatic conflict handling

### Maximum length of recordings

### Recording of recently removed recordings

### Recording of parallel broadcast and simulcast

### NorDig Record Lists recording functionality

## Playback

### General

The NorDig PVR **shall** be able to playback recordings of all supported service types (TV, radio etc) and all belonging components/PIDs (as described in 14.4.5).

Only the service related interactive applications from the current viewed service (live or playback) are required to be active, this means that during playback all interactive applications from the live service in the background may be terminated.

### Replay/Playback – trick modes

### Relative Synchronisation

### Simultaneous recording and playback

### Full service playback

During playback of recorded content, the user **shall** be able to perform the same full service selection as would have been possible during basic live viewing, such as select audio and/or subtitling language (if several components with same type are available), switch subtitling on or off, select audio format etc (with the limitation outlined in section 14.3.9). The basic live viewing refers to all streams excluding any HbbTV related streams. Dynamic changes in the services (such as a change of video aspect ratio or change of audio format) that occur during the recording **shall** be processed in the same way as during live viewing.

During playback, the NorDig PVR **shall** be able to set the same control as during live viewing, for example blanking of video and muting of sound depending on the event’s parental rating values (see 14.3.2) and signal protection (HDCP) on its digital output interface (see 9.9.4). For cases where the information is coming from EIT data (like parental rating descriptor), the playback **shall** at least act on the EIT signalling at the start of the recording (see 15.2.1). For the cases where the information is coming from PMT or the elementary streams (like signal protection and aspect ratio), the playback **shall** perform the same as live viewing and following any changes therein (i.e. PMT and elementary stream header information **shall** be stored and processed during playback).

### Resume Playback

### NorDig Record Lists management and playback functionality

# IRD System Software and API

## NorDig Basic IRD

The NorDig Basic TV IRD **shall** have a system software for interpretation and handling of the active service information and control of the local hardware/software.

## NorDig HbbTV IRD

The NorDig HbbTV IRD **shall** support all mandatory features and requirements of HbbTV v2.0.2 (1) as specified in ETSI TS 102 796 v1.5.1 (1) specification [27] or later version, including the most recently published errata (2) from the HbbTV Association.

NorDig HEVC iDTVs **shall** support HbbTV according to above.

The NorDig HbbTV IRD **shall** have a broadband interface in accordance with NorDig Section 8.3 (two-way interface).

The NorDig HbbTV IRD **shall** have HbbTV feature as enabled by default (see Section 16.3). It **shall** have a menu option to allow user to enable / disable the HbbTV feature as a whole and it should have a menu option to allow user to enable / disable the HbbTV feature service by service.

The implementation of the HbbTV in the NorDig HbbTV IRD **shall** be verified by the manufacturer, the verification testing is based on self-testing by manufacturer (unless otherwise specified by the relevant network/Operator). Verification testing of the HbbTV parts of NorDig HbbTV IRD **shall** be based on HbbTV test specification [79] and HbbTV test suite [23] (3) plus the extra HbbTV test cases defined by NorDig, for more information see NorDig Test Plan.

NorDig mandates some of the requirements that are optional in HbbTV [27], this also means that relevant test cases in the HbbTV test suite [23] also have to be performed successfully (for more information see NorDig Test Plan).

NorDig broadcast member may request to get a copy of the manufacture’s HbbTV Verification Test report with test results, before approving HbbTV IRD on the market.

Note 1: Optionally NorDig HbbTV IRDs released before 1 July 2020 may instead support all mandatory features and requirements of HbbTV v2.0.1 as specified in ETSI TS 102 796 v1.4.1 [80] including updates by published errata from the HbbTV Association, for HbbTV v2.0.1 at least Errata #1 shall be supported and from 1 July 2019 also Errata #3. At the time of writing (October 2018), the most recent published errata to HbbTV v2.0.1 is errata #3).

Note 2: Updates and corrections in errata shall be implemented within six months for new IRDs after HbbTV organisation published Errata, in order to give IRD manufacture a reasonable time for implementation. The IRD manufacture may ask for extra time for adjusting for a correction/update in the errata that has significant impact on the time of implementation.

Note 3: NorDig HbbTV IRDs implementing HbbTV v2.0.1 [80] as permitted by the grace period defined above in note 1 also need to pass the same HbbTV test suite [23] as those implementing HbbTV 2.0.2. The test suite lists which test cases are applicable to IRDs implementing different specification versions.

Note: NorDig members will typically use Nordic and Irish languages in text strings in HbbTV and some cases use multiple languages within one and the same HbbTV application, observe that the NorDig HbbTV IRD **shall** as stated in HbbTV specification [27] support all characters in these languages and multiple languages.

# User Preferences

## General

The user **shall** be able to store preference settings in persistent memory. All user preference settings listed below **shall** remain when changing service and when re-starting the IRD. The following user preferences **shall** be implemented in the NorDig IRD, unless it is stated below as optional (should) requirement. (See section 16.4 for factory default values).

## User Preference Settings

### General User Preference Settings

The user **shall** be able to select storable user preferences (stored as persistent settings) for following General related functions (see section 16.4 for factory default values):

* Service list as defined in section 13.2.
* Country setting based on country code [47] for pre-selection of the primary menu, primary audio language, primary subtitle language settings and channel list selection as defined in 12.2.9.3.
* Talking menus/Text-to-Speech preferences as defined in section 13.6.2, if this optional feature is supported by the IRD.
* SSU setting(s) to select whether system software upgrades are allowed or not if the IRD supports Fully Automatic mode. See chapter 10 more details and 16.4 for factory default for this.
* HbbTV setting(s) for NorDig HbbTV IRD as defined in section 15.2.

The following user preferences should be provided for NorDig IRDs:

* HDCP preferences as specified in sections 8.6.4.

### Video User Preference Settings

The user **shall** be able to select storable user preferences (stored as persistent settings) for following video related functions (see chapter 16.4 for factory default values):

* HDMI Video preferences for Output video format, as set by the user:
1. Automatic mode, based on use of E-EDID, as specified in section 8.6.1.2
2. Fixed format, as specified in section 8.6.1.2

### Audio User Preference Settings

### Subtitling User Preference Settings

## Deletion of service lists

## Reset to factory mode

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

The factory mode should be set to the following:

|  |  |
| --- | --- |
| **Factory default settings for IRDs (where supported)** | **Setting** |
| RF input DC power supply source for satellite front-end: | On |
| RF input DC power supply source for terrestrial front-end:  | off (1) |
| RF-output preset channel:  | Channel 43 (PAL-G) (2) |
| RF bypass gain | Disabled |
| Menu language:  | equal to country settings |
| Audio type (Normal, Audio Description, Spoken Subtitling or all Supplementary Audio) (4) | Normal (3) |
| Primary audio language: | equal to country settings |
| Dialogue Enhancement | Off |
| Audio format setting: | Stereo |
| Subtitling (normal):  | On |
| Primary subtitling language: | as country settings |
| Subtitling; hard of hearing/hearing impaired: | Off |
| HbbTV Interactivity | On |
| HDMI Audio output | Automatic, using E-EDID information  |
| HDMI ARC Audio output | Automatic, using CEC Short Audio Descriptor message |
| HDMI eARC Audio output | Automatic, using eARC Capability Data Structure information |
| HDMI Video output | Automatic using E-EDID information |
| HDCP | ON or as specified by the relevant network/ CA operator see section 8.6.4 (5) |
| SSU | If this menu item is supported, a value that disables Fully Automatic mode (6) |
| PVR recording priority, SD vs HD | HD |
| Talking menus (Text-to-Speech), optional | Off |
| Parental Control | Disabled |
| Note 1: In the first time installation and resetting to factory default settings, the DC power supply **shall** be switched off. It is recommended that the receiver ask if the DC power supply is turned on in the first time installation and in the installation after resetting to factory settings, to speed up the initialisation procedure.Note 2: Applicable for IRDs with RF PAL modulatorNote 3: Mode ‘Normal’ refers to Audio type 0x00 'Undefined' For the case of an IRD implementing audio type with two separate settings (Audio Description plus Spoken Subtitling), this mode ‘Normal’ refers to that Audio Description off and Spoken Subtitling off. Note 4: Supplementary Audio (SA) refers here to both Audio Description (AD) and Spoken Subtitling and (SS). Note 5: The IRD should provide an option to manually set the HDCP default to “ON” or “OFF”, or “AUTO”, see section 8.6.4.Note 6: Settings for SSU (System Software Update) may be implemented as one combined setting or several settings for different parts. The settings required will depend on the combination of modes supported (see 10.2) but could, for example, take the form of “Enable/Disable” or “Fully Automatic / Semi Automatic”. |

Table 16.1 Factory default settings for IRDs

1. : NorDig Members and Partners
2. : Background and options for IRDs with a terrestrial front-end
3. : Placeholder for changes in 13.4 for IP-based IRDs.
4. : Implementations Guidelines for best service selection in automatic channel search in terrestrial networks
5. : Raw carrier to noise values, (C/N)RAW
6. : Recommendation for menu wordings and translations
7. : Guidelines for NorDig IRD audio selection
8. : Loudness levels – Typical IDTV Audio Block diagram
9. : Examples of Signalling to be used for audio property
10. : Comparison of NorDig profiles