

Requirements to NorDig compliant PVR IRDs

Addendum to the

NorDig Unified Requirements (ver 2.0)

for

Integrated Receiver Decoders

for use in

cable, satellite, terrestrial and IP-based networks

Background to this PVR Addendum

This document specifies the requirements for NorDig compliant **PVR IRDs** for reception, recording and handling of HDTV and SDTV signals that target NorDig compliant receivers.

This document refers to the NorDig Unified Requirements version 2.0 (“NorDig-Unified”) with additional requirements and comments, in order to provide the performance minimum additional requirements for NorDig PVR IRDs. The following notations are used:

Unchanged (black print on shaded background) if there are complete chapters or sections in NorDig Unified that remain unchanged, without any additions, the text is skipped in this document and replaced by the word.

In chapters that have been modified or changed compared to the NorDig Unified version 2.0, the chapter’s complete original text is included as unmarked text (in black). Original text that has been removed/changed compared to the NorDig Unified v2.0 is still included but marked as ~~line-through~~ text.

New text (marked in yellow) is new requirement/text or modified text compared to the NorDig Unified version 2.0 that has been added or changed for the NorDig PVR.

This addendum will be kept as a separate document for some time, but the text will be merged into a NorDig Unified document in the future.

It should be noted that the NorDig specifications use the term “IRDs”, which includes both separate receiver units (Set Top Boxes = STBs) and relevant parts of Integrated Digital TV-sets (IDTVs).

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1 Introduction

1.1 Scope

This document specifies a set of 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. The specifications cover IRDs, both as separate units (set-top-boxes) and as relevant parts of integrated digital TV-sets.

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

The NorDig I specification was first issued in 1998 when the common DVB API solution had not taken specific direction and based on the technical status of that time. The NorDig II specification was first issued in 2000 and added some hardware and software requirements mainly to include a standard API, as specified for the DVB MHP Interactive Broadcast profile.

The NorDig Unified Requirements were first issued in 2002 and included the profiles; **Basic TV**, **Enhanced**, **Interactive** and **Internet Access**, in addition to the initial **NorDig I** profile. The NorDig Unified specification included the NorDig I and NorDig II specifications, plus new requirements for the Basic TV, Enhanced Broadcast and Internet Access profiles; the MHP Internat Access profile has, however, later been removed from the NorDig Unified Requirements.

The **NorDig Basic TV profile** corresponds to basic requirements for digital broadcasting, services that do not depend on enhancements by applications or interaction. This profile is a subset of the Enhanced Profile.

The **NorDig Enhanced profile** covers the NorDig requirements for enhanced services that do not depend on an interaction channel, but depend on a standardized API, based on the DVB-MHP 1.1 Enhanced Broadcast Profile. The Enhanced profile is a subset of the Interactive profile.

The **NorDig Interactive profile** (NorDig II) covers the NorDig requirements for interactive services, including a standardized API, based on the DVB-MHP 1.1 Interactive Broadcast Profile.

The various profiles refer both to the **SD Level**, which includes SDTV based on MPEG 2 video compression and **HD Level**, which also includes HDTV and SDTV, based on MPEG 4 AVC video compression. The NorDig profiles at HD Level are furthermore specified with some additional requirements, reflecting necessary enhancements for the provision of HDTV, and improvements in front-end performance. The NorDig HD Level IRD (“HD-IRD”) is specified to include the NorDig SD Level; i.e. backward compatibility with existing SDTV transmissions will be provided by NorDig compliant HD-IRDs.

The NorDig Unified specification text relates to all profiles. All requirements specified in this document are mandatory unless otherwise specified.

Figure 1.1 indicates the relationships between the NorDig profiles at **SD Level**, and the various building blocks.

Figure 1.2 indicates the relationship between the NorDig profiles at **HD Level** and the various building blocks; note that e.g. NorDig Basic profile at HD Level also includes the NorDig Basic Profile at SD Level.

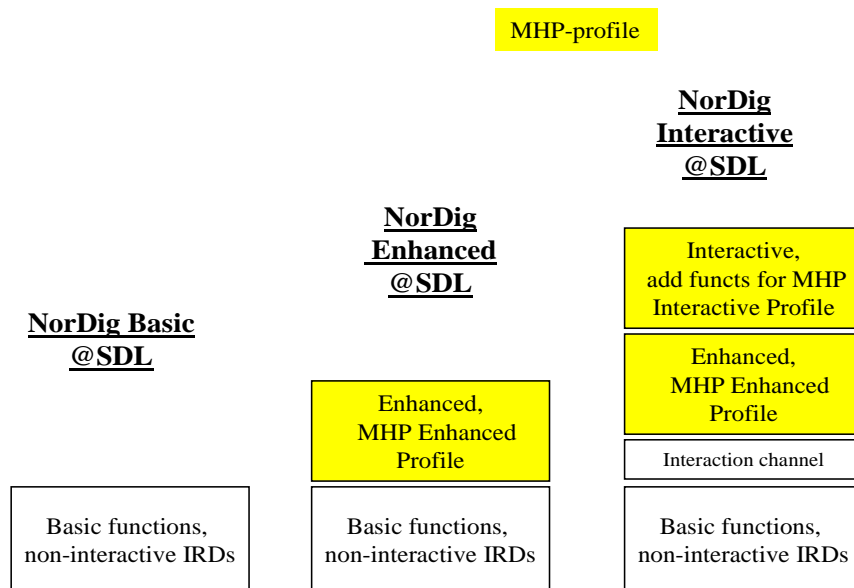


Figure 1.1 The NorDig profiles and the building blocks at SD IRDs

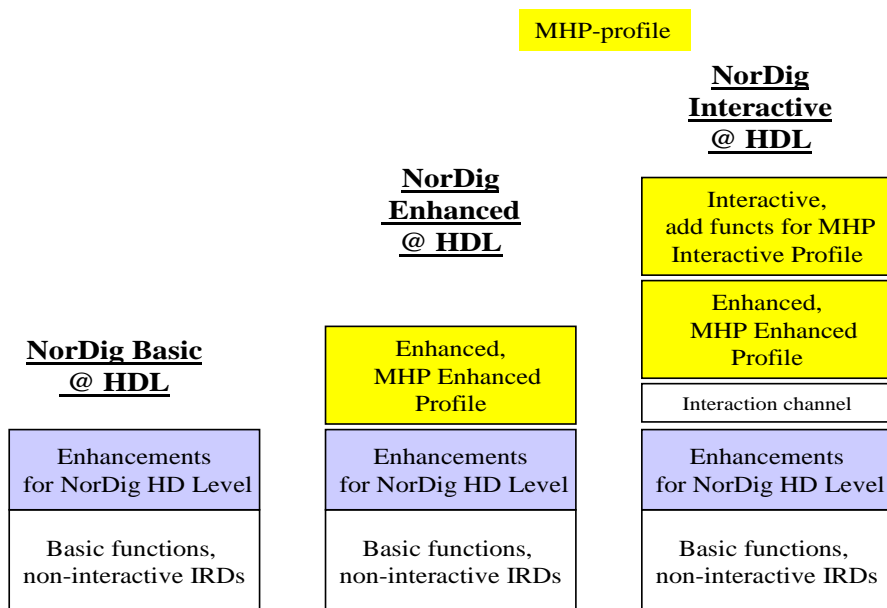


Figure 1.2 The NorDig profiles at HD Level IRDs. The HD Level includes enhancements to provide HDTV (and SDTV) based on MPEG 4AVC compression.

In addition to the different versions of the NorDig IRDs above, the NorDig IRDs may include support for recording services and later playback of them as specified here, then becoming a NorDig PVR IRD (or simply a NorDig PVR).

The NorDig Unified Requirements were updated in 2003, in 2004/2005 (Version 1.0.2) and in 2006 (version 1.0.3) when the IPTV-Addendum was merged into the text; in addition some new requirements were introduced as mandatory after a specified grace period. These requirements were all based on the SD Level only.

This version 2.0 includes the NorDig HDTV-Addendum; i.e. requirements to both SD- and HD- level IRDs and some updates to the older specification text.

It should be noted that compliance with the NorDig requirements will require full compliance with at least one of the specified sets of level/ profiles; SD/Basic, Enhanced or Interactive or HD/Basic, Enhanced or Interactive.

NorDig has also specified NorDig Rules of Operation for NorDig compliant networks [60], 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** [60] and the **NorDig Test Specifications** [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 Specifications** [62].

1.2 Document History

Version	Date	Comments
NorDig PVR Addendum ver. 2.0	09.03.2009	<p>This is the first version of the approved NorDig PVR specification. This specification includes the additional requirements for a NorDig IRD to become a NorDig PVR.</p> <p>This specification includes mainly new requirements but some few modifications have been made to the basal NorDig Unified specification (version 2.0), mainly regarding</p> <ul style="list-style-type: none"> - Remote Control (section 9.7), added PVR features - SI (chapter 13), added new descriptors for PVRs and some other changed - ESG (section 14.3). added support for 8 days ESG based on EIT sch PVR chapter (new chapter 15)

1.3 Terminology

Unchanged.

Shall (Mandatory) This word means that the item is mandatory.

Should (Recommended) This word means that this item is not mandatory, but is highly recommended.

1.4 Definitions

NorDig Basic

The NorDig Basic IRDs (hereafter denoted NorDig Basic) consist of a user terminal, including all possible low to high functionality implementations and its associated peripherals. NorDig Basic is specified as a subset of this unified NorDig-specification.

NorDig Enhanced

The NorDig Enhanced IRDs (hereafter denoted NorDig Enhanced) consist of a user terminal, including all possible low to high functionality implementations and its associated peripherals. NorDig Enhanced is specified as a subset of this unified NorDig-specification.

NorDig Interactive

The NorDig Interactive IRDs (hereafter denoted NorDig Interactive) consist of a user terminal, including all possible low to high functionality implementations and its associated peripherals. NorDig Interactive is specified as a subset of this unified NorDig specification.

Integrated Receiver Decoder (IRD):

Set-top-box (STB) or relevant parts of integrated digital TV (iDTV)-set.

SD-level IRD (“SD IRD”):

IRD that is based on **only** MPEG 2 video compression.

HD level IRD (“HD IRD”):

IRD that is based on MPEG 4 AVC video compression, in addition to MPEG 2 video compression. HD-level IRDs shall satisfy all requirements specified for SD level IRDs, unless stated otherwise.

NorDig PVR:

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 disk). The NorDig PVR (Personal Video Recorder) shall satisfy all requirements specified for a NorDig IRD (at either HD or SD level as applicable), unless stated otherwise

1.5 References

- | | | |
|-----|-----------------------------|---|
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| [3] | CEA 861-D | Consumer Electronics Association (CEA): A DTV Profile for Uncompressed High Speed Digital Interfaces, July 18, 2006 |
| [4] | Dolby Technical Bulletin 11 | Dolby Technical Bulletin 11: Requirement Updates for Dolby Digital and Dolby Digital Plus in DVB Products |
| [5] | DVB A 011 | Common Scrambling Algorithm. DVB Blue Book A011. |
| [6] | EICTA HD Ready | EICTA, European Information & Communications Technology Industry Association, “HD ready” Minimum Requirements, www.eicta.org |

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- [12] EN 61319-1 Interconnections of satellite receiving equipment - Part 1: Europe.
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Part 1-2 v1.9.0 Digital Enhanced Cordless Telecommunications (DECT); Common Interface (CI);
Part 1: Overview
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1.6 List of Abbreviations

AFC	Automatic Frequency Control
AFD	Active Format Descriptor
AFNOR	Association Francaise de Normalisation
API	Application Programming Interface
BAT	Bouquet Association Table
BCD	Binary Coded Decimal
BDR	Broadcast Discovery Record (part of SD&S)
BER	Bit Error Ratio
BOOTP	Bootstrap Protocol
bslbf	bit string, left bit first
C/N	Carrier to Noise ratio
CA	Conditional Access
CAT	Conditional Access Table
CATV	Community Antenna Television
CEA	Consumer Electronics Association (North American Association)
CENELEC	Comité Européen de Normalisation Electrotechnique
CI	Common Interface
CID	Content Identifier descriptor

CIF	Common Intermediate Format
CRC	Cyclic Redundancy Check
CRID	Content Reference IDentifier
CSO	Composite Second Order
CTB	Composite Triple Beat
CVBS	Composite Video Baseband Signal
D/A	Digital-to-Analogue converter
DAD	Default Authority Descriptor
DAVIC	Digital Audio-Visual Council
dBFS	dB Full Scale
DDS	Display definition segment
DDWG	Digital Display Working Group
DECT	Digital Enhanced Cordless Telecommunications
DHCP	Dynamic Host Configuration Protocol
DSB	Double SideBand
DSM-CC	Digital Storage Media Command and Control
DVB	Digital Video Broadcasting
DVB-C	Digital Video Broadcasting - Cable
DVB-data	Digital Video Broadcasting - Data Broadcasting
DVB-MHP	Digital Video Broadcasting - Multimedia Home Platform
DVB-S	Digital Video Broadcasting - Satellite
DVB-T	DVB-Terrestrial
EBU	European Broadcasting Union
ECCA	European Cable Communications Association
ECL	EuroCableLabs, technical cell of ECCA
EICTA	European Information & Communications Technology Industry Association
EIT	Event Information Table
EITp/f	Event Information Table, present/following tables
EITsch	Event Information Table, schedule tables
EITp	Event Information Table, present table/section of EITp/f
EITf	Event Information Table, following table/section of EITp/f
EPT	Effective Protection Target
EPG	Electronic Program Guide (based on API)
ESG	Event Schedule Guide (without any API)
FFT	Fast Fourier Transform
GAP	Generic Access Protocol
GOP	Group Of Pictures
GPRS	General Packet Radio System
GSM	Group Special Mobile
HDCP	High-bandwidth Digital Content Protection
HDMI	High-Definition Multimedia Interface
HDTV	High Definition Television
HTTP	HyperText Transfer Protocol
IDTV	integrated Digital TV
IEC	International Electrotechnical Commission
IEEE	Institute for Electrical and Electronic Engineers
IEFT	Internet Engineering Task Force
IGMP	Internet Group Management Protocol
INA	Interactive Network Adapter
IP	Internet Protocol
IRD	Integrated Receiver Decoder
ISO	International Organisation for Standardisation
JTC	Joint Technical Committee
LCD	Logical Channel Descriptor

LCN	Logical Channel Number
MAC	Medium Access Control
MHP	Multi Media Home Platform
MPEG	Moving Pictures Expert Group
MTU	Maximum Transfer Unit
NEM	Network Element Management
NIC	Network Interface Card
NIT	Network Information Table
NT	Network Termination in general
NVOD	Near Video On Demand
OSD	On Screen Display
OSD	On-screen display
PAL	Phase Alternating Line
PAT	Program Association Table
PID	Packet IDentifier
PMT	Program Map Table
PSI	Program Specific Information
PSTN	Public Switched Telephone Network
PVR	Personal Video Recorder, (same as PDR, Personal Digital Recorder, or DVR)
QAM	Quadrature Amplitude Modulation
QCIF	Quarter Common Intermediate Format
QEF	Quasi Error Free
QoS	Quality of Service
QPSK	Quaternary Phase Shift Keying
RF	Radio Frequency
RFC	Request For Comments
RMS	Root Mean Square
RoO	Rules of Operation
rpchof	remainder polynomial coefficients, highest order first
RS	Reed-Solomon
RST	Running Status Table
RTCP	Real-Time Transport Control Protocol
RTP	Real-Time Transport Protocol
RTSP	Real Time Streaming Protocol
SAP	Session Announcement Protocol
SD&S	Service Discovery and Selection
SDT	Service Description Table
SDTV	Standard Definition Television
SFN	Single Frequency Network
SI	Service Information
SMATV	Satellite Master Antenna Television
SNTP	Simple Network Time Protocol
ST	Stuffing Table
STB	Set-top box
SW	Software
TCP	Transmission Control Protocol
TDT	Time and Date Table
TFTP	Tunnelling File Transfer Protocol
TOT	Time Offset Table
TPS	Transmission Parameter Signalling
TS	Transport Stream
TV	Television
UHF	Ultra-High Frequency
uimsbf	unsigned integer most significant bit first



NorDig

UTC	Universal Time, Co-ordinated
VCR	Video Cassette Recorder
VHF	Very-High Frequency
VHS	Video Home System
VoIP	Voice over IP
VPN	Virtual Private Network
VSB	Vestigial SideBand
xDSL	x Digital Subscriber Line
XML	Extensible Markup Language

2 General Features of the NorDig IRD

2.1 Introduction

Unchanged.

2.2 IRD Hardware and Firmware

Unchanged for sections 2.2.1-2.2.15

2.2.16 Additional hardware/firmware for the PVR features

The NorDig PVR will include embedded or attached hardware/firmware (not shown in figure 2) for recording of 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), see section 15.3.

2.3 System Software and API

2.3.1 Introduction

Unchanged

2.3.2 Principal Software structure

Unchanged

2.3.3 System Software

Unchanged

2.3.4 NorDig APIs

Unchanged

2.3.5 PVR related software

The NorDig PVR includes additional software for handling of the PVR features, see chapters 13 and 15, and section 14.3.

2.4 General Product Requirement

Unchanged



PART A: Hardware and Firmware

3 The Frontend of the NorDig IRD

3.1 *Common Features*

Unchanged

3.2 *Satellite Tuner and Demodulator*

Unchanged

3.3 *Cable Tuner and Demodulator*

Unchanged

3.4 *Terrestrial Tuner and Demodulator*

Unchanged

3.5 *IP Based Front-End*

Unchanged

4 MPEG-2 Demultiplexer

4.1 *General*

Unchanged

4.2 *DVB Descrambler Performance*

Unchanged

4.3 *System Clock Recovery*

Unchanged



NorDig

5 Video Decoder

Unchanged

5.1 *Requirements for Video Decoder in NorDig SD IRDs*

Unchanged

5.2 *Additional requirements for Video Decoder in NorDig HD IRDs*

Unchanged



NorDig

6 Audio Decoder

Unchanged

6.1 *Requirements for Audio Decoder in NorDig SD IRD*

Unchanged

6.2 *Additional Audio Decoder requirements for HD IRDs*

Unchanged



NorDig

7 Teletext and Subtitling

7.1 *Teletext*

Unchanged

7.2 *DVB Subtitling*

Unchanged



NorDig

8 Graphics Processing

Unchanged

9 Interfaces and Signal Levels

9.1 Introduction

Unchanged

9.2 RF- bypass (option)

Unchanged

9.3 Interaction Channel Interface

Unchanged

9.4 SCART Interfaces

Unchanged

9.5 Audio Output Interfaces (Option)

Unchanged

9.6 Data Interface (Option)

Unchanged

9.7 Remote Control Interface

9.7.1 General

Unchanged

9.7.2 Functions

The remote control for the NorDig IRD shall include the following functions:

9.7.2.1 Numeric Entry

Unchanged

9.7.2.2 Basic TV Functions

Unchanged

9.7.2.3 Digital TV Functions

Unchanged

9.7.2.4 PVR Functions

The NorDig PVR IRD functions specified in chapter 15 shall be available via the remote control, using dedicated PVR keys or multifunctional keys or a combination of these. The Manufacturer shall state in the manual how to operate the NorDig PVR IRD's PVR features via the Remote Control.

The NorDig PVR IRD's remote control should include the following keys for PVR functionality. If present, they shall perform the following stated function:

- List of recordings – opens a screen with list of recordings (can be both history and booked).
- OTR – One-Touch-Recording
- Record – Start manual recording / start recording of present event.
- Timeshift – "pause" live TV (timeshift)
- Pause – pause Playback of recording.

- Play – start playing timeshift TV / start playback of recording.
- Stop – stop recording / stop timeshift / stop playback.
- Fast Forward – fast forward of the timeshift or recording (with different speeds).
- Fast Rewind – fast rewind of the timeshift or recording (with different speeds).

Note: Some keys may be multifunctional, including several IRD features using the same key. For example in a PVR the Timeshift and Pause functions or OTR and Record functions may be achieved using the same key.

The NorDig PVR should have the following functions available via the remote control. If present, they shall perform the stated function:

- Slow Forward – slow forward of the timeshift or recording (with different speeds).
- Slow rewind – slow rewind of the timeshift or recording (with different speeds).
- Jump – go to a specific time in the recording / fast jump to a manufacture defined fixed time or to next index point.
- Index – insert index point into recording

9.7.2.5 Design and Labelling

The manufacturer is free to modify the design of the remote control and the labelling of the Basic TV, "Navigator", "EPG" and "Application" -functions. All other functions should be labelled as in the conceptual illustration of the NorDig IRD remote control in Figure 9.1.

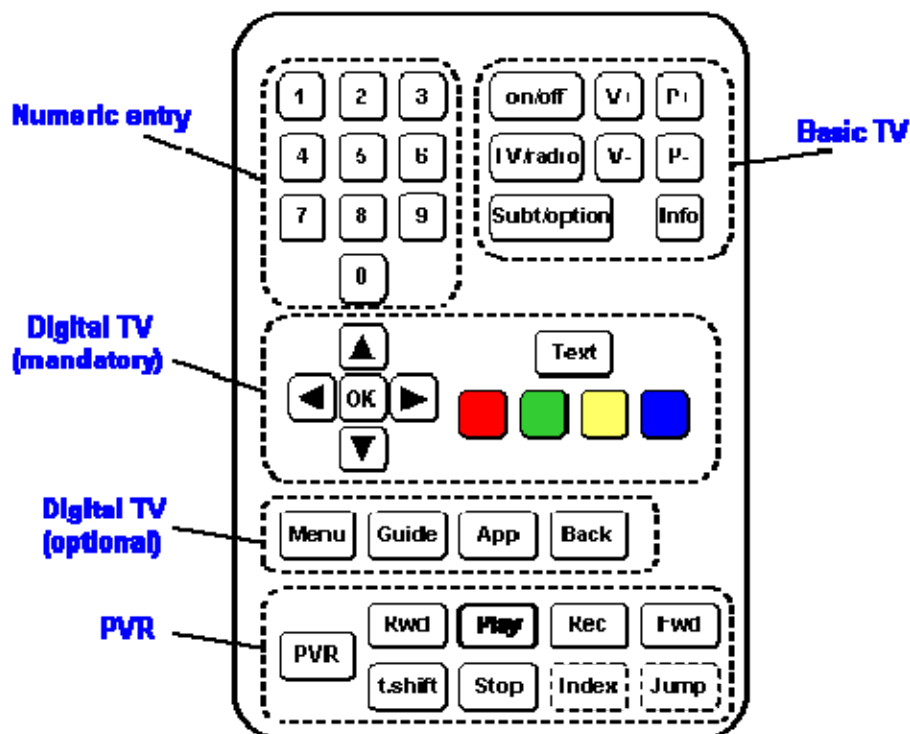


Figure 9.1 Conceptual illustration of the NorDig IRD remote control

9.7.2.6 Mapping of Key Events

Unchanged



NorDig

9.8 *Remote Keyboard Interface (Option)*

Unchanged

9.9 *The HD Interface for NorDig HD IRDs*

Unchanged.

9.10 *Additional analogue interfaces (optional) for NorDig HD IRDs*

Unchanged

10 Interfaces for Conditional Access

10.1 *General*

Unchanged

10.2 *Use of the DVB Common Interface*

Unchanged

10.3 *Use of Smart Card Reader*

Unchanged

11 The Bootloader (System Software Update)

11.1 *Introduction*

Unchanged

11.2 *Over-the-air/in-network via Broadcast Download*

Unchanged

11.3 *Local Download*

Unchanged

11.4 *Network Management and Provisioning*

Unchanged



NorDig

12 Performance

Unchanged

12.1 Introduction

Unchanged

12.2 Video Performance of RGB and PAL Signals

Unchanged

12.3 Audio Performance of the Decoded Digital Signal

Unchanged

12.4 Zapping Time for TV Services

Unchanged

Part B: The system software with application

Descriptor	Tag value	NIT (3)	BAT	SDT	EIT	TOT/TDT	CAT	PMT
service_identifier_descriptor	0x71	-	-	Ob Mr (1)				
default_authority_descriptor (4)	0x73	Ob Mr (4)	-	Ob Mr (4)	-	-	-	-
content_identifier_descriptor (4)	0x76	-	-	-	Ob Mr (4)	-	-	-
user defined	0x80-0xFE	-	-	-	-	-	-	-
NorDig private: logic_channel_descriptor (Version 1)	0x83	Ob Or	-	-	-	-	-	-
NorDig private: logic_channel_descriptor (Version 2) (3)	0x87	Ob Mr	-	-	-	-	-	-
Forbidden	0xFF	Fb	Fb	Fb	Fb	Fb	Fb	Fb
<p>- Descriptor not applicable or not yet used as minimum within NorDig</p> <p>Mb Mandatory to Broadcast, always/all time</p> <p>mb Mandatory to Broadcast if applicable, i.e. if certain criteria is met (e.g. if scrambling is used)</p> <p>Ob Optional to broadcast, but recommended (if applicable)</p> <p>Fb Forbidden to broadcast (may cause misinterpretation)</p> <p>Mr Mandatory to receive and interpret if broadcast</p> <p>Or Optional to receive and interpret (if broadcasted)</p> <p>* Optional for satellite and cable IRDs.</p>								
Note 1:	Mandatory for IRD with MHP API based profiles							
Note 2:	Mandatory to broadcast, in accordance with ETSI TR 101 211 [28].							
Note 3:	Descriptors carried in the NIT are not relevant for IRDs with IP-based Front-end, see Annex C							
Note 4:	Optional for NorDig PVR IRDs that are released before 1 January 2011.							

Table 13.1 Overview over minimum used descriptors in NorDig broadcast and receivers

13.2 Network Information Table (NIT)

13.2.1 The Network information Table Descriptors

NIT descriptors	Cable IRD	Satellite IRD	Terrestrial IRD
Network_name_descriptor	mandatory	Mandatory	Mandatory
Service_list_descriptor	mandatory	Mandatory	Mandatory
Satellite_delivery_system_descriptor	n/a	Mandatory	n/a
Cable_delivery_system_descriptor	mandatory	n/a	n/a
Terrestrial_delivery_system_descriptor	n/a	n/a	Mandatory
Linkage_descriptor	mandatory	Mandatory	Mandatory
Private_data_specifier_descriptor	mandatory	Mandatory	Mandatory
Frequency_list_descriptor	optional	Optional	Mandatory
default_authority_descriptor (4)	Mandatory (4)	Mandatory (4)	Mandatory (4)
(NorDig) logic_channel_descriptor (Version 2)	Mandatory	Mandatory	Mandatory

Table 13.2 NIT descriptors

Note: The NIT is not used with NorDig IRDs with IP-based frontends. 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 14.4.

Note 4: Optional for NorDig PVR IRDs that are released before 1 January 2011.

13.2.2 Cable Delivery System Descriptor

Unchanged

13.2.3 Terrestrial Delivery System Descriptor

Unchanged

13.2.4 Linkage Descriptor

Unchanged

13.2.5 Frequency List Descriptor

Unchanged

13.2.6 NorDig linkage for bootloader

Unchanged

13.2.7 Default authority descriptor (in NIT)

The Default Authority Descriptor (DAD), defined in DVB document Carriage and signalling of TV-Anytime (TVA) information ETSI TS 102 323 [64], may be used to shorten the CRIDs carried within EIT by defining an appropriate CRID default authority over a defined scope.

The DAD may be used in first loop of NIT to set a common Default Authority (DA) for all services within that Network. It may also be used in second loop (TS loop) to set a common Default Authority for all services within a Transport Stream.

The prefix “crid://” may be omitted from the start of the text string in the Default Authority in the NIT (both first or second loop). See separate chapter about CRID usage in 13.4.7

As described in ETSI TS 102 323 [64], where an event in the EIT does not have a complete URL within the Content Identifier Descriptor (CID) (i.e. a CRID starting with '/'), the NorDig PVR IRD shall (1):

- Use default authority (DA) defined for this service in the SDT.
- If no default authority is defined in the SDT, the PVR shall use the default authority in the second TS loop of the NIT for the actual transport stream this service belongs too.
- If no default authority is defined for the actual transport stream in second loop of NIT, the receiver shall use default authority in first loop in NIT for the network this service belongs too.

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

Example of handling of CRID together with Default authority values.

Broadcast signalling		
DAD , Default Authority Descriptor	Default authority:	
in NIT, first loop	'network.se'	
in NIT, second loop for TS1	'ts1.network.se'	(no other TS has default authority in NIT TS loop)
in SDT, service 1 of TS 1	'provider_A'	(no other services has default authority in SDT)
<i>Service 1 in TS 1, Service 2 in TS 1 and Service 3 in TS 2 have all events with above Event1 and Event2</i>		
CID , Content Identifier descriptor	CRID in EIT for services:	
Event1	'/abc/soap_event12345'	Example with non-complete CRID
Event2	'abc/soap_event6789'	Example with complete CRID
Receiver CRID compilation		Interpretation within IRD of CID + DAD
Service 1 belonging to TS 1	Event 1	crid://Provider_A/abc/soap_event12345
Service 1 belonging to TS 1	Event 2	crid://abc/soap_event6789
Service 2 belonging to TS 1	Event 1	crid://ts1.network.se/abc/soap_event12345
Service 2 belonging to TS 1	Event 2	crid://abc/soap_event6789
Service 3 belonging to TS 2	Event 1	crid://network.se/abc/soap_event12345
Service 3 belonging to TS 2	Event 2	crid://abc/soap_event6789

13.2.8 NorDig private; Logic_Channel_descriptor (LCD)

Unchanged

13.3 Service Description Table (SDT)

13.3.1 The Service Descriptor Table Descriptors

SDT descriptors
Service_descriptor
CA_identifier_descriptor
Linkage_descriptor
Service_identifier_descriptor
Default_authority_descriptor (4)

Table 13.3 SDT descriptors

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

Note 4: Optional for NorDig PVR IRDs that are released before 1 January 2011.

13.3.2 Service Descriptor

Unchanged

13.3.3 CA Identifier Descriptor

Unchanged

13.3.4 Linkage Descriptor

Unchanged

13.3.5 Default authority descriptor (in SDT)

The default authority descriptor, defined in DVB document Carriage and signalling of TV-Anytime (TVA) information ETSI TS 102 323 [64], may be used to shorten the CRIDs carried within EIT by defining an appropriate CRID authority over a defined scope.

The DAD may be used in the descriptor loop of each service in the SDT to set a Default Authority for all events in that service which do not have a complete URL (see example in chapter 13.2.7 Default authority descriptor in NIT).

The prefix “crid://” may be omitted from the start of the text string in the Default Authority in the SDT (normally the “crid://” will be omitted within the transmission). See separate chapter for CRID usage in 13.4.7.

13.4 Event Information Table **Present/Following (EIT p/f)**

13.4.1 General

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

The NorDig IRD shall support EIT schedule (sch) (2) 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.

Note 2: EIT schedule is recommended (optional) for NorDig Basic without PVR and for NorDig IRDs with IP-based Front-end.

13.4.2 The Event Information Table Descriptors

Event p/f descriptors	EIT p/f	EIT sch
short_event_descriptor	M	M (2)
Component_descriptor	M	M (2)
Extended_event_descriptor	M	O
Content_descriptor	M	M (2)
Parental_rating_descriptor	M	M (2)
CA_identifier_descriptor (optional)	O	O
Content_identifier_descriptor (4)	M (4)	M (4)

Table 13.4 EIT descriptors

Note 2: EIT schedule is recommended (optional) for NorDig Basic without PVR and for NorDig IRDs with IP-based Front-end.

Note 4: Optional for NorDig PVR IRDs that are released before 1 January 2011.

13.4.3 Keyword Descriptor / New Private descriptor (WL 022, alt B)

<Keyword has been removed from this first NorDig PVR phase, will be part of next phase.>

13.4.4 CA Identifier Descriptor

Unchanged

13.4.5 Content Descriptor

Unchanged

13.4.6 Content Identifier Descriptor

The Content Identifier Descriptor (CID), defined in DVB document Carriage and signalling of TV-Anytime (TVA) information ETSI TS 102 323 [64], section 12.1, is used to associate a CRID to an event and is placed within the event loop of EIT. One or more instances of the descriptor may be present in the EIT (schedule and p/f) and a single descriptor may contain multiple CRIDs. Usage shall be consistent between EIT schedule actual and other within a Network. If a Content Identifier Descriptor is present in EITp/f, a NorDig PVR should use this in preference to the Content Identifier Descriptor for the same event in EIT schedule.

NorDig uses TV Anytime standard values for the `crid_type`, which are:

- 0x01, TVA programme CRID
- 0x02, TVA series CRID
- 0x03, TVA recommendation CRID

Only a single TVA programme CRID (`crid_type` 0x01) shall be associated with an EIT event.

The Content Identifier Table is not used in NorDig networks, (i.e. only `crid_location == '00'` is used).

All events having the same programme CRID (type 0x01), regardless of IMI (see ETSI TS 102 822-4 [65], Section 10), refer to the same programme content.

All events having the same series CRID (type 0x02) belong to the same series. An event may be associated with more than one series CRID. A CRID value may be reused after 91 days for other content.

13.4.7 CRID encoding and reuse

The CRID shall be according to ETSI TS 102 822-4 [65], Section 8. The use of abbreviated CRIDs shall follow the rules set out in ETSI TS 102 323 [64] Section 6.3.1.

The NorDig PVR shall (1) support a 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 utmost 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.

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

13.4.7.1 CRID type 0x01 – programme CRID

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.

13.4.7.2 CRID type 0x02 – series CRID

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 15.3.3).

13.4.7.3 CRID type 0x03 – recommendation CRID

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 (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.

13.4.7.4 Split programme (split content)

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.

13.4.8 Event Information Table Schedule

Upon user request for EIT schedule information, the IRD shall (1) look for the reference using linkage descriptor mechanism in the NIT and perform a frequency re-tuning if necessary. Linkage_type 0x04 (“Transport Stream containing complete network/bouquet SI”) shall be used to refer to EIT schedule information.

Note 1: Recommended for NorDig Basic

13.4.9 Event Information Table, Schedule, Descriptors

Event schedule descriptors
Short_event_descriptor
Component_descriptor
Content_descriptor
Parental_rating_descriptor
CA_identifier_descriptor (optional)

Table 13.5 EIT schedule descriptors

13.4.10 CA Identifier Descriptor

This descriptor is optional, however, it may be present in the EIT Schedule whenever at least one service component is scrambled. CA_system_id is allocated by ETSI and is given by ETSI ETR 162 [24]. When used, it will be used dynamically, i.e. following the services scrambling status, mainly targeting the ESG/EPG applications.

13.4.11 Content Descriptor

The NorDig IRD should handle all content nibbles listed in the DVB-SI specification (ETSI EN 300 468 [15]), 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.

13.5 Time and Date Table and Time Offset Table

Unchanged

13.5.1 Time Offset Table Descriptor

Unchanged

13.6 PSI Requirements

13.6.1 Program Map Table Descriptors

Unchanged

13.6.2 Component priority multiple video or audio streams

Unchanged

13.6.3 Content_Protection_descriptor

Unchanged

14 Navigator

14.1 General

Unchanged

14.2 Service List

14.2.1 Service List Requirements

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

Unchanged

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

Unchanged

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

Unchanged

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

Unchanged

14.2.4 Network Evolution and Service Changes

Unchanged

14.3 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 with a Graphical User Interface (GUI) defined by the IRD manufacture.

14.3.1 ESG Requirements

14.3.1.1 ESG and length

The NorDig IRD shall be able to display an ESG for the user with a minimum of eight days of schedule data (1), defined as whole days from present day and ahead according to EN 300 468 [15]. The ESG shall be based on the information from include the EIT present/following tables (2), see section 13.4 and EN 300 468 [15] and should include the EIT schedule, see sections 12.4 and 12.5.

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: Eight days of ESG is optional for NorDig Basic IRD (without PVR); the minimum requirement for Basic IRD corresponds to display of present and following program event information for all services derived from EIT p/f.

Note 2: EIT schedule tables are optional for NorDig Basic IRD without PVR and for NorDig IRDs with IP-based Front-end. The NorDig IRD with IP-based Front-end may use equivalent format for EIT schedule data

14.3.1.2 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.

14.3.1.3 ESG performance

In normal operation, 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 14.3.2 and 14.3.3).

14.3.2 Event Information Table (EIT)

NorDig IRD shall make use of the EIT p/f tables from both EIT_actual and EIT_other tables.

Event p/f descriptors	EIT p/f	EIT sch
Short_event_descriptor	M	M (2)
Extended_event_descriptor	M	M (2)
Component_descriptor	M	O
Content_descriptor	M	M (2)
Parental_rating_descriptor	M	M (2)
CA_identifier_descriptor (optional)	O	O
Content_identifier_descriptor (4)	M (4)	M (4)

Table 14.1 EIT p/f descriptors

Note 2: EIT schedule is recommended (optional) for NorDig Basic without PVR and for NorDig IRDs with IP-based Front-end.

Note 4: Optional for NorDig PVR IRDs that are released before 1 January 2011.

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 id). Information in the ESG shall be updated within 10 second after reception of the updated tables.

Some NorDig networks transmit EIT data in multiple languages; the NorDig IRD shall be able to display the EIT data from chosen language (according to user preferences).

If information is missing (i.e. not included in the transmission) the ESG shall not display an error message, instead the text information field shall stay empty (i.e. no information like “no information available”).

The NorDig IRD manufacturer shall provide a procedure that allows the user to configure blanking of video and muting of sound for certain parental rating values.

The IRD should provide a functions 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).

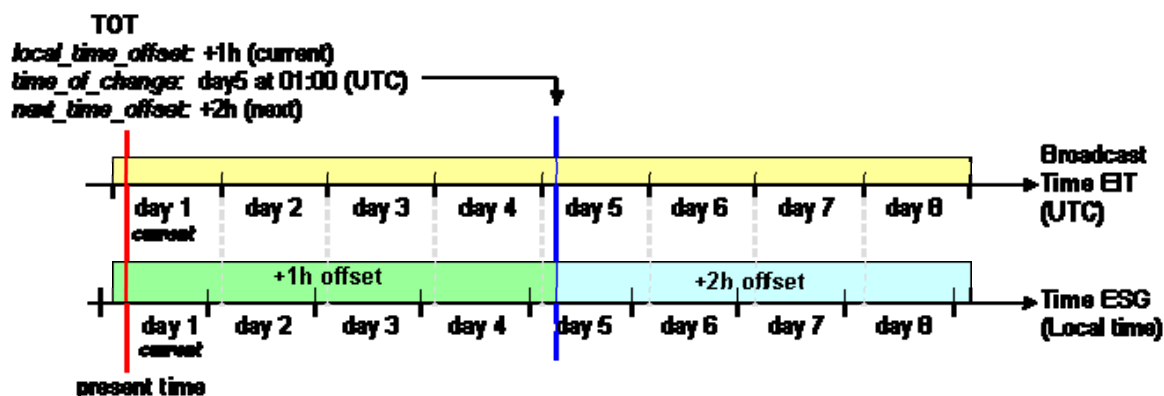
14.3.3 Time and Date Table (TDT) and Time Offset Table (TOT) (OL)

The ESG shall display correct event times as conveyed by the TDT, adjusted by the offset relayed in the TOT using the country name selected by the user.

Time Offset Table
Local_time_offset_descriptor

Table 14.2 TOT descriptors

The ESG shall display all events using the correct time offset applicable at the event start time and date signalled in the EIT. The offset applied to the events UTC time shall be determined first on time of booking and subsequently updated if there is a new next_time_offset received. If there is more than one time_offset_section, ESG shall use the section that is applicable for event start time and date, see illustrative example below.



Note: TDT contains UTC time, but no descriptors.

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

Unchanged

15 NorDig PVR feature requirements

15.1 Introduction- PVR

This chapter (together with PVR-related requirements specified in chapter 13 and section 14.3) 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).

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.

15.2 General- PVR

15.2.1 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).

15.2.2 Recording capacity

The NorDig PVR shall be able to indicate its momentary available recording capacity. The basis for the indication shall be explained in the instruction manual and should be in terms of capacity (e.g. GB), percentage or time (e.g. hours). (PVRs should consider when indicating available capacity in terms of time that many services often uses variable bitrate and that the capacity will vary between different services types, like SDTV, HDTV, radio etc)

The Manufacture shall clearly state the recording capacity for the NorDig PVR in marketing specification and in the instruction manual. It shall as minimum be specified in terms of bytes (like GigaByte, GB etc).

15.2.3 Deletion of recordings

The user shall be able to manually delete any recorded event in the NorDig PVR by deleting one recording at the time. The user should be able to manually delete all recorded events in the NorDig PVR. The user should be able to manually delete all recorded events belong to the same Series in the NorDig PVR.

The NorDig PVR shall have a mode (set as factory default) where the NorDig PVR shall ask for user confirmation before deletion of recordings (i.e. the PVR may in addition have alternative mode where the PVR will delete recordings without any extra confirmation).

15.2.4 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.

15.2.5 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 PVR shall keep all recordings from that Series.

15.2.6 File system intact after update

The NorDig PVR’s file systems of recorded events shall be intact after

- updating of the PVR IRD’s System Software and/or
- updating of CA system and/or
- re-installation or update of installed services

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

Some of the broadcasted content are 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 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 PVR in un-protected format, therefore all recordings shall be stored in a protected format not easy to extract by the user.

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

NorDig PVRs’ using standardised removable media, such as DVD or Blu-ray for recording of protected content shall downscale any HD content to SD resolution (maximum 720x576) before storing it to the removable media. HD content may be recorded in it 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 5.2.2.12.

15.2.8 Disk management / de-fragmentation

The NorDig PVR shall have appropriate disk management (including de-fragmentation handling for Hard Disk Drive based PVRs) to minimise need for re-formatting disk during its lifetime.

15.2.9 Safe margins

The NorDig PVR should have the possibility to add extra recording time before and after the event's scheduled time, as a safe margin. Typically this could be done as a pre-defined default user preference setting value, configurable by the user via the menu.

15.3 PVR Recording

15.3.1 General PVR recording

The NorDig SD PVR shall as a minimum support recording up to 20 Mbps per (SD) service and the NorDig HD PVR shall as a minimum support recording up to 30 Mbps per (HD) service. The NorDig PVR shall be able to record for at least 60 minutes with the above transmission figures.

The NorDig PVR shall be able to record all supported service types (TV, radio etc) and its components (as described in 15.3.9).

If the NorDig PVR has a suitable display, other than that used to display the content, it should indicate to the user when a recording is in progress.

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

15.3.2 ESG/EPG recording programming

The NorDig PVR shall make it possible for the user to select individual events and series to be recorded from the ESG or EPG display (based on information from EIT data).

The NorDig PVR shall be able to make a booking from the ESG/EPG and later record this event both for events that do not include any CRID (i.e. only based on service and event_id) and events that include CRID's (1).

The selected event(s) for recording shall be marked as selected for recording on the ESG and EPG display.

If the user selects an event for recording from the ESG/EPG which has the same programme CRID value as an earlier recording within the NorDig PVR list of recordings, the NorDig PVR shall inform the user at the time of booking that this new selected event might already have been recorded and offer the option for the user to record anyway or not (1). The PVR should display information about this earlier recording (like the event name, date of recording and description).

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

15.3.3 Series recording

All events that have the same series CRID belongs to the same Series. An individual event inside a Series is referenced here as an Episode. (For definition of CRID see section 13.4.7.2).

The NorDig PVR shall be able to record a complete Series via the CRID (1).

The NorDig PVR shall store and track series CRIDs that are programmed for recording for up to 91 days between occurrences in EIT schedule (1). To allow broadcasters to reuse a series CRID for a different editorial concept, the NorDig PVR shall discard any series CRIDs not seen in EIT for 91 days.

The display of programmes selected for recording shall include an indication if the programme is included as a consequence of being one of a series.

The IRD should be aware that the default authority may be changed over time (for example a service might have default authority added in SDT), the NorDig PVR should automatically update its stored default authorities (not only during installation).

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

15.3.3.1 Series, record all episodes

The PVR IRD shall support recording of all episodes of a specific series via series CRID'ws in the broadcast (1).

It shall be possible from ESG/EPG to program the PVR to record a series of events (1). The PVR shall indicate in the ESG/EPG that an event is part of a series (1). The PVR shall (1), if the user selects to record the event that belongs to a series, request the user what to record:

1. Only the single event selected.
2. Several or All events (episodes) of the series

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

15.3.3.2 Series, record limited number of episodes for a series

The PVR should support recording of a (limited) number of episodes of a specific series via series tagging in the broadcast. The limitation should either be a period of time or a number of episodes.

15.3.3.3 Series, only one instance/copy of each episode

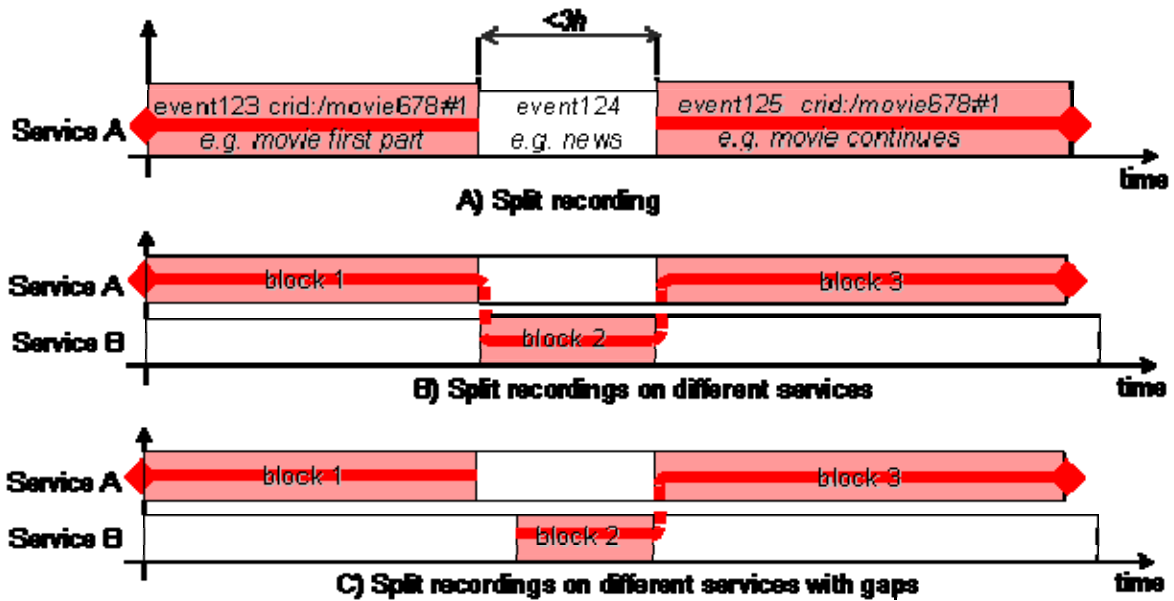
The PVR should support the feature to only record one instance/copy of each episode in a series for series recording (to handle re-runs).

15.3.4 Split recordings

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 (see figure A below) or a longer sport event might be split into several parts/blocks over several services, (see figure B below).

Signalling carried in the SI allows the PVR to identify and record all the events containing the parts of a single programme. A "split programme" is a single piece of content which comprises of two or more EIT events having the same CRID and IMI value with the gap from the scheduled end time (start_time plus duration) to the scheduled start time of any two of those events is less than 3 hours (see section 13.4.6 Content Identifier Descriptor).

The NorDig PVR shall consider a split programme to be segments of a single item of content (1). When selecting a split programme for recording, the NorDig PVR shall select and record all constituent events so that the complete programme content is recorded (1).



There are cases where a NorDig PVR may during the time of programming a recording only see a single event with the booked CRID and IMI combination (for example initially only the first part/block of the split programme has so far been included in the EIT). A NorDig PVR shall continue to monitor the EIT for additional events with the same CRID and IMI combination and include them to the selected recording (1).

In case of overlap between the split events and if the NorDig PVR has limitation in recording capacity when back-to-back recording, then the NorDig PVR shall first finalise recording of the first part/event of the split programme (according to the events start time and duration) before starting recording the next part of the split programme, This is the same behaviour as back-to-back recordings.

During the lifecycle of EIT schedule broadcasters may change programmes from split to single or vice versa.

In the NorDig PVR split recordings shall clearly be marked in the list of recordings as constituent parts belonging to the same programme, for example as one and the same entity or similar (1). It shall be enough to select only one entity from the file list of recording to get a playback of the complete programme (including all its all constituent events) (1).

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

15.3.5 Recommended events

When the event selected has one or more recommendation(s) associated with it (signalled from original event with crid_type 0x03), the NorDig PVR should offer the option to record the recommendations (programme or series) as well as the selected programme or series.

Once selected, the appropriate recommended event(s) shall also be marked as selected to be recorded on the EPG display.

The recommended event(s) may also have recommendation(s) of its own. When user chooses to select to include the recommendation(s) into the recording, the NorDig PVR shall not include more than the original event's recommendation(s) (i.e. the PVR shall not follow more than the original event's initial recommendation and a recommendation should not be used to create a linked list of events to be recorded).

15.3.6 Alternative instance

When scheduled recordings overlap, the NorDig PVR shall 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 shall detect an alternative instance of a programme (as when two events has same programme CRID) (1). This can be used to assist in resolution of booking clashes. 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.

Note 1: Optional for NorDig PVR IRDs that are released before 1 January 2011.

15.3.7 Accurate Recording

The PVR shall determine the timing of the recording through monitoring of the EIT schedule and EIT present/following information.

The PVR shall record at least for the duration where the event ID in the EIT present table matches the event ID of the event selected from the EIT schedule to a precision of 10 Seconds, unless there is a conflict with another recording event.

The PVR may monitor the running status of the event in EIT present table and record only that part where the running status is set as running. (Note as specified in DVB SI Guidelines TR101 211 [28], 'undefined' running status in EIT present table shall treat the present event as running).

Where the Event ID is signalled in EIT present table early (in advance of the schedule start_time) the receiver shall start recording. As a minimum the NorDig PVR shall handle early starts of at least 10 minutes, provided there are no other recordings in progress.

The PVR shall monitor the EIT schedule and EIT present/following for updates to the start time and duration such that any event will be captured should the schedule be updated no later than 2 minutes prior to the current scheduled time of broadcast.

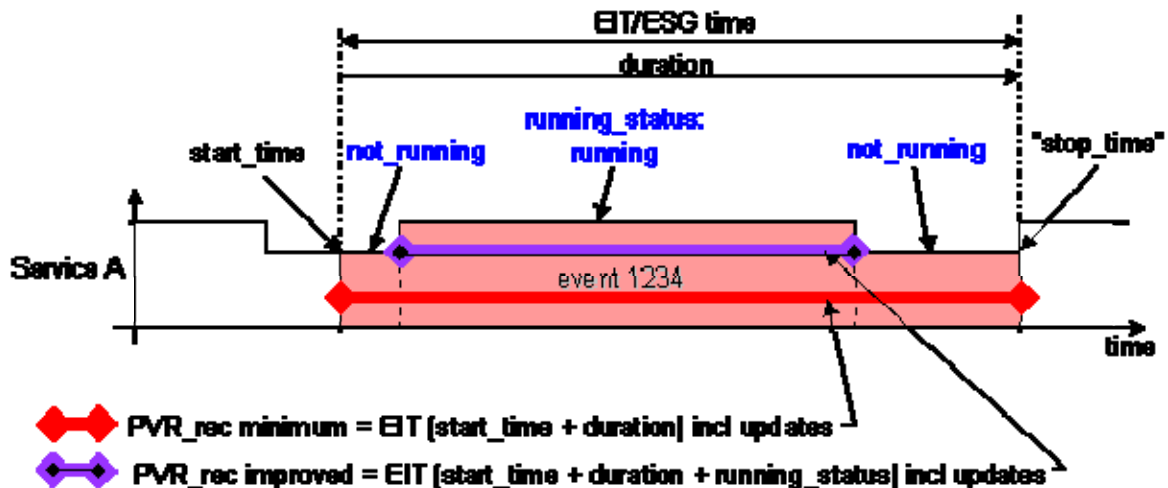
Where the Event ID does not appear within EITp/f (in neither the present nor following tables) within the expected schedule time and duration the PVR should record according to the scheduled start time and duration. If the event id appears in the EIT following table at the scheduled start time, it means that the event is delayed and the NorDig PVR should wait with the start of the recording until the event ID appears in the EIT present table.

The duration of the recording shall be changed even if the EITp/f is updated after the start time has elapsed, until the event is no longer present in the EIT present table.

If the NorDig PVR starts to record at the expected scheduled start time even if the event does not appear within EITp/f, the recording shall be considered as incomplete.

Where there is a loss of signal or EIT present table is no longer being received, the PVR will continue to record at least until the end time of the event (defined by start_time plus duration) in the last received EITp/f. If the signal is restored the PVR will continue to record according to its normal operation.

In standby mode (where the IRD is not decoding any transport stream) the NorDig PVR shall have the capability to power on automatically twice per day to update the EIT and scheduled recordings. There may be an option to amend the time of power on or to switch off the facility as a user option, but factory default for this shall be that it is on.



15.3.8 Simultaneous recording

The NorDig PVR shall be able to record one service while viewing another, at least if the services are on the same transport streams.

NorDig PVRs with more than one tuner/front-end shall be able to record one service while viewing another, independently even if the services are on different transport streams.

The NorDig PVR should be able to record a background service (that is not viewed) at the same time as timeshift record the viewing service, independently if the services are on different transport streams.

15.3.9 Complete recording

The NorDig PVR shall be able (factory default) for all recordings to include all supported components/PIDs listed in the PMT of the recorded service (e.g. video, audio 1, audio 2, Teletext, MHP, PCR etc).

If the (MHP) application in the transmission is signalled as not to be recorded, the NorDig Enhanced and/or Interactive PVR should not record these application streams.

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.

15.3.10 Trailer booking

Trailer booking (promotion link) is not part of this version of the specification.

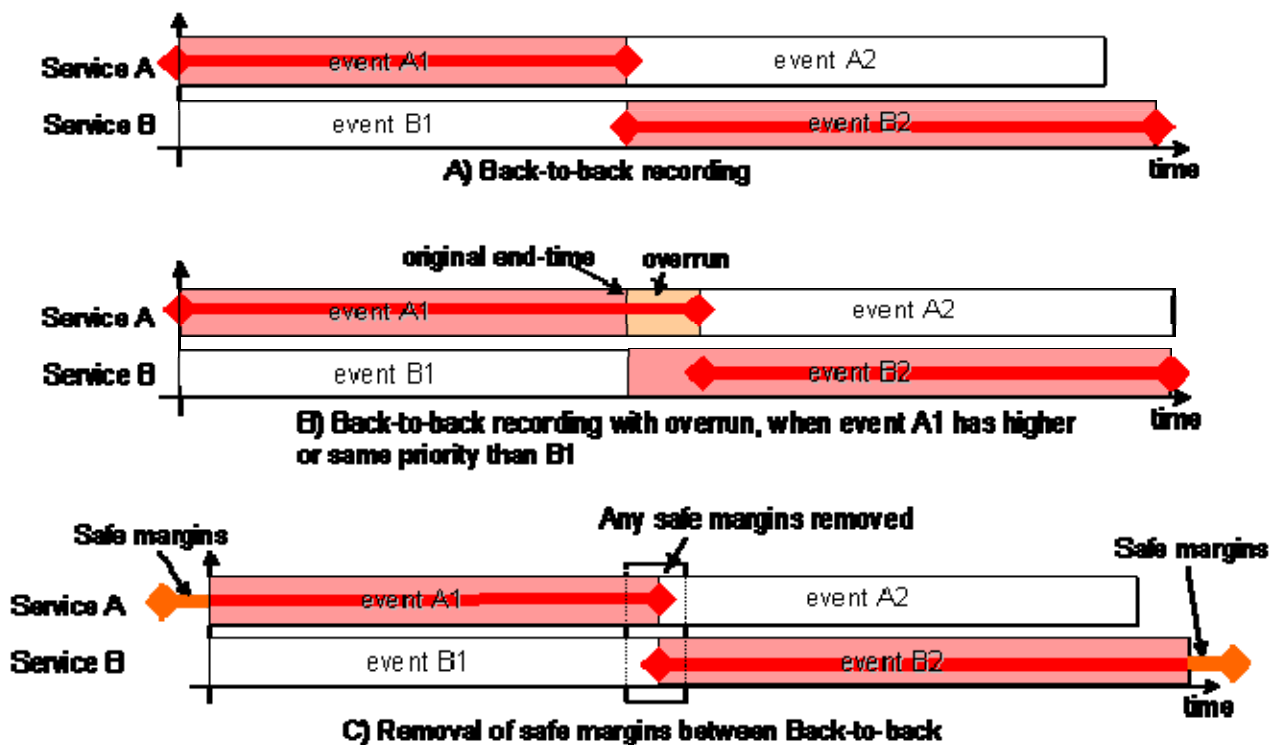
15.3.11 Back-to-back recording

The NorDig PVR shall be able to record back-to-back events both on same and on different services.

Back-to-back events refer to two events that immediately follow each other, i.e. the following event start_time is immediately after the previous events stop time, (start_time plus duration), see figure below.

For overlapping events see 15.3.17.2. If the first event has same or higher priority as the second event (see 15.3.17.2) and the first event will overrun, if the NorDig PVR has limitation in recording capacity, it shall first finalise recording of the first event (including its overrun part) before starting recording the next event. The overrun shall be treated as the more important part of the events, see figure below.

If the NorDig PVR has been set to add additional recording time ("safe margins") before and after recorded events' start and stop time, any overlapping "safe margins" between the back-to-back events shall be removed (if the NorDig PVR has limitation in recording capacity for this), see figure below.



15.3.12 Timeshift recording

The NorDig PVR shall be able to pause or timeshift live TV for at least 60 minutes. It should be possible to save time-shifted events into the PVR list of recordings.

15.3.13 Late Recording

The NorDig PVR should support a continuous time-shift buffer for late catch-up recording. If supported then the NorDig PVR (based on Hard Disk Drive) shall be able to disable the continuous time-shift buffer in settings. It should be possible to record a complete event after the event has started including any portion already in the time-shift buffer.

A late recording is when the user programs the PVR to record an event after it has started (according to the events start_time and that it is within EIT present table). If the time-shift buffer includes the start of the event, the recording is treated to be a complete late recording. If the time-shift buffer does not include the start of the event or if the PVR does not have any time-shift buffer, the recording is treated to be an incomplete late recording.

For incomplete late recording the NorDig PVR shall check if there is an alternative instance available within the EIT data (i.e. an event with same CRID value). If an alternative instance of the event is found within the EIT data, the NorDig PVR should offer for the user to automatically replace the incomplete recording later with a complete recording using the alternative instance (the NorDig PVR should however anyway first finalise the rest of the present incomplete recording). If there is conflict because of the alternative instance, the NorDig PVR shall not use alternative instance, it shall then keep the late incomplete recording.

If there is no alternative instance information available at the time of recording, the NorDig PVR shall monitor EIT tables for alternative instance until incomplete recording is removed from the PVR.

~~The Late recording should not include recordings from previous event, even if the continuous time shift buffer did included that at the time of programming.~~

The manufacture should inform the user in the PVR's manual about limitation in late recording, for example it could typically be that it is only possible to record/store as long to back in time for one service as the service has been selected for viewing or as long time as the timeshift buffer is.

15.3.14 Manual recording

The NorDig PVR shall make it possible for the viewer to set a manual recording, without using the EPG/ESG/EIT data, by setting the service, start-time and end-time (or duration).

The time and date for the user when programming shall be the local time, including any offset, at the time of recording according to the IRD's settings, and not the local time at the time of programming. This means that if there is a change in local time offset (e.g. change in daylight-saving time) between the time of programming and the time of recording, the time and date shall refer to the new local time at the time of recording.

It should be possible to set weakly repeated manual recording (like every Monday 19:00:00 to 20:00:00 or every weekday between 12:00:00 to 12:15:00)

15.3.15 One touch recording (OTR)

The NorDig PVR shall include a direct recording setting as a One-touch recording (OTR) function which allows the user to start a recording, while watching live TV, with one button press on the remote control.

This One-touch recording shall not be delayed by further requests for user interaction unless to proceed would affect a recording that is either already underway or scheduled to start before the end of the OTR recording.

The duration of the One-touch recording operation shall be based on either a pre-set time or current viewed event.

In addition, the NorDig PVR may have another setting alternative that when pressing the OTR button the NorDig PVR asks for user confirmation whether the direct recording shall be based on current viewed event (from EIT data) or on a pre-set time.

15.3.16 Automatic conflict handling

A conflict arises when the NorDig PVR is restricted to perform a recording due to limitation in recording capacity.

15.3.16.1 Conflict during the time of programming a (individual, series or manual) recording

If a conflict is detected it shall be indicated immediately to the user, together with details of the cause, so that the user can take appropriate action.

When programming a recording which comes in conflict with an earlier programmed recording and when the NorDig PVR can detect an alternative instance in one or both of them, the NorDig PVR shall either automatically re-program one of the to the alternative instance or propose that viewer solve the conflict by moving one of the recordings to the alternative instance and asking for confirmation.

15.3.16.2 Conflict occurring after the time of programming recording(s)

If the NorDig PVR has a number of active programmed series recordings and if there occurs a request of more simultaneous recordings than the NorDig PVR is capable of handling, the NorDig PVR shall be able to handle this without user confirmation at the time of actual recording, i.e. the IRD may inform of the conflict via the OSD but shall automatically solve the conflict at the time of actual recording if the user does not manually change the conflict handling. Any information on OSD about conflict shall not be included in recording and shall have a time-out if no user reaction. All requests for user confirmation shall be done during the time of programming or during the setting of user preferences.

The conflict(s) shall be solved with higher priority recordings having preference before recordings with a lower priority. It is up to the NorDig PVR manufacture to define the PVR's priority list, however it may typically be as prioritised in table below. Conflict(s) of recording with same priority level shall also

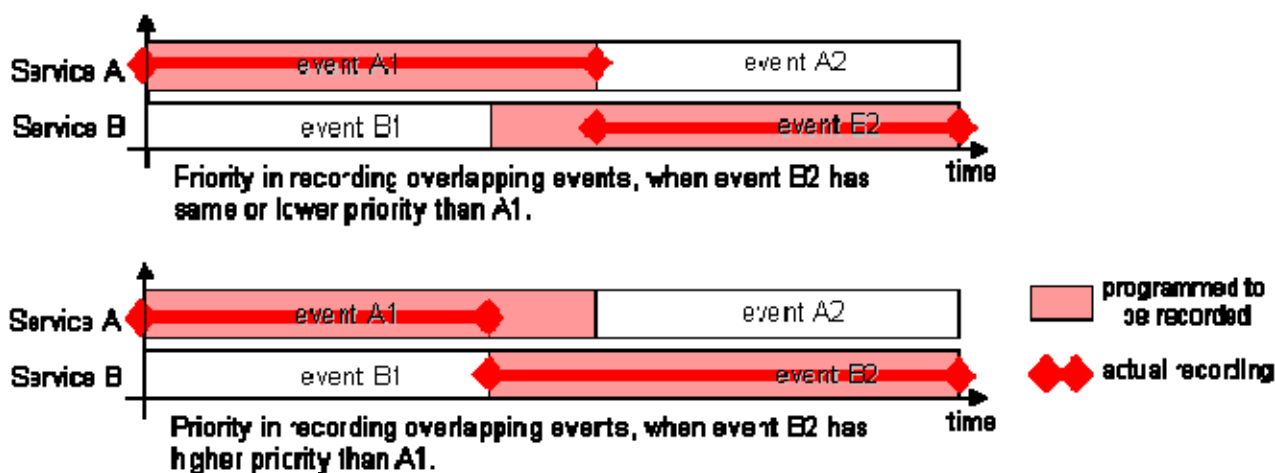
be automatically solved (at least one of them shall be recorded), but it is up to the NorDig PVR manufacture to define a mechanism. The NorDig PVR should offer for the user the ability to change the conflict priority in the user preferences.

Factory default Priority list of handling recording conflict in NorDig PVR

Priority	Recording type
1 (high)	Manual single recordings
2	Manual repeated recordings
3	Individual event recording (single shot) without alternative instance
4	Individual event recording (single shot) with alternative instance
5	Series recordings without alternative instance
6	Series recordings with alternative instance
7 (low)	Automatic Keyword recordings

If a conflict occurs in a partially or completely overlapping recording after the time of programming the NorDig PVR shall prioritise the recording with the highest priority, as illustrated in figures below. For conflict with events with same priority, the NorDig PVR shall first finalise the first recording (including any late over-run) before starting with next. (See also back-to-back recording).

Any recording that may only be partially recorded (incomplete) due to overlapping of other recordings (including late over-run) should be recorded anyway (see Failed and incomplete recordings).



15.3.17 Maximum length of recordings

If there is a failure within the transmission of the EIT and other transmission errors, the NorDig PVR shall stop recording 4 hours after scheduled duration of the event has passed (even if the event still appears in EIT present table).

For events that have a duration that is longer than 8 hours, the NorDig PVR may stop recording after 8 hours.

15.4 Playback

15.4.1 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 15.4.5).

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.

15.4.2 Replay/Playback – trick modes

The NorDig PVR shall support the following trick modes during playback of recorded events (incl time-shift) for all supported video formats/codecs:

- **Play** (playback at normal speed)
- **Pause**
- **Stop** (stop may be combined with pause, but must enable an easy way to stop playback and return to list of recordings and live viewing mode)
- **Fast forward** and shall support fast forward at minimum 3 different speeds, (like x3, x6, x15 and x30).
- **Fast reverse** and should support fast reverse at minimum 3 different speeds, (like x3, x6, x15 and x30).

The audio may be muted during trick modes (except during normal playback). The subtitling (Teletext or DVB Subtitling) and other event based data application may be skipped during trick modes (except during normal playback). The NorDig PVR should make use of the AU_information according to ETSI TS 101 154 [29], if that information is available in the recorded video stream. The slower fast forward and fast reverse modes should be smoother rather than trying to keep the exact selected trick mode speed.

The NorDig PVR should support the following trick modes during playback of recorded events (incl time-shift) for all supported video formats/codecs:

- **Slow forward** (like x1/2 and x1/4 of the normal speed)
- **Slow reverse** (like x1/2 and x1/4 of the normal speed)
- **Next**, go to next recorded event within same series (i.e. to a event within same series with a newer date or “episode_id”, if the current event belongs to a series and the NorDig PVR has recorded several events) otherwise go to next recording within the list of recordings.
- **Previous**, go to a previous recorded event within same series (i.e. to a event within same series with an older date or lower episode_id, if the current event belongs to a series and the NorDig PVR has recorded several events) otherwise go to previous recording within the list of recordings.
- **Jump**, go to a specific time in the recording and/or fast jump a manufacture defined fixed time (e.g. 4 min forward).

The NorDig PVR should be able to insert indexes into the recordings to enable fast access to different parts of the recording.

15.4.3 Relative Synchronisation

The NorDig PVRs shall not introduce more relative delay (reduced “lipsync”) during playback between the audio, video and other PES packetised components (like subtitling) compared to decoding of live content, measured 5s or later after start of normal playback (see chapter 6.1.2.1 and 7).

After using trick mode the relative delay shall meet the requirements within 5s after resuming back to normal playback speed.

15.4.4 Simultaneous recording and playback

The NorDig PVR shall be able to record and playback simultaneously. It shall be possible to record one service from the live transmissions while playback another earlier recording.

The user shall be also able to start the playback of a recording for which the recording has not yet completed (“chase playback”).

15.4.5 Complete service playback

During playback of recorded content the user shall be able to perform the same selection as would have been possible during 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 15.3.9).

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).

15.4.6 Resume Playback

When resuming back to a partially viewed recording, the NorDig PVR should resume back to the point of the recording (or a moment before that point) where the previous playback was stopped.

It should be possible to set index points of interest during playback, where later playback may be jumped too.

15.5 Examples

< To be included later >



NorDig

16 IRD System Software and API

Unchanged

16.1 *NorDig Basic*

Unchanged

16.2 *NorDig Enhanced*

Unchanged

16.3 *NorDig Interactive*

Unchanged



NorDig

17 User Preferences

17.1 *Stored preferences*

Unchanged

Additional requirements for the NorDig PVR:

To be specified.

17.2 *Deletion of service lists*

Unchanged

17.3 *Reset to factory mode*

Unchanged

Additional requirements for the NorDig PVR:

To be specified.



Annex A: NorDig Members

Unchanged

Annex B: Background and options for IRDs with a terrestrial front-end

Unchanged

Annex C: Bootloading and Service Lists in IP-based and other networks

Unchanged

Annex D: Implementations Guidelines for NorDig Bootloader

Unchanged

Annex E: Comparison of NorDig profiles