

Document number	Document name / type Terrestrial Receiver Specification v2.1.1	Revision/version v2.1.1	Page 1 (16)
Author / Prepared Ptu, Mnr, Phy, SB MII	Document responsible/Approved Per Tullstedt		Date 2010-04-27



Minimum Receiver Requirements for Teracom and Boxer DTT Networks

(in Sweden and Denmark)

Additions and clarifications to the NorDig Unified specification
(CA System, MPEG4 AVC HDTV, DVB-T2 etc)

Version
2.1.1
Date
2010-04-27

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	2 (16)
Author / Prepared	Document responsible/Approved	Date	
Ptu, Mnr, Phy, SB MII	Per Tullstedt	2010-04-27	



Contents

1.	Introduction	3
1.1.	Scope	3
1.2.	Document History	4
1.3.	Terminology	4
1.4.	List of Abbreviations	5
2.	General features for a digital receiver	6
3.	CA System and interfaces for the DTT Network	8
3.1.	Requirements in additional to NorDig specifications (chapter 4 and 15).....	8
4.	Terrestrial Tuner and Demodulator.....	9
4.1.	Additional requirements for terrestrial tuner and demodulator	9
5.	Demultiplexing and decoding	10
5.1.	Video	10
5.2.	Audio	10
6.	Interfaces	11
6.1.	HDMI and HDCP (NorDig chapter 9.9.4)	11
6.2.	Analogue HDTV: component YUV/YPbPr	11
6.3.	External interfaces and removable media	11
7.	Service Information (SI).....	12
7.1.	Additional requirements to NorDig Unified specification	12
7.2.	Clarifications to NorDig Unified specification (chapter 12).....	12
8.	Receiver states	15
8.1.	Installation mode.....	15
8.2.	(Normal TV viewing mode) Active mode	15
8.3.	(Automatic) Update mode	15
8.4.	Stand-by and power off mode	16
9.	Controller and Memory	16
9.1.	Clarifications to NorDig Unified specifications (chapter 11)	16

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	3 (16)
Author / Prepared	Document responsible/Approved	Date	
Ptu, Mnr, Phy, SB MII	Per Tullstedt	2010-04-27	

1. Introduction

1.1. Scope

This document specifies the minimum receiver (technical) requirements for the Swedish and Danish Digital Terrestrial TV (here shorten as S-DTT and D-DTT) network to receive Standard Definition TV (SDTV) and High Definition TV (HDTV) services. This receiver is hereafter denoted as an Integrated Receiver Decoder (IRD). The IRD shall be DVB compliant, able to receive MPEG-2 Transport Streams from a terrestrial modulated signal and to decode and de-scramble the services within.

(For the Swedish DTT this document specifies requirement for all kind of IRDs (i.e. both pure FTA IRDs and IRDs intended to handle scrambled services with embedded CAS or via Common Interface. For the Danish DTT this document specifies requirements for receivers intended to handle scrambled services. For pure FTA IRDs, the NorDig Unified specification is the requirement and this document can be seen as a guideline).

1.1.1. Swedish DTT (S-DTT) network

The S-DTT network includes 6 parallel Multiplexes. The service bouquet within the current S-DTT network is a mixture of Free-to-Air (FTA) and scrambled services. The majority of the services within the S-DTT are normally scrambled (in total by spring 2010 approx 42 TV services within the network, where approx 35 scrambled and 5-7 FTA services).

At spring 2010 most services as based on MPEG2 codec and using DVB-T broadcast. During 2009 approximately 8-10 new (SDTV) services has been launched within the S-DTT network and these new services are based on MPEG4 codec.

1.1.2. Danish DTT (D-DTT) Network

The D-DTT network includes 5 parallel Multiplexes (launched 1 November 2009) with a service bouquet of a mixture of Free-to-Air (FTA) and scrambled services.

Services within D-DTT Multiplex 2-5 are based on DVB-T and advanced codecs (MPEG4) for video and audio. Multiplex 1 in the D-DTT network will continue broadcasting services based on DVB-T and MPEG2 codecs until 2012.

1.2. Document History

Version	Date	Comments
A / 1.0	2002-05-06	First final version
B / 1.0.3	2007-07-04	2nd version
C / 2.0	2008-08-08	3rd version, (incl requirement for reception of MPEG4 HDTV services)
D / 2.1	2009-12-01	4th version, with the following (main) changes from v2.0: - references to latest NorDig IRD specification (v2.1) - optional DVB-T2 reception - Common Interface Plus extensions for CI receivers - Content Protection for any external digital interfaces
2.1.1	2010-04-27	5th version, with the following (main) changes from v2.1: - exclusion of DVB CSA3 for embedded descrambling

Contact person(s):
Per Tullstedt, Teracom AB, (per.tullstedt@teracom.se, phone +46 8 5554 1726)

1.3. Terminology

Mandatory / shall This word means that the item is mandatory.

Recommended / should This word means that this item is not mandatory, but is highly recommended. If included, then it shall be implemented as specified.

Optional This word means that this item is not mandatory, gives added value to different IRD implementations. But if this item is included then it shall be implemented as specified here.

1.4. List of Abbreviations

AAC	(MPEG-4) Advanced Audio Coding (ISO/IEC 14496-3) here refers to HE-AAC level 4
AC3	Dolby Digital audio coding (ETSI TS 102 366)
AC3+	Enhanced AC3, Dolby Digital Plus audio coding, (ETSI TS 102 366)
API	Application Programming Interface (for example DVB MHP)
AVC	Advanced Video Coding (MPEG-4 part 10 ISO/IEC 14496-10, ITU-T H.264)
BAT	(DVB SI) Bouquet Association Table
bslbf	bit string, left bit first
CA	Conditional Access
CAM	Conditional Access Module
CAS	Conditional Access (CA) System
CI	(DVB) Common Interface
CI+	(DVB) Common Interface Plus specification v1.2 or later
CSA	(DVB) Common Scrambling Algorithm
CSA2	CSA version 2
CSA3	CSA version 3
DTS	DTS audio (ETSI TS 102 114)
DTT	Digital Terrestrial Television
DVB-T	DVB T Terrestrial broadcast (ETSI EN 300 744)
DVB-T2	DVB T2 Terrestrial broadcast (ETSI EN 302 755)
DVB	Digital Video Broadcast
E.AC3	Enhanced AC3, Dolby Digital Plus audio coding, (ETSI TS 102 366)
EICTA	European Information & Communications Technology Industry Association, (today Digital Europe)
EIT	(DVB SI) Electronic Programme Guide
EPG	Electronic Programme Guide
EPT	(DVB-T) Effective Protection Target
ESG	(DVB SI) Event Schedule Guide
FTA	Free To Air
H.264	Same as AVC (MPEG-4 part 10 ISO/IEC 14496-10, ITU-T H.264)
HD	High Definition (TV)
HDTV	High Definition TeleVision
HE.AAC	(MPEG-4) High Efficient AAC version 1 Level 4
IRD	Integrated Receiver Decoder
LCD	(NorDig) Logical Channel Descriptor
LCN	(NorDig LCD) Logical Channel Number
MFN	(DVB-T) Multiple Frequencies Network
MHP	Multimedia Home Platform (API)
Mono	Monaural audio, i.e. 1.0 channel audio stream
MPEG	Moving Picture Expert Group
Multi-channel	Multichannel audio, i.e. up to 5.1 channel audio stream (i.e. 3.0, 4.0, 5.1 etc)
n/a	Not Applicable
NID	(DVB SI) Network Identifier
NIT	(DVB SI) Network Information Table
NVOD	Near Video On Demand
ONID	(DVB SI) Original Network Identifier
OSD	On Screen Display
p/f	(DVB SI) Present / Following (event)
PCM	Pulse-Code Modulation audio (IEC 60958)
PSI	(MPEG) Programme Specific Information
QEF	(DVB-T) Quasi Error Free (reception)
sch	(DVB SI) Schedule (event)
SDT	(DVB SI) Service Description Table
S-DTT	Swedish DTT (Digital Terrestrial Television)
SDTV	Standard Definition TeleVision
SFN	(DVB-T) Single Frequency Network
SI	(DVB) Service Information
SID	(DVB SI) Service Identifier (== MPEG Program Number)
SMC	(CA) Smart Card
Stereo	Stereo (left and right) audio, 2.0 channel audio stream
TDT	(DVB SI) Time and Date Table
TOT	(DVB SI) Time Offset Table
TS	(MPEG) Transport Stream
TSID	(DVB SI) MPEG-2 Transport Stream Identifier
uimsbf	unsigned integer most significant bit first
UTC	Co-ordinated Universal Time

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	6 (16)
Author / Prepared	Document responsible/Approved		Date
Ptu, Mnr, Phy, SB MII	Per Tullstedt		2010-04-27

2. General features for a digital receiver

The requirements for IRDs (integrated receiver decoders) in the DTT network in this specification are fully based on the **NorDig Unified receiver specifications** (version 2.1 or later) and its **HD Level** (www.nordig.org) with some additions and clarifications included in this document (mainly CA). Teracom is an active member of NorDig and participates in NorDig's development of receiver requirements.

All IRDs shall be able to receive and decode MPEG2 SDTV based services as well as MPEG4 AVC (H.264) based SDTV and HDTV services. Both Swedish and Danish DTT network are using DVB Common Scrambling Algorithm based on Conditional Access System from Viaccess for scrambling of services.

When using '**IRD**' (Integrated Receiver Decoder) it refers to all types of receivers. The IRDs can be divided into the following main implementation categories:

- A **STB** (Set Top Box) is an IRD which is a separate unit (external) from the TV Set (Display)
- An **iDTV** (integrated Digital Television Set) is an IRD which is a integrated into the TV Set/Display

Other IRD implementations such as a PC Card (e.g. PCI) or USB/Firewire external receivers or similar, these products together with the PC are treated as an iDTV excluding the CA requirements.

In addition theses implementation IRD categories (STB and iDTV), the IRDs can be divided into the following main variants (referring to its DVB Front end):

- DVB-T IRD, is an IRD which supports only DVB-T demodulation (and no DVB-T2 support)
- DVB-T2 IRD, is an IRD which supports both DVB-T2 and DVB-T demodulation

Currently all IRD shall support DVB-T demodulation. Support of DVB-T2 demodulation is optional. (The requirement for DVB-T2 is expected to be changed from optional to mandatory for all new IRD in the future). If the IRD specifies support for DVB-T2, it shall support all (additional) requirements for a DVB-T2 IRD.

Table below provides a general overview of the mandatory, optional and recommended features and interfaces for the all the different categories of IRDs defined in this specification.

Overview table

IRD variant	DVB-T IRD	DVB-T2 IRD
Minimum requirements for IRD types		
DVB-T demodulation (“DVB-T1”)	M	M
DVB-T2 demodulation	-	M
UHF band IV-V and 8 MHz	M	M
VHF band III and 7 MHz raster	M	M
DVB-T2, Time Frequency Slicing	-	O
DVB-T2, 1.7 MHz raster within VHF band III	-	O
CSA2, DVB Common Scrambling Algorithm version 2 (1)	M	M
DVB Common Interface (2)	M	M
Common Interface Plus (2)	O until 2012 (M from 2012)	M
Video decoding: MPEG2 MP@ML & MPEG4 AVC HP@L4	M	M
Audio decoding: MPEG1 L.II, HE.AAC (up to 5.1) & E.AC3 (up to 5.1) (3)	M	M
Audio down-mix multichannel (5.1, 4.0, 3.0 etc) down to 2.0 (stereo)	M	M
Subtitling decoding: EBU Teletext & DVB Subtitling (up to HD)	M	M
EBU Teletext	M	M
API (like DVB MHP)	O	O
V/A Interface out: HDMI with HDCP for STB IRD (4)	M	M
V/A Interface out: analogue TV out (like SCART) for STB (4)	O	O
De-compression of lossless compressed SI data (5)	-	O (future)
<p>M; Mandatory, R; (Highly) Recommended, O; Optional item to include, alt; different alternatives:</p> <p>Note 1: requirement for CSA v2 are applicable for IRDs with built-in descrambler.</p> <p>Note 2: requirement for DVB CI or CI+ are applicable for IRDs with Common Interface, see chapter 3.</p> <p>Note 3: recommended/optional to support Dolby Digital Pulse audio decoding.</p> <p>Note 4: HDMI &/or analogue TV out is optional for iDTV.</p> <p>Note 5: IRD not supporting this shall be able to ignore/skip this data fields (text strings)</p>		

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	8 (16)
Author / Prepared	Document responsible/Approved	Date	
Ptu, Mnr, Phy, SB Mll	Per Tullstedt	2010-04-27	

3. CA System and interfaces for the DTT Network

This chapter covers the requirement defined for DVB Descrambling for the DTT's CA System, and refers to the NorDig Unified specification chapters 4 (4.2), 9 (9.4) and 15.

3.1. Requirements in additional to NorDig specifications (chapter 4 and 15)

Used DVB Conditional Access System (CAS) in the Swedish and Danish Terrestrial TV Network is the **Viaccess** CAS which is based on the DVB Common Scrambling Algorithm (CSA). (The DTT network's CA operator is 'Boxer TV Access', here shorten to 'Boxer').

IRD may have either no CA support (pure FTA) for the DTT networks or CA support for scrambled services. IRD with CA support for DTT networks may either be via embedded CA System with SmartCard Reader or via DVB Common Interface / Common Interface Plus.

iDTV with display screen diagonal larger than 30 cm shall include at least one Common Interface.

DVB-T IRD with Common Interface and released before 1 January 2012 should support Common Interface Plus extension. DVB-T IRD with Common Interface and released from 1 January 2012 shall support Common Interface Plus extension.

DVB-T2 iDTV with Common Interface shall support Common Interface Plus extension.

Common Interface Plus extension refers to the "CI Plus Specification, Content Security Extensions to the Common Interface" version 1.2 or later.

Descrambling for DVB-T IRD (CAM or embedded CAS) shall support at least DVB CSA2.

Descrambling for DVB-T2 IRD (CAM or embedded CAS) shall support CSA2.

For IRDs with embedded CA System, the requirements are:

- Viaccess ACS 3.0 or higher (Boxer version) shall be used.
- Secure Chipset with Viaccess key shall be used
- The implementation shall be certified by Viaccess SA and a copy of the approval shall be sent to DTT network's CA operator; Boxer
- Support Boxer specific CA OSD messages (for error messages and IRD support information), contact Boxer for the time valid detail information for this
- The use of an approved Boxer logo is mandatory for use on product and packing

For IRDs with DVB Common Interface or Common Interface Plus for CA System, the requirements are:

- shall be able to handle Viaccess approved secure CA Module with Viaccess CA System for:
 - CI IRD ACS 3.0 or higher and
 - CI+ IRD ACS 4.0 or higher
- shall support download of new CA system software to a CA Module via using DVB SSU.

For approved CA Modules see the Service Operators, Boxer TV Access, listed approved products, for example at www.boxer.se.

Informative; the requirements for Common Interface for iDTVs with display larger than 30 cm, follows the European Union Directives.

Document number	Document name / type Terrestrial Receiver Specification v2.1.1	Revision/version v2.1.1	Page 9 (16)
Author / Prepared Ptu, Mnr, Phy, SB MII	Document responsible/Approved Per Tullstedt	Date 2010-04-27	

4. Terrestrial Tuner and Demodulator

This chapter covers the requirement defined for Terrestrial Tuner and Demodulator and refers to the NorDig Unified specification chapter 3.4 with the following clarifications and additional requirements.

4.1. Additional requirements for terrestrial tuner and demodulator

A DVB-T2 IRD shall fulfil all the DVB-T2 IRD requirements specified by NorDig.

However support of DVB-T2 Time Frequency Slicing and 1.7 MHz raster are optional, (this to be noted since NorDig's first version of the specification for DVB-T2 requirements specified these as mandatory from 2012).

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	10 (16)
Author / Prepared	Document responsible/Approved	Date	
Ptu, Mnr, Phy, SB MII	Per Tullstedt	2010-04-27	

5. Demultiplexing and decoding

This chapter covers the requirement defined for MPEG demultiplexing, Video, Audio, Teletext and subtitling decoding, and refers to the NorDig Unified specification chapter 4, 5, 6 and 7 with the following clarifications and additional requirements.

The IRD shall fulfil the NorDig HD Level IRD requirements as specified in the NorDig specification, which for the demultiplexing and decoding, which means following main requirements (see NorDig specification for all details).

5.1. Video

The IRD shall support video decoding for;

- MPEG2 video decoding up to Main Profile at Main Level (MP@ML) and
- MPEG4 AVC (H.264) video decoding up to High Profile at Level 4 (HDTV).

Observe specifically that this means that all IRD shall support MPEG4 SDTV services using High Profile video encoding tools, MPEG4 AVC (H.264) HP@L3. (This HP@L3 is the common usage for MPEG4 AVC video encoding of SDTV services within the Swedish DTT network).

The IRD shall support still picture for all MPEG4 AVC profiles.

5.2. Audio

5.2.1. Audio format decoding

The IRD shall support monaural (mono), stereo (including joint stereo) and multi-channel (up to 5.1) audio decoding for:

- MPEG-4 HE AAC Level 4, version 1 (ISO/IEC 14496-3) and
- Enhanced AC3 (“Dolby Digital Plus”) (ETSI TS 102 366) and
- MPEG-1 Layer II (ISO/IEC 11172-3), here only up to 2.0 stereo

The IRD should also support parametric stereo audio decoding for MPEG-4 HE AAC Level 4 (i.e. version 2). (*Parametric Stereo (PS) is only applicable for use of MPEG4 HE.AAC version 2 stereo audio and mainly target for use in Radio services, i.e. not applicable for 5.1 or mono audio services and not applicable for any Enhanced AC3 or MPEG-1 Layer II).*

5.2.2. 2-channel audio downmix

The IRD shall support 2-channel Downmix of both HE.AAC and Enhanced AC3 incoming multi-channel (up to 5.1) stream into a 2 channel output (stereo).

It shall not be required to use external audio (decoder) equipment, like audio home theatre system, for the MPEG4-services with multi-channel audio. External interfacing equipment (like TV display unit) shall not be required to support more than 2 channel PCM audio within main V/A interface (HDMI/SCART).

5.2.3. Audio settings from factory default

Factory default shall be that 2-channel down-mix of multi-channel audio for the Main output (HDMI and SCART for STB and internal speakers for iDTV).

5.2.4. Variable bitrate

The IRD shall support decoding of variable bitrate of HE.AAC up to level 4 audio stream.

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	11 (16)
Author / Prepared	Document responsible/Approved	Date	
Ptu, Mnr, Phy, SB MII	Per Tullstedt	2010-04-27	

5.2.5. HDMI/SCART audio during digital audio output

The audio should not be silence in main V/A interface (HDMI/SCART for STB and internal speakers for iDTV) when outputting digital (surround) on digital audio interface (SPDIF) interfaces, i.e. it is recommended to continue outputting 2 channel PCM audio in parallel when outputting multi-channel audio (DTS/AC3/AAC/PCM) on the separate audio interface.

For IRDs with separate digital audio interface (SPDIF), the user shall be able to mute the audio in the main V/A interface HDMI/SCART for STB and internal speakers for iDTV) via the IRDs menu.

6. Interfaces

This chapter covers the requirement defined for Interfaces and Signal Levels and refers to the NorDig Unified specification chapter 9.

6.1. HDMI and HDCP (NorDig chapter 9.9.4)

The HDCP must be on (enabled/activated) in the signal within the HDMI-link out of the IRD for services in case of any following alternatives:

- if any of service's components has copyright flag in TS/PES header is set on ('1') and/or
- if signalised as must be on via PSI/SI descriptor in PMT as specified in NorDig specification and/or
- if signalised as must be on via CA-system as specified in NorDig specification.

If any of the above alternatives request the HDCP must be on, then the service is here referred to as a 'protected' service.

Only if none of above alternatives signalise that the service must have the HDCP on, then the IRD may send out a signal without HDCP on and then the service is here referred to as an 'open' service.

(Signalised via CA-system refers to "control information" inside the ECM data of the service or in the EMM data).

It shall be possible to change user settings in the IRD for 'open' services if the HDCP shall be on (enabled) or off (disabled). (An IRD may send out signal with HDCP on (enabled) even for 'open' services, this for example to reduce zapping time between services and avoid re-negotiation of the HDMI-link between the devices).

6.2. Analogue HDTV: component YUV/YPbPr

Due to the current strict requirements of content protection for HDTV material and there is today still a lack of copy protection mechanism (like Macrovision) for the analogue HDTV signals (like 720p and 1080i), any analogue video output of the HDTV IRD shall be maximum 576 lines regardless of incoming video signal.

6.3. External interfaces and removable media

Clarification to NorDig Unified 14.2.7 Limitations in local storage, interfaces, extraction and removable media for recordings, IRD (even "non-PVR" IRDs) shall not be able to output protected content (video and/or audio signals) from incoming MPEG signals on any interface in any un-protected compressed format (exception for digital audio over SPDIF interface).

For more information regarding applicable requirements for local storage, external digital interfaces, removable media etc of compressed signals please contact Teracom or Boxer TV Access.

7. Service Information (SI)

This chapter covers the requirement defined for Service Information, and refers to the NorDig Unified specification chapter 12 and 13.

7.1. Additional requirements to NorDig Unified specification

7.1.1. Compressed SI and text strings

To achieve more efficient broadcast (save bandwidth) for SI in DVB-T2 multiplexes, lossless data compression may be used for some SI data (typically on text string data, CRIDs etc) and/or in some EITs use “copy from” linkage to other events. The methods for this are still under development and optimisation for Nordic languages. It will be based upon open and non-discriminating technology.

IRD not supporting this shall skip all this unknown data and not output any error messages for the viewer.

Compressed text string inside known DVB and NorDig descriptors will be signalled with that the first byte of the text string has a specific start code (0x1F or other non DVB allocated byte outside the range 0x00 to 0x15 and 0x20 to 0xFF). This lossless compression will typically be used for EIT schedule tables’ text string data. IRD not supporting needed de-compression shall ignore the complete text strings starting with such specific start code.

“Copy from” linkage refers to an event (e.g. rerun) that only include a linkage pointing to another event in current the broadcast from which the IRD should copy all the description from into the EPG for this event with this linkage. This “copy from” linkage may not be service bounded, i.e. it could be a linkage pointing to event(s) from another service within the network.

7.2. Clarifications to NorDig Unified specification (chapter 12)

Following clarification is applicable in the DTT network.

7.2.1. Unknown SI and non-supported character tables

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

IRD not supporting needed de-compression of compressed text strings, shall ignore the complete text strings that starts with 0x1F or other non DVB allocated byte outside the range 0x00 to 0x15 and 0x20 to 0xFF.

IRD shall ignore/skip the complete text string that is using DVB character tables that the IRD do not support.

7.2.2. SI Identification coding

7.2.2.1. Original Network ID and Network ID

The DVB Identifiers for the DTT networks are as follows (according to ETSI ETR 162, today maintained at DVB home page):

DTT Network	Original_Network_ID	Network_ID
Sweden	0x22F1	colour B plan (0x3101 to 0x3200)
Denmark	0x20D0	colour C plan (0x3201 to 0x3300)

The IRD should map the original network ids into the appropriate country in the OSD menus (for example together with NorDig Logical Channel descriptor version 1).

Note: Within DVBS allocation (ETR162), there is normally an un-written code of practise for digital terrestrial networks that the original network id has been allocated by the DVB office to the value of 0x2000 plus the country’s ISO 3166 Country code value.

Which is true for almost all countries, as far as we know of, BUT with one exception; the Swedish DTT. For some reason this was not the case for the Swedish DTT original network id value (0x22F1), Sweden has the ISO3166 numeric country value 752 (0x2F0).

7.2.2.2. **Private data specifier values**

For the used private data specifier values, the following applies in the DTT network (also according to the DVB SI code allocation, ETSI ETR 162, inserted and used as specified in DVB SI Guidelines);

- Boxer TV Access private_data_specifier value: **0x00000014** (Swedish Terrestrial TV)
- NorDig private_data_specifier value: **0x00000029**

7.2.3. **Logical Channel Descriptor (in NIT)**

The IRD shall support both NorDig Logical Channel Descriptors (LCD), version 1 and 2.

7.2.4. **Parental rating descriptor (in EIT)**

This descriptor is used to give a rating of programme based on age or other criteria and is used to prevent children from viewing unsuitable programmes. The prevention mechanism, blanking of video and muting of sound, shall be included within the manufacturer software and it should make use of 4 digits pin code to access and change settings.

The IRD should start/(stop) its prevention mechanism, blanking video and muting audio, within 1 second after reception of selected service's present (running) event information (EIT pf) containing parental rating higher/(lower) than its user settings. I.e. the IRD should continuous check the parental rating conditions for selected service and each time the user zaps into a new service. It is common that the IRD also informs the viewer that the program event contains unsuitable material.

Example: When the user setting in the IRD for the maturity level is set to 17 years and the present event (EIT pf) for the selected service includes a parental rating descriptor with (country code "SWE" and) rating "0x0F" (i.e. at least 18 years old content), the IRD shall blank the outgoing video (e.g. black frame) and mute the outgoing audio.

7.2.5. **Country and Language Codes within PSI & SI**

Preferably all (main) codes in ISO 3166 and ISO 639-3 should be handled. Due to the quite large number of codes in these specifications, table 5 and 6 specifies the minimum types of codes that shall be handled by the IRD with the recommended translations.

(The codes in ISO 3166 (Country codes) are all in capital letters, the codes in ISO 639-2 (Language codes) are all in lower-case letters and observe the capital vs lower case letter notation in the translations.

Country (in English)	ISO 3166 code	Translation to be used (to native)	Comments
SWEDEN	SWE	Sverige	Mandatory
DENMARK	DNK	Danmark	Mandatory
FINLAND	FIN	Suomi	Mandatory
NORWAY	NOR	Norge	Mandatory

Table 5: ISO 3166, Country codes

Both ISO 639-2/B (Bibliographic Code) and ISO 639-2/T (Terminology Code) may be used, but for encoding it is recommended to only use ISO 639-2/B-codes. Of the current used descriptors that are using country or language codes, see also table below for help when to use each code.

Language (in English)	639-2/B	639-2/T	Translation to be used in DTT	Comments
	Code	Code	To native	
Danish	dan	dan	Dansk	Mandatory
German	ger	deu	Deutsch	Recommended
English	eng	eng	English	Mandatory
Finnish	fin	fin	Suomi	Mandatory
French	fre	fra	Francais	Recommended
Norwegian	nor	nor	Norsk	Mandatory
Spanish	spa	spa	Español	Recommended
Swedish	swe	swe	Svenska	Mandatory

Table 6: ISO 639-2, Language codes

7.2.6. Text strings and fields size of the SI descriptors

The recommended maximum transmitted field sizes in the descriptors in the DTT network are stated in the table 7 below. These values can be used as a guideline in the IRD implementation (and if the transmitted text strings are longer than below, the IRD could typically truncate after this value).

Name Field	Name Length	Comments
Network Name	24	
Service Provider Name	20	
(Full) Service Name	22	
(Short) Service Name	12	May be used in overview service list, info banner and/or ESG.
Event Name	40	
Short Event Description	250	
Extended Event description	255	
Component Description	32	Typically used in the ESG and/or in the info banner
Application Name	32	(for IRD with DVB MHP v1.1)

Table 7 Descriptor field length used in the DTT

Document number	Document name / type	Revision/version	Page
	Terrestrial Receiver Specification v2.1.1	v2.1.1	15 (16)
Author / Prepared	Document responsible/Approved	Date	
Ptu, Mnr, Phy, SB MII	Per Tullstedt	2010-04-27	

8. Receiver states

This chapter covers the requirements defined for different receiver states and is only partly covered by the NorDig Unified specification (see NorDig Unified chapter 3.4.4, chapter 13 and 14).

8.1. Installation mode

Installation mode is defined as the state where the IRD is searching, scanning and installing new multiplexes (transport streams) and services that is possible to receive. During (first time) installation mode, the generic user preferences are normally set (like languages, country etc).

It shall be possible to perform an automatic or manual search at any time (see NorDig Unified chapter 3.4.4).

Upon first time installation or after a reset to factory mode, the IRD shall perform an automatic search through the whole supported frequency range.

8.2. (Normal TV viewing mode) Active mode

Active mode is defined as the state where the IRD normally operates on the received services. The IRD continuously demodulate tuned frequency and decode all video, audio and data components.

All received dynamic PSI and SI data (PMT, EIT, TDT/TOT, running status and CA mode) shall be processed within 1 second (see chapter 5 of this document).

Typical dynamic changes that the IRD shall be able to handle are (with in some cases some disturbance):

- New PID(s) (e.g. DVB subtitling) is attached to a service
- PID(s) for video and/or audio is changed for a service
- Change from one (mono/stereo) audio to two dual mono audio mapped in one PID, i.e change of the audio encoding and in the ISO 639 language descriptor in the PMT.
- Changes of running status and/or CA mode (working together with linkage to replacement)
- Updates in EIT, TOT/TDT

8.3. (Automatic) Update mode

Update mode is defined as when the IRD is able to apply changes in the received “quasi-static” SI data (i.e. SI that is normally stored in the flash memory for service navigations such as Original Network ID, Transport Stream ID, Network ID, Service name, Service ID, Logic Channel Number, RF centre frequency and RF mode etc). The update mode should not affect the basic video and audio (see chapter 5 of this document). The IRD shall at least enter into update mode once (one time) from the time it has been turned off until the time it has been turned on (i.e. during stand-by mode). (The update mode is allowed to be interrupted by the user). .

For example, the IRD shall in ‘update mode’ update for:

- new services within installed frequencies (multiplexes/transport streams)
- changes in service name, logical channel number and service provider name
- remove services that are permanently removed from transmitted SI within installed frequencies. The IRD shall not remove any service(s) automatically from the ‘visible’ service list without user confirmation (to avoid irritation). I.e. the IRD shall automatically inform the user when a service is permanently removed and ask for user confirmation to remove the service from the service list. Removed services that are defined as ‘non-visible’ shall be removed without user confirmation

For example, the IRD should in ‘update mode’:

- not overwrite any user preferences

Document number	Document name / type Terrestrial Receiver Specification v2.1.1	Revision/version v2.1.1	Page 16 (16)
Author / Prepared Ptu, Mnr, Phy, SB MII	Document responsible/Approved Per Tullstedt	Date 2010-04-27	

The IRDs Service List shall be based on information from the SDTs. (The services listed in the NIT, e.g. in the NorDig Logic Channel Descriptor, might not be complete).

Updates that require actual tables (SDT actual and/or NIT actual) from another transport stream than the IRD is currently scanned to, should wait until the user select a service from a transport stream that contains the actual table(s) for this update.

8.4. Stand-by and power off mode

Stand-by mode is defined as when the IRD does not present any decoded components, like video and audio, on any of the IRD's outgoing connectors (RF loop through shall not be affected in this mode). The user shall be able to turn the IRD from Stand-by into Active mode. The IRD should have a minimum of power consumption during stand-by mode (typical 1W or less).

Power off mode is defined as the mode where the IRD is completely turned off.

9. Controller and Memory

This chapter covers the requirement defined for Controller and Memory, and refers to the NorDig Unified specification chapter 11.

9.1. Clarifications to NorDig Unified specifications (chapter 11)

An upgrade/replacement of the IRD's software is here referred to as System Software Update (SSU). If the SSU is via transmitting the new IRD's software over the broadcast channel it may also be referred to as Over-The-Air (OTA) download.

The IRD shall provide a mechanism to detect corrupt downloaded system software before it is used to replace the current working software. If the received system software is corrupt (refer to subclause 10.2 in NorDig Unified), the IRD shall keep the current (working) version of the system software, thus making the IRD operational again. If so, the failure to download shall be indicated to the user with an error message that can be used in the contact with the customer relations office. It shall be possible for the user to abort the download (in areas of bad reception quality the download may take too long time) and the IRD shall be operational using the current version of system software.

The IRD manufacturer shall provide the required MPEG-2 TS binary file (containing only the applicable SSU service and all its (PSI/SI) signalling necessary for successful upgrade) intended for cyclic broadcast for each new version intended for system software download. For each new version of system software over-the-air download, the manufacturer shall provide all necessary description documents to the network operator required for the transmission of the new software.