

Unified Rules of Operation for Digital Cable and Terrestrial Television Networks in Finland

Version 4.1

2018-01-29

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1 Introduction

1.1 General

This document describes the technical parameters and transmission rules for the Finnish digital cable and terrestrial TV networks.

This Rules of Operation document shall come into force on 1st of March 2018 and is made to satisfy the present demand of the operators and broadcasters. Consequently the versioning of this document is harmonized and updated together with corresponding *Unified Requirements for DVB-C and DVB-T2 Digital Receivers for the Finnish Market* [1] and *Unified Test Plan for DVB-C and DVB-T2 Digital Receivers for the Finnish Market* [2]. This document should be used together with the aforementioned documents.

The current version of this document is made to satisfy the present demand and the document will be updated whenever needed. The Finnish operators reserve all rights to change the content of this document, these changes being aimed to improve the quality of services to both the customers and broadcasters. If there is something to add or comment, please do not hesitate to contact any of the Finnish digital cable and terrestrial TV network operators.

1.2 Version History

Version	Date	Comments
V. 4.0	2016-10-28	First Unified version of Cable and Terrestrial RoO.
V. 4.1	2018-01-29	Updated references to NorDig 2.6.

1.3 References

- [1] Unified Requirements for DVB-C and DVB-T2 Digital Receivers for the Finnish Market, version 4.1 (2018-01-30)
- [2] Unified Test Plan for DVB-C and DVB-T2 Digital Receivers for the Finnish Market, version 4.1 (2018-01-30)
- [3] NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, version 2.6 (2017-01-20)
- [4] NorDig Unified Rules of Operation 2.5 (INFORMATIVE)
- [5] ISO/IEC 13818-1:2015: "Information technology -- Generic coding of moving pictures and associated audio information - Part 1: Systems"
- [6] Security requirements of digital HDTV receiver for the Finnish market, Version 2.0. (2011-12-13)
- [7] Unified Requirements of HDTV DVB-C and DVB-T2 digital receiver for Finnish market, Version 2.0 (2011-12-13)
- [8] Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems, ETSI TS 102 006, V1.3.2 (2008-07).
- [9] CI Plus Specification – Content Security Extensions to the Common Interface v1.3.1
- [10] Digital Video Broadcasting (DVB): Digital broadcasting systems for television, sound and data services: Specification for Service Information (SI) in Digital Video Broadcasting (DVB) systems, ETSI EN 300 468, V1.14.1
- [11] Digital Broadcasting Systems for Television, Sound and Data Services; Guidelines on the Implementation and Usage of DVB Service Information, ETSI TS 101 211, V1.12.1.
- [12] Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams, ETSI EN 300 472, V1.3.1. (2003-05)
- [13] HbbTV specification v1.5, HbbTV Association 2012 (2012-03-16)
- [14] Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB systems, ETSI TS 101 162, v.1.7.1 (2014-02)
- [15] Digital Video Broadcasting (DVB); Measurement guidelines for DVB systems, ETSI TR 101 290, v1.3.1 (2014-07)
- [16] ISO 639-2: "Codes for the representation of names of languages - Part 2: Alpha-3 code".

1.4 Abbreviations and definitions

Mandatory / M	Feature which is mandatory to support always/all the time
Mandatory / m	Feature which is mandatory support if applicable
Optional / O	Feature which is not mandatory to support but strongly recommended
Shall (Mandatory)	Item is mandatory
Should (Recommended)	Item is not mandatory, but is highly recommended

AC-3	Audio Codec-3 (Dolby Digital)
AIT	Application Information Table
AVC	Advanced Video Codec
BER	Bit Error Ratio
CAS	Conditional Access System
CI	Common Interface
CI+	Common Interface Plus
CRID	Content Reference Identifier
DASH	Dynamic Adaptive Streaming over HTTP
DRM	Digital Rights Management
DTTV	Digital Terrestrial TV
DVB	The Digital Video Broadcasting Project
DVB-C	DVB standard for Digital Cable Transmission
DVB-T	DVB standard for Digital Terrestrial Transmission
DVB-T2	DVB standard for Digital Terrestrial Transmission – 2 nd generation
HbbTV	Hybrid Broadcast Broadband TV
HDTV	High Definition Television
HE-AAC	High-Efficiency Advanced Audio Coding
HOH	Hard-Of-Hearing
EIT	Event Information Table
E-AC3	Enhanced AC-3
IRD	Integrated Receiver Decoder
LCN	Logical Channel Number
MMI	Man-Machine Interface
NIT	Network Information Table
ONID	Original Network ID
OTA	Over-The-Air
PAL	Phase Alternating Line
PCM	Pulse Code Modulation
PSI	Program Specific Information
PVR	Personal Video Recorder
RF	Radio Frequency
SAS	Specific Application Support
SDT	Service Description Table
SFN	Single Frequency Network
SI	Service Information
SID	Service ID
SQI	Signal Quality Indicator
SSI	Signal Strength Indicator

SSU	System Software Update
STB	Set-Top-Box
TDT	Time/Date Table
TOT	Time Offset Table
TS	Transport Stream
TSID	Transport Stream ID
UHF	Ultra High Frequency
VHF	Very High Frequency

2 Scope

This document supersedes the documents, *Rules of Operation of Service Information in the Finnish DTTV Networks* and *The Rules of Operation for Finnish Digital Cable TV Networks*.

The document defines the set of transmission rules to satisfy IRDs compliant with NorDig Unified [3] and Unified Requirements for DVB-C and DVB-T2 Digital Receivers for the Finnish market [1].

Transmission rules for DVB-S and IPTV delivery or IRD requirements are not covered.

Unless otherwise noted or overridden with the requirements in this document, the rules of operation of SI comply with the specifications EN 300 468 [10] and TS 101 211 [11].

3 Background

Digital terrestrial and cable television broadcasts were started in Finland in 2001. Analogue switch-off was completed in Finnish Terrestrial networks in September 2007 and in Finnish Cable networks in March 2008. No analogue broadcasts are available in either Cable or Terrestrial. Currently digital television covers 99,9% of the population of Finland.

First HD broadcasts began in Cable networks in late 2008 and HD services were introduced to terrestrial networks together with DVB-T2 in November 2010. Cable and Terrestrial operators offer both free-to-air and pay-tv services in both standard and high definition.

Currently, 2016-19-19, approximately half of the Finnish households is connected into Cable and/or IPTV network and approximately half of households into Terrestrial network. Small share of households is using satellite network and on summer cabins it is normally used DVB-T network. Recently there has been steady small increase of the share of IPTV connected households.

Latest information on the current situation can be found at FiCom website <http://www.testatutlaitteet.fi/> following the link 'Briefly in English'.

4 Digital television features in Finland

The Terrestrial networks in Finland are based on both DVB-T and DVB-T2 and are operated on both VHF (DVB-T2) and UHF (DVB-T, DVB-T2).

Switchover from DVB-T to DVB-T2 broadcasts in all terrestrial networks is planned for Q1/2020.

The Cable networks in Finland are based on DVB-C. DVB-C2 may be introduced in the future.

The signalization in the networks is defined on basis of DVB recommendations [11] and NorDig requirements [3] with restrictions, additions and exceptions as described in this document.

The networks include both free-to-air and scrambled services. Some of the free-to-air services are must-carry and consequently available in all networks. Scrambled services are encrypted with Conax CAS. Simulcrypt with other CA systems may be used [6].

The networks in Finland carry MPEG-2 SD and MPEG-4 SD and HD television services and MPEG-2 radio services. Television services may be multilingual in terms of audio, subtitles and teletext.

Subtitling in the services can be multi-lingual, consisting of DVB subtitling and EBU Teletext subtitling or both. Subtitling may be available with several different languages. Same subtitling language may be available with different subtitling techniques.

EBU Teletext pages are available and commonly used.

All networks utilize Nordig privately defined *logical_channel_descriptor* for channel list numbering. NorDig *logical_channel_descriptor_v2* may be introduced in the future and may be broadcasted in parallel with *logical_channel_descriptor*.

Some broadcasts include HbbTV applications. The role of HbbTV may be increased in the future.

Audio for the visually impaired is available. For compatibility with legacy receivers, the visual impaired audio is signaled for the time being as 'Dutch' (ISO-639-2 language code *dut* [16]) regardless of the audio language.

Subtitling for the hard-of-hearing is available. For compatibility with legacy receivers, the subtitling for the hard of hearing on MPEG-2 SD services is signaled as 'Dutch' (ISO-639-2 language code *dut* [16]) regardless of the subtitling language.

4.1 Service information and Program Specific Information

Rules for PSI and SI tables are found in chapter 6.2. Service IDs and program numbers are fixed and do not change dynamically.

PMT tables are updated dynamically. That is, number of components (audio, subtitling) and their descriptors (audio language, subtitling language, application descriptors) may change.

PCR can be either embedded to a component (usually video) or on a separate PID.

4.2 Video signalization

The networks in Finland carry MPEG-2 SD and MPEG-4 SD and HD television services and MPEG-2 radio services. Video streams may be both VBR and CBR.

Different luminance resolutions and aspect ratios may be used and they may be changed dynamically.

Services with HEVC video components and UHD resolution may be broadcasted in the future.

4.3 Audio signalization

MPEG-2 SD services have audio tracks broadcasted in MPEG1L2. MPEG-2 SD services may have additional audio tracks broadcasted in AC-3.

MPEG-4 SD services are broadcasted with HE-AACv1L2 audio. MPEG-4 HD services are broadcasted with HE-AACv1L2 or AC-3 audio.

E-AC3 and HE-AACv1L4 audio components may be broadcasted in the future.

Audio channel configuration for MPEG1L2 may be mono, stereo or dual-channel. Audio channel configuration for advanced codecs may be 2.0 or 5.1.

The PMT entry for an audio stream contains at least *ISO-639_language_descriptor*. *AC-3_descriptor* and *AAC_descriptor* are used when applicable. Other descriptors may be signalled.

Services may have multiple audio tracks. These audio tracks may be broadcasted with different audio languages, audio types and audio formats. Same audio language can be broadcasted with different audio types and audio formats. There may be both supplementary audio and normal audio with the same language.

4.3.1 Audio for visually impaired

Audio type of an audio elementary stream component is defined in PMT by the *ISO_639_language_descriptor*. "Normal" audio (type 0x0) is intended for the majority of users.

Supplementary audio for the visually impaired is broadcast-mixed spoken subtitling. It is typically signalized for subtitled events and its component can be added to and removed from the PMT dynamically.

For compatibility with legacy receivers, the visual impaired audio is signalized for the time being as 'Dutch' (ISO-639-2 language code *dut* [16]) regardless of the audio language of the actual content. Audio type in the *ISO_639_language_descriptor* is 0x3 (Visual impaired commentary).

Supplementary_audio_descriptor can also be used to indicate services for the visually impaired.

Services with receiver-mixed supplementary audio may be broadcasted in the future.

4.4 Conditional Access

Encrypted services in Finnish networks are scrambled using the Conax CAS. Simulcrypt with other CA systems may exist. [6]

Location of CA descriptors at PMT can be either in *program_info* loop or at *ES_info* loop. Scrambling may be either statically on or off, or switched on/off on event basis. Signalization of ECM PID is in PMT table.

5 Digital television networks in Finland

5.1 Terrestrial Networks

Finnish Digital Terrestrial Network consists of three different network operators networks. As per the status of 2017 networks are:

- Digita DVB-T and DVB-T2 networks
- DNA DVB-T2 network
- Elisa DVB-T network (regional)

Latest information on network coverage areas, network structure and services are available at the operator web sites <http://www.digita.fi>, <http://www.dna.fi> and <http://www.elisa.fi>.

In some parts of Finland it is possible to receive digital terrestrial multiplexes from the neighboring countries Sweden, Norway, Estonia and Russia.

It is intended that IRDs are able to install all receivable services from all receivable multiplexes from all networks. All domestic networks have equal priority.

DVB-SI information is cross-distributed within each network. DVB-SI is not cross-distributed between the networks. All transmitters of a multiplex share common SI tables but audiovisual content may differ.

Currently regional service definitions are not used in terrestrial networks. Regional service definitions may be introduced in the future.

Terrestrial networks operate on frequency bands VHF III, UHF IV and UHF V. Due to the co-existence of LTE 4G 700MHz frequency band, the UHF V band is limited. The highest UHF V -band channel available for digital terrestrial television is Ch 48 (Centre frequency 690 MHz).

12.9.2016: Ministry of Transport and Communications has invited applications for UHF multiplexes B, C and D. Licenses will be issued for a period from 17 May 2017 to 10 January 2027.

UHF B: DVB-T2 / MPEG-4

UHF C: technology neutral (network operator may decide which transmission and compression technologies are used)

UHF D: technology neutral

It is expected that the licenses are granted later in 2016.

5.1.1 Use of IDs

ETSI TS 101 162 defines the SI code allocation for *network_id*, *bouquet_id*, *CA_system_id* and Country codes [14]. Bouquets are not used in Finland so *bouquet_ids* are not in use either. Finnish Communications Regulatory Authority (FICORA) is responsible for the ETR 162 parameters.

5.1.1.1 Original Network ID

All Finnish Digital Terrestrial Networks share the same Original Network ID (0x20F6).

5.1.1.2 Network ID

Finland has 256 unique *network_id* values for its sub-networks. Document ETSI TS 101 162 [32] defines a "Colour code" to each European country for defining the usable *network_id* range. Colour-code of Finland is D. Consequently the *network_id* values in Finland are between 0x3301 and 0x3400.

Unique *network_id* values are allocated to network operators according to Table 1.

Network Operator	Values (Hex)
Digita	0x3301-3328
Elisa	0x33D8-33FF
DNA	0x332C-3353
SMATV info channels	0x332B
Otadigi	0x33A0
Reserved for test networks	
Digita	0x3329
Elisa	0x33D7
DNA	0x3354

Table 1 Network ID values in Terrestrial networks (status of 2017)

5.1.1.3 TS_ID (Transport Stream Identifier)

Each service can be uniquely defined by the DVB triplet (ONID, TSID and SID).

This is a 16-bit field which serves as a label to identify this Transport Stream from any other multiplex within a network.

The TSID values in Finnish terrestrial networks are assigned as follows:

The first nibble (HEX) indicates the multiplex, the next indicates the frequency range (UHF=0xx0xx, VHFIII=0xx3xx) and the last two digits indicate the network or region.

Transport Stream	Network Operator	Value (Hex.)
Reserved	n/a	0x0xxx
Multiplex A	Digita	0x10xx
Multiplex B	Digita	0x20xx
Multiplex C	Digita	0x30xx
(Multiplex D)	Digita	0x40xx
Multiplex E	Digita	0x50xx
Multiplex F	Digita	0x60xx
Multiplex VHF1	DNA	0x13xx
Multiplex VHF2	DNA	0x23xx

Multiplex VHF3	DNA	0x33xx
Multiplex SveaTV	Elisa SveaTV	0x1101
Multiplex SveaTV	Elisa SveaTV	0x2101
Multiplex SveaTV	Elisa SveaTV	0x3101
Multiplex VTT/Otadigi DVB-T	VTT	0x0001
SmaTV info channels		0x010 – 0x0020

Table 2 TSID values in Terrestrial networks (status of 05/2017)

1) Network licenses for multiplexes B, C and D will be granted later in 2016.

5.1.1.4 SID (Service Identifier)

Each service_ID shall be unique within original network ID. Service IDs are allocated by the network operator. It is recommended that the SIDs are allocated using the following logic:

First two hex digits of the SID are taken from the TSID. Last two hex digits can be chosen freely.

Example: Services in UHF Multiplex A should use SIDs from 0x1000 - 0x10FF.

To avoid problems with legacy IRDs, it is likely that existing services will continue to use their current SIDs even after 2017-01-10.

5.1.1.5 PID (Packet Identifier)

Operators may freely choose PID values from range 0x20-0x1FFA.

5.1.1.6 DVB Triplet

Each service in the networks in Finland can be uniquely defined by its DVB triplet (ONID, TSID and SID).

5.1.2 Measurement guidelines

Finnish DTTV systems provide signals which follow ETSI TR 101 290 measurement guidelines [15]. Signals pass priority 1, 2 and 3 tests.

For IRDs it is assumed that IRD is able to show picture, audio, subtitling, teletext and applications normally if signal temporarily fails priority 2 or 3 tests.

5.1.3 Network Structure – Digita

Digita DVB-T network is a MFN network in UHF band with local SFN regions. The network consists of three multiplexes (A, C and E). Multiplex A is transmitted in all stations whereas multiplex C and E are not available in all stations. Multiplexes C and E may have different service selection between transmitters. On-channel repeaters and transponders are used in all multiplexes.

Digita DVB-T2 network is a MFN network in UHF band with local SFN regions. The network consists of two multiplexes (B and F). These multiplexes are not available in all transmitter stations.

Digita has 2 DVB-T multiplexes A and E and one DVB-T2 network F. Multiplex A is nationwide, E and F are not available in all transmitter stations.

RF Parameters	DVB-T multiplexes: A, C and E	DVB-T2 multiplexes: B, F
Channels:	UHF	UHF
Mode:	64-QAM	256-QAM
Code rate:	2/3	4/5
Guard Interval:	1/8	19/128
Modulation:	COFDM	COFDM
Transmission Mode:	8k	32ke
Pilot Pattern	-	PP2

Table 3 RF transmission characteristics of Digita DVB-T and DVB-T2 networks

5.1.4 Network Structure – DNA

DNA DVB-T2 networks are MFN networks in VHF band with local SFN regions. The network consists of three multiplexes (VHF A, VHF B and VHF C). All three multiplexes are transmitted from all stations, so all DNA services are available throughout the coverage area.

RF Parameters	DVB-T2 multiplexes
Channels:	VHF
BW:	7 MHz
Mode:	256-QAM
Code rate:	4/5
Guard Interval:	19/256
Modulation:	COFDM
Transmission Mode:	32K
Pilot Pattern	PP4

Table 4 RF transmission characteristics of DNA DVB-T2 network

5.1.5 Network Structure – Elisa

Elisa DVB-T network is a regional DVB-T network in UHF band with local SFN regions. The network consists of one multiplex (SveaTV).

5.2 Cable Networks

The biggest cable television operators are DNA, Elisa and Telia. These operators also act as super-head-end operators for digital television services.

Cable operators collect their signals from the Finnish digital terrestrial networks and digital satellite transmissions from available satellites. Some additional locally distributed and generated signals are also transmitted. Cable TV operators may also exchange signals between each other.

The free TV signals on the Finnish digital terrestrial network are mostly publicly available all around the Cable networks. Other services are usually offered as a part of pay-TV packages. Encrypted services in Finnish Cable networks are scrambled using the Conax CAS. Simulcrypt with other CA systems may exist on some of the networks.

In addition, there are approximately 20 smaller cable television operators providing TV services locally in specific areas.

5.2.1 Transmission parameters

Currently the transmission parameters in Cable television networks in Finland are as follows:

Frequency range:	114 MHz - 858 MHz
Modulation:	64, 128 or 256 QAM
Symbol Rate:	6,875 Msym/s or 6,900 Msym/s

6 Program Specific Information and Service information

6.1 Overview

The network signalization follows the DVB standards referred in this document as closely as possible. In addition to that, NorDig logical channel descriptors (versions 1 and 2) are in use as per NorDig Unified Specification [3].

6.2 PSI and SI table repetition rates

For all PSI/SI defined in this document the minimum time between arrival of the last byte of a section to the first byte of the next transmitted section in the same PID, table_id and table_id_extension and with the same or different section number shall be 25 ms. That is, maximum repetition rate is 25 ms.

PSI and SI table repetition rates are based on ETSI recommendation [11]. Minimum repetition rates are specified in order to reflect the need to impose a limit on the amount of available bandwidth used for this purpose.

Repetition rates defined in Table 5 are use in the Digital Terrestrial Television networks.

Table	PID (hex)	M/O	MPEG/DVB [ms]	Digita [ms]	DNA [ms]	Elisa [ms]
PAT	0000	M	25-500	100	100	tbd
PMT	0020- 1FFE	M	25-500	100	100	tbd
CAT	0001	M	25-500	100	100	tbd
NIT_actual	0010	M	25-10000	8000	1000- 30000	tbd
NIT_other	0010	O	25-10000	n/a	-	tbd
SDT_actual	0011	M	25-2000	1000	1000	tbd
SDT_other	0011	m ¹	25-10000	2000		tbd
EIT_actual p/f	0012	M	25-2000	1000	2000-4000	tbd
EIT_actual schedule ²	0012	M	25-10000 25-300000	40000 (first 4 days) 40000 (next 4 days)	10000- 20000 (0-3 days) 10000- 30000 (4-7 days)	tbd
EIT_other p/f	0012	M	25-10000	6000	10000- 20000	tbd
EIT_other schedule	0012	O	25-10000 25-300000	60000 (first 4 days) 100000 (next 4 days)	10000- 60000 (0-3 days) 10000- 60000 (4-7 days)	tbd
TDT/TOT	0014	M	25-30000	30000	1000- 10000	tbd
AIT		m	300-1000	300-600		

- 1) Receiver shall rely only on SDT_actual tables. SDT_other is transmitted for informative purposes.
- 2) Mandatory for one day when the scheduled information is available.

Table 5 PSI/SI table repetition rates in Digital Terrestrial Television networks

Table	PID (hex)	M/O	MPEG/DVB [ms]	DNA [ms]	Elisa[ms]	Telia [ms]
PAT	0	M	25-500	100	100	100
PMT	0020-1FFE	M	25-500	100	100	200
CAT	1	M	25-500	100	100	100
NIT_actual	10	M	25-10000	1000 ¹ - 10000	1000	1000
NIT_other	10	O	25-10000	-	-	-
SDT_actual	11	M	25-2000	1000	1000	1000
SDT_other	11	m1	25-10000	-	-	.
EIT_actual p/f	12	M	25-2000	1400-2000	2000	1900
EIT_actual schedule	12	M	25-10000 25-300000	6000-1000 (0-3days) ¹ 6000-20000 (4-7 days) ¹ 8000-1000 (0-3 days) ² 8000-20000 (4-7 days) ¹	30000	10000
EIT_other p/f	12	M	25-10000	4000-10000 ²	-	5000

EIT_other schedule	12	O	25-10000 25-300000	10000-30000 (0-3 days) ² 60000-400000 (4-7 days) ²	-	60000
TDT/TOT	14	M	25-30000	2000-10000	30000	29000
AIT		m	300-1000			

- 1) DNA MUXes 102-127
- 2) DNA MUXes 1, 100 and 101

Table 6 PSI/SI table repetition rates in Digital Cable Television networks

6.3 SI text strings

The text strings are coded using “Latin alphabet number 5” as specified in ISO 8859-9 or optionally using “Latin alphabet” as specified in ISO/IEC 6937.

6.4 Program Specific Information (DVB-PSI) tables

Mandatory and optional descriptors are handled according to NorDig Rules of Operation [4] and ISO/IEC 13818-1 [5].

6.4.1 Program Association Table (PAT)

PAT shall be encoded according to ISO/IEC 13818-1 [5].

PAT shall indicate the PID values of the Program Map Tables for the services in the multiplex.

Program_number 0 shall be reserved for the NIT table. NIT PID shall always be 0x0010.

6.4.2 Program Map Table (PMT)

PMT tables shall be encoded according to ISO/IEC 13818-1 [5].

PMT shall indicate the PIDs of the elementary streams that construct each service.

The broadcasted descriptors in PMT are given in Table 5.

Descriptor	Explanation	M/O
CA_descriptor	Shall be inserted whenever a service or service component is scrambled. It may be inserted both in the service level or component level (first or second loop). Private data is optional.	M
Video_stream_descriptor	Mandatory if MPEG still pictures are transmitted.	M

	If still pictures are transmitted this shall be indicated by setting the "still_picture_flag" in the video_stream_descriptor in the PMT to "1"..	
ISO_639_language_descriptor	Shall be inserted for every transmitted audio component. Any value defined in ISO 13818-1 [5] is allowed. For dual-channel audio components, the first descriptor value refers to the left audio channel and the second descriptor value refers to the right audio channel.	M
Teletext_descriptor	Shall be inserted for teletext components.	M
Subtitling_descriptor	Shall be inserted for DVB subtitling components.	M
Private_data_specifier	Shall be inserted when privately defined descriptors are used. For NorDig private defined descriptors the private_data_specifier shall be set to 0x00000029 (http://www.dvb.org/index.php?id=16)	M
Data_broadcast_id_descriptor	Shall be inserted when DVB bootloading mechanism is used.	M
Stream_identifier_descriptor	Shall be inserted for elementary streams carrying DSM-CC object carousels. Optional but recommended for other elementary streams.	M

Table 7 Descriptors in Program Map Table

6.4.2.1 Dynamic update of PMT

PMT is updated dynamically on some services according to event changes. Typical reasons for PMT update are changes in

- number of audio components
- language codes of audio components
- number of subtitling components
- language codes of subtitling components
- page id of subtitling component

IRD is expected to react to the PMT table changes both when PMT version number has changed and when tuning to the particular service.

6.4.3 Conditional Access Table (CAT)

CAT shall be encoded according to ISO/IEC 13818-1 [5].

CAT provides information on the CA systems used in the multiplex. CAT shall be transmitted if at least one service component in the transport stream is scrambled. The broadcasted descriptors in CAT are given in Table 8.

Simulcrypt is used in some of the networks for IPTV broadcasting purposes. Used CA systems and their CA_System_ID values are given in Table 9.

Descriptor	Explanation	M/O
CA_descriptor	CA_descriptor shall be inserted for each CA_system_id of the CA operator to identify the EMM PID.	M

Table 8 Descriptors in Conditional Access Table

CA_System_ID	CA system	Operator
0x0B00	Conax CAS	Anvia
0x0B00	Conax CAS	DNA
0x5601	Verimatrix	
0x0B00	Conax CAS	Elisa
0x1850	Nagravision1	
0x0B00	Conax CAS	Telia

Table 9 CA_System_IDs in the networks

6.5 Service Information (DVB-SI) Tables

The following SI tables shall be used in the networks:

Table	Name	PID (hex)
NIT_actual	Network Information Table	0010
SDT_actual	Service Description Table (Actual)	0011
SDT_other	Service Description Table (Other)	0011
EIT_actual p/f	Event Information Table (Present/Following, Actual)	0012
EIT_actual schedule	Event Information Table (Schedule, Actual)	0012
EIT_other p/f	Event Information Table (Present/Following, Other)	0012
EIT_other schedule	Event Information Table (Schedule, Other)	0012
TDT	Time Date Table	0014
TOT	Time Offset Table	0014

Table 10 Service Information tables

Mandatory and optional descriptors are transmitted according to ETSI EN 300 468 [10] , ETSI TS 101 211 [11] and NorDig Rules of Operation [4].

6.5.1 Network Information Table (NIT)

NIT describes the physical organization of the multiplexes (transport streams) carried in the given network and characterizes the network itself.

NIT_actual shall be transmitted for each transport stream in the network. NIT_other may be transmitted. NIT is always transmitted on PID 0x0010. All sections of NIT shall be transmitted with the repetition rates specified in chapter 6.2.

It is expected that the IRDs monitor the NIT version number and thereby are able to detect the changes in the network accordingly. Consequently the NIT table content shall be consistent for every transport stream in the given network.

NIT descriptors are given in Table 11.

Descriptor	Explanation	DVB-T M/O	DVB- T2 M/O	DVB-C M/O
Network_name_descriptor	Shall be inserted for each NIT subtable	M	M	M
Multilingual_network_name_descriptor	If transmitted, shall be inserted for each NIT subtable. May include multiple language codes	O	O	O
Terrestrial_delivery_system_descriptor¹	Shall be inserted for each transport stream.	M	O	O
T2_delivery_system_descriptor	Shall be inserted for each transport stream.	O	M	O
Cable_delivery_system_descriptor	Shall be inserted for each transport stream.	O	O	M
Private_data_specifier	Shall be inserted when privately defined descriptors are used. For NorDig private defined descriptors the private_data_specifier shall be set to 0x00000029 (http://www.dvb.org/index.php?id=16)	M	M	M
Logical_channel_descriptor	NorDig private descriptor [3], [4]. Shall be inserted in the 2 nd descriptor loop. All services in a transport stream should be listed.	M	O ²	M

Logical_channel_descriptor_v2	NorDig private descriptor [3], [4]. Shall be inserted in the 2 nd descriptor loop. All services in a transport stream should be listed.	O	O ²	O
Linkage_descriptor	See chapter Over The Air Downloading (Bootloading)	m	m	m
Service_list_descriptor	Shall be inserted to the 2 nd descriptor loop. Optional according to ETSI [11] but mandatory due to requirement for service categorization as per NorDig [3].	M	M	M

- 1) At the moment in Digital DVB-T network, Terrestrial_delivery_system_descriptor centre_frequency values are as per Espoo transmitter regardless of the actual transmission frequency.
- 2) Either LCNv1 or LCNv2 shall always be transmitted in DVB-T2 networks

Table 11 Descriptors in Network Information Table

6.5.1.1 Logical channel numbering

Channel numbering is defined with NorDig privately defined *logical_channel_descriptor* and/or *logical_channel_descriptor_v2*. They shall be transmitted as per defined in NorDig RoO [4] and NorDig Unified Specification [3]. *Private_data_specifier* shall be broadcasted with value 0x00000029. It shall be transmitted before a *logical_channel_descriptor* and *logical_channel_descriptor_v2*.

All services in a transport stream should be listed in the logical channel descriptor loop. Services not included will be 'visible' for the IRD but located as last in the service list.

For each service type, the logical channel number shall be unique within the network (defined by the *network_id*). In areas where several terrestrial networks defined by original network ID intersect and the same logical channel number is used by several services, only the service belonging to the preferred original network will be assigned to its logical channel number.

When T2 network and receiver penetration is large enough logical channel numbering could be changed. Thus HD services could be signaled in lower numbers and SD versions in higher numbers for DVB-T2 devices using LCN v2. Legacy devices (DVB-T) will receive LCN v1 where SD services are in lower numbers and HD services in higher numbers.

6.5.2 Service Description Table (SDT)

SDT describes the services in a multiplex. *SDT_actual* describes the services in the current multiplex and *SDT_other* describes the services in the other transport streams in the same network.

SDT_actual shall be transmitted for each transport stream in the network. *SDT_other* may be transmitted. SDT is always transmitted on PID 0x0011. All sections of SDT shall be transmitted with the repetition rates specified in Table 5 and Table 6.

For each service the parameter *running_status* is set to 'running'.

Entries for services requiring CI+ include *CI_protection_descriptor*. It is preceded with *private_data_specifier* having value 0x00000040 (CI Plus LLP) [9].

SDT descriptors are given in Table 12.

Descriptor	Explanation	DVB-T M/O	DVB- T2 M/O	DVB-C M/O
Service_descriptor	Provides the names of the service provider and the service in text form together with the service_type	M	M	M
CA_identifier_descriptor	Indicates whether a particular bouquet, service is associated with a conditional access system and identifies the CA system type by means of the CA_system_id.	O	O	O
Linkage_descriptor	Identifies a service that can be presented if the consumer requests for additional information related to a specific entity described by the SI system.	O	O	O
Multilingual_service_name_descriptor	Conveys the names of the service provider and service name in one or more languages.	O	O	O
Private_data_specifier_descriptor	Is used to identify the specifier of any private descriptors or private fields within descriptors.	O	O	O
Data_broadcast_descriptor	Identifies the type of the data component and may be used to provide a text description of the data component.	O	O	O
CI_protection_descriptor	Provides a means of indicating the CI operating mode required by a service.	O	O	O

Table 12 Descriptors in Service Description Table

6.5.3 Event Information Table (EIT)

EIT describes the events in the services. The information includes the event name, text description, start time and duration of the event.

In the domestic broadcasts, the name and the short description of the events are be presented in Finnish and optionally in Swedish. Other languages are optional. The order of EIT descriptors using different languages is not fixed in the EIT. (i.e. some events may list Finnish first while others list Swedish first).

EIT schedule sections shall be transmitted for the actual transport stream for one day (when the information is available). EIT schedule is optional for the rest of the days and for other transport streams.

EIT schedule information may be transmitted only on one transport stream of a network, called the Barker Channel. All transport streams in the network that have its EIT schedule information located on another transport stream shall then contain a link to this EIT schedule information, implemented by a linkage_descriptor with linkage_type 0x04 in the NIT.

There is no defined upper limit for the EIT bitrate.

EIT descriptors are given in Table 13.

Descriptor	Explanation	DVB-T M/O	DVB- T2 M/O	DVB- C M/O
short_event_descriptor		M	M	M
extended_event_descriptor		O	O	O
component_descriptor ¹		M	M	M
content_descriptor		O	O	O
parental_rating_descriptor		O	O	O
private_data_specifier_descriptor		O	O	O

1) Only in EIT p/f, not always available

Table 13 Descriptors in Event Information Table

6.5.4 Time Date Table (TDT)

The TDT carries only the UTC-time and date information.

TDT section shall be transmitted in TS packets with a PID value of 0x0014, and the table_id shall take the value 0x70.

Repetition rates are defined in Table 5 and Table 6.

6.5.5 Time Offset Table (TOT)

The TOT carries the UTC-time and date information and local time offset. The TOT shall consist of a single section. This TOT section shall be transmitted in TS packets with a PID value of 0x0014, and the `table_id` shall take the value 0x73.

The `local_time_offset_descriptor` is carried within the TOT. It is used to describe country specific dynamic changes for Finland of the local time offset relative to UTC. Time offsets for other countries may be transmitted as well.

`Next_time_offset` parameter signalled in TOT `local_time_offset_descriptor` shall contain accurate information.

Note that TDT and TOT may be delivered in the same transport stream packet.

Descriptor	Explanation	DVB-T M/O	DVB-T2 M/O	DVB-C M/O
<code>local_time_offset_descriptor</code>	Used in the TOT to describe country specific dynamic changes of the local time offset relative to UTC.	M	M	M

Table 14 Descriptors in Time Offset Table

7 SSU signalization

The networks have capability to broadcast OTA SSU updates for the receivers and CI+ modules.

The SSU signalization is organized as per DVB SSU specification [8].

DVB-SSU Simple Profile is the recommended update method for the receivers.

When a SSU is being broadcasted, `NIT_actual` tables carry a `linkage_descriptor` of type 0x09 in the network descriptor loop to point at the Service ID of the service carrying the DSM-CC data carousel.

Network operators may choose to include one or multiple different SSU in a single SSU update service. Simultaneously there may be more than one SSU service available.

SSU service parameters (TSID, SID and PID values) will be determined individually by each operator depending on the current network configuration and available bandwidth.

Bandwidth reserved for DSM-CC data is typically 64kbit/s in terrestrial networks and between 100kbit/s and 1.5Mbit/s in Cable networks. The reserved bandwidth for DSM-CC data may be shared with the available DSM-CC data PIDs.

The SSU services are of `service_type` 0xC. The SSU services are not included in `logical_channel_descriptor`.

8 Teletext and Subtitling

Subtitling may be provided through ITU-R system B Teletext or through the DVB Subtitling System.

ITU-R System B teletext is inserted in DVB-TS according to ETSI EN 300 472 [12]. It is optional to transmit synchronized PTS in the PES header of teletext transmission. Consequently inaccurate PTS may be broadcasted or there may not be any PTS included in the PES header of the teletext.

The number of subtitle components or the language code can vary from event to event. The information on the configurations and their changes is updated dynamically in PMT.

Services may contain both 'normal' and 'hard of hearing' subtitles. For compatibility with legacy receivers, the subtitling for the hard of hearing on domestic MPEG-2 SD services is signaled as 'Dutch' (ISO-639-2 code *dut*) regardless of the subtitling language. MPEG-4 services may also use other languages for HoH subtitles. Consequently, there may be normal and HoH subtitles using the same language code.

9 Signalization for PVR

Some services may update EIT present/following information in real-time based on the information from the playout while others update EIT based on the predefined schedule.

In EIT an *event_id* shall be associated with a single event within the schedule. That is, if an event is rescheduled within the currently transmitted schedule, its *event_id* should remain intact.

More advanced PVR options like Content Reference Identifiers (CRID) are not currently used for domestic services.

10 HbbTV

When applicable the HbbTV is signalled using the Application information table in the transport stream. The presence of the AIT table is declared as a private sections component in the PMT of the corresponding service. The PMT includes application signaling descriptor in the component loop describing the AIT stream.

Descriptor	Explanation	DVB-T M/O	DVB-T2 M/O	DVB-C M/O
application_signalling_descriptor	Includes the application type (0x0010) and the AIT version number.	m	m	m

Table 14 Descriptors in Program Map Table for AIT stream (private sections, type 5). Transmitted only if the service includes HbbTV Applications

The AIT table includes information necessary for the receiver to launch the HbbTV application. It contains the following descriptors. The repetition rate for AIT table, if signaled, is 300-1000 ms. Table ID of the AIT table is 0x74. Only one AIT table is transmitted per service.

Each application has its own application loop in the AIT. The application identifier (organization and application id's) are declared before any descriptors. Version field can be used to require HbbTV 1.5 compliant (or better) receiver.

Descriptor	Explanation	DVB-T M/O	DVB-T2 M/O	DVB-C M/O
application_descriptor	HbbTV version information, visibility, protocol priority, service bound flag, application priority	M	M	M
application_name_descriptor	One entry for each language code	M	M	M
transport_protocol_descriptor	HTTP or DSMCC carriage, or both	M	M	M
simple_application_location_descriptor	Start page of the application	M	M	M

Table 15 Table 16 Descriptors in Application Information Table

10.1 Synchronization

It is expected that “do it now” stream events will be signaled in the future. This signaling will follow the HbbTV specification [13] and related references.

10.2 HbbTV Application Security (informative)

Trusted applications shall be signaled in the trusted application id range (16384->32767) in the AIT. Untrusted applications shall be signaled in the untrusted application id range (1-16383). Application ID 0 shall not be used.