
The Rules of Operation for
YouSee Digital Cable TV Networks in Denmark

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Table of Contents

1	General	3
1.1	Document change history	3
1.2	References	3
2	YouSee DVB-C networks in Denmark	4
2.1	Overview of YouSee network	4
2.2	YouSee service processing and delivery	4
3	Network signalling	5
3.1	Network quantitative figures	5
3.2	Overview	5
3.3	Program specific information (MPEG-2) tables	7
	BAT	7
	PAT	7
	CAT	7
	PMT	7
3.4	DVB Service information (DVB-SI) tables	8
	NIT	8
	SDT	10
	EIT	11
	TDT	11
	TOT	11
3.5	Privately defined descriptors	12
	Private Data Indicator PDI:	12
	Logical Channel number (LCN) Descriptor:	12
	Channel Descriptor	13
	Private Location ID	13
	Private Extended location ID	14
	Event tag descriptor	14
	TV-Anytime descriptor [9]	15
	OpenTV private descriptor	16
	OpenTV TID descriptor	16
	OpenTV Track Tag descriptor	16
4	CPE software update	17
4.1	System Software Update description	17
	Finding the service containing the Software Update component	17
	Finding the SSU component inside the service	17
	SSU data carriage	18
4.2	Detection and user notification of a software update	18
5	Conditional access system	19
6	Subtitling systems	20
7	CPE installation and channel search procedure	21
	Homing channel tuning parameters:	21
	Dedicated NIT ID's according to actual CPE support:	21
7.1	Service signalling conventions	21
7.2	Proposed CPE NIT-based channel search	22
7.3	Background for the signalling conventions	22
7.4	Manual frequency scan	22
8	RF network parameters seen on the users wall outlet	23
8.1	Downstream:	23
8.2	Upstream:	24

1 General

This document states the rules of operation of the YouSee digital cable television network. CPEs used in the YouSee network must comply with these specifications.

YouSee commits to the NorDig specification, and reserves the right to take advantage of the full NorDig Specification interpreted by YouSee. YouSee is not responsible for broadcasters changing the signal which may cause changes in YouSee's network.

The CPE must be compliant to the latest and all time current document: "NorDig Unified specification", YouSee Rules of Operation and follow the demands stated in the YouSee ready certification document.

1.1 Document change history

- February the 11. 2008, Version 1.09 issued
- July the 2. 2008, version 1.10. Added descriptor for serial recording.
- September the 10. 2008. Version 1.11. Added Extended location ID descriptor and change history added.
- Marts the 30. 2009, version 1.12. Change in "Network quantitative figures"
- August the 3. 2009 version 1.13. Changed extended loc ID descriptor tag and added OpenTV descriptors.
- Marts the 5. 2010 version 1.14. Changed subtitle preference and Serial record delimiter. Added RF parameters.
- December the 9. 2011 version 1.15. Corrections done on SI table playout interval, network size in TS, SSU, disclaimer and some minor editorial changes.
- March the 12. 2012 version 1.16. Corrected default network in CPE installation and channel search procedure section.

1.2 References

- [1] NorDig Rules of Operations for NorDig I and NorDig II receiver networks (www.nordig.org)
- [2] ETSI EN 300 472 V1.3.1: DVB Specification for conveying ITU-R System B Teletext in DVB bit streams (www.etsi.org)
- [3] ETSI EN 300 743 1.3.1: DVB Subtitling Systems (www.etsi.org)
- [4] ETSI EN 300 468 V1.11.1: DVB Specification for Service Information in DVB Systems (www.etsi.org)
- [5] ITU-R BT.653-3: Teletext Systems (www.itu.int)
- [6] ETSI TR 102 154 1.1.1: DVB Implementation Guidelines for the use of MPEG-2 Systems, Video and Audio in Contribution and Primary Distribution Applications (www.etsi.org)
- [7] ETSI TR 211: DVB Guidelines on implementation and usage of Service Information SI (www.etsi.org)
- [8] ETSI TS 102 006 v1.3.2: "Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems"
- [9] ETSI TS 102 323 V1.4.1: "Technical Specification Digital Video Broadcasting (DVB); Carriage and signalling of TV-Anytime information in DVB transport streams"
- [10] ETSI EN 300 429 V1.2.1: Digital Video Broadcasting (DVB), Framing structure, channel coding and modulation for cable systems.
- [11] CENELEC IEC 60728-1.

2 YouSee DVB-C networks in Denmark

2.1 Overview of YouSee network

YouSee today has more than one million homes passed, which represents about 45% of the Danish households. The biggest operators are YouSee and TeliaStofa, who share around 70% of the total market of 2.4 million households.

YouSee has started to offer digital television services around 1998. YouSee offers free-to-air and Viaccess-based subscription TV on the digital cable platform.

Digital cable TV (DVB-C) CPE or iDTV devices are available to Danish consumers in retail shops. If a household buys a CPE or iDTV devices in a retail store the user can get conditional access card from YouSee, or the conditional access card may be distributed with the CPE.

2.2 YouSee service processing and delivery

The TV and radio services are received in various ways. The majority of services are received by DVB-S Transport Stream receivers / descramblers. These services, all in clear format are filtered through in the output multiplexers. Normally both the service components and PMT are passed but it can happen that certain descriptors are needed. In this case the PMT is generated in output MUX. This means that YouSee is not in control of Video and Audio codec on all channels as well format of DVB and EBU subtitles and EBU teletext. But the variations will be limited to formats available from satellites in Nordic region.

Some of the MPEG2 or H264 services received by DVB-S or DVB-S2 have to be modified before broadcasting. It can be due to bad teletext, inconvenient bandwidth or need of OSD subtitles or unsupported codecs. If bandwidth modifications are needed, the services can be decoded to SDI, processed and re-encoded to MPEG2 or H264 before being passed to output MUX'es. Or the MPEG2 services can be trans-rated to fit a trans-rate group. Other services are received as digital uncompressed video over SDI or HD-SDI; these are just encoded with the right parameters.

All services received over DVB-T and DVB-S are re-multiplexed to form new multiplexes. By this the original DVB-triplet can not be preserved. In reality all Original Network Id, TS ID and Service IDs from DVB-S and DVB-T are changed. The Original Network Id is normally changed to the YouSee specific value 0xFE00.

All SI tables are generated in the output multiplexers: TDT, TOT, SDT, EIT p/f, EIT-S and NIT actual and other. All tables are played out as actual and other tables.

Most services are scrambled; the scrambling is performed in the output MUX'es

3 Network signalling

3.1 Network quantitative figures

The headend is designed to carry and handle the below listed numbers. The numbers are lower in the present configuration but will increase to the listed figures in the future. The CPE must be able to handle the figures listed for all applicable items.

Item	Max values
Number of bouquets. (DVB BAT is not used)	1
Number of services.	< 500
Numbers of DVB transport streams (QAM)	< 80
PAL channels. (Not signalised in SI)	< 40
Numbers services pr TS	< 25
Length of service names	< 50 Bytes
Components pr service	< 10
Number of EIT p/f events	< 2*500
Size of EIT p/f	< 4096 Bytes
EIT-S schedule depth	<= 8*24H (currently 8 full days)
Number of EIT-S events	500 *8 *24
Size of EIT-S event	< 4096 Bytes (16 extended event descrip)
Total size of all EIT (EITp/f +EIT-S actual/other)	< 20 MByte
EIT (PID 18) bandwidth	Between 100Kbps and 4000 Kbps
Number of NIT's	< 120
Number of NIT tables the CPE has to handle at a time	1

3.2 Overview

In general, the network signalling follows the DVB standards referenced in this document as closely as possible. In addition, NorDig Logical Channel Numbering descriptor is used for operator-defined channel line-up. Specific requirements for descriptor support in PSI/SI are described in 3.3 and 3.4.

The following table summarizes the repetition rates used in the YouSee networks. DVB and MPEG minimum repetition rates are included as reference.

SI Homing channel (Present at 143 MHz, TS ID 1020):

Table	Playout interval (ms)	CPE use
NIT actual	5000 (DVB: 25- 10000)	Not used
NIT other	2000 (DVB: 25- 10000)	One NIT other ID for each cable subnet
SDT actual	1000 (DVB: 25-2000)	Channel scan and monitoring
SDT other	2000 (DVB: 25-10000)	Channel scan and monitoring
PAT	100 (DVB: 25-500)	Channel location within TS
PMT	100 (DVB: 25-500)	Component location within channel.
CAT	100	Entitlement management
TDT	15S-30S (DVB: 25-30000)	Time adjustment
TOT	15S-30S (DVB: 25-30000)	Time adjustment
EIT actual p/f	5000 (DVB: 25-2000)	Zapping Info banner and accurate recording
EIT other p/f	20000 (DVB: 25-10000)	Zapping Info banner and accurate recording
EIT-S act	4S-150S (DVB: 25-10000)	EPG day 0 to 3

EIT-S other	4S-1000S (DVB: 25-10000)	EPG day 0 to 3
EIT-S act	25S-1500S (DVB: 25-10000)	EPG day 4 to 7
EIT-S other	25S-3600S (DVB: 25-10000)	EPG day 4 to 7
EIT-S act	(DVB: 25-10000)	EPG day 8 to 11. Currently not used
EIT-S other	(DVB: 25-10000)	EPG day 8 to 11. Currently not used
BAT		Not used
RST		Not used
ST		Not used

All TS QAM channel except SI Homing channel:

Table	Playout interval (ms)	CPE use
NIT actual	6000 (DVB: 25- 10000)	Not used
NIT other	10000 (DVB: 25- 10000)	One NIT other ID for each cable subnet
SDT actual	500 (DVB: 25-2000)	Channel scan and monitoring
SDT other	4000 (DVB: 25-10000)	Channel scan and monitoring
PAT	100 (DVB: 25-500)	Channel location within TS
PMT	100 (DVB: 25-500)	Component location within channel.
CAT	100	Entitlement management
TDT	15S-30S (DVB: 25-30000)	Time adjustment
TOT	15S-30S (DVB: 25-30000)	Time adjustment
EIT actual p/f	5000 (DVB: 25-2000)	Zapping Info banner and accurate recording
EIT other p/f	20000 (DVB: 25-10000)	Zapping Info banner and accurate recording
EIT-S act	150000 (DVB: 25-10000)	EPG day 0 to 3
EIT-S other	1000000 (DVB: 25-10000)	EPG day 0 to 3
EIT-S act	1500000 (DVB: 25-10000)	EPG day 4 to 7
EIT-S other	3600000 (DVB: 25-10000)	EPG day 4 to 7
EIT-S act	(DVB: 25-10000)	EPG day 8 to 11. Not used
EIT-S other	(DVB: 25-10000)	EPG day 8 to 11. Not used
BAT		Not used
RST		Not used
ST		Not used

3.3 Program specific information (MPEG-2) tables

The repetition rates are based on the DVB recommendations. The maximum repetition rate for all tables is 25 ms. PAT and PMT tables [7] are transmitted every 100 milliseconds.

After each table description, a list of mandatory and optional descriptors with their explanations is given.

BAT

BAT is not used in the YouSee network.

PAT

The Program Association table is a mandatory field and always transmitted on PID 0x0000. PAT provides the link between the program number (same as Service ID) and the corresponding PMT PID. PAT will be transmitted every 100 milliseconds.

CAT

The Conditional Access table is a mandatory field if one or more components in the transport stream are scrambled. CAT is always transmitted on PID 0x0001.

The CAT carries the CA descriptor with Viaccess CA ID 0x0500. The descriptor is pointing to the EMM PID. Normal only one descriptor is present but during swap of CA technology several descriptors can be present to signalise several EMM PID's.

Other descriptors than the ones listed below are optional to transmit and optional to process in the PMT.

Descriptor	CPE use
CA descriptor	Used to identify CA system and EMM pid.

PMT

Program Map Tables are transmitted for each service on the network. For each PMT, there will be a separate PMT PID inside one transport stream. PMT will be transmitted every 100 milliseconds. The PMT will change dynamically according to changes for example in audio and subtitling languages available for the service.

The Descriptors listed below are optional to transmit.

Descriptor	YouSee rule of Operation	Description
CA descriptor	Present in the component loop or in the first descriptor loop. Only the case when service is scrambled.	Used to identify CA system and ECM pid for service or component.
ISO_639_language_descriptor	Present in the component loop.	Used to identify audio tracks and EBU subtitle pages. Any value defined in 13818-1 is allowed. For dual mono components, the first ISO_639 descriptor refers to the left audio channel and the second refers to the right audio channel.
Teletext_descriptor	Present in the component loop whenever a teletext component is present.	Used to identify teletext components and teletext subtitles.
Subtitling_descriptor	Present in the component loop whenever a DVB subtitling component is	Used to identify DVB subtitle components.

	present.	
AIT descriptor	When applicable	Used to signalise a HbbTV component in a TV service
Data_broadcast_id_descriptor	When applicable	Used in the component loop to identify the PID and OUI for the DVB SSU data carousel or signalise a DSM-CC HbbTV object carousel.
AC-3_descriptor	Present in the component loop for digital audio components. Used to identify Dolby Digital audio tracks.	Mandatory to handle if applicable

3.4 DVB Service information (DVB-SI) tables

NIT

The NIT_other will be transmitted for each transport stream on the network. The NIT shall always be transmitted on PID 0x0010. NIT will be transmitted every 2000 milliseconds (2 seconds) on the homing channel.

The NIT version number shall be monitored to detect changes on the network. If the version number is changed, the CPE shall in background start an automatic channel information update process. For this reason, the version number of the NIT will be the same for each transport stream on the network.

NIT_actual (TID 0x40) is used for specific purpose and does not cover all channels.

Other descriptors than the ones listed below are optional to transmit.

Descriptor	YouSee rule of Operation	Description
Network_name_descriptor	Always present in first descriptor loop.	Network name shall be displayed during installation/channel search.
Cable_delivery_system_descriptor	Always present in second descriptor loop to describe all transport streams on this network. All valid transport streams are listed in the second descriptor (TS) loop.	Used to get tuning information for all transport streams during channel search.
Linkage_descriptor of type 0x02	Present in the first descriptor loop when relevant.	Used to link to OpenTV EPG service
Linkage_descriptor of type 0x04	Present in the first descriptor loop when relevant.	Used to identify the transport stream that carries EIT schedule information for all services on the network (barker).
Linkage_descriptor of type 0x09	Present in the first descriptor loop when relevant	Used to identify the OUI and the transport stream that contains the DVB SSU data carousel.
Linkage_descriptor of type 0xA0	Present in the first descriptor loop when relevant.	Used to link to OpenTV VOD service
Linkage_descriptor of type 0xA6	Present in the first descriptor loop when relevant.	Used to link to OpenTV ITV service
Linkage_descriptor of type 0xA7	Present in the first descriptor loop when relevant.	Used to link to WEB service
Private_data_descriptor 0x29	Always present in the second descriptor loop.	Will process NorDig private descriptors after detecting this

	Precedes the first Logical Channel Number descriptor.	specifier.
Private_data_specifier 0x31	Always present in the second descriptor loop. Precedes the first private descriptor.	Will process YouSee private descriptors after detecting this specifier.
Logical_channel_descriptor, TID 0x83	Present in the second descriptor loop	Used in second descriptor loop for channel numbering purposes. See section 7.2. Only interpreted if preceded by a NorDig private data specifier descriptor (0x29).
Channel_Descriptor TID 0x82	Present in the second descriptor loop	Used in second descriptor loop for channel numbering purposes. See section 7.2. Only interpreted if preceded by a YouSee private data specifier descriptor (0x31).
Service_list_descriptor	Always present in second descriptor loop. Identifies all services and service types on each TS.	Used during channel search.

SDT

The Service Description Table is mandatory for each transport stream on the network. SDT is always transmitted on PID 0x0011. The table id values 0x42 and 0x46 are used to identify actual and other tables, respectively. SDT will be transmitted (both actual and other) every 1000 milliseconds (1 second).

The SDT version number of each TS shall be monitored to detect changes on the network. If the version number is changed, the CPE shall in background start an update process. For this reason, the version number of each SDT will be the same across the whole network.

Each TS shall carry one and only one SDT_actual table.

Each TS shall carry one SDT_other for each of the other TS's present in the network.

E. g. if there are thirty transport streams in the network, there shall be one SDT_actual and twenty-nine SDT_others present on each transport stream.

Other descriptors than the ones listed below are optional to transmit.

Descriptor	YouSee rule of Operation	Required CPE use
Service_descriptor	Always present in the descriptor loop for each service.	Used to identify and associate name with services.

Service types available in SDT:

Services types	Description	YouSee rule of Operation	Required CPE use
0x01	TV service with MPEG2 SD Video	Available in network	Mandatory to handle
0x02	Radio service with MPEG1/2 Layer I/II audio codec	Available in network	Mandatory to handle
0x07	PAL B/G TV service	Available in network	Mandatory to handle if applicable
0x0A	Radio service with AVC audio codec	At the moment not available in network	Mandatory to handle if applicable
0x10	DVB MHP service	At the moment not available in network	Optional to handle
0x11	TV service with MPEG2 HD Video	Available in network	Mandatory to handle if applicable
0x16	TV service with AVC SD codec	Available in network	Mandatory to handle if applicable
0x19	TV service with AVC HD codec	Available in network	Mandatory to handle if applicable
0x84	Sagem firmware download service	Available in network	Mandatory for legacy CPE (ICD3000, ICD4000 and ICD60)
0x87	Sagem OpenTV out_of_list_service	Available in network	Mandatory for legacy CPE (ICD3000, ICD4000 and ICD60) Service type for VOD services. Mandatory for CPE supporting VOD.
0x88	Sagem OpenTV in_list_service	Available in network	Mandatory for legacy CPE (ICD3000, ICD4000 and ICD60).

EIT

Each transport stream will carry EIT p/f Actual for all services on the stream. In addition each transport stream will carry EIT p/f Other for all other services in the network. The Homing transport stream will carry EIT schedule. The CPE should be factory set to process linkage_descriptor of type 0x04 to locate a transport stream that carries all EIT schedule (Homing channel).

The descriptors used in EIT p/f and EIT scheduled are the same. Other descriptors than the ones listed below are optional to transmit.

Descriptor	YouSee rule of Operation	Required CPE use
Short event descriptor	Always present	Display to user in TV guide and during channel navigation. The text field in that descriptor is not used and the length is set to 0.
Extended event descriptor	Always present	Display to user in TV guide and channel navigation whenever user asks for additional information about a program. The text length can be up to 255 characters.
Content descriptor	Always present	content_nibble_level_1 possible values 0 to 15. content_nibble_level_2 possible values 0 to 15. User_nibble is not used.
TV-Anytime descriptor [9]	When applicable	The descriptor carry CRID values signalling Programs, Series or Recommendations information according to Nordig specification.
Event Tag descriptor	When applicable	Tag value is assigned the value 0x88

TDT

The Time and Date table (TDT) carries the UTC time and date information. It is mandatory in each transport stream on the network. The time accuracy shall be ± 2 seconds from UTC. Each section of the TDT shall be transmitted at least every 30000 milliseconds (30 seconds). TDT is transmitted on PID 0x0014.

TOT

The Time Offset table (TOT) carries the UTC time and date information and local time offset as well as the date when the next change shall happen. It is mandatory in each transport stream on the network. The time accuracy shall be ± 2 seconds from UTC. Each section of the TOT shall be transmitted at least every 30000 milliseconds (30 second). TOT is transmitted on PID 0x0014.

The TOT always carries the current UTC offset. YouSee is responsible for timely update of the TOT on change between summer and winter time. CPE is responsible for monitoring the offset time in TOT and the date when the next change shall happen and adjusting its clock accordingly.

Descriptor	YouSee rule of Operation	Required CPE use
Local_time_offset_descriptor	<p>Always present on all TS.</p> <p>Country code "DNK" is used.</p> <p>Country_region_id shall be set to zero.</p> <p>The local_time_offset/local_time_offset_polarity fields are not necessarily updated at the time of switchover, as time_of_change is used to signal the DST switchover time.</p>	<p>Adjusts clock according to TDT and TOT.</p> <p>Time_of change and next_time_offset must be interpreted by the CPE.</p>

3.5 Privately defined descriptors

Private Data Indicator PDI:

The PDI descriptor is placed ahead off all private descriptors.

```
private_data_indicator() {
    descriptor_tag           8      Uimsbf
    descriptor_length        8      Uimsbf
    for (i=0;i<N,i++){
        indicator_data      8      Uimsbf
    }
}
```

	Private data indicator
descriptor_tag	Is assigned to value 0x0f
descriptor_length	0x04
Indicator_data	Value assigned by ETSI in TR101 162. The value for YouSee is 0x00000031

Logical Channel number (LCN) Descriptor:

Logical channel descriptor descriptors are defined to provide support for user-friendly channel numbering.

The LCN descriptor is used to assign a certain channel number to a service. For each service type, the logical channel number will be unique across the network. It is not necessary to include all services to the logical channel descriptor. Services that are not included will be visible and located last in the service list. The logical channel numbers can start at any value and do not have to be continuous.

```
Logical_channel_descriptor() {
    descriptor_tag           8 Uimsbf
    descriptor_length        8 Uimsbf
    for (i=0;i<N;i++) {
        service_id           16 Uimsbf
        visible_service_flag 1 Bslbf
        reserved              1 Bslbf
        logical_channel_number 14 uimsbf
    }
}
```

Descriptor_tag	Will be assigned to 0x83
Service_id	The DVB service ID ranging from 0x0001 to 0xffff
Visible_service_flag	Set to 1 if the service is intended to be accessible and visible in channel lists Set to 0 if the CPE is not supposed to list this service. Service can still be accessed by entering the channel number directly.
Reserved	All reserved bits shall be set to 1
Logical_channel_number	This field indicates the logical channel number for the service. It shall be used as the channel number of the service in the CPE main channel list (for visible services). The range of channel numbers is 1 to 16383

Channel Descriptor

The Channel Descriptor is an propriety Sagem descriptor implementation, located in the second loop of the NIT, after service_list_descriptor. It is used to assign a certain channel number to a service. For each service type, the logical channel number will be unique across the network. It is not necessary to include all services to the logical channel descriptor. Services that are not included will not be visible. The channel numbers can start at any value and do not have to be continuous. The descriptor always follows a Private Data Specifier ID 49. (YouSee)

```
Channel_descriptor() {
    descriptor_tag           8 Uimbsf
    descriptor_length       8 Uimbsf
    for (i=0;i<N;i++) {
        service_id          16 Uimbsf
        Channel_number      16 uimbsf
    }
}
```

Descriptor_tag	Will be assigned to 0x82
Service_id	The DVB service ID ranging from 0x0001 to 0xffff
Channel_number	This field indicates the logical channel number for the service. It shall be used as the channel number of the service in the CPE's main channel list (for visible services). The range of channel numbers is 1 to 65535

Private Location ID

The descriptor is used to signalise the physical origin location of a service. The descriptor is optional for each service. If present it is to be placed in loop one of PMT, before component descriptors. When the CPE is asked to return the Location ID on a service where descriptor isn't present the return value should be "-1"

```
user defined location_ID_descriptor() {
    descriptor_tag           8      uimbsf
    descriptor_length       8      uimbsf
    for (i= 0;i<N;i++){
        location_ID         8      uimbsf
    }
}
```

}

Descriptor_tag	Will be assigned to 0x87
Descriptor_length	The length of the descriptor data field is normally set to 4
Location ID	Location ID is normally a number ranging from 0 to 99, but 4 bytes are normally assigned which implies numbers from 0 to 4294967295. When the CPE is asked to return the Location ID on a service where descriptor isn't present the return value should be "-1"

Private Extended location ID

The descriptor is used to signalize the physical location identified by a location ID and NIT ID of the appropriate network. The descriptor is optional and located in the Service PMT. If present it is to be placed in loop one of PMT, before component descriptors. When the CPE is asked to return the Location ID and NIT ID of a service where descriptor isn't present the return value should be "-1".

```

user defined extended_location_ID_descriptor() {
    descriptor_tag          8      uimsbf
    descriptor_length      8      uimsbf
    for (i= 0;i<N;i++){
        location_ID        32     uimsbf
        for (j= 0;j<P;j++){
            NIT_ID          16     uimsbf
        }
    }
}

```

Descriptor_tag	Will be assigned to 0x92
Descriptor_length	The length field reflect length of the descriptor data field. If descriptor is present the minimum length is 6. For each NIT ID added the length is incremented by two.
Location ID	Location ID is a number ranging from 0 to 4294967295 and NIT ID is a number ranging from 0 to 65535. When the CPE is asked to return the Extended Location ID on a service where descriptor isn't present the return value should be "-1"

Event tag descriptor

The descriptor is carrying YouSee specific information of the event. The descriptor is optional for each event. If present it is located after the content_descriptor in the second loop of the EIT. When the CPE is asked to return the Event TAG values of an event where descriptor isn't present the return value should be Boolean value FALSE.

```

user defined event_TAG_descriptor() {
    descriptor_tag          8      uimsbf
    descriptor_length      8      uimsbf
    for (i= 0;i<N;i++){
        RAM_cached_event    1      bslbf
        HD_cached_event     1      bslbf
        RAM_cached_trig_enabled 1      bslbf
        HD_cached_trig_enabled 1      bslbf
        reserved_future_use  4      bslbf
    }
}

```

Descriptor_tag	Will be assigned the value 0x88
Descriptor_length	The length of the descriptor data field is 0x1
RAM_cached_event	If set, indicates that the event is cached on RAM on a video server. The event is offered as catch-up and can be ordered as VOD for a limited time.
HD_cached_event	If set, indicates that the event is cached on Hard Drive on a video server. The event can be ordered as VOD as long as it present on Video server Hard Drive.
RAM_cached_trig_enabled	VOD trig mode are allowed on RAM cached events
HD_cached_trig_enabled	VOD trig mode are allowed on HD cached events
reserved_future_use	Can be defined later.

TV-Anytime descriptor [9]

The descriptor is carrying TV-Anytime specific information of the event. The descriptor is optional for each event. If present it is located after the content_descriptor or event tag descriptor in the second loop of the EIT. If the CPE is asked to return e.g. the Serial recording text string of an event where descriptor isn't present the return value should be the value null.

Content identifier descriptor [9] (ETSI TS 102 323 V1.2.1 (2005-11))
Table 106:

```

Syntax:
content_identifier_descriptor() {
    descriptor_tag          8      uimsbf
    descriptor_length      8      uimsbf
    for (i=0;i<N;i++) {
        crid_type          6      uimsbf
        crid_location      2      uimsbf
        if (crid_location == '00' ) {
            crid_length    8      uimsbf
            for (j=0;j<crid_length;j++) {
                crid_byte  8      uimsbf
            }
        }
        if (crid_location == '01' ) {
            crid_ref       16     uimsbf
        }
    }
}

```

Descriptor_tag	0x76 (see ETR 162 [8]).
Descriptor_length	Set to the actual length
CRID Type	E.g. Value 0x2 (series)
CRID byte	<p>The value is in the format: <'/><1 byte flag><8 byte Series ID as HEX values presented in ASCII format>< 0 to 54 bytes Series Title in ASCII format> where:</p> <ul style="list-style-type: none"> • 1 byte flag: 0x30: global (search for Serial ID across all services in network). • 1 byte flag: 0x31: single service (search for Serial ID only on the specific services). • 8 byte Series ID: Value uniquely the series • 0 to 54 bytes Series Title: Serial title for display purpose only <p>Example: 0x2F3034313546443739444D415348 represent: “/”, flag:</p>

	global series, serial id: 1096800157, display name: "MASH"
--	--

OpenTV private descriptor

The descriptor is carrying OpenTV specific information of component track.

```

user defined OpenTV_private() {
    descriptor_tag      8
    descriptor_length   8
    for (i=0;i<N,i++){
        indicator_data  8
    }
}

```

Descriptor_tag	Will be assigned the value 0x89
Descriptor_length	The length of the descriptor data field is 0x4
indicator_data	The value has to be set to 0x54534900.

OpenTV TID descriptor

The descriptor is carrying OpenTV specific information of component track.

```

user defined OpenTV_TID() {
    descriptor_tag      8
    descriptor_length   8
    for (i=0;i<N,i++){
        opentv_data     8
    }
}

```

descriptor_tag	Will be assigned the value 0x90
descriptor_length	The length of the descriptor data field is 0x1
opentv_data	The value has to be set to 0x86

OpenTV Track Tag descriptor

The descriptor is carrying OpenTV specific information of component track.

```

user defined openTV_track_tag() {
    descriptor_tag      8
    descriptor_length   8
    for (i=0;i<N,i++){
        track_tag_data  8
    }
}

```

descriptor_tag	Will be assigned the value 0xfe
descriptor_length	The length of the descriptor data field is 0x4
indicator_data	The value has to be set to OpenTV track value

4 CPE software update

4.1 System Software Update description

The service that offers firmware upgrade of CPE units is based on the ETSI 102 006 System Software Update, SSU specification [8], simple and enhanced profile.

Finding the service containing the Software Update component

NIT_other is used as the starting point to locate the update service. Inside the first descriptor loop of the NIT, there shall be located a linkage descriptor with linkage type equal to 0x09. This linkage descriptor points to the system software update service, which contains the SSU.

This linkage descriptor points to a DVB triplet (Org Network ID, TS ID and Service ID) uniquely identifying a service where the PMT signalise a data broadcast id descriptor with the data broadcast id equal to 0x000A. The linkage descriptor is shown in Figure 1. The program identified in the PMT may carry several DSM-CC based SSU elementary streams, possibly in combination with other types of elementary streams. The network operator governs the detailed assignment of elementary streams. In the case of enhanced profile the service references an Update Notification Table, UNT that carry detailed information of the software packages.

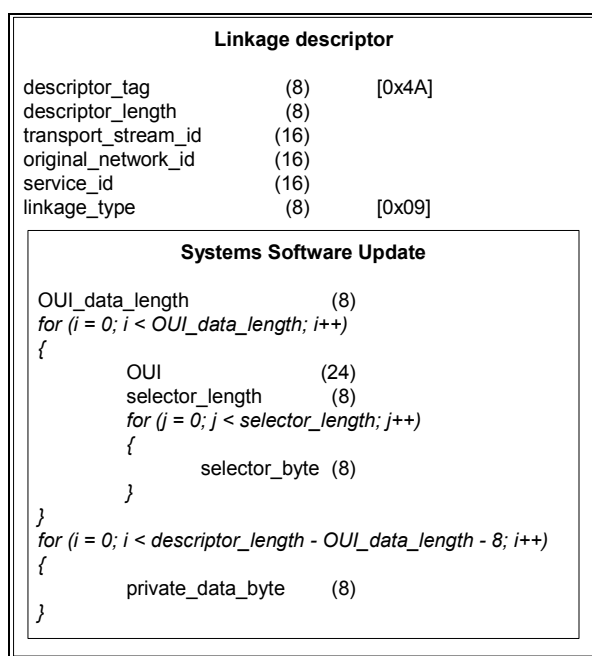


Figure 1
Linkage descriptor of type 0x09

The OUI inside the System Software Update (SSU) refers to the Organizationally Unique Identifier assigned to the CPE vendor by IEEE. If a matching linkage descriptor is found, the CPE will tune to the corresponding service, as given by the DVB triplet original network id, transport_stream_id and service_id.

Finding the SSU component inside the service

Once the CPE has tuned to the TS containing the service containing the SSU stream, it will use the PAT to find the PID of the PMT carrying the SSU. Inside the PMT, the CPE will search for a component with a data broadcast ID descriptor of type 0x0A and with an OUI that matches the CPE manufacturer's OUI or DVB defined default OUI with value 0x00015A. If such a component is found, it will identify the PID of the SSU. In the case of enhanced profile the service references an UNT that carry detailed information of OUI and the corresponding software packages.

SSU data carriage

The Software Update service shall use the DSM-CC “Standard update carousel” format, see section 5.2 of [8].

The bitrate used in one single DSM-CC carousel can be between 100 Kbps and 20 Mbps.

4.2 Detection and user notification of a software update

The intentional behaviour of the CPE should be to periodically check whether a new SW update is available, e.g. when it is in standby mode.

If a new software is available, the user shall be notified with on-screen message. YouSee shall have the capability to define the content of the notification in Danish language on a case by case basis.

The user shall have the option to update immediately or to postpone until later. If the user chooses to postpone until later, he shall be reminded of the new software every time the CPE is taken out of standby mode until he finally updates the CPE.

If the user decides to download immediately, there should be clear guidance on the screen about the progress of the update and on which actions to do, if any.

5 Conditional access system

A number of TV and radio services are scrambled in the YouSee Kabel TV network. The scrambling is based on DVB CSA algorithm and Viaccess SmartCard based encryption. The CA descriptor uses Viaccess CA ID 0x0500. Normally only one CA descriptor which is pointing at the ECM PID is used for each scrambled service. But during swap of CA technology several descriptors and ECM PID's can be present. The Viaccess decrypting and entitlement functionality used is:

1. Subscription rights. (Theme/ Level and Class subscription)
2. Pre-booked OPPV rights (pnumb numbers)
3. Preview (Preview numbers/ channels)

Functions in Viaccess ACS for interrogate and edit setting in SmartCard are:

1. Select Viaccess SOID (Several values can be present)
2. List subscription rights (Theme/ Level and Class)
3. List purchased OPPV events (list pnumb)
4. Change of PIN code.
5. Change of Morality level.

6 Subtitling systems

Both teletext (ITU-R BT.653-3) [6] [2] and DVB Subtitling System (ETS 300 743) [3] standards are used in the network and shall be supported by the CPE. If both subtitling options are available for the selected language, DVB Subtitling should have preference. The initial language of the subtitles will be the same as set on the language settings of the CPE.

7 CPE installation and channel search procedure

As the total network topology can be extracted from the Homing channel, fast CPE channel search and installation can be achieved. The CPE only needs the below listed figures to perform the complete channel installation without tuning to other QAM channels. 5 NIT other tables each designated different groups of CPE equipment are broadcasted in the network:

Homing channel tuning parameters:

1. QAM Frequency, default value: 143.000 MHz
2. Symbol rate, default value: 6,8750 MS/s
3. Modulation: default value: QAM64

Dedicated NIT ID's according to actual CPE support:

Feature	Support	Support	Support	Support	Support
SD Services	X	X	X	X	X
HD Services	X	-	X	-	-
Nordig LCN	X	X	NA	NA	X/NA
Euro LCN	NA	NA	X	X	NA/X
OnDemand ¹⁾	-	-	X	-	-
NIT ID to use	100	110	120	130	999 ²⁾

NIT ID 110 and 120 don't carry the SD services which are available in HD format.

- 1) CPE which support YouSee propriety On-Demand universe.
- 2) NIT ID 999 limited to Must Carrier services.

7.1 Service signalling conventions

In order to support a flexible and fast channel search, the following service signalling conventions will be applied

1. There will be a defined Homing channel with pre-defined frequency, QAM constellation and symbol rate.
2. A complete NIT_other and a complete set of SDT_actual/SDT_other will be maintained on all TS's
3. All entries in the second descriptor loop of the NIT_others will contain a service list descriptor
4. All entries in the second descriptor loop of the NIT_others will contain the Channel descriptor
5. All entries in the service loop of the SDT (both actual and other) will contain a service descriptor with a valid service_type and service name
6. A service that is listed in the service loop of an SDT does not have to be listed in the corresponding service list descriptor in the NIT
7. A service that is listed in the service list descriptor in the NIT also has to be listed in the service loop in the SDT
8. Whenever there are changes to the services signalled in the NIT_others, the NIT_other version number will be increased.
9. The NIT_other will have the same version number on all TS'es.
10. Whenever there are changes to the service loop in the SDT, the SDT version number shall be increased.

7.2 Proposed CPE NIT-based channel search

The CPE shall process the NIT_other on the defined homing channel as follows:

1. The CPE shall loop through the second descriptor loop of the NIT (the “TS loop”), and process the service list descriptor and the Channel descriptor for each TS entry.
2. The CPE shall install all services in the service list descriptor that are applicable.
3. If a service has the visible_service_flag in the LCN set to 0, the service shall be installed in the CPE, but hidden from the main channel list.
4. Services with a visible_service_flag in the LCN set to 1, shall be installed in the main channel list of the CPE with a channel number indicator equal to the logical_channel_number in the LCN.
5. If a service is present in the SDT but not in the service list service list descriptor for the corresponding TS, that service shall not be installed in the CPE.
6. The CPE shall monitor the NIT_other version number and perform a background channel scan when the version number increases
7. The CPE shall monitor all SDT version numbers and re-scan the service names when an SDT version number increases.

7.3 Background for the signalling conventions

The signalling conventions listed in sections 7.1 and 7.2 are defined in order to

1. Allow for background update, since
 - Any changes in the service list will be reflected in a NIT version change.
 - The CPE can perform a re-scan without tuning away from the current TS
2. Allow YouSee to define the channel line-up in the main channel list
3. Allow YouSee to re-name services without changing the NIT version.
4. Allow for “out of list” channels that will be installed but hidden to the CPE, but that can be reached through direct entry of channel number

7.4 Manual frequency scan

In addition to the NIT-based channel search described in the previous sections, the CPE menu can offer a way to perform a single TS channel scan installing all channels listed in the service loop of the SDT, disregarding any information in the NIT.

8 RF network parameters seen on the users wall outlet

8.1 Downstream:

- Frequency range: 110 to 862 MHz, from Q1 2011 extended to 1002 MHz
- PAL RF level range: Min: 60 dB μ V, Max 75 dB μ V
- FM (87-108MHz) RF level range: Min: 53 dB μ V, Max 65 dB μ V
- QAM RF level range: Min: 50 dB μ V, Max 65 dB μ V
- MAX total RF power level: -6dBm@75 Ω
- Guaranteed MAX RF tilt: 3 dB / 8MHz, 6 dB / 60MHz and 12 dB on total spectrum
- Worst case CTB/CSO load scenario: 42 PAL channels w. equal spacing
- MAX undesired LF AM modulation -60 dB

- MIN PAL C/N: 46 dB
- MIN QAM C/N: 44.4 dB
- MIN MER:
 - QAM64: 29 dB
 - QAM256: 35 dB

- Modulation scheme: QAM64, QAM256
- QAM Roll off 0.15.
- Symbol rate: 6.875 Msps
- Maximum RF power back-off between QAM and adjacent PAL:
 - QAM64: 12 dB
 - QAM256: 12 dB
- Echo guaranteed to be kept within following template:

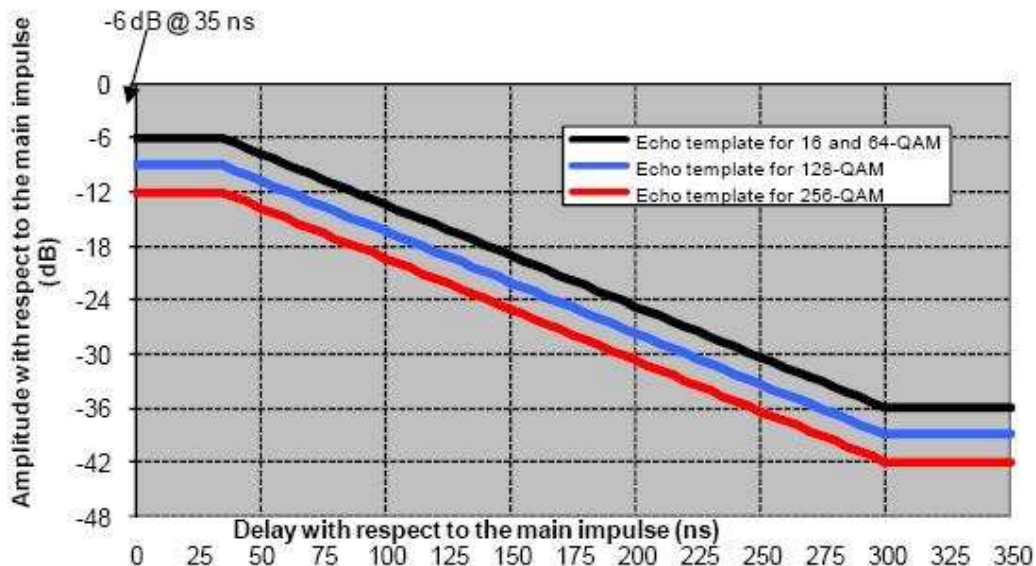


Figure 1 (Source: Nordig Unified 2.1)

-
- Guaranteed MAX phase noise:
 - 1 kHz -44 dBc
 - 10 kHz -86 dBc
 - 100 kHz -106 dBc
 - 1000 kHz -116 dBc
 - MAX group delay: 90nS / 8MHz
 - Expected introduction of new modulation scheme: DVB-C2, possible introducing QAM1024.

 - In general network will be compliant to specifications:
 - CENELEC IEC 60728-1
 - DVB-C spec: EN 300 429 >V1

8.2 Upstream:

- Return path channel has to follow DOCSIS 2.0 and 3.0 specifications.