



KPN Digitenne Specifications for devices using DVB-T2 CAM v1.4

Target audience: manufacturers

Version 1.0
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Introduction

The KPN Digitenne T2 service is in the Netherlands a major TV distribution platform. Initially after switch over from Digitenne T1 the service was fully based on a DVB-T2 set top box.

With more devices coming to the market that are capable of decoding the DVB-T2 signal and MPEG HEVC, like Smart TV's and standalone receivers, KPN introduced the Irdeto CI plus 1.4 module.

In general the Digitenne service is based on ITU, MPEG2, DVB-T2 and user guidelines and specifications from DVB, NORDIG and aligns with the Deutsche tv platform specifications¹².

This document is offered as a help to TV manufacturers specifying the parameters and allowing an optimal viewing experience for Digitenne within the geographical footprint of Digitenne T2.

1. CI plus CAM 1.4

Specifies the CI plus 1.4 CAM and the properties of the Irdeto CA system.

2. Digitenne service described

With a set of minimal adaptations Smart TV sets and third part receivers will give an optimal performance. Some mandatory requirements are described and helpful to align with the Dutch media law for TV and radio broadcasts.

3. Future developments

Gives an outline of expected new features in the coming period.

¹² Minimum Requirements for DVB-T2 Devices in Germany. June 2015 V1.

1 CI plus CAM 1.4

1.1 CI+ 1.4 specification

The device shall be compliant to the CI+ 1.4 specification and interwork with the Irdeto CCA CAM v1.4 module.

1.2 CA menu and support

Encryption system

IRDETO CCA encryption system needs to be supported

Reference ^{1,2}

1.3 CA-implementation

A CAM menu for the CA status shall display the information of the Irdeto CA data according to the Irdeto CAM V1.4 module requirements. The device should support displaying the CAM menu according to the CI+ 1.4 specifications ³.

Digitenne supports the following CA features:

- Subscriptions (minimum requirement).
- Parental rating (minimum requirement).
- CSDN (minimum requirement).
- Subscription status (minimum requirement).

Minimum requirement: The user shall have the possibility to set the parental rating in a set-up screen. The CA's PIN must be entered to get access to the content whenever restricted by parental rating.

1.4 OTA SSU

Over the air software updates of the Irdeto CCA CAM v1.4 module should be supported according to the CI+ 1.4 specifications.

¹ CI plus 1.4 CI Plus Specification v1.4.4

² CI Plus Implementation Guidelines v1.1

³ Irdeto CI Plus 1.4 Consumer CAM Technical Specification CI Plus 1.4

2 Digitenne service described

2.1 General

This part specifies:

- The Front end.
- Service discovery and channel numbering.
- Service play and parameter specifications.
- Dynamic PSI & SI.

2.2 Front End

2.2.1 DVB-T2 General Standard Compliance

The device shall generally comply with the specifications of the DVB-T2 standard ETSI EN 302 755 ⁹ with the following restriction, that devices are not required to decode FEFs but they should not be disturbed by them as long they follow the pattern described in section 13 of the DIGITAL EUROPE White paper: Standardized DVB-T2 RF specifications.

2.2.2 Antenna Power

The current used STB's are supporting an active antenna. The front end will provide the needed +5 V for the antenna. In cases that the antenna power is not available, an external power inserter is needed.

2.2.3 Bandwidth

The device shall support 8 MHz bandwidth according to ETSI EN 302 755 ⁹.

Tuning Range

The device shall support the tuning range 470 MHz – 694 MHz (center frequencies 474 MHz – 690 MHz).

DVB-T2 Variants & Dynamic Changes

The device should be capable of receiving and demodulating DVB-T2 signals with any valid combination of the following parameters as specified ⁹:

FFT Sizes	1K, 2K, 4K, 8K, 16K and 32K
Constellations	QPSK, 16-QAM, 64-QAM and 256-QAM , all rotated and unrotated
Forward Error Correction Codes	1/2, 3/5 , 2/3, 3/4, 4/5 and 5/6
Guard Intervals	1/128, 1/32, 1/16, 19/256, 1/8 , 19/128 and 1/4
Pilot Patterns	PP1, PP2 , PP3, PP4, PP5, PP6 and PP7
PLPs	Single PLP, Multiple PLP Type 1 and 2

Currently KPN is using parameters FFT=32K Const=256QAM CR=3/5 GI=1/8 PP=PP2.

⁹ ETSI EN 302 755 1.3.1: Digital Video Broadcasting: Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)

The device shall be able to receive SISO and MISO transmissions, modulations with and without rotated constellation, and shall support the usage of extended carrier mode.

When tuning to a broadcast signal, the device shall be capable of automatically detecting the modulation parameters.

The device shall not be required to handle Time Frequency Slicing (TFS) mode.

The device shall be able to receive DVB-T2 transmissions consisting of a single PLP and transmissions consisting of a common PLP together with one or more data PLPs.

Receiver Noise Figure

The tuner noise figure shall be 6 dB or better in accordance with NorDig Unified v.2.5.1¹¹.

C/N Performance

The device shall comply with the C/N values for Gaussian channels as required by NorDig Unified v.2.5.1¹¹ in chapter 3.4.10.3 and NorDig Unified Test plan, ver 2.4 (Table 2.3 und Table 2.4)¹³.

Minimum Input Levels

The device shall be compliant with performance requirements as derived in chapter 3.4.10.4 in NorDig Unified 2.5.1¹¹ for the required minimum input levels.

Presence of Echoes

The device shall comply with specification of NorDig Unified v.2.5.1¹¹. The same values as described in 3.3.1 shall be obtained when the channel contains two static paths with a relative delay from 1.95 μ s to 0.95 times the guard interval length, independently of the relative amplitudes and phases of the two paths. For specific echo attenuation, the required C/N shall not be more than 1 dB higher compared to the median value when calculated for the required C/N values over the echo delays from 1.95 μ s up to 0.95 times guard interval length.

Presence of Echoes outside the guard interval

The device shall comply with specification of NorDig Unified v.2.5.1¹¹ chapter 3.4.10.9, particularly with regard to Table 3.22.

The device shall be able to correctly equalise the signal for an echo range (i.e. distance from first to last echo) up to 57/64 ($\approx 89,1\%$) of the Nyquist time for the scattered pilots (after time interpolation) for a particular FFT size, pilot pattern and RF bandwidth, independently of the echo profile.

Neglecting other interference sources, the equivalent total available C/(N+I) in a given location can be determined by the formula given in NorDig¹¹ Annex B.

¹¹ NorDig-Unified Specification v.2.5.1: NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, 25 August 2014

¹³ NorDig Unified Test Plan for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, NorDig Unified Test plan, ver. 2.4

2.2.4 Interference Immunity

The device shall comply with the interference immunity as outlined in NorDig Unified v.2.5.1¹¹.

Guideline for Interference Immunity against LTE signals

The requirement is sub-divided into three parts, according to the time schedule:

- a) The device should (provide) an ACS of at least 60 dB for frequencies below 470 MHz.
- b) Devices introduced into the market before 2020 should (provide) an ACS of at least 50 dB for 694 MHz and frequencies above. The device should apply a frequency filter to the incoming RF antenna signal for masking LTE 700 signals. This optional filter shall provide an attenuation of at least 15 dB for 703 MHz and above. The application of this optional filter should be switchable via the device's set up menu. The initial manufacturer's setting shall come with deactivated LTE filter. In case this option is turned off, no (external) LTE filter shall be applied to the incoming RF antenna signal.
- c) Devices introduced into the market after 1 January 2020 should provide an ACS of at least 70 dB for 694 MHz and frequencies above 694 MHz after 2020. This includes the above mentioned 50 dB as well as a frequency filter to the incoming RF antenna signal for 703 MHz and above, switchable via the device set up menu or fixed installed in the device tuner.

2.3 Service Discovery and Channel numbering

2.3.1 LCN Support

General

The device should support Logical Channel Numbering at least version 1 as described in the technical specification NorDig Unified v.2.5.1 Requirements¹¹.

All services, collected from all receivable NIT of the actual and other networks and flagged as "visible", should be displayed in the service list(s), sorted according to logic_channel_number and be addressed with a number in the service list equal to the logic_channel_number, as far as possible.

In case of a collision the NIT of the actual network is preferred for the NIT of the other network.

2.3.2 Service List Management

Case of Identical Services

If there are multiple identical services, then the instance of the service with the highest signal quality should be granted the channel number according to the broadcast LCN. If several instances of the same service have the same quality level, then the instance with the highest signal level should be granted the channel number according to the broadcast LCN^a.

Services with LCN 0 or Hidden Services

Services marked as "hidden" in the LCN descriptor or where the LCN is zero (0) shall be stored but should not be visible in the service list presented to the viewer.

¹¹ NorDig-Unified Specification v.2.5.1: NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, 25 August 2014

^a It is assumed that identical services will have the same broadcast LCN

2.3.3 Update of Service Lists

The device shall be capable of automatically detecting changes in the services configuration of each broadcast transport stream provided that such changes are implemented by the broadcaster in accordance to ETSI TS 101 211 ⁶.

The intent of this requirement is to allow the broadcaster to vary the services offering within the relevant broadcast transport stream(s) or change the frequency and other parameters of the terrestrial network over night without the viewer needing to rescan the device.

User defined channel lists shall be updated (with or without confirmation by the user) in a way that services that have been moved and which still can be received are kept at the same position of the list(s). For this purpose, services shall be identified by the Original Network ID (ONID) and Service ID (SID).

Changes should be processed within 24 hours of the presence of correct SI signaling including NIT for the actual networks and NIT for the other networks ^b.

NIT from other network

When more than one NIT is received the services coming from the other network should be placed above channel number 200. An example of other networks are foreign broadcasts received near the Dutch border.

The behaviour should be if services from another network are found, the service must be placed in the service list starting at position 200, starting with number 201.

2.4 Service Play and parameter specifications

2.4.1 Video/HEVC Support

The device shall fulfil the requirements for 50 Hz HEVC HDTV 8-bit devices as defined in ETSI TS 101 154 v2.1.1. ⁷.

Default: 1080p50 16:9

Luminance resolution (number of hor/vert pixels)		Scan (interlace/progressive) (number of frames per second)	Aspect ratio
Horizontal	Vertical		
1920	1080	i25	16:9
1920	1080	p50	16:9
1280	720	p50	16:9
960	540	p50	16:9

⁶ ETSI TS 101 211 V1.12.1 (2013-12): Digital Broadcasting Systems for Television, Sound and Data Services; Guidelines on the Implementation and Usage of DVB Service Information

⁷ ETSI TS 101 154 v2.1.1. (2015-03) Digital Video Broadcasting (DVB): Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream

^b For service identification during the initialization process, it is recommended to use Original Network ID (ONID), Transport Stream ID (TSID) and Service ID (SID)

2.4.2 Audio Support

If a service provides more than one audio bitstream, the device shall select the appropriate audio bitstream according to NorDig Unified v.2.5.1, section 6.5 ¹¹.

The device shall be able to gracefully handle dynamic changes in the bitstream according to NorDig Unified v.2.5.1, section 6.9 ¹¹.

Codecs

The device shall be able to decode or transcode the following incoming audio stream formats:

- E-AC-3 as specified in TS 101 154, section 6.2 ⁷
- MPEG-4 HE-AAC Profile Level 4 ¹ as specified in TS 101 154, section 6.4 ⁷
- MPEG-1 Layer II ² as specified in TS 101 154, section 6.1 ⁷

The audio decoders shall support sampling rates as of NorDig Unified v.2.5.1 ¹¹, section 6.2.

Decoding and AV Synchronization

An incoming mono bitstream shall be output as dual-stereo signal.

The device shall meet the requirements for audio/video synchronization as specified in NorDig, section 6.7 ¹¹.

Extra audio channels containing native language or spoken subtitles shall be selectable for end users.

2.5 Dynamic PSI & SI

The device shall be able to manage changes in PSI in the PMT, CAT and PAT (like changes of PIDs and availability of components) in a graceful way for the user.

Device shall be able to manage changes in SDT, NIT of the actual networks and NIT of the other networks according to chapter 3 Service Discovery and Channel numbering.

The device shall be able to handle dynamic changes in the Program Map Table (PMT).

A practical use case for dynamic PMT changes is for example the requirement to support switching on and off regional variants of programs by a broadcaster.

The device shall handle dynamic PMT changes in the correct manner:

- Dynamic changes in the PMT shall not produce any disturbances in the Audio/Video output.
- In case switching of elementary audio and/or video streams is triggered, the maximum switching time (measured from PMT update to clear picture) shall be 3 seconds. The maximum switching time shall be met regardless the elementary streams are scrambled or not.

It is recommended, that the video stream should freeze (freeze frame), until the new video stream is displayed ⁹.

2.5.1 Character Sets for DVB Service Information, Teletext and Subtitles

SI character tables: default character table following DVB standard (ISO/IEC 6937)

- service name encoding (SDT): ISO/IEC 6937 (default-case no table id) or ISO/IEC 8859-9 (table id 0x05)
- event name/text encoding (EIT): ISO/IEC 6937 (default-case no table id) or UTF-8 encoding of ISO/IEC 10646-1 (table id 0x15)

¹ CI plus 1.4 CI Plus Specification v1.4.4

² CI Plus Implementation Guidelines v1.1

⁷ ETSI TS 101 154 v2.1.1. (2015-03) Digital Video Broadcasting (DVB): Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream

¹¹ NorDig-Unified Specification v.2.5.1: NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, 25 August 2014

2.5.2 Teletext

Digitenne is broadcasting Teletext as defined by ETSI standard EN 300 706 ⁸ Enhanced Teletext Specification including up to Teletext level 1.5. A suitable remote control key must be provided to launch the Teletext OSD.

2.5.3 Subtitles

Digitenne is broadcasting EBU and DVB subtitles as defined⁴. When a device supports DVB timed text and the device can handle the essential fonts, this shall be used as default subtitling.

2.5.4 EPG

Digitenne is broadcasting EPG information based on DVB-SI according to ETSI EN 300 468 ⁵.

The device should support service and event information processing. If the device supports service and event information processing, then:

“Now/Next” information for use in an on-screen banner shall be derived using information from DVB SI EITp/f tables defined in ⁵.

The EPG “Now and next” is available for usage in “Mini epg” displayed for a short period when the user changes service and shall also be launched using the “Info” (virtual) button on the remote control unit.

Changes of the “Now/Next” event information using the Current_next_indicator shall result in an immediate change of the “now” event as described in ⁵ 5.1.1e.

The following items for “Now/Next” information are signaled:

- Current time.
- Start time of now and next programme.
- End time or durations of now and next programme.
- Logical Channel Number of current service if supported.
- Service Name.
- Icon or message for parental locked services and events.

Multiple sections starting per transport stream packet shall be supported, thus allowing utilization of the complete transport stream body data (“optimized EIT packetization”).

Support of the extended EPG Info

The extended EPG fields are used for extra program information and are available for the service.

2.5.5 Gamma and color space

Digitenne services currently only support SDR services and use ITU-R Rec 709 and EOTF Gamma.

⁸ EN 300 706 V1.5.1: Digital Video Broadcasting (DVB): Enhanced Teletext specification

⁴ ETSI EN 300 743 V1.5.1: Digital Video Broadcasting (DVB): DVB Subtitling Systems

⁶ When there are PSI/SI changes are done, the NIT version will not be increased. Advised is to use the table version in the NIT-actual table to detect changes.

⁵ ETSI EN 300 468 V1.14.1 (2014-01): Digital Video Broadcasting (DVB): Digital broadcasting systems for television, sound and data service

3 Future developments

Channel line-up LCN

Forward compatibility: Usage of LCN V2 is being studied, but is currently not implemented. It will allow receivers to display a correct channel line up when more than one regional multiplexes are received. In current solutions the additional regional channels will be displayed in the EPG above logical channel number 300.

HDR and WCG

Forward Compatibility: In future HDR services are expected to be supported according to rec 2100 (in HDR and HLG). VUE/SEI signaling will be according to ¹⁵ ISO/IEC: Doc. ISO/IEC 23008-2:2015 “Information technology -- High efficiency coding and media delivery in heterogeneous environments -- Part 2: High efficiency video coding”.

Timed text

In the near future services will include EBU Timed text. Digitenne will comply to the DVB guideline for Timed Text ¹⁴.

TTML (Timed Text Markup Language) subtitling support according NorDig spec or ETSI EN 303 560 v1.1.1 the DVB TTML Subtitling Systems specification.

It defines a default conformance point that is the common intersection of conformance between EBU-TT-D and IMSC 1 Text Profile and allows for subtitle and caption documents conformant to EBU-TT-D, IMSC1 Text Profile or other profiles of TTML to be sent and signalled within DVB MPEG-2 transport streams and includes the ability to embed fonts for subtitle presentation, also within the transport stream.

¹⁵ ISO/IEC: Doc. ISO/IEC 23008-2:2015 “Information technology -- High efficiency coding and media delivery in heterogeneous environments -- Part 2: High efficiency video coding”

¹⁴ EN 303 560 - V1.1.1 Digital Video Broadcasting (DVB): TTML subtitling systems

References

In order to align with the general developments within Europe, KPN has aligned its specifications with the specifications composed by Germany Media Broadcast. If further design of the Dutch DVB-T2 network requires special or different specifications, KPN will change its specifications.

- ¹ CI plus 1.4 CI Plus Specification v1.4.4 (<http://www.ci-plus.com/documentation/>)
- ² CI Plus Implementation Guidelines v1.1 (<http://www.ci-plus.com/documentation/>)
- ³ Irdeto CI Plus 1.4 Consumer CAM Technical Specification CI Plus 1.4 (Irdeto)
- ⁴ ETSI EN 300 743 V1.5.1: Digital Video Broadcasting (DVB): DVB Subtitling Systems
- ⁵ ETSI EN 300 468 V1.14.1 (2014-01): Digital Video Broadcasting (DVB): Digital broadcasting systems for television, sound and data services: Specification for Service Information (SI) in Digital Video Broadcasting (DVB) systems
- ⁶ ETSI TS 101 211 V1.12.1 (2013-12): Digital Broadcasting Systems for Television, Sound and Data Services; Guidelines on the Implementation and Usage of DVB Service Information
- ⁷ ETSI TS 101 154 v2.1.1. (2015-03) Digital Video Broadcasting (DVB): Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream
- ⁸ EN 300 706 V1.5.1: Digital Video Broadcasting (DVB): Enhanced Teletext specification
- ⁹ ETSI EN 302 755 1.3.1: Digital Video Broadcasting (DVB): Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)
- ¹⁰ DIGITAL EUROPE White paper: Standardized DVB-T2 RF specifications
- ¹¹ NorDig-Unified Specification v.2.5.1: NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, 25 August 2014
- ¹² Minimum Requirements for DVB-T2 Devices in Germany. June 2015 V1.0
- ¹³ NorDig Unified Test Plan for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks, NorDig Unified Test plan, ver. 2.4
- ¹⁴ EN 303 560 - V1.1.1 Digital Video Broadcasting (DVB): TTML subtitling systems
- ¹⁵ ISO/IEC: Doc. ISO/IEC 23008-2:2015 "Information technology -- High efficiency coding and media delivery in heterogeneous environments -- Part 2: High efficiency video coding"