**Draft update for NorDig RoO spec. v. 3.1.1**

**ONLY parts for 4. MPEG multiplexer and 9. CA scrambling**

**(based upon common draft006)
Updated to NorDig Unified spec. v.3.1.1**

Draft v001**NorDig Rules of Operation**

 **Version 3.1.1**

**for**

**NorDig Unified Receiver Networks**
Date: dd.mm.yyyy

Following text is only during drafting and will be removed before final NorDig RoO specification

DRAFTING GUIDELINES / Explanation from the editors related to DRAFT versions:

This NorDig RoO spec. for v3.1.1 draft document is based on the official NorDig Unified Test Plan v3.1.1

Yellow highlight marking marks changes in text compared to NorDig Unified Test Plan v2.6.0

* + New modified text: without strikethrough marks new additional text,
	+ ~~Removed text~~: with strikethrough marks old text proposed to be removed
* Green marked text: highlighting text that under extra scrutiny during this update (not yet agreed).
* Blue marked text: comments or other raw text that will be removed before final version.
* Grey marked text: refers to text that not are relevant to this review/update.

Guide: To improve version handling and readability, old text from NorDig RoO v2.5 that is proposed to be deleted in future “v3.1.1” should not be removed from draft version.
Use instead ~~strikethrough~~ and yellow highlighted marking. Microsoft Word function “Track Changes”, will be used in addition to highlight changes, BUT from one draft version to another draft sometimes all “Track Changes” are *Accepted* to easier read changes in updates of proposals during our work.

When drafting a proposal, cross-references should be manually set and same for proposing correction, i.e. yellow mark and manual reference value. NorDig editor will update cross-references when preparing final draft.

# MPEG-2 Demultiplexer

~~See chapter 5 Video Transmission~~

## General Multiplexing

The NorDig IRD and CA Modules has limitations in their MPEG2 TS demultiplexing capability (minimum requirements defined in NorDig Unified IRD specification section 4.1) which the Network/Operators must take in account. Some Networks/platforms has a variety of different legacy IRD models that are used by their viewers on market, from old to new IRDs. NorDig IRD requirements has changed slightly over the years, resulting in that markets with many different IRD models from old to new ones, it can be that no all IRDs fulfil the latest NorDig IRD requirements or that some (older) legacy IRDs has implemented another scheme from when the NorDig IRD requirement was slightly different.

Networks/Operators might need to compensate the transmission/encoding for some “limitations”, “bugs” and other “mis-behaviour” in some of markets legacy IRD and it is recommended to keep track upon the compensations the network/platform takes due to known “limitations”, “bugs” etc in the consumer IRDs.

The multiplexing into the MPEG-2 transport layer **shall** be compliant to ISO/IEC 13818‑1 (MPEG2 Systems), ETSI TS 101 154 and with the additional requirement stated below:

* The MPEG-2 Service Information as specified in here (e.g. see section 6, 12 and 13), NorDig IRD specification, DVB SI (ETSI EN 300 468) and MPEG2 Systems (ISO/IEC 13818‑1)
* For PayTV DVB scrambled services the CA descriptor shall be used as defined in ETSI ETR 289.
* The data rates/bitrate of the MPEG2 transport stream shall not higher than maximum supported modulation scheme the network’s IRD front-end can handle.
* TV, Radio and other services shall not have more than 32 elementary streams/PIDs simultaneously (observe that it is not uncommon that some legacy IRDs has lower maximum number of simultaneous streams/PIDs for one service and network/operator be careful in using too many elementary streams/PIDs per service). For PayTV DVB scrambled services see section 4.2 (not more than 6 streams/PID with different access rights),
* For the classical audio encoding schemes MPEG-1 L.II, Dolby AC-3 and E-AC-3 it is recommended to use constant bit rate for the audio encoding for a format (mono, stereo or multi), (unless the network/operator is sure that the all IRDs on the market support variable bit rate for these audio codecs). For MPEG-4 HE-AAC NorDig IRDs should theoretically support variable bit rate but should be used with care.
* When changing audio format (between for example stereo and multi) it is often acceptable to change bit rate (e.g. from stereo mode with MPEG-4 HE-AAC 80kbps to 5.1 multichannel mode with MPEG-4 HE-AAC 180kbps).
* Regular or periodically change video, audio or subtitling codecs for one service, if used should preferable be made between program events or when service is off-air/outside main broadcast hours for the service, since even if supported by IRDs it can be expected some decoding disturbances for the viewers during transition. (However, Network/Operator should carefully test the networks targeted legacy IRD models for this).

## DVB scrambling

DVB scrambling of PayTV services has following rules of operation:

* The DVB scrambling shall be based on the common scrambling algorithm as specified by DVB, see DVB A 011 [3].
* Common Scrambling Algorithms versions 3 may be used for services that target NorDig IRDs that supports both versions 2 and 3. Common Scrambling Algorithms versions 2 should be used for services that also target older legacy NorDig IRDs that supports only versions 2.
* PayTV services should not have more 6 different scrambled streams/PIDs (either PES or transport level scrambling) with different access conditions. (Some network might be restricted to even fewer due to legacy IRD limitation).

For more Rules of Operation (related SmartCard reader and CommonInterface) see section 9 below.

Note : ETSI acts as a neutral custodian for the distribution of the system information concerning the common scrambling system

## System Time Clock/Program Clock Reference (PCR)

PCR jitter (PCR accuracy error) should be within DVB Measurement guidelines (ETSI TR 101 290) before the transmission point to the viewers’ IRDs (i.e. PCR jitter within the MPEG TS should be less than 500ns).

# Video Transmission

# Audio Transmission

# Teletext and Subtitling

# Interfaces and Signal Levels

No RoO specification

# Conditional Access

~~TBD~~

## General

The NorDig IRD used for PayTV services, typically uses Common Interface Plus (together with a CA Module/CAM) and/or Smart Card interface for conditional access of the PayTV services (scrambled services). (Some IRDs/STBs may implement a complete embedded CA System function with SmartCard-less/”built-in” SmartCard function).

See section 4.2 for the DVB descrambling.

## Use of the Common Interface

(For software update of the CAM inside an IRD see section 10 System Software Update).

The IRD’s and CA Module’s Common Interface has limitations in capacity/bandwidth they can handle (typically these should support 72-96Mbps of higher, but very old generation of IRDs or CAM might only support 54Mbps). The Common Interface typically receive and return at its interface the complete MPEG Transport Stream (TS) for the selected service that the IRD is scanned into (often a Multi Program Transport Stream, MPTS).

It is up to the PayTV operator to ensure that the MPEG TSs for all PayTV services of the Network does not go above the maximum supported bitrate in the Common Interface of the supported IRDs and CAMs on the market (especially if the Network support old generations of IRD and/or CAM).

## Use of Smart Card Reader (IRD and CA Module)

Basic tasks for the SmardCard is typically to decrypt the viewed service’s ECM(s) into the control word(s) used for descrambling inside the IRD/CAM and to store the viewer’s “monthly”/”weekly” access rights from the EMM or other period for periodical subscription (or other access rights). NorDig IRDs with SmardCard reader based upon DVB CSA and CA Module with SmartCard reader, includes a filtering function for the ECM and EMM see section 4.2 (among things to reduce the data bandwidth from the incoming EMM stream(s) to the Smart Card Interface).

The Smart Card Interface (in IRDs and CA Modules) has limitations in capacity/bandwidth and number of simultaneous ECM/EMM filters it can handle. (In some cases the IRD’s DVB CSA ECM and EMM filtering is defined by the signalling in PMT (for ECM) and CAT (for the EMM). Signalling for one service many different ECM and/or EMM streams/PIDs from same CA System (e.g. for different generations of the same CA System), could (if too many) result in that legacy IRDs/CA modules on the market has not enough CA filters or other effects that gives disturbance/errors in descrambling the service.

In section 4.2 of NorDig United IRD specification, NorDig has defined how many parallel scrambled streams/PIDs with different access conditions that that NorDig IRD with embedded descrambling support shall be able to process in parallel (i.e. up to at least 6 different). NorDig has not defined more than this the number of CA ECM and EMM filters that IRD or CAM shall support (that is up to each Operator and CA system to defined). (For example with Simulcrypt, each scrambled video/audio stream/PID could have multiple ECM streams for different generations of the same CA System. This could for example mean that simulcrypt with many different CA system might work fine for all legacy IRDs/CAMs while simulcrypt with many different generation of same CA system id could cause issues in some legacy IRDs/CAMs).

It is up to the PayTV operator to ensure that the EMM and ECM streams/PIDs does not result the data bandwidth for the Smart Card Interface is above the maximum supported bitrate for the supported IRDs and CAMs on the market.

It is up to the PayTV operator to ensure PMT and CAT signalling does not request more CA filtering than the IRD and CA Modules on the market can handle.

# System Software Update (SSU)

# Performance

# Programme Specific Information and Service information (P)SI

# Navigator

# PVR

# IRD System Software and API

# User Preferences

# Appendix A: NorDig PVR

# Appendix B: AC-4 Audio (informative)