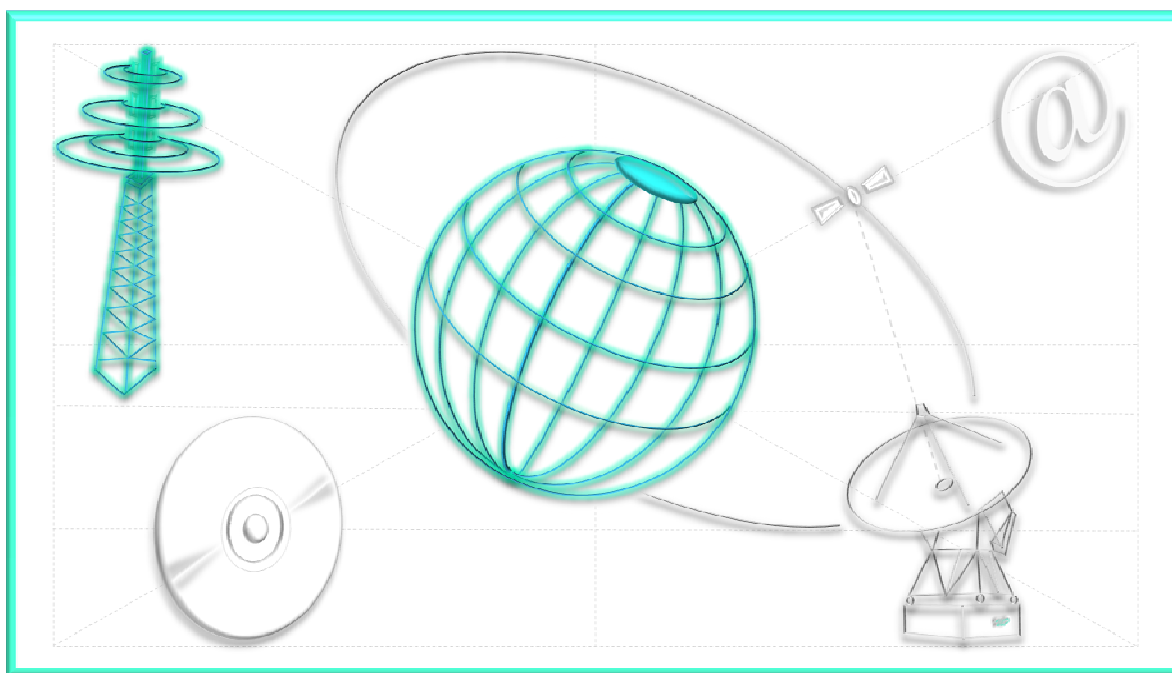# HD Book
# *DTT platform*

*(Digital Terrestrial Television)*

## Compatible High Definition receivers for the Italian market: baseline requirements

**Final 2.0**

HD FORUM ITALIA

dgtv

# HD Book Collection

## Compatible High Definition receivers for the Italian market: baseline requirements

# *DTT platform*

### *(Digital Terrestrial Television)*

# Table of Contents

**Tables**

# 1.  Foreword

Since 2005, the High Definition Television formats, 720p and 1080i, have entered the European satellite TV broadcasting market, with a wide offering of tens of HDTV channels provided by different Pay TV aggregators, as for instance Sky Italy with an offering of HDTV Sport channels.

The current terrestrial TV broadcasting in Italy, although still mostly in standard definition format (SD), with a mixture of 16/9 and 4/3 aspect ratios and interlaced scanning, has progressed the offering of genuine HDTV services from the original trials in "all-digital" regions (i.e. areas where ASO[1] has been already completed) to a more convenient amount. Thanks to the new frequencies made available in all-digital areas (70% of population at the end of 2010) Broadcasters have experienced SD/HD simulcast[2] services, both up-scaling SD contents already available on standard TV transmissions and using genuine HD format. Recently some 3DTV trials have been announced and first 3DTV live transmissions have already taken place on Italian DTT in ASO area.

The vast majority of TV sets currently off the shelf are characterised by screen displays larger than 26 inches, with progressive scanning, panoramic view geometry (16/9) and compatible with HDTV formats.

New media players for Home Video, as BluRay disc, or domestic entertainment appliances, as HDV Cams or videogame consoles, are designed to reproduce hi-quality HD contents once connected to an HD screen. That makes the user capable of enjoying and appreciating the high definition experience, which represents a valid alternative to the TV programming still broadcasted in standard definition (SD).

In perspective, *"today HDTV is moving be the standard definition of tomorrow"*[3]. Based on this sentence, it is important continuing to evolve the migration route from SD to HD and beyond to 3DTV, aiming to promote the widespread diffusion of free to air HDTV and 3DTV programming matching the increased quality of large screen displays and TV sets and the increasing demand coming from new experienced customers.

Appealing hi-quality content productions, like those necessary for a successful offering of innovative technologies like HDTV and 3DTV, require huge investments. Broadcasters are considering SD/HD simulcasting a viable start towards the complete turnover of SD programmes into HD ones, but they know that a complete refurbishing and reengineering of the entire production, packaging and delivery platform has to occur for a broad diffusion of genuine HDTV services.

In the meanwhile, new innovative technologies in content definition enhancement, as 4K format, Super Hi-Vision (UHDTV) and enhanced Stereoscopic TV, out of this document's scope, are progressively emerging as the new Television benchmark for the future.

### *Market outlook*

European CE industry is particularly committed to boost sales of large screen and plano-stereoscopic displays. For this purpose they undertook, through their major category association EICTA[4], the initiative of creating a set of licensed labels, corresponding to a precise set of technical requirements: HD Ready (for TVs) and HDTV (for STBs) and their counterparts in 1080p format.

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[1] ASO: Analogue Switch-Off
[2] Simulcast: the concurrent broadcasting of same TV programming in different formats (analogue and digital,  SD and HD)
[3] Today in Japanese labs Super Hi-vision (SHV), which it is intended to be the Ultra High Definition format for the future, is almost a reality.
[4] EICTA: European Industry Consumer Technical Association

***Displays** or **Video Projectors***                                    ***Receivers***



Production and transmission of HD contents has become a need for a successful competitive positioning of Italy in the worldwide digital television market. Here there is potentially a serious risk of losing relevant market quotes in the promotions of Italian culture, in an industrial context where large European and extra-European entities are rapidly progressing. Recently, a strong demand of enhanced user experience for Stereoscopic TV, mostly boosted by Real 3D technology in Digital Cinema Theatres and by the increasing availability of 3DTV contents (e.g. movies) on BluRay disc for domestic user entertainment appliances, has emerged. Manufacturers have already started introducing 3DTV-ready displays in their product line-ups. Italian Broadcasters are showing some interest to the commercial evolution of Stereoscopic TV and are pursuing technical solutions to maintain interoperability and backward compatibility of Frame Compatible 3DTV transmissions with legacy 2D and 3D aware receivers.

### HDTV in the ASO regulatory plan

If terrestrial ASO would have occurred in December 2006, as originally foreseen, HDTV would have certainly been the natural evolution of digital television. Having the ASO deadline been moved first to 2008 and then to 2012, the role HDTV will play during the migration from analogue to digital must also be carefully evaluated.

### «Liaison » with DGTVi

The "Italian way" to analogue switch off is built on ideas developed by colleagues in other European countries. However, it is all but a copy of what has been done elsewhere: the strong support by all players (State, administrations, broadcasters) of interactivity both for television related offers and for stand-alone services (e.g. T-Government), the emergence of new business models (Pay-TV; Pay-per-View with or without subscription, till the most recent Over-the-Top TV services), the creation of new national digital networks through frequency trading, a taut timing for switch off, are all specific to our country. In the last few years, Italy has become one of the largest markets for digital terrestrial television in Europe, with many new and interesting features.

The experimentations initiated in 2003, and the initial commercial transmissions of 2004 have brought to the members of DGTVi[5], the Italian association for the promotion and interoperability of interactive digital terrestrial television, a vast sum of information on what is needed to create an open market, attractive for end-users, technically stable for broadcasters and content providers, competitive and innovative for manufacturers.

One of the most important aspects concerns the compatibility of receivers with the transmissions and the applications. Therefore the DGTVi has created a technical committee to produce a baseline specification, incorporating the experience gained in Italy and elsewhere. A stable baseline specification is necessary to create trust for the consumer, to give operational certainty to the operators and to provide a reference for manufacturers.

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[5] DGTVi was created in December 2003, by RAI (the public service broadcaster), Mediaset (the main commercial broadcaster), TV International (a private national broadcaster owned by Telecom Italia), and the Ugo Bordoni Foundation (in charge of coordinating T-Government experimentation). Since then, the founding members have been joined by D-Free (a broadcaster and digital terrestrial network operator) the FRT (a federation of TV and radio broadcasters, both national and local) and Aeranti-Corallo (the other main Italian association of local TV and radio stations).

The first baseline specification was finalized in September 2004 under the name of "D-Book, Compatible DTTV receivers for the Italian market" (v1.0).

This specification was later updated with different stand alone addendums. The "D-Book 1.2" merged all these addendums in a single clean document which took into account the comments received by the industry.

The D-Book 1.2 has been the basis on which HD-Book DTT 1.0 was developed, by introducing all HD-specific features (formats, codecs, connectors, signalling, simulcasting). At the same time, latest developments in the areas of supplementary audio and of automatic channel ordering (LCN) to cope with cross-border conflicts were taken into account. Such developments were then incorporated in D-Book 1.3.

Besides applying all the necessary corrigenda to HD-Book DTT 1.0, this document merges the so-called "Broadband Addendum" which has been developed by DGTVi in the second half of 2009, after HD-Book DTT 1.0 was published, to complement it in the area of media delivery over broadband (IP) lines. The 2.0 numbering of this document stems from the new advanced features, like DVB-T2, first generation (Frame Compatible) 3DTV and broadband enhancements (e.g. Adaptive Streaming and generic DRM support), which have been introduced, with proper grace periods to be defined by DGTVi.

## 1.1. Compliance notation

A word on the vocabulary: the use of shall, must, should, may is often baffling for non native English speakers. We have chosen to follow the IETF (Internet Engineering Task Force) which in its RFC 2119 states:

1. MUST:   This word, or the terms "REQUIRED" or "SHALL", means that the definition is an absolute requirement of the specification.
2. MUST NOT:  This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.
3. SHOULD:   This word, or the adjective "RECOMMENDED", means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
4. SHOULD NOT:   This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
5. MAY:   This word, or the adjective "OPTIONAL", means that an item is truly optional.  One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. "

N.B. Throughout this document "MANDATORY" is also often used as a "REQUIRED" synonym.

## 1.2. Acknowledgments

The persons that have contributed to the D-Book first and then to the HD-Book DTT are so numerous we would shortly run out of space if we tried to thank them individually. The HDFI / DGTVi Joint Technical Group can only extend its gratitude to all of them and repeat that without them, this work could not have been completed. Of course, all errors and omissions are the sole responsibility of the editors and of the HD Forum Italia.

Manufacturers, through their constructive remarks and questions have played a major role in helping us to clarify and improve many points of the specification. Let them be thanked here.

December 2010

# 2.  Document History

| Document | Revision | Changes | Date |
|---|---|---|---|
| HD-Book DTT 1.0 | 1 | Final issue ready for Publishing | 28/10/2008 |
| HD-Book DTT 1.5 | Draft | - EIT schedule requirements cleared up and aligned in Tables 26 and 27<br>- country_availability_descriptor no more required<br>- added note on service_type=0x0<br>- LCN visibility_flag support  made mandatory<br>- New requirement on CAM powering off when in stand-by<br>- following AGCOM Deliberation 155/90/CONS, 7MHz Italian channel raster in VHF Band III is no more required<br>- Broadband Interaction channel mandatory also for iDTVs<br>- DGTVi Broadband Addendum merged within sections 6.1.2 and 8.4<br>- New requirement related to application autostart<br>- MMI-MHP interaction scenarios specified<br>- Download CoD OPTIONAL -> RECOMMENDED<br>- EIT schedule compression specified<br>- Download CoD API clarified<br>- Memory requirements in Table 8 clarified<br>- HTTP proxy option added<br>- Removed Resident Broadcaster Defined Applications section<br>- LCN management reviewed (Preference Overflow and Successor Service concepts deleted)<br>- PAE's Pause/Resume controls fixed<br>- Section 5.2 (Broadband Features) imported from HD-Book SAT<br>- New property system.hw.macaddress<br>- error message for broadband apps<br>- corrections and more details to Streamed CoD APIs<br>- custom player creation made RECOMMENDED in 8.4.1.1<br>- SCART in connector for iDTVs made mandatory (as per EC Directive and CCE)<br>- recommended procedures for CI+ CAM behavior during first installation and reset<br>- .mov extension equated to .mp4<br>- rules for multiple audios over broadband<br>- only 1 HD graphic plane required again<br>- 1080p50 support removed, 1080p25 added<br>- updated references to OIPF R2<br>- OIPF HAS mandatory support added<br>- OIPF generic DRM API support required<br>- Monitoring&Reporting API (Annex K)<br>- explicit support for HTTP REDIRECT added<br>- guidelines for AIT URL (§8.3.6)<br>- correct sequence of embedded and MMI Parental Control messages specified<br>- support for "Frame-Compatible" 3D TV added at decoder, HDMI and signaling level<br>- added OpenGL API requirement<br>- DVB-T2 specified (Sections 6 and 7)<br>- Annex A redefined for DVB-T2 tables<br>- Clarified that AAC-LC is required<br>- MIME-Type for HAS detailed | 27/10/2010 |

| Document | Revision | Changes | Date |
|---|---|---|---|
| HD-Book DTT 2.0 | 1 | - only MediaLocator can be passed to JMF player<br>- STB -> receiver in §7.5.2<br>- MENU key behavior further specified in §6.4<br>- Prioritization of EIT Schedules (Normal/Compressed) and MHP view specified<br>- HD graphics requirements clarified (new text and figure)<br>- Updated Streaming monitoring API<br>- Removed MHP as IP media format<br>- Frame-Compatible 3DTV text aligned to DVB<br>- OTT Locator introduced<br>- notes on JMF time, ? in URL and content length added in 8.4.1.1<br>- new org.dvb.user.GeneralPreference "Last Locator" required<br>- §8.6.1 text improved<br>- PP8 applicable only in Single PLP mode<br>- note on service_type=0x00 removed (LCN visibility flag to be used for that purpose)<br>- no root certificates OTA<br>- T2 Noise Figure set to 6dB as per Nordig (former NF Table in Annex A dropped)<br>- New tables in Annex A for C/N Performance, FEF and AUX testing<br>- Warning recommended if service auto update is disabled by user<br>- Reminder section on IXC added<br>- New reqs linked to low-power standby mode<br>- new org.dvb.user.GeneralPreference "IXC" mandated<br>- step-by-step JMF Player start procedure enforced in §8.4.1.1.1<br>- introductory section on 3DTV added (§5.3) pointing to new Annex M for 2D Service Compatible scenarios<br>- minimum input level specified for DVB-T and T2<br>- new introductory section on DRM added (§5.2.3)<br>- §8.4.2 title changed and text reworded<br>- 720p50 Side-by-Side 3DTV format added (broadcast and broadband)<br>- 3D Display STB menu setting added | 10/01/2011 |

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# 3. References

For the purposes of this HD-Book, the following references apply:

[1] "Easy TV" Research Report, ITC 2003, and PsychNology Journal, 2003, Volume 1, Number 4, 355 – 377, "Helping Viewers Press the Right Buttons: Generating Intuitive Labels for Digital Terrestrial TV remote controls", Jane Lessiter, Jonathan Freeman, Robert Davis and Andrew Dumbreck

[2] AGCOM Delibera n. 216/00/CONS: "Determinazione degli standard dei decodificatori e le norme per la ricezione dei programmi televisivi ad accesso condizionato"

[3] CEI - Comitato Elettrotecnico Italiano, Comitato Tecnico 100, "Guida alla tecnologia e ai servizi dei ricevitori (Set Top Box e televisori digitali integrati) per la televisione digitale terrestre", Progetto di Guida, 03/06/2003

[4] CENELEC EN 500 74 "Domestic and similar electronic equipment interconnection requirements: Peritelevision connector"

[5] Digital TV Group: "Baseline functional specification for DTT receivers for the UK" (D-Book)

[6] DVB BlueBook A016: "Digital Video Broadcasting (DVB); Interfaces for DVB Integrated Receiver Decoder (DVB-IRD)"

[7] EBU Recommendation R-110-2004 on "Subtitling on Digital TV Services

[8] EICTA, Digital Terrestrial TV Receivers for the DVB-T System, Draft Specification 2.0 (June, 2008)

[9] ETSI TS 101 154 V1.10.1: Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream

[10] ETSI EN 300 468 V1.12.1: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems

[11] ETSI EN 300 472: Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams

[12] ETSI EN 300 706: Enhanced Teletext specification (analogue television)

[13] ETSI EN 300 744: Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television

[14] ETSI EN 301 195: "Digital Video Broadcasting (DVB); Interaction channel through the Global System for Mobile communications (GSM)"

[15] ETSI EN 50221: "Common Interface Specification for Conditional Access and other Digital Video Broadcasting Decoder Applications"

[16] ETSI ES 202 130 V1.1.1 (2003-10): "Human Factors (HF); User Interfaces; Character repertoires, ordering rules and assignments to the 12-key telephone keypad"

[17] ETSI ES 202 218: "Digital Video Broadcasting (DVB); Interactive channel through the General Packet Radio System (GPRS)"

[18] ETSI ETS 300 743: "Digital Video Broadcasting (DVB); Subtitling systems"

[19] ETSI TR 101 162: "Digital Video Broadcasting (DVB); Allocation of Service Information (SI) codes for DVB systems"

[20] ETSI TR 101 211: "Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)"

[21] ETSI TR 102 308 V1.1.1 (2004-02):"User Group; User interoperability criteria"

[22] ETSI TS 201 812 V1.1.2: "Digital Video Broadcasting (DVB); Multimedia Home Platform (MHP) Specification 1.0.3"

[23] ETSI TS 102 006 1 V1.1.1 (2001-12): DVB Data Download Specification; Part 1: Simple Profile

[24] ETSI TS 102 006 V1.2.1 (2002-10): Specification for System Software Update in DVB Systems

[25] DVB Blue Book A068 Rev.3: "Digital Video Broadcasting (DVB); Multimedia Home Platform (MHP) Specification 1.1.3"

[26] IEC 13818-1: "Information technology - Generic coding of moving pictures and associated audio information: systems"

[27] IEC 61937 Digital audio - Interface for non-linear PCM encoded audio bit streams applying IEC 60958

[28] IEC 62216-1: "Digital terrestrial television receivers for the DVB-T system – Part 1: Baseline receiver specification" (E-Book, v.1). NB: This version has been superseded by [8]. It is referenced only for information purposes.

[29] IETF RFC 1334: "PPP Authentication Protocols"

[30] IETF RFC 1994: "PPP Challenge Handshake Authentication Protocol (CHAP)"

[31] ITU-R BT.653-2: "Teletext systems"

[32] AGCOM Delibera n. 155/09/CONS: "Integrazione della delibera 216/00/CON recante "Determinazione degli standard dei decodificatori e le norme per la ricezione dei programmi televisivi ad accesso condizionato" a seguito del nuovo piano nazionale di ripartizione delle frequenze"

[33] NorDig: "NorDig Unified Requirements for profiles Basic TV, Enhanced, Interactive and Internet for Digital Integrated Receiver Decoders and relevant parts of Integrated Digital TV sets", ver 1.0

[34] Sun Microsystems Inc., "Security and Trust Services API for J2METM Specification", June 1, 2004

[35] DTG Implementation and User Group, "Digital Receiver Implementation Guidelines and Recommended Receiver Reaction to Aspect Ratio Signalling in Digital Video Broadcasting", Issue 1.2.1, Feb. 2001

[36] DGTVi D-Book, "Compatible DTTV receivers for the Italian market, September 2004

[37] CI+ Forum, "CI+ Specification. Content Security Extensions to the Common Interface", Version 1.2

[38] HDMI Licensing, LLC, "High-Definition Multimedia Interface", rev.1.4a

[39] Intel, "High-Bandwidth Digital Content Protection System", rev 1.3

[40] ETSI TS 102 757: "Digital Video Broadcasting (DVB); Content Purchasing API

[41] C.Poynton, "Digital Video and HDTV. Algorithms and Interfaces", Morgan Kaufmann Publishers

[42] ISO/IEC 14496-14: "Coding of audio-visual objects -- Part 14: MP4 file format"

[43] Open IPTV Forum Release 2 Version 2.0 specification, "Volume 2: Media Formats" <http://www.openiptvforum.org/docs/Release2/OIPF-T1-R2-Specification-Volume-2-Media-Formats-v2_0-2010-09-07.pdf >

[44] IETF, RFC 2616, "Hypertext Transfer Protocol – HTTP/1.1", < http://www.rfc-editor.org/rfc/rfc2616.txt>

[45] Open IPTV Forum Release 2 Version 2.0 specification, "Volume 4: Protocols" <http://www.openiptvforum.org/docs/Release2/OIPF-T1-R2-Specification-Volume-2-Media-Formats-v2_0-2010-09-07.pdf >

[46] Open IPTV Forum Release 2 Version 2.0 specification, "Volume 6: Procedural Application Environment" <http://www.openiptvforum.org/docs/Release2/OIPF-T1-R2-Specification-Volume-6-Procedural-Application-Environment-v2_0-2010-09-07.pdf >

[47] ETSI EN 302 755 V1.1.1: Framing structure, channel coding and modulation for a second generation digital terrestrial television broadcasting system

[48] ETSI dTR 102 831: DVB-T2 implementation guidelines

[49] IETF, RFC 1950, "ZLIB Compressed Data Format Specification version 3.3", < http://www.rfc-editor.org/rfc/rfc1950.txt>

[50] IETF, RFC 1951, "DEFLATE Compressed Data Format Specification version 1.3", < http://www.rfc-editor.org/rfc/rfc1951.txt>

[51] DGTVi Broadband Addendum, "Compatible High Definition receivers for the Italian market: special requirements for broadband media delivery", October 2009

[52] USB Implementers Forum, Inc. "Universal Serial Bus Specification Revision 2.0", April 2000

[53] Open IPTV Forum Release 2 Version 2.0 specification, "Volume 2a: HTTP Adaptive Streaming" <http://www.openiptvforum.org/docs/Release2/OIPF-T1-R2-Specification-Volume-2a-HTTP-Adaptive-Streaming-V2_0-2010-09-07.pdf>

[54] HDMI Licensing, LLC, "High-Definition Multimedia Interface – Specification Version 1.4a – Extraction of 3D Signalling Portion", March 2010

[55] ISO/IEC 14496-12:2008 | 15444-12:2008 (3rd edition) / Amendment 2: "Support for sub-track selection & switching, post-decoder requirements, and colour information", July 2010

[56] JSR 239: "Java™ Binding for the OpenGL® ES API, August 2007

[57] NorDig: "Requirements to NorDig-T2 compliant IRDs  - Addendum to the NorDig Unified Requirements (ver 2.1) for Integrated Receiver Decoders for use in cable, satellite, terrestrial and IP-based networks" (ver 1.0.1)

[58] ETSI TS 101 547: "Frame Compatible Plano-stereoscopic 3DTV", January 2011

[59] ITU-T Recommendation H.264 / ISO/IEC 14496-10:2010: "Information technology -- Coding of audio-visual objects -- Part 10: Advanced Video Coding"

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# 4. Definitions and abbreviations

## 4.1. Definitions

***3DTV "Frame-Compatible" Mode:*** a frame-compatible 3DTV format is one that carries separate left and right video signals within the video frame used to convey a conventional 2D high-definition signal by squeezing them to fit within the space of one picture.

***3DTV "Service-Compatible" Mode:*** in service-compatible 3DTV transmissions a regular 2D high definition signal is broadcasted to all viewers, while additional data are sent to complete the picture for those homes with a 3D display.

***Adaptive Streaming:*** a technique, used in the context of OTTV to cope with Open Internet varying throughput conditions, where more files corresponding to encodings at different bit rates of the same content which the receiver can seamlessly switch to are made available by the Service Provider.

***Application Service Provider:*** an entity that manages and distributes applications and services for interactive television to customers (i.e. broadcasters and consumers) from a central data center. This entity may also provide interaction channel processing services.

***Bound Application:*** A MHP application that is linked to another service and that is meant to be accessed only after tuning in to the other service.

***Cross carriage:*** Carrying the data (typically EIT data) pertaining to one multiplex on a different multiplex. Cross carriage agreements usually imply reciprocity.

***Domain of an Application***: The domain of an Xlet characterizes the "space" within which the Xlet is able to execute. This includes both the "connection" where the Xlet is delivered and other "connections" where an already executing Xlet is allowed to continue executing. An application cannot run outside its domain. The maximum lifetime of an application extends from the moment the user navigates to its domain until the moment that the user navigates away from its domain. In the broadcast case a "connection" corresponds to a DVB-service. Broadcast signalling indicates which services can load an application and which services allow an already active application to continue.

***Independent Application:*** A MHP service which is meant to be directly accessed by the end user (e.g. through a Channel number). An Independent Application may have bound applications linked to it. EPGs are an example of independent application. Also called Non Bound Application

***Interaction Channel***: a bi-directional link connecting the Receiver to a Server for providing extra functionality, such as personalized data, billing, e-commerce, etc. Often called return channel.

***Locator:*** The unique identifier of a DVB service/event.

***Out of Box Experience:*** the first contact of the user with the product, as experienced when taking it out of the packaging box and plugging it into the wall socket and antenna cable (without having to read tons of manuals…).

***Over-The-Top Services:*** A general term for video services delivered over the Open Internet. It's referred to as "over-the-top" because these services ride on top of plain Internet access service and don't require any business or technology affiliations with the network operator.

***Receiver:*** a piece of equipment designed to receive (and decode) DTTV signal. It can be provided as a separate box – in this case it is often called Set Top Box, and sometimes Integrated Receiver Decoder (IRD) – or can be incorporated into a TV set, which is then called an Integrated Digital TV set (iDTV).

***Service:*** For TV and Radio, a sequence of programmes under the control of a broadcaster which can be broadcast as part of a schedule [10]. For Applications and Data, refers

to a data stream in the MHP that can be used directly or be presented to an output interface, without having to tune into a TV or Radio service.

**Service List:** List of all autonomously accessible services (television, radio, application, and data) identified through a service number

**Plano-stereoscopic TV:** First Generation 3DTV systems are sometimes called 'Plano-stereoscopic TV' because the underlying characteristic of these systems is that they carry two channels, for viewing by the left and right eye (L and R). These systems usually require the viewer to wear glasses for large screen viewing.

**T-Government Services:** services of e-government provided on digital television receivers. Those services in many cases require the use of an interaction channel, and of a smart card ("citizen's card", e-ID card, etc.)

**TV Viewing Mode or Viewing Mode**: normal TV viewing condition, when less than 5% of the screen area is covered by any MHP, or receiver proprietary, GUI.

## 4.2. Abbreviations

| | |
|---|---|
| 3DTV | Plano-stereoscopic 3D TV |
| AAC | Advanced Audio Coding |
| AAC-LC | AAC Low Complexity |
| AC-3 | Audio Coding 3 |
| ACE | Active Constellation Extension |
| ADSL | Asymmetric Digital Subscriber Line |
| AFD | Active Format Descriptor |
| AGCOM | Autorità per le Garanzie nelle Comunicazioni |
| AIT | Application Information Table |
| API | Application Programming Interface |
| AVC | Advanced Video Coding |
| BAT | Bouquet Association Table |
| BER | Bit Error Rate |
| CA | Conditional Access |
| CAM | Conditional Access Module |
| CHAP | Challenge Handshake Authentication Protocol |
| CI | DVB Common Interface |
| CICAM | CI CAM |
| CoD | Content on Demand |
| COFDM | Coded Orthogonal Frequency Division Multiplexing |
| CVBS | Component Video Baseband Signal |
| DAB | Digital Audio Broadcasting |
| DAE | Declarative Application Environment |
| DHCP | Dynamic Host Configuration Protocol |
| DRM | Digital Rights Management |
| DTS | Digital Theater Systems |
| DTTV | Digital Terrestrial Television |
| DTV | Digital Television |
| DVB | Digital Video Broadcasting |
| DVB-H | DVB Handheld |
| DVB-T | DVB Terrestrial |
| EACEM | European Association of Consumer Electronics Manufacturer |
| EDID | Extended Display Identification Data |
| EHDF | European HD Forum |
| EICTA | European Information and Communication Technology Association |
| EIT | Event Information Table |
| EPG | Electronic Program Guide |
| ETSI | European Telecommunications Standards Institute |
| EU | European Union |

| FEF | Future Extension Frame |
|-----|------------------------|
| FIFO | First In First Out |
| FFT | Fast Fourier Transform |
| FTTH | Fiber To The Home |
| GPRS | General Packet Radio System |
| GS | Generic Stream |
| GUI | Graphic User Interface |
| HAS | HTTP Adaptive Streaming |
| HD | High Definition |
| HDCP | High bandwidth Digital Copy Protection |
| HDFI | HD Forum Italia |
| HDMI | High Definition Multimedia Interface |
| HDSPA | High-Speed Downlink Packet Access |
| HDTV | High Definition TV |
| HE-AAC | High Efficiency AAC |
| HTTP | Hyper-Text Transfer Protocol |
| iDTV | Integrated Digital TV Set |
| IP | Internet Protocol |
| IPTV | IP Television |
| IRD | Integrated Receiver Decoder |
| ISO | International Organization for Standardization |
| ISP | Internet Service Provider |
| IXC | Inter-Xlet Communication |
| i-TV | Interactive Television |
| JMF | Java Media Framework |
| LAN | Local Access Network |
| MFN | Multi Frequency Network |
| MHP | Multimedia Home Platform |
| MIME | Multipurpose Internet Mail Extensions |
| MPD | Media Presentation Description |
| MPEG | Moving Picture Experts Group |
| MUG | MHP Umbrella Group |
| NID | Network ID |
| NIT | Network Information Table |
| NTS | Network Time-Shift |
| OFDM | Orthogonal Frequency Division Multiplexing |
| OIPF | Open IPTV Forum |
| OMA | Open Mobile Alliance |
| ONID | Original Network ID |
| OSD | On-Screen Display |
| OTA | Over The Air |
| OTT-TV | Over The Top TV |
| PAE | Procedural Application Environment |
| PAL | Phase Alternate Lock |
| PAP | PPP Authentication Protocol |
| PAPR | Peak-to-Average Power Ratio |
| PAT | Program Association Table |
| PCMCIA | Personal Computer Memory Card International Association |
| PDC | Program Delivery Control |
| PID | Packet IDentifier |
| PLP | Physical Layer Pipe |
| PMT | Program Map Table |
| POP | Point Of Presence |
| PPP | Point-to-Point Protocol |
| PPPoE | PPP over Ethernet |

| | |
|---|---|
| PSI | Program Specific Information |
| PSTN | Public Switched Telephone Network |
| QAM | Quadrature Amplitude Modulation |
| QEF | Quasi Error-Free |
| QPSK | Quadrature Phase Shift Keying |
| RRC | Regional Radio Conference |
| SATSA | Security And Trust Services API |
| SCART | Syndicat des Constructeurs d'Appareils Radiorécepteurs et Téléviseurs |
| SD | Standard Definition |
| SDT | Service Description Table |
| SEI | Supplemental Enhancement Information |
| SFN | Single Frequency Network |
| SI | Service Information |
| SID | Service ID |
| SIM | Security Identity Module |
| SSU | System Software Update |
| STB | Set Top Box |
| T-DMB | Terrestrial Digital Media Broadcasting |
| T2-IRD | DVB-T2 Integrated Receiver Decoder |
| TM | DVB Technical Module |
| TFS | Time Frequency Slicing |
| TR | Tone Reservation |
| TS | Transport Stream |
| TSID | Transport Stream ID |
| UHF | Ultra High Frequency |
| UI | User Interface |
| UNT | Update Notification Table |
| URL | Uniform Resource Locator |
| USB | Universal Serial Bus |
| VHF | Very High Frequency |
| WAN | Wide-area Access Network |
| WLAN | Wireless LAN |
| WSS | Wide-Screen Signalling |

# 5.  The HD-Book

HD Forum Italia (HDFI) is an association constituted on September 19th. 2006, to represent the general interests of the industry and consumers towards high definition. HDFI is aimed to promote, support, illustrate and disseminate the utilization of multimedia contents and audiovisual programmes, productions and technology in high definition format (HD).

The HDFI association members represent the major institution & companies in the audiovisual & telecommunication Industry in Italy. They cover most of the segment of the entire production chain, from the content creations to end users: ADB, Aeranti Corallo, Dahlia TV, Eutelsat, Fastweb, Fondazione Ugo Bordoni, Fracarro, Frame, IDS Multimedia, Mediaset, RAI, SBP, Sky Italia, Sony, STMicroelectronics, Telecom Italia, Telecom Italia Media and Telsey.

HDFI adhere, as Italian member organization, to European HD Forum (EHDF), promoted and jointly chaired by the international organizations EBU (European Broadcasting Union) and DIF (Digital Interoperability Forum), consequently to the strong stimulus impressed by the European Conference on HDTV held on June 7th, 2005 in Luxembourg, organized by the former EU Luxembourg Presidency under the European Community patronage.

DGTVi is the association which represents the general interests of the Italian DTT industry.

This document describes the **baseline requirements** that are needed for a HDTV DTT receiver with broadband connectivity to claim compatibility with joint HDFI/DGTVi specifications.

The objective of those baseline requirements is continuity of service. This means:

- The compatibility with Standard Definition services
- A smooth transition from analogue to digital, accompanying the increased simulcasting (analogue and digital, SD and HD) of the different services, the staged switch off of channels, and the necessary re-allotment of the frequencies, in accordance with the National Digital Frequency Plan, and the results of the RRC-GE06. The use of Logical Channel descriptors, in that respect, will play an important role to ease the inconveniences that will arise from the continuous changes in the intermediate period.
- Protection from and robustness in presence of the new uses of the VHF and UHF broadcasting frequencies (DVB-H, DAB, T-DMB, etc.)
- The compatibility of new DVB-T2 transmissions with existing DVB-T services
- The compatibility with Broadband Services based on DGTVi's *"Broadband Addendum 1.0"* [51]
- Paving the way for introducing innovative FREE or PAY broadband services requiring adequate content protection mechanisms
- Supporting 3DTV "Frame-Compatible" services and spatial sound for better user experience

Special attention has been paid to the needs of impaired people through some ancillary requirements specifically devoted to them. The following symbols are used by European broadcasters to mark transmissions offering audio description or video subtitling services.

Some optional features are also described that allow compatibility with the innovative services being introduced on the digital TV networks.

## 5.1. Terminology and notation

The features are divided into two main categories: *"mandatory"* and *"optional"*.

When a feature is "mandatory", its inclusion is mandatory and it must conform to the defined specification.
When a feature is "optional", its inclusion is left at the choice of the manufacturer, but whenever implemented, it shall be implemented in conformance with the specification.
Within the optional category, the document presents some features, which would be of a great advantage to the user, as "recommended".

Features or requirements which apply only to either STBs or iDTVs are clearly highlighted both in the text and in visual form, namely:

Refers to a feature or a section applicable only to iDTVs    (yellow marker)

Refers to a feature or a section applicable only to STBs    (light blue marker)

 *Refers to an HD-specific feature*                          (italic)

*The different TV formats are represented in the document according to the following notation [41]:*

>       *<active lines> <scanning> <frames/s>*

*For instance:*
>    *576i25 (aka 576@50i) represents the 720x576 interlaced format in 50Hz systems*
>    *720p50 (aka 720@50p) represents the 1280x720 progressive format in 50Hz systems*
>    *1080i25 (aka 1080@50i) represents the 1920x1080 interlaced format in 50Hz systems*

## 5.2. Broadband Features

*This HD Book DTT 2.0 fully includes the so-called "Broadband Addendum" [51] specification, which was issued by DGTVi as a separate document on October 2009, mainly based on Open IPTV Forum R1 specification [43][45][46].*

*The aim of the Broadband Addendum was to complement HD Book DTT 1.0 specification in the area of media delivery, mostly on-demand but not necessarily restricted to, over broadband lines. In fact whilst usage of MHP interaction channel of the broadband port herein required had been fully specified, no clear provision had been made for accessing media contents over broadband (IP) lines.*

*In the scope of this document "broadband (IP) lines" are best-effort internet connections offered by ISPs. In other words, the services enabled by the specification included don't strictly require a connection to the (managed) network of an IPTV Service Provider.*

*HD-Book DTT 2.0 progresses Broadband Addendum specifications by addressing also adaptive streaming and, to a minimum extent, broadband content and service protection.*

*Although the compatible receiver herein specified is provided with 2 different interoperable but independent front-ends, (broadcast DTT tuner and broadband IP port), both capable of supporting media Contents Delivery Services, the adjective "Hybrid" does not apply to this document. In fact core Broadcast-centric services, essentially treated in this HD-Book, are*

*considered as prevalent with respect to other ancillary delivery services (OTT-TV CoD or NTS[1]) made available by broadband lines connectivity defined in this specification.*

### 5.2.1.  Broadband Addendum mapping

*The sections which constituted the "Broadband Addendum" document, in the original DGTVi form shape, have been re-mastered to be harmonically merged in the present HD-Book DTT 2.0 document.*

*For those already familiar with the "Broadband Addendum" document:*
- *Section 5, introducing the service profiles of interest, has been merged into §6.1.2*
- *Section 6, dealing with the various (standard) media formats possibly delivered over broadband, has been merged into §6.1.2.1*
- *Section 7, outlining the (standard) ways 2 or more single medium contents can be grouped together to form a multimedia content available for broadband access, has been merged into §6.1.2.1*
- *Section 8, dealing with protocols for streaming or downloading multimedia contents over broadband (IP) connections, has been merged into §6.1.2.1*
- *Section 9, outlining the Application Environment (AE) trough which user interfaces are built and applications access the capabilities introduce above, has been merged as a new section §8.4*
- *Section 10, introducing new features related to accessing media contents over broadband (IP) lines the resident navigator should make available to end user, has been merged as a new section §8.5*

### 5.2.2.  Broadband Connectivity Programme: Easy-net

*In order to promote the widespread diffusion of emerging Over the Top TV services towards all the Customers equipped with HD-Book compatible receivers, manufacturers are warmly invited to join HDFI "Easy-net" Programme.*

*"Easy-net" Programme is a promotional campaign launched by HDFI, aimed at producing implementation guidelines to facilitate end users with the connection between the receiver port and the domestic broadband line plug.*

*Although the Ethernet cable would be by far the most affordable, cheap and simple method for connecting the HD receiver port to the broadband line plug, in a number of cases it would call for wiring not viable in most domestic environments.*

*Promoting a particular home networking is outside the scope of "Easy-net" Programme. Both wired (e.g. Powerline) or wireless (e.g. WLAN) technologies could be conveniently used by manufacturers. It rather intends suggesting guidelines to make the domestic installation between receiver port and domestic broadband lines plug really easy and functional. Through simple and plug&play connectivity solutions, the user will be able to enjoy the best seamless broadcast / broadband experience.*

**Manufacturers are warmly invited to join and promote "Easy-net" Programme, including all the necessary tools and information in their commercial packaging to offer to the Customer a real Out of Box Experience making the full connectivity really quick & easy.**

*For further information go to: http://www.hdforumitalia.org/EasynetProgramme*

### 5.2.3.  Broadband content and service protection

Whilst DGTVi Broadband Addendum didn't mention anything related to broadband content and service protection, HD-Book DTT 2.0 provides a minimum level of interoperability for

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[1] OTT-TV Over the Top TV; CoD Content on demand; NTS: Network Time Shift

applications in this area by specifying a generic DRM API (§8.4.1.3), where generic means not tied to any particular DRM system.

In fact, as done so far for CA systems, adoption of one or more specific DRM systems is outside the scope of this document and it's left up to interested operators and manufacturers instead.

Nevertheless, a "system-wide" DRM, i.e. a DRM adopted by all the platform's players, would be highly beneficial for both manufacturers and operators, then for consumers. At the time of releasing this document it must be acknowledged that there are ongoing efforts in this direction by the Italian operators in the selection of a single DRM system based on an open solution.

## 5.3. 3DTV Features

Another new key area addressed by HD-Book DTT 2.0 is the so-called "Frame-Compatible Plano-stereoscopic 3DTV" [58].

A frame-compatible 3DTV format is one that carries separate left and right video signals within the video frame used to convey a conventional 2D high-definition signal by squeezing them to fit within the space of one picture.

Most recent DVB work on 3DTV formats and signalling has been endorsed in this document, including provisions for some degree of 2D service compatibility (see Annex M).

## 5.4. Linkage with other organizations

Where available and compatible with the Italian situation, the specification contained in this document refers to standards developed by standards setting organisations (DVB, ETSI, EICTA, NorDig, MPEG, OIPF, ISO, CEI, CEN). Furthermore, it follows the Italian legislation in force concerning DTTV and reception equipment for Digital Terrestrial Television[2].

**For the aspects of the receiver where nothing is indicated, the HDFI expects the manufacturers to follow the EICTA E-book. The version 2.0 is taken as a reference (with the exception of obvious editorial errors).**
**However, the HDFI <u>does not endorse</u> the E-Book specifications concerning the transmitted signal (which principally concerns networks operators and not receiver manufacturers) and expects that receivers shall be compatible with all DVB legal configurations and signalling. This is to great extent due to the fact that the E-Book is not adapted to the specific structure of digital terrestrial broadcasting in Italy.**

## 5.5. Graceful Degradation

A receiver compliant with this specification shall implement a "graceful degradation" mechanism for specific unsupported (optional) features and shall behave as follows:

- the receiver shall not unexpectedly terminate the current runtime application
- the receiver shall not hang up
- the user shall be unaware of any exception thrown by the middleware (for applications conforming to the MHP specification), but shall be informed of the unavailability of the requested service or functionality on the receiver.

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[2] Specifically the Italian Communication Authority Deliberation n° 216/00/ CONS

# 6.  Basic requirements

## 6.1. Hardware requirements for the receiver

The Italian DTT network is still evolving. Receivers must support a range of transmission parameters and modes to allow for changes in the use of the allocated spectrum.

Receivers MUST meet minimum performance criteria to maximise both network coverage and the reliability of receivers acquired by consumers in the retail market.

### *6.1.1.  Terrestrial Front End & Signal Decoding*

The receiver SHALL support the signal characteristics specified in the following.

*A receiver capable of receiving DVB-T2 broadcasts [47] SHALL also be capable of receiving DVB-T broadcasts [13]. Such a receiver is in the following referred to as "T2-IRD", when there is a need to differentiate such a receiver from a receiver supporting DVB-T only. The T2-IRD shall automatically detect whether DVB-T or DVB-T2 signal is being used in the specific channel.*

#### 6.1.1.1.  Mandatory features

| Feature | Specification | Comment |
|---|---|---|
| **DVB-T** | | |
| Channel Bandwidth | - 7 MHz in Band III (European VHF channel allocation) <br> - 8 MHz in Band IV-V (UHF) | Since July 2009, according to resolutions taken at Regional Radio Conference GE06, Italy has adopted 7MHz bandwidth in Band III with European channel allocation [32] |
| Digital demodulation | COFDM DVB-T (EN 300 744) | Ref. : [2] |
| Transmission mode | 2k and 8k | Ref.: [2] |
| Constellation Combinations | QPSK, 16-QAM, 64-QAM, hierarchical 16-QAM, hierarchical 64-QAM) | Ref.: [2] |
| Code rates | 1/2, 2/3,3/4, 5/6 or 7/8 | Ref.: [2] |
| Guard Interval | 1/4, 1/8, 1/16 or 1/32 | Ref.: [2] |
| Hierarchical Modulation | Alpha=1, 2 or 4 (where applicable) | The receiver is required to demodulate and present all and only the services that it is able to handle among those possibly available in both high (HP) and low priority (LP) streams. Ref.: [13] |
| Noise Figure (NF) | Better than 8 dB | Ref.: [2] <br> Same as §12.7.3 in E-Book [8] |
| Implementation Margin | Better than 3 dB. | Ref.: [2] |

| Feature | Specification | Comment |
|---|---|---|
| Minimum signal level | The demodulator operates on Gaussian channel at QEF performance (i.e. BER less than $2\times10^{-4}$ after convolutional decoding and before Reed-Solomon decoding) with a minimum input signal of -78.2dBm across the whole UHF range (8k, 64 QAM mode, 2/3 code rate, Tg/Tu ¼, 8dB NF and 7.61MHz bandwidth). | Ref.: [2] |
| Maximum Signal Level | Greater than -28 dBm (80 dBµV on 75 Ohm) without degrading the signal (Implementation Margin). | Even with a strong reduction in the power transmitted, in the hypothesis of an antenna gain of 12 dB and a cable loss of 4 dB there could be levels reaching the receiver of -35dBm (73 dBµV on 75 ohm) and of the order of -25, -30 dBm.<br>The deliberation of AGCOM reports: "The front end must operate with an over-specified Implementation Margin (note of the editor: equivalent to 3dB) with maximum signal of -35dBm."<br>Ref.: [2] |
| Resistance to interference (analogue and digital) co-channel and on adjacent channel. | Reference values contained in Annex A #1.m, of AGCOM decision 216/00/CONS | Ref.: [2] |
| Behaviour in the presence of two static (distant) echoes | The receiver correctly operates in the presence of two static echoes (i.e. 2 paths) with a relative delay in a range of 0,2 µs. and 0,9 times the duration of the guard interval, independently of the value of the amplitude and of the relative phases. This requirement applies to all possible modes. | This is the minimum requirement if one wants the receiver to also operate in a Single Frequency Network as well.<br>The minimum performance and test profile are those presented in E-Book [8], §12.7.8.1 |
| Behaviour in the presence of short echoes | In the presence of echoes of matching levels, the demodulator operates with an implementation margin of 3.5 dB when the channel profile corresponds to that reported in EN 300 744 [13] (Rice and Rayleigh profiles using the six strongest rays). In the presence of an echo at 0 dB, in the absence of noise, to the limit of the guard interval, and for any guard interval, the demodulator operates with QEF performance in the 64 QAM mode and with 2/3 code rate. | Ref: [13] [2]<br>The minimum performance and test profile are those presented in E-Book [8], §12.7.8.2 |
| Change of modulation parameters | At least code rate, time guard and constellation changes shall be automatically detected | Network(s) evolution shouldn't impact existing services |
| Analogue reception | Digital and analogue tuners present | Analogue reception facilitates the migration to DTTV in its introductory phase. It is MANDATORY for IDTVs till the switch-off, just OPTIONAL for STBs. |
| Demultiplexing | MPEG-2 System Transport Stream | Ref.: [9] |

| Feature | Specification | Comment |
|---------|--------------|---------|
| **DVB-T2** | | |
| Channel Bandwidth | - 1.7 MHz (OPTIONAL)<br>- 7 MHz (European VHF channel allocation) in Band III<br>- 8 MHz in Band IV-V (UHF) | Since July 2009, according to resolutions taken at Regional Radio Conference GE06, Italy has adopted 7MHz bandwidth in Band III with European cannel allocation [32] |
| Digital demodulation | COFDM DVB-T2 | Ref. : [47] |
| Transmission mode | 1K, 2K, 4K, 8K normal and extended, 16K normal and extended, 32K normal and extended | Ref.: [47]<br>- For 8 MHz DVB-T2 signal, a normal carrier mode corresponds to a signal bandwidth of 7.61 MHz and an extended carrier mode corresponds to a signal bandwidth of 7.71 MHz for FFT size of 8K and 7.77 MHz for FFT size of 16K and 32K.<br>- For 7MHz DVB-T2 signal, a normal carrier mode corresponds to a signal bandwidth of 6.66 MHz and an extended carrier mode corresponds to a signal bandwidth of 6.80 MHz.<br>- For 1.7 MHz DVB-T2 signal, a normal carrier mode corresponds to a signal bandwidth 1.54 MHz and an extended carrier mode corresponds to a signal bandwidth of 1.57 MHz |
| Constellation Combinations | QPSK, 16-QAM, 64-QAM, 256-QAM, both rotated and non-rotated | Ref.: [47] |
| FEC Frame length | 64800, 16200 | Ref.: [47] |
| Code rates | 1/2, 3/5, 2/3, 3/4, 4/5, 5/6 | Ref.: [47] |
| Pilot pattern | PP1, PP2, PP3, PP4, PP5, PP6, PP7, PP8 | Ref.: [47]<br><br>N.B. PP8 is only applicable when Time Interleaving is not applied and in Single PLP mode |
| Guard Interval | 1/128, 1/32, 1/16, 19/256, 1/8, 19/128, 1/4 | Ref.: [47] |
| Single/Multiple PLP | Both | The receiver is required to demodulate and present all and only the services that it is able to handle among those possibly available.<br>Input Mode A (single PLP) or Input Mode B (Multiple PLPs – Common PLP, Type 1 and 2 up to the maximum allowed figure 255)<br>Ref.: [47] |
| Time interleaving | $2^{19}+2^{15}$ OFDM cells for a data PLP and its common PLP together | Ref.: [47] |

| Feature | Specification | Comment |
|---|---|---|
| PAPR | All possible configurations:<br>- No PAPR<br>- ACE-PAPR only<br>- TR-PAPR only<br>- both ACE and TR | Ref.: [47] |
| SISO/MISO | Both | Ref.: [47] |
| Time Frequency Slicing (TFS) | Not required | Ref.: [47] |
| FEF parts and Auxiliary streams | The receivers are not required to demodulate or decode the content of FEF parts and auxiliary streams, but the existence of FEFs and/or auxiliary streams shall not cause receiver to malfunction. | Ref.: [47]<br>See Annex A |
| Noise Figure (NF) | Better than 6dB | [57] |
| C/N Performance | See Annex A | |
| Minimum signal level | The receiver SHALL provide QEF reception for the following minimum signal levels ($P_{min}$):<br><br>For 7MHz Normal/Extended Bandwidth:<br>$P_{min}$ = -105.7dBm + NF [dB] +  C/N [dB]<br>For 8MHz Normal Bandwidth:<br>$P_{min}$ = -105.2dBm + NF [dB] +  C/N [dB]<br>For 8MHz Extended Bandwidth:<br>$P_{min}$ = -105.1dBm + NF [dB] +  C/N [dB] | [57] with C/N values given in Annex A |
| Demultiplexing | MPEG-2 System Transport Stream | Ref.: [9] |
| **A/V Decoding** | | |
| *Audio Decoder (SD and HD modes)* | *The following standards shall be supported:*<br>- *MPEG-1 Audio Layer I & II*<br>- *HE-AACv1 up to level 2 for stereo and level 4 for multichannel (5.1)*<br>- *AC-3 (aka Dolby Digital)*<br>- *Enhanced AC-3 (aka Dolby Digital Plus) up to 5.1 channels*<br><br>*Receivers are required to support audio description in the following formats as per [10]:*<br>*- MPEG-1 L2 broadcaster mix*<br>*- MPEG-1 L2 receiver mix*<br>*- HE-AACv1 and Enhanced AC3 receiver mix*<br>*Receivers may support other modes of audio description.*<br>*Receiver may support "clean-audio" in broadcaster-mix format.* | *Ref.: [9]*<br>*Full decoding of stereo transmissions is mandatory for any of the standards listed aside.*<br><br>*PCM Stereo downmix of 5.1HE-AACv1, AC-3 or Enhanced AC-3 transmissions is mandatory. Presentation of the downmixed analog signal on SCART and RCA outputs (if present) is mandatory.*<br><br>*Transcoding of 5:1 HE-AACv1 transmissions to AC-3 or DTS and of Enhanced AC-3 transmissions to 5:1 AC-3 signal is mandatory unless the receiver provides a minimum 5 channel audio reproduction system capable of driving at least 5 speakers.*<br>*Presentation of the transcoded or native AC-3 signal on SPDIF output (if present) is mandatory.* |
| Audio Multi-Language | Language shall be selectable. | Behaviour as specified in [7.5.1.1 Audio Language] |

| Feature | Specification | Comment |
|---|---|---|
| *Video Decoder (SD mode)* | *MPEG-2 Video Main Profile @ Main Level and H.264/AVC High Profile @ Level 3 (576i25) shall be supported.*<br><br>*Video Aspect Ratio: 4:3; 16:9.* | *The support of a picture aspect-ratio conversion function to transform programmes broadcast in the format 16:9 to 4:3 (and vice-versa) is mandatory. The receiver shall follow indications given by the Active Format Descriptor, if present (see section 7.5.3)*<br>*Ref. : [9], [2]* |
| *Video Decoder (HD mode)* | *H.264/AVC High Profile @ Level 4 (1080i25) support is MANDATORY [3].*<br><br>*H.264/AVC High Profile @ Level 3.1 (720p25) support is MANDATORY [4].*<br><br>*H.264/AVC High Profile @ Level 3.2 (720p50) support is MANDATORY.*<br><br>*Receivers SHALL also be capable of correctly rendering (3D iDTVs) or notifying through HDMI (STBs) at least the following "Frame-Compatible" 3DTV formats:*<br>*- 720p50 Top-and-Bottom*<br>*- 720p50 Side-by-Side*<br>*- 1080i25 Side-by-Side* | *Ref.: [8], [9], [54], [58]*<br><br>*For Frame-Compatible 3DTV signalling at video level:*<br>▪ *H.264/AVC frame packing arrangement Supplemental Enhancement Information (SEI) message is used*<br>▪ *SEI message related to every video frame*<br>▪ *SEI message in a separate Network Abstraction Layer (NAL) unit*<br>▪ *frame_packing_arrangement _cancel_flag set to 1 indicates transition to 2D*<br><br>*According to [9] (section 5.7.1.2) H.264/AVC HDTV decoders SHALL support frame cropping and Sample Aspect Ratio (SAR) value as encoded within Video Usability Information.* |

Table 1: Mandatory features table

### 6.1.1.2. Recommended features

| Feature | Recommended value | Comment |
|---|---|---|
| Graphic processing | 16-bit colour palette | The minimum envisaged in the MHP specification (8 bit: MHP palette giving 188 colours) is not sufficient for evolving graphical applications (e.g. photos). |
| Video sizing | Arbitrary resizing | In case of discrete resizing, the receiver shall select and use the value nearest to the requested value |

Table 2: Recommended features table

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[3] *This profile includes also supporting 1080p25, a format which broadcasters might be interested into for certain applications*
[4] *This profile includes also supporting 576p50 (Enhanced Definition TV), a format which broadcasters can consider for new H.264/AVC SD services.*

### 6.1.1.3. Optional features

| Feature | Option value | Comment |
|---|---|---|
| RF Modulator | Useful to distribute the digital (decoded) signal from the principal TV to others present in the house. Also functional to connect receivers to TV Sets with no SCART connector plugs.<br>*In case of HD signal, the composite downsampled SD version has to be presented on this output, with the same user settings defined in the SCART menu page for connection to 4:3 or 16:9 TV sets. Teletext reinsertion on VBI is required.* | Frequency of the output RF shall be selectable through a dedicated receiver menu, by indicating the UHF channel. |

Table 3: Optional features table

### *6.1.2. Interaction Channel*

*Support to interactive TV, with specific reference to true interactive services, including media delivery over broadband (IP) connections, is deemed of paramount importance for HD receivers. Therefore*

- *Both STB and iDTV receivers SHALL have at least one wireline interaction channel*

*Two families of interaction channel implementations are in fact considered[5]:*
- *wireline interaction channel*
- *mobile interaction channel.*

*It is up to the manufacturer to implement, as an option, a mobile interaction channel in addition to the wireline default one.*

*In the scope of this document "broadband (IP) connections" are best-effort Internet connections offered by ISPs. In other words, the services enabled by this addendum don't strictly require a connection to the (managed) network of an IPTV Service Provider.*

*For delivering media contents over broadband (IP) lines, the scope of this document is restricted to Content on Demand (CoD) type of services.*

*Content on Demand (CoD) service is a service where a user can select the individual content items they want to watch from the list of available content. Consumption of the content is started upon user request.*

*2 types of CoD services are addressed in the following:*
- *Streamed CoD services, where content is consumed while the content itself is being delivered (real-time streaming)*
- *Download CoD services, where the whole content has to be downloaded first to the local storage in the receiver before consuming it. Consumption is then independent of the delivery.*

*Support of Streamed CoD services is MANDATORY.*
*Support of Download CoD services is RECOMMENDED in receivers with internal or external storage capabilities.*

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[5] this classification refers to the technology used to access the public network: so for instance a receiver connected via a Wireless LAN to an ADSL modem/router fits into the wireline interaction channel family

### 6.1.2.1.  Wireline interaction channel

*A wired or wireless (IEEE 802.11 b/g/n) Ethernet port for connecting to broadband access services (e.g. ADSL, FTTH) through a residential gateway (e.g. ADSL modem, ADSL modem/router, FTTH termination) would offer the user the full potential of interactivity, through always-on and broadband capabilities.*

*From the application viewpoint, Ethernet connections can be seen either as LAN (connectionless) or virtual dial-up connections. The former is mandatory, whereas the latter, which requires support for PPPoE by the receiver, is optional.*

| Feature | Specification | Comment |
|---|---|---|
| *Ethernet* | *IEEE 802.3*<br>*10/100 Mbit/s autosense* | |
| *IP address* | *Obtained either:*<br>• *via DHCP or*<br>• *manually* | *DCHP shall be the factory default. For manual configuration it shall be possible to insert a static address from the resident menu.* |
| *Optional Supplementary Protocol* | *PPPoE* | *For virtual dial up. The resident menu shall allow to introduce username and password* |
| *HTTP Proxy* | *A resident menu for defining an HTTP proxy server is RECOMMENDED.* | |
| *Protocols for streaming* | *Unicast streaming using HTTP 1.1 [44] SHALL be supported as defined in clause 5.2.2.2 of the OIPF Protocols specification [45][45]. In order to reduce unnecessary network usage, by allowing partial retrieval for use in cases such as trick play or seek operations, the Range HTTP header in a GET request form SHALL be supported.*<br><br>*HTTP REDIRECT SHALL be supported.*<br><br>*HTTP Adaptive Streaming (HAS) solution specified by OIPF [53] SHALL be supported.* | *To optimize the streaming user experience over best-effort broadband lines when HAS is not used, the receiver SHALL implement proper buffering and playback strategies to cope with varying network conditions. The details of such strategies are implementation dependant.* |
| *Protocols for download* | *If content download is supported, HTTP SHALL be supported as defined in clause 5.2.3 of the OIPF Protocols specification [45].* | |

| Feature | Specification | Comment |
|---|---|---|
| *Media formats* | *All audio and video formats specified for broadcast in Table 1, including Frame-Compatible 3DTV ones, SHALL be supported plus:*<br>*- H.264/AVC Baseline Profile @ Level 2*<br>*- MPEG-1 Audio Layer III*<br>*- AAC-LC up to level 2 for stereo and level 4 for multichannel (5.1)*<br>*- Teletext*<br>*- DVB Subtitles* | *Further to the constraints specified in [9], those specified for Video and Audio formats in clauses 5 and 8 of OIPF Media Formats specification [43] apply.*<br>*Some restrictions on the media types allowed within some specific container may apply (see below)*<br>*Maximum bit rate of video delivered over broadband (IP) lines that the receiver SHALL be able to correctly decode and present for Streamed CoD services is 8 Mbit/s.* |
| *Media container[6]* | *For delivery of media contents over broadband (IP) lines the following standard container formats SHALL be supported:*<br>*- MPEG-2 Transport Stream (TS)*<br>*- MPEG-4 File Format (MP4) [42]* | *Further to the constraints specified in [9], those specified for "TS system layer format" in clause 4.1 of OIPF Media Formats specification [43] apply. In particular, only a single program SHALL be contained in the Transport Stream container. The TS SHALL contain only one Program Map Table (PMT).*<br>*Frame-Compatible 3DTV streams will contain AVC_video_descriptor in PMT (see §7.2.2.4).*<br>*For the MP4 container the constraints specified in clause 4.2 of OIPF Media Formats specification [43] apply.*<br>*Frame-Compatible 3DTV MP4 files will contain information about the Supplemental Enhancement Information (SEI) messages present in the AVC stream in the SEI Information box [55].* |

Table 4: Wireline interaction channel features

*The media formats supported within each container type are listed in the following table:*

| | | Container | |
|---|---|---|---|
| | **Media Format** | **MPEG-2 TS** | **MP4** |
| Video | *H.264/AVC High Profile @ Level 4 (1080i25)* | X | X |
| | *H.264/AVC High Profile @ Level 4 (1080i25) Side-by-Side* | X | X |
| | *H.264/AVC High Profile @ Level 3.1 (720p25)* | X | X |
| | *H.264/AVC High Profile @ Level 3.2 (720p50)* | X | X |
| | *H.264/AVC High Profile @ Level 3.2 (720p50) Top-and-Bottom* | X | X |
| | *H.264/AVC High Profile @ Level 3.2 (720p50) Side-by-Side* | X | X |
| | *MPEG-2 Video Main Profile @ Main Level* | X | |
| | *H.264/AVC High Profile @ Level 3 (576i25)* | X | X |
| | *H.264/AVC Baseline Profile @ Level 2* | | X |
| Audio | *MPEG-1 Audio Layer I & II* | X | |
| | *HE-AACv1 up to level 2 for stereo, level 4 for multichannel (5.1)* | X | X |
| | *AC-3 (aka Dolby Digital)* | X | X |
| | *Enhanced AC-3 (aka Dolby Digital Plus) up to 5.1 channels* | X | X |
| | *AAC-LC up to level 2 for stereo and level 4 for multichannel (5.1)* | X | X |
| Teletext | *EBU Teletext carried in DVB streams* | X | |
| Subtitles | *DVB Subtitles* | X | |

Table 5: Container/media compatibility matrix

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[6] "Container" is what in MPEG jargon is called "system layer", i.e. a means for multiplexing and synchronizing multiple media streams with associated system information (metadata).

In order to make video encoded with H.264/AVC Baseline Profile decodable also by a Main/High Profile decoder, support of AVC error resilience tools included in Baseline Profile is OPTIONAL (i.e. `constraint_set1_flag` is equal to "1" in case of Baseline Profile).

Particular cases of "self-contained" contents which can be delivered over broadband (IP) lines are audio-only streams. The following formats SHALL be supported for such streams:
- MPEG-1 Audio Layer III
- HE-AACv1
- AAC-LC

Audio-only streams based on the latter two formats carried within the containers indicated in Table 4 SHALL also be supported.

Usage of MPEG-1 Audio Layer III is restricted to audio-only streams, i.e. it will not be used for audiovisual streams, either broadband or broadcast.

File extensions and MIME types used for the previously defined container formats and for HAS's MPD manifest file are the following:

| Format | Extension(s) | MIME Type |
|---|---|---|
| Media Presentation Description (MPD) | .mpd | video/vnd.3gpp.mpd |
| MPEG-2 Transport Stream (TS) | .ts, .trp, .mpg | video/mpeg or video/mp2t |
| MPEG-4 File Format (MP4) | .mp4, .mov | video/mp4 |
| MPEG-1 Audio Layer III | .mp3 | audio/mpeg |
| HE-AACv1 | .m4A | audio/mp4 |
| AAC-LC | .aac | audio/mp4 |

Table 6: File extensions and MIME types for the various container formats

According to [53], when HAS is used in conjunction with MP4 container a Media Segment SHALL be delivered with MIME type "video/vnd.3gpp.Segment". An Initialization Segment SHALL be delivered with MIME type "video/mp4".

### 6.1.2.2. Mobile interaction channel

Any advanced packet-switched mobile connections (e.g. GPRS over EDGE, HSDPA, …) can be used as mobile interaction channel.

See Annex B.1 and D as an example of assisted and manual configuration in the GPRS case.

### 6.1.2.3. Presentation of Interaction Channel Type to Applications

The values returned by the getType() method of the org.dvb.net.rc.RCInterface class in the MHP specification [25] shall be as follows:

| Interaction Channel Type | Value Returned | Comment |
|---|---|---|
| Wireline PSTN Modem interface | TYPE_PSTN (value: 1) | |
| Wireline Ethernet Interface | TYPE_CATV (value: 4) | For LAN and PPPoE |
| Mobile Interface | TYPE_OTHER (value: 9) | |

Table 7: Interaction channels values

### 6.1.2.4. User Instructions

Each receiver shall include instructions that clearly describe all the specific conditions to successfully execute connected interactive applications.

*Examples of such instructions are:*

- *receivers equipped with an Ethernet port*
  1. *must be connected with a proper cable to a Residential Gateway*
  2. *the customer must have a valid ISP subscription*
  3. *specific interactive applications may not support the broadband interaction channel.*
  4. *for specific applications access agreements might be required between the Application Service Provider and the user's ISP.*

- *receivers equipped with an internal HSDPA modem*
  1. *may have to be connected to a high gain antenna*
  2. *need a valid SIM, inserted in the proper slot, and an active subscription to a HSDPA service*
  3. *specific interactive application may not support the HSDPA interaction channel (e.g. based on the speed of the interaction channel).*
  4. *an interconnection agreement must be in place between the interactive Application Service Provider and the mobile ISP and/or mobile operator of the user*

### 6.1.3. Memory

The receiver shall provide at least the following minimum memory sizes

| Feature | Minimum Value | Comment |
|---|---|---|
| Flash Memory | 8 MByte of PMS (persistent non-volatile memory) dedicated and shared between all the broadcasters | Memory space effectively available, net after an eventual MHP security system. *At least further 8 Mbytes of PMS shall be reserved for MHP 1.1.3 stored applications.* |
| SDRAM Memory | 16 MByte not contiguous net (Java heap SDRAM memory), available on request for MHP application use. | Memory has to be freed up to the maximum amount of 16 Mbytes (**RECOMMENDED 24 MByte**) when an MHP application is loaded. This condition is testable by loading into RAM a specific MHP application with a 16/24 MByte footprint. |

Table 8: Memory capacity requirements

### 6.1.4. I/O Connectors

The following requirements complement, modify or extend the requirements of the E-Book, which remain valid where nothing specific is said hereunder.

#### 6.1.4.1. Mandatory Connectors

The following connectors shall be present in any applicable receiver (see comments).

| Connector | Specification | Comment |
|---|---|---|
| Input RF connector. | Input: IEC 169-2 Female, 75 ohm | Tuner input |

| Connector | Specification | Comment |
|---|---|---|
| Output RF connector (pass-through) | IEC 60169 Male | "Loop through" facility. Only applicable to STBs.<br><br>Necessary to transmit the signal from the receiving antenna to a VCR, and/or to a TV set.<br><br>In presence of the RF modulator ,this output carries also, on a user selectable channel, the digital (decoded) signal |
| SCART Connector (Primary) | Peritelevision standard [4]<br>• RGB<br>• CVBS: PAL Out<br>• Audio Output<br>A/V Control Pin 8 | For connection to the TV set. Only applicable to STBs<br><br>As an option, the user menu may offer the possibility to output a Y/C signal instead of the RGB signal.<br><br>*In case of HD signal, the downsampled SD version has to be presented on this output, both in composite and component mode, with the same user settings defined in the menu page for connection to 4:3 or 16:9 TV sets. Teletext reinsertion on VBI is required (see §8.1.2).*<br><br>*The stereo output pins will carry one of the following:*<br>*• a mono or stereo signal, in the case of the received audio component being mono or stereo;*<br>*• a two channel downmixed signal, in the case of the received audio component being multi-channel.* |
| SCART In Connector (1) | Peritelevision standard [4]<br>• RGB In<br>• CVBS: PAL In<br>• Audio In<br>• A/V Control Pin 8 | Applicable only to iDTVs, for connecting legacy SD devices. |
| Output SPDIF Connector | As per [27]:<br>• Electrical (RCA connector) or<br>• Optical connector | This output may be omitted when the receiver provides a minimum 5 channel audio reproduction system capable of driving at least 5 speakers. |

| Connector | Specification | Comment |
|---|---|---|
| *Output HDMI Connector with HDCP content protection* | *Type A (Female) [38]*<br>*Automatic audio/video sync is required.*<br>*HDCP [39] must be ON by default.*<br>*720p50 is the recommended default output format.*<br>*When Frame-Compatible 3DTV formats are decoded, receivers SHALL transmit an accurate HDMI Vendor Specific InfoFrame (as per section 8.2.3 of [54]) at least once every two video fields*<br>*Receivers SHALL handle an HDMI Vendor-Specific Data Block (HDMI VSDB) in the E-EDID Data Structure as indicated in section 8.3.2 of [54].* | *For digital connection of STBs to HD Ready TV or HD Ready 1080p sets.*<br>*According to EICTA HD TV and HD TV 1080p logos' requirements, a "dynamic" output (unscaled) mode shall be available where the HD output format (720p50 or 1080i25) will match the HD transmission format (720p50 or 1080i25 respectively) based on EDID. By avoiding possible (even multiple) format conversions, such mode would in theory provide the best video quality. But due to limitations in current HDMI/HDCP implementations it would likely cause some substantial extra delay, with respect to a fixed 720p50 or 1080i25 output setting, when moving between services or events with different HD or SD transmission formats.*<br>*For these reasons, the dynamic output mode shall be available in user menus but not necessarily as the default value.*<br>*In order to possibly minimize the number of cascaded conversions, when dynamic output mode is selected SD output towards HD Ready or HD Ready 1080p sets shall be set to 576p50.* |
| *Input HDMI Connector with HDCP content protection* | *Type A (Female) [38]*<br>*E-EDID support, including HDMI VSDB (Vendor-Specific Data Block) Lipsync-related fields, is required.*<br>*HDCP [39] must be ON by default.*<br>*It's highly RECOMMENDED that 3DTV capable iDTVs interpret HDMI Vendor Specific InfoFrame packet (as per section 8.2.3 of [54])*<br>*3DTV capable iDTVs SHALL contain an HDMI Vendor-Specific Data Block (HDMI VSDB) in the E-EDID Data Structure as indicated in section 8.3.2 of [54].* | *For digital connection of STBs to HD Ready or HD Ready 1080p TV sets.* |
| *Ethernet Port* | *RJ 45 Connector* | *Mandatory for receivers with wireline interaction channel also in case they provide (in-house) wireless access[7].* |
| Smart card slot | ISO 7816 1,2,3 with T=0 and T=1 | For CA and non-CA applications |

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[7] An USB port could actually turn into an Ethernet (wired or wireless) or advanced mobile (GPRS, EDGE, UMTS, HDSPA) port through a suitable adapter but the sole presence of such a port doesn't fulfil the requirement. A receiver with USB port will be considered compliant with this requirement only if the aforementioned adapter would come bundled with the receiver itself.

| Connector | Specification | Comment |
|---|---|---|
| *Common Interface (CI+)* | *EN 50 221, as explained in section 9.1.3, with extensions by CI+ Forum [37]* | *Applicable and mandatory only for iDTVs with screen diagonal over 30cm (13").* |
| *USB Port (Host)* | *USB Type A Connector* | *Compliant with USB 2.0 or later specification [52]*<br><br>*For user-managed software upgrade and/or for attaching external storage media* |

Table 9: Mandatory connectors table

### 6.1.4.2. Optional Connectors

The following table includes a non exhaustive list of connectors which might be present in some receivers. When present the specifications given therein do apply.

| Connector | Specification | Comment |
|---|---|---|
| *Output HDMI Connector with HDCP content protection* | *Type A (Female) [38]*<br><br>*Automatic audio/video sync is required.*<br><br>*HDCP [39] must be ON by default.* | *For digital connection to other external equipment (e.g. Home Theater, Video Projector).* |
| SCART Connector (Secondary) | • CVBS: PAL Out<br>• Audio: Output<br>• Y-C (super VHS) | Useful to record Digital Channels on a VCR. Such output must not to be affected by OSD (On Screen Display) graphics. Applicable only to STBs.<br><br>*In case of HD signal, the downsampled SD version has to be presented on this output, either/both in composite or/and component mode (if present), with the same user settings defined in the menu page for connection to 4:3 or 16:9 TV sets. Teletext reinsertion on VBI is recommended (see §8.1.2).*<br><br>*The stereo output pins will carry one of the following:*<br>*• a mono or stereo signal, in the case of the received audio component being mono or stereo;*<br>*• a two channel downmixed signal, in the case of the received audio component being multi-channel.* |

| Connector | Specification | Comment |
|---|---|---|
| SCART Connector (Primary) | Peritelevision standard [4]<br>• RGB<br>• CVBS: PAL Out<br>• Audio Output<br>A/V Control Pin 8 | For connection to external legacy SD equipment.<br>As an option, the user menu may offer the possibility to output a Y/C signal instead of the RGB signal.<br>*In case of HD signal, the downsampled SD version has to be presented on this output, both in composite and component mode, with the same user settings defined in the menu page for connection to 4:3 or 16:9 TV sets. Teletext reinsertion on VBI is required (see §8.1.2).*<br>*The stereo output pins will carry one of the following:*<br>*• a mono or stereo signal, in the case of the received audio component being mono or stereo;*<br>*• a two channel downmixed signal, in the case of the received audio component being multi-channel.* |
| RCA Connectors (Composite) | • 1 Video<br>• 2 Audio (left/ right) | *In case of HD signal, the composite downsampled SD version has to be presented on the video output, with the same user settings defined in the SCART menu page for connection to 4:3 or 16:9 sets. Teletext reinsertion on VBI is required.*<br>*The stereo output connector will carry one of the following:*<br>*• a mono or stereo signal, in the case of the received audio component being mono or stereo;*<br>*• a two channel downmixed signal, in the case of the received audio component being multi-channel.* |
| *RCA Connectors (Component)* | • *3 Video (YPbPr) as per CEA 770.3*<br>• *2 Audio (left/ right)* | *In case of HD signal, the composite downsampled SD version has to be presented on the video output, with the same user settings defined in the SCART menu page for connection to 4:3 or 16:9 sets.*<br>*The stereo output connector will carry one of the following:*<br>*• a mono or stereo signal, in the case of the received audio component being mono or stereo;*<br>*• a two channel downmixed signal, in the case of the received audio component being multi-channel.* |
| Serial data port (RS-232)  9-pin | D-sub connector Female | |
| SIM slot | Receptacle for standard GSM SIM. Access to the SIM slot shall not need opening the case of the receiver. | For receivers with mobile interaction channel. The slot may be either inside the receiver box itself or in an external device (see note 7). |
| Mobile high gain antenna connector | One of three possible standards<br>• RP TNC female<br>• RP MC Card female<br>• RP SMA female | For receivers with mobile interaction channel. |

Table 10: Optional connectors table

### 6.1.4.3. Audio outputs matrix

*The following matrix specifies which audio shall be presented on which output (if present) of a compliant receiver, based on the received signal, both for broadcast and broadband:*

| | HDMI | SCART | RCA | SPDIF |
|---|---|---|---|---|
| *Mono/stereo audio (any codec)* | *Decoded PCM mono/stereo audio* | *Decoded analog mono/stereo audio* | *Decoded analog mono/stereo audio* | *Decoded PCM mono/stereo audio* |
| *AC-3 5.1 audio* | *AC-3 5.1 audio or stereo downmix of multichannel audio, in the given preference order, based on sink's capabilities (as per EDID)* | *Analog stereo downmix of multichannel audio* | *Analog stereo downmix of multichannel audio* | *AC-3 stream* |
| *Enhanced AC-3 5.1 audio* | *Enhanced AC-3 5.1 audio or AC-3 5.1 transcoded stream or stereo downmix of multichannel audio, in the given preference order, based on sink's capabilities (as per EDID)* | *Analog stereo downmix of multichannel audio* | *Analog stereo downmix of multichannel audio* | *AC-3 5.1 transcoded stream* |
| *HE-AAC v1 5.1 audio* | *AC-3 or DTS 5.1 transcoded audio or stereo downmix of multichannel audio, in the given preference order, based on sink's capabilities (as per EDID)* | *Analog stereo downmix of multichannel audio* | *Analog stereo downmix of multichannel audio* | *AC-3 or DTS 5.1 transcoded stream* |

Table 11: Audio channel mapping

## 6.2. Remote Control

### 6.2.1. Introduction

To ensure a common and stable reference for application developers and consumers, it is necessary to specify a certain number of points concerning the remote control. This necessity has been identified and confirmed by different groups (e.g. ETSI STF228 on "User interoperability criteria", see Annex B and ref. [21]).

The points taken into consideration cover aspects of:
- physical layout of the remote
- labelling of the keys
- behaviour on "undo" commands
- interaction of output from the remote with the OSD
- interaction with applications for alpha-numeric input

In all cases where possible, the requirements are based on specifications produced by other bodies (see Annex B).

Lastly this chapter contains some advice on good remote control design, taken from extensive research conducted elsewhere (summarized in Annex B). It is highly recommended manufacturers follow this advice – for the benefit of the consumer.

Unlike vertically integrated digital platforms it is not possible to mandate a single remote control design. However, it is essential to have a common minimum of remote-control functionality to ensure that all broadcast services – and in particular interactive applications - are available to the viewer as intended by the broadcaster. In addition, any labelling used needs to be consistent, both to allow the inclusion of on-screen instructions in broadcast services and to enable an easy dialogue with any support staff, e.g. call-centres

### 6.2.2.  Overview

The mandatory keys and key events available to the application are very limited, and thus keys and key event may vary from manufacturer to manufacturer. Even if all necessary (for the consumer and the applications) keys are present on the remote, there is no obligation to make the events available to the application (see Annex B).

Events necessary to a smooth operation of interactive TV – such as « undo » - are not specified in the MHP standard and have been specified in different ways by different groups (see Annex B). They might not be treated in a uniform way by manufacturers and thus create inconsistencies for application providers and their communication with the consumer.

### 6.2.3.  Generic functional description of the remote control

The remote control is used for different purposes:



Figure 1: Typical Remote Control

- TV/receiver control
- channel selection

- accessing information about programs and services
- interactivity

It is strongly recommended that the keys be grouped together by function, and the groupings should be clearly separated (see "Easy TV" [1] research summary in Annex B).

### *6.2.4. General Recommendations*

The following recommendations are based on international studies and on evidence coming out of qualitative research based on DTTV-MHP trials that took in place in Italy.

#### 6.2.4.1. The Main Remote

Receiver remotes need to make possible controlling all the main functions of the TV Set. It has to replace the analogue remote by keeping the same simplicity and user friendliness (few & large keys are needed).

#### 6.2.4.2. Single hand friendly

- The remote control needs to stay comfortably in one hand and be balanced in weight. A rubber band can be useful if placed around the border of the remote.
- The remote will stay in one hand and the keys will be pressed with the thumb. All the keys need to stay in "thumb range".

#### 6.2.4.3. Clear structure

Keys for normal TV viewing and keys for interactivity and navigation need to be grouped in clearly separated sections of the remote

#### 6.2.4.4. Channel selection

- Speed: channel selection (video-video switch) should take less than 0,8 seconds both for an inband or an outband switch. For a channel switch implying a change of hierarchical mode, a maximum of 1 second is tolerable for switching. The switching time shall be calculated using the channel up/down button and will not consider the time for validating the channel number to switch to when using the numeric pad for channel selection..
- AV source dedicated key for VCR or DVD (or other receiver)
- Led on the receiver to indicate the reception of signal coming from the remote.

#### 6.2.4.5. TV controls

STBs whose remote gives the opportunity of directly controlling volume on the TV-set were ranked at the top both in Easy-TV and Italian Broadcasters' research.

#### 6.2.4.6. Now and Next

Need for a dedicated key for Now-and-Next information and for accessing on screen help for navigating channels and services.

#### 6.2.4.7. Navigation keys

- Navigation keys need to be near and consistently placed.
- Colour keys need to be placed following on screen layout.
- There has to be one only red key on the remote
- Symbols: use well known metaphors.

#### 6.2.4.8. Dimensions

Large remote (hand size with large and clearly separated keys).
Comfortable to handle (rubbery and rounded). Every key has to be pressed with thumb.
Weight: quite consistent. Light means fragile.

### 6.2.5.  The Numeric Pad

#### 6.2.5.1.  Overall Function Description

The Numeric Pad is used:

- For channel selection
- In MHP, for application specific purposes.
- For various (manufacturer proprietary) purposes within the receiver's menus

#### 6.2.5.2.  Requirements for the Numeric Pad

##### 6.2.5.2.1  Time-out for channel selection

It is recommended that the time-out for channel selection/switching through numeric pad should be less or equal to 1 second *for SD video and 2 seconds for HD video*[8]. Longer time out length is perceived as misfunctional or annoying by users (see Easy-TV research findings in Annex B)

##### 6.2.5.2.2  Labelling of Numeric Pad keys

The labelling of the numeric pad keys shall be as shown in the picture.
This labelling is fully compliant with standard ETSI ES 202 130 v. 1.1.1 (2003-10) [16]. Letter labels can be also printed on the numeric keys, if they are clearly visible.

### 6.2.6.  Interactive Pad

#### 6.2.6.1.  Overall Function Description

The Interactive Pad is used:

- For navigating within any receiver proprietary GUI
- For navigating within any MHP application

#### 6.2.6.2.  Requirements for Interactive Pad

No receiver proprietary function shall be assigned to the interactive pad when outside of a proprietary STB menu or sub-menu and, in general, when in TV viewing mode condition (see definition in § 4.1). As a consequence, the arrows should not be used neither for channel switching (Ch+ / Ch – should be used instead) nor for volume adjustments. These functions have to be performed by specific dedicated keys.

No key that can bring to a sudden and unexpected killing of an MHP application should be placed near to the interactive pad keys.



Figure 2: The Interactive Pad

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[8] It is acknowledged that meeting such targets will depend also on broadcasted signal (e.g. MPEG GOP size) and HDMI/HDCP switching time (if dynamic output mode has been selected)

The order of the colour keys shall be strictly followed (Red, Green, Yellow, and Blue).

### 6.2.7. The Navigation Pad

#### 6.2.7.1. Overall Function Description

The Navigation Pad is used:

- For accessing SI tables data (e.g.: EIT present/following, AIT)
- For accessing the overall channel list
- For selecting the alternative audio track (if any)
- For accessing the EPG application (resident or on-air)
- For accessing Subtitles (DVB or Teletext)

Not all the keys shown in the Navigation PAD are mandatory and have to be included on the remote control.
Refer to following section in the Remote Control chapter for more detailed specifications.

#### 6.2.7.2. Suggestions for Navigation Pad

All the keys in this particular group are receiver proprietary and labels shown in the picture are to be taken as suggestions, but are completely up to the manufacturer for definition.
Shape, disposition and order of such keys are up to the manufacturer. It is warmly suggested using keys with a clearly distinct shape for identifying these keys and distinguishing them from Interactive Pad keys.



Figure 3: The Navigation Pad

It is strongly suggested keeping these keys grouped together in order for the user to access them easily.

Availability on remote controls, or at least on custom models, of a dedicated "hot" key for people who are blind and visually impaired to easily access Audio Description possibly associated to certain programs is RECOMMENDED.

### 6.2.8. The TV Pad

#### 6.2.8.1. Overall Function Description

The TV Pad is used:

- For accessing to receiver proprietary settings.
- For controlling volume and for channel hopping.
- For selecting alternative video sources (DVD, VHS, Gaming Consoles…).
- To return to TV mode.

Not all the keys shown in the TV Pad are mandatory and have to be included on the remote control.
Refer to following section in the Remote Control chapter for more detailed specifications.

### 6.2.8.2. DGTVi Requirements

All the keys in this particular group are receiver proprietary and labels shown in the picture are to be taken as suggestions, but are completely up to the manufacturer for definition.
Keys for volume adjustments and for channel up/down scrolling should be easy to identify and clearly separated from the Interactive Pad.
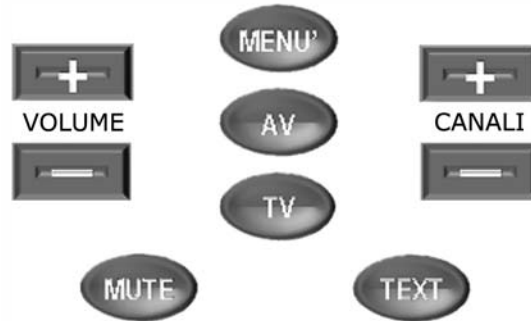


Figure 4: The TV Pad

## 6.3. Remote control keys detailed specifications

### 6.3.1. The Numeric Pad

| item | Keys | Status | Function | Additional specs |
|---|---|---|---|---|
| 1 | ⓪ .. ⑨ | Mandatory | MHP standard | The letter text labelling has to be followed |

Table 12: The Numeric Pad

### 6.3.2. The Interactive Pad

| item | Keys | Status | Function | Additional specs |
|---|---|---|---|---|
| 2 | Back | Mandatory | VK_F9 has to be passed to MHP applications | Refer to chapter "Requirements for Undo function". |
| 3 | Exit | Mandatory | VK_ESC has to be passed to MHP app. | Refer to chapter "Requirements for Undo function". |
| 4 | ▼▲ | Mandatory | MHP standard – Arrow Up / Down | |
| 5 | ◄ ► | Mandatory | MHP standard – Arrow Left / Right | |
| 6 | Ok | Mandatory | MHP standard | |
| 7 | 🔴 | Mandatory | MHP standard – Red Key | |
| 8 | 🟢 | Mandatory | MHP standard – Green Key | |
| 9 | 🟡 | Mandatory | MHP standard – Yellow Key | |
| 10 | 🔵 | Mandatory | MHP standard – Blue Key | |

Table 13: The Interactive Pad

### 6.3.3. The Navigation Pad

| item | Keys | Status | Function | Additional specs |
|------|------|--------|----------|------------------|
| 11 | **Info** | Mandatory | This key gives access to the receiver's proprietary present and following SI information. | |
| 12 | **EPG** | Mandatory | This key gives access to the Electronic Program Guide. | The labelling has to be decided by the manufacturer. |
| 13 | **App** | Optional | This receiver's proprietary key gives access to the list of MHP application that is related to video services. | The labelling has to be decided by the manufacturer. |
| 14 | **List** | Optional | This key gives access to the receiver's service list | Audio/video, audio only and stand alone interactive services (see § 7.2.5.1). |
| 15 | **Audio** | Optional | This key allows the viewer to choose among different audio. | |
| 16 | **Sub** | Optional | This key allows the viewer to visualize subtitling. | Shall give access to DVB subtitling. Should also give access to Teletext subtitling when it is sole present |

Table 14: The Navigation Pad

### 6.3.4. The TV Pad

| Item | Keys | Status | Function | Additional specs |
|------|------|--------|----------|------------------|
| 17 | **Menu** | Mandatory | Access to receiver's proprietary menu. Labelling is up to the manufacturer. | |
| 18 | Vol+ | Mandatory | Increase volume | |
| 19 | Vol- | Mandatory | Decrease volume | |
| 20 | CH + | Mandatory | Switch channel up of one position according to the channel list | |
| 21 | CH - | Mandatory | Switch channel down of one position according to the channel list | |
| 22 | **AV** | Optional | Selection of external video sources such as DVD, VHS, Gaming Consoles | |

| Item | Keys | Status | Function | Additional specs |
|------|------|--------|----------|------------------|
| 23 | TV | Optional | This key allows the viewer to restore the "initial state" of MHP applications. | Refer to Requirements for the "Undo" function § 6.5 |

Table 15: The TV Pad

### 6.3.5. Other Keys

| item | Keys | Status | Function | Additional specs |
|------|------|--------|----------|------------------|
| 24 | ⬤ | Mandatory | Switch on/off the receiver | This key should NOT be red. |
| 25 | TEXT | Mandatory | Teletext for iDTVs and for STBs supporting (see also [8.1.2]. MHP standard otherwise. | The labelling "Text" is recommended. |
| 26 | MUTE | Optional | Muting the volume | Pressing this key once will mute the volume. By pressing the same key again the volume level will be restored at the previous level |

Table 16: Other keys

## 6.4. Interaction between (proprietary) receiver GUI and MHP applications

- In case any proprietary receiver GUI is shown on screen while an MHP application is running, the MHP application shall be kept alive and not killed. (The MHP application can either be paused and re-started, or cached and then re-initiated, after the proprietary STB menu or GUI is closed/disappears.)
- In case the application is being loaded when the proprietary receiver GUI is shown, the MHP application shall continue being loaded in the background.
- These behaviours admit only one significant exception: the «MENU» key and the associated proprietary menu GUI. In that case, when MENU key is pressed 2 different behaviours are considered acceptable, namely either
  o any running/loading MHP application SHALL be paused until resident menu application is exited, or
  o any running/loading/paused MHP application MAY be killed, but a confirmation message SHALL be presented first to the user and, as soon as the menu GUI disappears from the screen, any MHP autostart application SHALL be automatically re-loaded with no need of re-accessing the channel/mux.

## 6.5. Requirements for the "Undo" Function

### 6.5.1. Preface

The areas covered hereafter include:
- General requirement
- State of the IRD
- Number of keys and labelling of keys
- Key mapping and rules for applications

### 6.5.2. General Requirements

To have a consistent man-machine interaction there is a need to have the possibility to

- « undo last » (cancelling the last action).
- « undo all » (cancelling all actions, going back to the initial state or going back to the top menu)

Those functions shall be implemented by the applications (resident of downloaded).

No « undo » action by the user should lead to an unexpected state, i.e. to a state different from where he started from.

### 6.5.3. States of the IRD

For the user, the state of the receiver will determine how the receiver will behave at the next command (from the remote). As such, the state remains invisible to the user, but the behaviour has to remain consistent.

List of possible states:

- (State ''zero''): ''full kill'', zapper-like, no MHP capability (e.g. auto-start inactive)
- (Initial state): as OoB default or as modified by user
- (Basic state): Initial state + 1 OTA app (such as a launcher). If no broadcast application available or auto-start has been set to OFF by the user, is equivalent to (Initial state)
- (Top of tree): Home page or top of menu, within an application

**The out of box (OoB) default shall be MHP auto-start active (see §11)**
**The receiver shall never go to state "zero" if it was not the initial state on accessing the channel.**

### 6.5.4. Other groups' proposals for key mapping

Different specifications groups have addressed (or not) this issue. The main proposals are summarized in Annex B.

As there is no coherence between the proposals, and some uniformity is necessary to ensure a consistent interface for the user, the DGTVi has established a set of recommendations:

### 6.5.5. Keys and Labelling

2 keys are required as a minimum and 3 keys are recommended with following labels:
.
**- 3 Keys**
- « Back » for cancel of last action (back)
- « Exit » for go to (top of tree) or (basic state)
- « TV » for go to (initial state)

**-2 Keys**
- « Back », for cancel of last action (back)
- « Exit », for go to (top of tree) or (basic state)

### 6.5.6. Key mapping

**- 3 Keys**
- « Back » passes VK_F9 to the application
- « Exit » passes VK_ESC to the application
- « TV » goes to (initial state), hardwired

**- 2 Keys**
- « Back » passes VK_F9 to the application
- « Exit » passes VK_ESC to the application

# 6.6. Requirements for Text Entry Function

### 6.6.1. The present situation for text input in I-TV

Many remote controls only provide for the minimum set of codes envisioned in the MHP specification (cf. Annex G.5 to TS 101812) i.e. only provide numeric data entry. For alpha-numeric entries, application developers have had to create « helper applications » to create a virtual keyboard, typically through an intermediate sequence of keys, thus potentially contravening to Annex J.5 of the MHP standard.

Furthermore key labelling is incomplete and/or different from manufacturer to manufacturer, making difficult communication about text entry with the end-user. The current terminals have different keyboard layout hence hindering easy use and service access. A standardised layout (same or "subset-compatible") should be used for the same service when applicable, particularly for "special" characters, like "+, "*", "#", …..

### 6.6.2. Rules for « Request Focus »

To ensure consistent user experience, the following rules about requesting focus are defined in [25]:
- an application creating an HScene and placing components into it shall not by default get the input focus for these components
- the application may request to get the input focus by calling Component.requestFocus(). If this is granted and the focus moved to the requested component, this component shall receive input events as defined in J.1 (on page 367).
- the application may request to receive a subset of input events via the org.dvb.event API even when not having the AWT focus.
- On platforms where key events are generated from a sequence of other (intermediate) key events, the intermediate key events shall not be visible to MHP applications by any mechanism. Examples of these intermediate key events include;
  o For multi-key press entry (as used in some mobile phones), the keys pressed before the final value is resolved.
  o For eventual predictive text entry functionality (T9 or similar systems)

### 6.6.3. Text Entry General Requirements

All receiver manufacturers shall implement text input following the DVB MHP Specification, Appendix A.7 HAVi [25].

In particular, the following classes shall be implemented:
- org.havi.ui.HSinglelineEntry
- org.havi.ui.HMultilineEntry

When passing numerical and alphanumerical strings to MHP applications, the receiver shall use, at least, the "SMS like" mode (multi-key press entry) and the remote control as a text input device. This is to be intended as the minimum requirement.

In case other text input devices and modes are used, they shall be in addition to the multi-key press entry and shall be implemented by the receiver manufacturer.

In any case, and not withstanding which text input mode will be used (the minimum multi-key press entry or any other proprietary and additional mode), no proprietary receiver GUI will be shown on screen covering or overlapping MHP applications graphic layout, when inputting text. **As a consequence, no resident virtual keyboard shall be used for inputting text into a MHP application**.

Labelling of numeric pad for text input shall follow specifications mentioned later in this document

In assigning specific alphanumeric characters to single numeric pad keys, the manufacturers shall take ETSI ES 202 130 v. 1.1.1 (2003-10), page 103 table 48 "Keypad assignment for Italian" as a guideline.

### 6.6.4. Key Pad Suggested assignment for text entry

A subset of the mandatory characters is recommended to be implemented within the overall ETSI character list.

#### 6.6.4.1. Standard Characters Subset

| Key | Requirement | Subset Character Sequence | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| a b c **②** | Mandatory | a | b | c | 2 | à | A | B | C |
| d e f **③** | Mandatory | d | e | f | 3 | è | D | E | F |
| g h i **④** | Mandatory | g | h | i | 4 | ì | G | H | I |
| j k l **⑤** | Mandatory | j | k | l | 5 | J | K | L | |
| m n o **⑥** | Mandatory | m | n | o | 6 | ò | M | N | O |
| p q r s **⑦** | Mandatory | p | q | r | s | 7 | P | Q | R | S |
| t u v **⑧** | Mandatory | t | u | v | 8 | ù | T | U | V |
| w x y z **⑨** | Mandatory | w | x | y | z | 9 | W | X | Y | Z |
| **⓪** | Mandatory | 0 | "space" | "new line" | | | | | |

Table 17 : Standard Character subset

#### 6.6.4.2. Special Characters Subset

As per ETSI ES 202 130 v. 1.1.1 (2003-10), (page 103 table 48 "Keypad assignment for Italian") all special characters have to be assigned to numeric key "1".

| Key | Requirement | Subset Character Sequence |
|---|---|---|
| .,;@ **①** | Mandatory | . , ; @ 1 ? ! : " % ( ) + - / * = < > € # |

Table 18: Special Character Subset

The subset of special characters listed in the previous table has to be considered as the minimum mandatory requirement for manufacturers.

All receivers shall be compliant with the subject ETSI specification.

### 6.6.5. Text Entry Functions

The "multi-key press entry" mechanism has to provide a user experience very similar to that of cell-phone SMS text input.

As a consequence, some simple functions have to be implemented in order to improve overall user experience when entering text:

| Rule | Function | Subset Character Sequence |
|---|---|---|
| A | Moving cursor between characters and lines | Left arrow and Right arrow shall be used for moving the cursor among characters while inserting text. Up and Down arrows shall be used for moving the cursor among different lines while inserting text. |
| B | Inserting characters | In case a character has to be inserted between two characters already typed, the user shall move the cursor using left and right arrows. The new inserted character shall be placed right before the character where the cursor is located. |
| C | Erasing characters | A dedicated key of the remote control shall be used for erasing characters. Such key will be "Back" key. When TextField(HsinglineEntry) gets focus, the MHP application shall not consider "VK_F9" unless the text entry field is empty. If the text entry field is not empty the MHP application shall not perform any action on receiving "VK_F9". Thus, "back" key shall be used only for erasing characters when focus is active and within one single widget. If the text input field is empty and the "back" key is pressed, MHP application shall remove focus from text entry field. For further specifications on interaction between text entry, resident application and MHP application please refer to the sample Xlet provided in the section E. |
| D | Focus gained/lost | When the user moves the focus to a text entry field it shall become immediately active <u>without any need</u> of pressing a particular key for activating the text field. If, while typing text within the text field, the user presses the "OK" key the characters already inserted shall be preserved and the focus will be lost. |
| E | Timeout | The cursor shall automatically progress to the next position 0.8 second after the last input from the remote control was received. |
| F | Fast sequence of different key keys. | The cursor shall immediately progress to the next position (and write the appropriate character) in case a numeric key, different from the previously used one, is pressed (same as for cell phones). E.g. If key "3" is pressed twice for typing letter "e" and, immediately after, key "2" is pressed twice for typing letter "b", letter "b" has to be displayed immediately with no need for waiting any time-out period. |

Table 19: Text Entry Rules

### 6.6.6. Text Entry Devices

All receivers have to use remote control as a text entry device. This is the minimum common requirement.

In case some receiver manufacturer will provide text input devices other than remote control (such as infrared keyboards): these devices will be added to the remote control. E.g. a receiver can have both the remote control and the infrared keyboard as a text entry device, but can not have only the infrared keyboard.
Remote control will be a text input device for all receivers. Resident virtual keyboards, when present, shall not be used for text entry in conjunction with non resident MHP applications.

In any case, any text input device will need to be compliant with the functionalities specified in the previous section.

### 6.6.7. Text Entry Layering
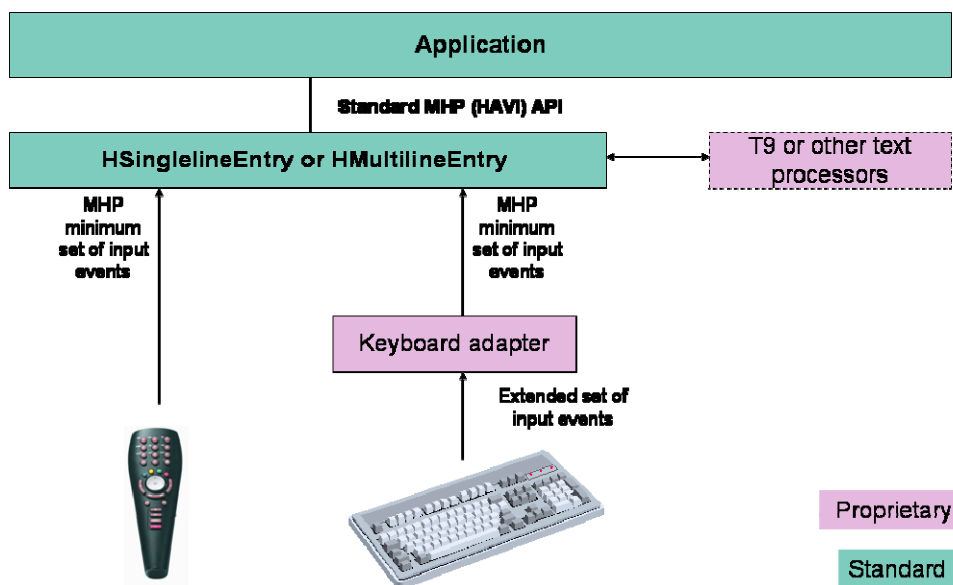


Figure 5: Text Entry Layering Schematic

### 6.6.8. Text Entry Layering - Underlying Considerations

- HSinglelineEntry and HMultilineEntry recognize only the MHP minimum set of events.

- HSinglelineEntry and HMultilineEntry shall handle multi-press key entries according to the specified key pad assignments and behaviour.

- Specialized (proprietary) adapters are in charge of mapping more complex events coming from richer input devices (e.g. VK_A from an infrared keyboard) to the MHP minimum set (e.g. VK_2 VK_2 VK_2 VK_2 VK_2 VK_2).

Text processors, when available, shall act directly on HSinglelineEntry and HMultilineEntry visible output.

### *6.6.9.  MHP applications and Text entry functionality*

- For objects referring to MHP classes HSinglelineEntry/HMultilineEntry, receiver shall activate editing mode on method *focusGained(FocusEvent e)* and de-activate editing mode on method *focusLost(FocusEvent e)*.

- Focus is lost:
  1. When object is empty (0 characters) and the keyEvent.VK_F9 is pressed
  2. When keyEvent.VK_Enter is pressed

- In order to have a standardized and harmonized behaviour when managing focus (*focusListener*) and events (*HkeyListener*), MHP application shall be compliant with the following Java class.

#### 6.6.9.1. MHP applications and Text entry sample class

A comprehensive example is given in Annex E.

# 7. Service Information & Channel Selection

On installation, receivers must offer the viewer all services that may be received at the current location. Due to the distributed nature of DTTV transmissions, a receiver may be able to receive more than one instance of a particular service, which may include regional variants of a service, and must handle such an occurrence sensibly from a viewer perspective.

The services being broadcast in the DTTV networks will change over time. To ensure that the viewer is always able to access every service being broadcast, the receiver must detect and reflect to the viewer any such changes with minimal viewer involvement.

Services may have an associated Channel Number. Broadcasters may use this as a marketing tool for service promotion to the viewer. Consequently, when possible, receivers should present the channels so that a numeric entry will always select the service with the corresponding Channel Number.

The transition period before switch off will see the coexistence of digital and analogue channels. Receivers supporting seamless zapping shall be able to automatically make use of both LCN information in digital multiplexes and of PDC (Programme Delivery Control) information in analogue transmissions, when PDC is used by a manufacturer implemented table.

However, viewers shall also be free to re-order and/or filter the channel list as they require.

Access to, and use of, accurate service information is essential if the viewer is to enjoy all of the content being broadcast. Receivers must offer a complete list of available services and information about the current and following programmes.

## 7.1. DVB Locator

The DVB locator is the unique identifier of a DVB service. It is composed of three elements:
- Original_Network_ID
- Transport_Stream_ID
- Service_ID

Its format is dvb://<onID>.<tsID>.<sID>[.<ctag>[&<ctag>]][;<evID>][<path>]. (The optional parameter [;<evID>] allows to identify a single event within a service.)

To ensure a harmonious use of the relevant codes, a coordinated allocation of codes and code ranges is recommended for the Italian Digital Terrestrial Television environment. The operators who are members of DGTVi are already compliant with this recommendation.

The detail of this scheme is given in Annex F.

## 7.2. SI and PSI Information

When possible, Italian digital terrestrial operators will respect the rules suggested by the E-Book. However, a receiver specification cannot put any constraints on the broadcast signal because the receiver must be robust against erroneous or incomplete signalling and present all services whenever they are present. Of course, receiver behaviour, in many cases will be dependent on the presence, in the signal, of supplementary signalling. In this sense support to the part of the E-Book which seeks to specify the broadcast signal is not guaranteed.

Receivers are expected to behave in the way specified in the E-Book where the signals broadcast conform to the E-Book recommendations concerning the signal, except in the few cases explicitly listed in the present document.

When for specific reasons, rules different from the E-Book ones are recommended for the formation of the multiplex, the behaviour of the receiver shall be as described in the present document (in the sections beneath and elsewhere).

### 7.2.1. Notation

The same symbols as in the E-book (# 9.1.4 [8]) are adopted for specifying the expected implementation for Broadcast or Receiver.

| Meaning | Specification applies to: | |
|---|---|---|
| | Broadcast | Receiver |
| Mandatory to broadcast – this shall be present in all broadcasts | M | |
| Mandatory to understand – receivers are required to understand and act on this item | | m |
| Conditional to broadcast – this shall be present if certain criteria are met (for example, certain signalling is required for CA controlled services) | C | |
| Recommended to broadcast – inclusion of this item improves the usefulness of broadcasts to receivers and allows them to provide better facilities to users. It is preferable for broadcasts to include this. However receivers shall be able to work correctly without this information | R | |
| Optional to broadcast – this item is allowed in broadcasts and has a defined meaning. However, receivers shall be able to work correctly without it | O | |
| Undefined to broadcast – this item is allowed in broadcasts but has no defined use within this specification. Receivers should ignore this information unless they are designed with information from other specifications that define its use | U | |
| Forbidden to broadcast – this item is not allowed in broadcasts as it may cause confusion to receivers that conform to this specification | F | |

Table 20: Symbols notation as per E-Book

### 7.2.2. Program Map Table (PMT)

The descriptors possibly carried by this table at Program level are the following:

| Descriptor | Tag | Status |
|---|---|---|
| Conditional access descriptor | 0x09 | C |
| Private data specifier descriptor | 0x5F | C |

Table 21: Program descriptors (PMT)

The descriptors possibly carried by this table at Elementary Stream level are listed hereafter.

| Component | Descriptor | Tag | Status |
|---|---|---|---|
| Any | Stream identifier descriptor | 0x52 | C m |
| | Conditional access descriptor | 0x09 | C |
| | Private data specifier descriptor | 0x5F | O |
| Audio | ISO 639 language descriptor | 0x0A | C m |
| Private data (AC-3) | AC-3 descriptor | 0x6A | C m |

| Component | Descriptor | Tag | Status |
|---|---|---|---|
| Private data (EAC-3) | Enhanced AC-3 descriptor | 0x7A | C m |
| Private data (AAC) | AAC descriptor | 0x7C | C m |
| DVB Subtitles | Subtitling descriptor | 0x59 | C m |
| Teletext | Teletext descriptor | 0x56 | C m |
| SSU stream | Databroadcast_id descriptor | 0x66 | O m |
| *Video* | *AVC_video_descriptor* | *0x28* | *O m* |

Table 22: Elementary stream descriptors (PMT)

### 7.2.2.1.  Multiple components of the same type

The PMT may contain multiple instances of components with identical signalling. For example, multiple audio components with the same stream type, language and audio_type, or multiple video components in services providing multi-angle viewing (and single audio).

In this case the receiver shall select as default component the one with the lowest PID among those of the same type.

However, all the components shall be presented for manual selection when requested by the user. As another example, multiple interactive services listed inside an AIT table shall be presented in ascending order from the lowest application_ID, and if multiple AIT are referenced in one PMT, their order shall also be preserved.

### 7.2.2.2.  HD-specific elementary stream types

*Further to the stream types*
- 0x02 for MPEG-2 or MPEG-1 constrained parameter video streams
- 0x03 for MPEG-1 audio streams
- 0x05 for MPEG-2 TS private_sections
- 0x06 for PES packets containing private data
- 0x0B for MPEG-2 DSM-CC type B streams

*whose support was already required by DGTVI's D-Book, the following stream_type values shall also be supported in the scope of this HD-Book:*
- *0x11 for MPEG-4 AAC and MPEG-4 HE AAC packetized elementary streams*
- *0x1B for H.264/AVC video streams*

*The value of stream_type for an Enhanced AC-3 elementary stream will be 0x06 (indicating PES packets containing private data), same as for AC-3.*

### 7.2.2.3.  Supplementary Audio

For TV-broadcasting applications, noticeably public service broadcasting, there is often a requirement for commentary or narration audio services to provide for different languages or Visually Impaired or Hearing Impaired audiences.

#### 7.2.2.3.1  DVB solution

DVB solution encompasses both receiver-mixed and broadcast-mixed Supplementary Audio. Relevant signalling specifications are contained in new Annex to latest [9] revisions.

#### 7.2.2.3.2  Enhanced AC-3 solution

*Compliance with the behaviour specified in [9] §6.2.2.2 is required.*

### 7.2.2.4. AVC_video_descriptor

*This descriptor is used to signal the presence of the frame packing arrangement supplemental enhancement information (SEI) message in the AVC video stream. Thanks to this message the receiver will be able to recognize [58]:*

- *the frame-compatible video format used, or currently in use, for the 3DTV service;*
- *format switches within a running Frame-Compatible 3DTV service (between 2 3DTV formats, to/from a 3DTV from/to a 2D HD format).*

*The detailed usage of the frame packing arrangement SEI message for Frame-Compatible 3DTV services is specified normatively in Annex H of [9].*

## 7.2.3. Network Information Table (NIT)

The descriptors possibly carried by this table in first loop are the following:

| Descriptor | Tag | Status | |
|---|---|---|---|
| | | Actual | Other |
| Network_name_descriptor | 0x40 | M m | O m |
| Multilingual_network_name_descriptor | 0x5B | O m | O m |
| Linkage_descriptor | 0x4A | C | C |
| Private_data_specifier_descriptor | 0x5F | C | C |
| Eacem_stream_identifier_descriptor | 0x86 | O | O |

Table 23: Network descriptors (NIT first loop)

The descriptors possibly carried by this table in second loop are the following:

| Descriptor | Tag | Status | |
|---|---|---|---|
| | | Actual | Other |
| Terrestrial_delivery_system_descriptor | 0x5A | M m* | O |
| Frequency_list descriptor | 0x62 | R | R |
| Service_list_descriptor | 0x41 | R | R |
| Private_data_specifier_descriptor | 0x5F | C | C |
| Logical_channel_descriptor | 0x83 | O m | O |
| *HD simulcast descriptor* | *0x88* | *O m* | *O m* |
| T2_delivery_system_descriptor | ext(0x04) | M m | O |
| *Receiver shall ignore the majority of the fields of this descriptor, see below § 7.2.3.2 | | | |

Table 24: Transport stream descriptors (NIT second loop)

### 7.2.3.1. Eacem Stream Identifier Descriptor (Eacem SD)

It is expected that broadcasters in Italy will not use this descriptor.

### 7.2.3.2. Terrestrial delivery system descriptor

Receivers may use the modulation parameters in the terrestrial_delivery_system_descriptor as a recommendation when trying to tune to a multiplex.

**The receiver shall always be able to detect the modulation from the transmission itself (e.g. assisted by TPS bits).**

MFN network may include repeaters (or channel translations can be performed in MATV systems): the receiver shall ignore the "centre_frequency" specified in the terrestrial delivery system descriptor. In other words the receiver shall select the service in a DVB-T channel according to the frequency used during the tuning procedure, ignoring the value contained in the NIT.

The receiver should take into account the
- other_frequency_flag (inside the terrestrial_delivery_system_descriptor)

Receiver shall ignore the "bandwidth", "priority", "constellation", "hierarchy_information", "code_rate",   "guard_interval"   and   "transmission_mode"   values   in   the terrestrial_delivery_system_descriptor of the NIT.

If a change occurs in the "network_id" in the NIT, during transmission, the receiver shall ignore it and continue to present the services already in the list and not delete them.

If a change occurs in the "network_name_descriptor" the receiver shall ignore it and continue to present the services already in the list and not delete them

### 7.2.3.2.1  T2 Delivery System Descriptor

T2_delivery_system_descriptor is signalled in the extension_descriptor (Tag extension value 0x04).

The T2-IRD SHALL uses the system parameters in the T2_delivery_system_descriptor to determine the mapping between original_network_id/network_id/transport_stream_id and T2_system_id/plp_id.

The   T2-IRD   SHOULD   uses   the   other   system   parameters   in   the T2_delivery_system_descriptor as a recommendation when trying to tune to a multiplex. The T2-IRD SHOULD, however, always be able to detect these system parameters from the transmission itself (i.e. assisted by L1 signalling).

Operators can broadcast the same transport stream in the same network using different system parameter settings, reflected in a different T2_system_id. This allows for optimization of the network coverage in frequency planning involving SFN and MFN combination networks.

### 7.2.3.3.  Other_frequency_flag

The terrestrial_delivery_system_descriptor may signal the use of possible alternative frequencies through the other_frequency_flag. According to the SI Guidelines [25], this flag may be used (inter alia) to advise the receiver that an identical multiplex may be receivable on other centre frequencies. The receiver must always be able to receive all the available services in the RF channels.

If the same service is available on two different RF channels, both were tuned (with the automatic or manual scan procedure), and both are available to the user.

In the case the user decides to leave in the list of the available programs only one of the two instances of the same service (e.g.. the one with the better quality), then when this service is no more available (i.e. due to changes in propagation or interferential conditions) and the descriptor other_frequency_flag is "on", then the receiver may try to make available (at the same number of the list) the second instance of the same program.

Considering the network architectures, which are going to be used by Italian operators, this is the most likely use of this flag.  Support by receivers of this flag is OPTIONAL. It is expected that broadcasters in Italy will not use this flag.

### 7.2.4.  Bouquet Association Table (BAT)

Even though BAT has been experimentally used for some time in Italy for running applications with a domain defined across multiple services and/or multiple connections within a bouquet, receivers can ignore it.

### 7.2.5.  Service Description Tables (SDT)

The descriptors possibly carried by this table are the following:

| Descriptor | Tag | Status | |
|---|---|---|---|
| | | **Actual** | **Other** |
| Service_descriptor | 0x48 | M m | O m |
| Component_descriptor | 0x50 | C m | C m |
| CA_identifier_descriptor | 0x53 | C m | C m |
| Private_data_specifier_descriptor | 0x5F | C | C |
| Preferred_name_list_descriptor | 0x84 | O | O |

Table 25: Service descriptors

In presence of a CA_Identifier_Descriptor, the receiver shall always try to present the service to the end user. In case the service is effectively scrambled, and the relevant CA system is not present, the receiver shall present an error message (see 7.5.1.2).

The preferred_name_list_descriptor, as defined by EICTA, provides a list of alternative names, and name identifiers, for the service. This information is quasi-static.

*New component types have been defined for stream content_type 0x05 (AVC/H.264) to signal in the component_descriptor frame-compatible video component formats. Those required by this specification are:*
- *H.264/AVC plano-stereoscopic frame compatible high definition video, 16:9 aspect ratio, 25 Hz, Side-by-Side (component_type code 0x80);*
- *H.264/AVC plano-stereoscopic frame compatible high definition video, 16:9 aspect ratio, 25 Hz, Top-and-Bottom (component_type code 0x81);*

#### 7.2.5.1.  Service Types

Receivers shall only list a service in their service selection interfaces where the service is of a type, as declared in the service_type value in the Service Descriptor, which the receiver is able to present to the user or to a receiver interface.

NB: Users may be confused or frustrated if the receiver presents for selection services that are not decodable by the receiver (such HD services on an SD receiver) or are not intended for user selection (such as receiver firmware update broadcasts).

Receivers are required to support at least the following service types:

service_type = 0x01, digital television service
service_type = 0x02, digital radio sound service (MPEG-1 Layer 1 or 2 audio)
*service_type = 0x0A, advanced codec digital radio sound service*
service_type = 0x10, DVB MHP service
*service_type = 0x16, advanced codec SD digital television service*

*service_type = 0x19, advanced codec HD digital television service*
*service_type = 0x1C, advanced codec frame-compatible plano-stereoscopic HD digital television service*

*According to DVB SI [10], service_type=0x01 should be used for MPEG-2 SD digital television service. However, it may also be used for services using other encodings, including encodings that have a specific entry, e.g. advanced codec HD digital television service.*

*A service, as identified by its DVB triplet, will exclusively be either SD or HD.*

Support for other service types (for example service_type = 0x06, mosaic service) is optional.

### 7.2.5.2. Running status

Receivers are required to support at least the following values and behaviours for the running_status in SDT:

running_status = 1, not running    -> display banner
running_status = 4, running    -> normal behaviour

## 7.2.6. Event Information Table (EIT)

### 7.2.6.1. Event Information Descriptors

The EIT can carry the following descriptors to meet the requirements of EN 300 468 [10] and TR 101 211 [19]:

| Descriptor | Tag | Present/Following | | Schedule | |
|---|---|---|---|---|---|
| | | Actual | Other | Actual | Other |
| Linkage descriptor | 0x4A | O m | O m | C | C |
| Short event descriptor | 0x4D | M m | M m | O m* | O m* |
| Extended event descriptor | 0x4E | C m | C m | O | O |
| Component descriptor | 0x50 | M | M | O | O |
| CA identifier descriptor | 0x53 | C | C | C | C |
| Content descriptor | 0x54 | R | R | R | R |
| Multi lingual component descriptor | 0x5E | O | O | O | O |
| Parental rating descriptor | 0x55 | O m | O | O | O |
| Time shifted event descriptor | 0x4F | F | F | F | F |
| Private data specifier descriptor | 0x5F | C | C | C | C |
| PDC descriptor | 0x69 | C | C | C | C |
| Preferred name identifier descriptor | 0x85 | O | O | O | O |
| * Mandatory only if no other EPG than the one based on SI data is available on the receiver | | | | | |

Table 26: Event Information Descriptors

The preferred_name_identifier_descriptor, as defined by EICTA, may be used in the EIT to identify the preferred service name at the time of an event and so allows a schedule of service names.

*The "special characteristics" content class in the content_descriptor has been extended to include the following event characteristic for Frame-Compatible 3DTV events [58]:*

- *Stereoscopic (content_nibble_level_2 code 0x4).*

*Operators are thus able to highlight events broadcast in a Frame-Compatible 3DTV format in the EIT. Receivers may use this information to highlight such events in the EPG.*

### 7.2.6.2. Carriage of EIT

It is expected that network operators carry data for current and next events concerning the services they are broadcasting, on a multiplex per multiplex basis. This will be done within the ability of the content providers to transfer the relevant data to the network operator.

### 7.2.6.3. Cross Carriage of EIT

It is expected that national network operators will cross carry EIT data, at least for national services. Similar agreements may exist with regional/local network operators.

The policy of allocation of TS_ID and S_ID on mixed national or regional networks may influence the carriage of cross-SI among a given number of operators. Therefore it is extremely important that network operator follow the DGTVi recommended procedures for ID allocation and use (see Annex F).

A basic requirement when an operator carries EIT p/f of other operators in EIT_other tables is that such functionality shall not have excessive impact on bandwidth or complexity of operation. This can be achieved e.g. by limiting the number of variants when a national network partially splits into regional programming.

### 7.2.6.4. EIT schedule compression

In order to allow efficient transmission of schedule data spanning more than just a couple of days, a private compressed version of EIT schedule tables is hereafter defined. For this purpose and for avoiding possible backwards compatibility issues, new EIT tables are introduced, using "user defined" table_ids in [10]. Namely:

- Table_ids from 0x80 to 0x8F are used for compressed event_information_section - actual_transport_stream, EIT schedule tables
- Table_ids from 0x90 to 0x9F are used for compressed event_information_section - other_transport_stream, EIT schedule tables

Compression algorithms and further details are given in Annex J.

In case both raw (uncompressed) and compressed EIT schedule tables are transmitted, the receiver SHALL use the latter ones.

In presence of compressed EIT schedule tables all MHP `org.dvb.si` classes and methods applicable to EIT schedule tables SHALL refer to the compressed ones.

## 7.2.7.  Summary of mandatory tables

| Table | Actual | Other |
|-------|--------|-------|
| Program association table | M m | N/A |
| Program map table | M m | N/A |
| Conditional access table | C | N/A |
| Network information table | M m | O m |

| Table | Actual | Other |
|---|---|---|
| Bouquet association table | U | N/A |
| Service description table | M m | M m |
| Event information table present/following | M m | M m |
| Event information table schedule | O m* | O m* |
| Event information table schedule (compressed) | O m* | O m* |
| Time and date table | M m | N/A |
| Time offset table | R m | N/A |
| Running status table | U | N/A |
| * Mandatory only if no other EPG than the one based on SI data is available on the receiver | | |

Table 27: List of mandatory tables

## 7.3. Private Data

When private descriptors are present in a broadcast, a private data specifier descriptor SHOULD be used (cf. EN 300 468) to identify the definer of the private descriptor.

For the Logical Channel Descriptor, the private data specifier value used in the E-Book, as registered in ETSI TR 101 162, shall be used; it is the one registered for EACEM (EICTA today).

The following table lists this value and the other private SI items that are defined within its scope.

| Organisation/ specification | PDSD | Private SI information | Value | Type |
|---|---|---|---|---|
| EACEM | 0x00000028 | Eacem stream identifier descriptor | 0x86 | Descriptor tag |
| EACEM | 0x00000028 | Logical channel descriptor | 0x83 | Descriptor tag |
| EACEM | 0x00000028 | Preferred name list descriptor | 0x84 | Descriptor tag |
| EACEM | 0x00000028 | Preferred name identifier descriptor | 0x85 | Descriptor tag |
| *EACEM* | *0x00000028* | *HD simulcast descriptor* | *0x88* | *Descriptor tag* |

Table 28: Private SI recognised in the E-Book

### 7.3.1.  Logical Channel Descriptor

The logical channel descriptor provides a default channel number label for services. This information is quasi-static. The logical channel descriptor may be inserted once in the second descriptor loop of the NIT. **The logical channel number is not necessarily unique within the same original_network_id** (except when its value is zero) **but may be re-used for regional variants of a service or for local services with strictly not overlapping coverage**. Hence the number is not unique within the original network.

**The logical channel number does not take into account the service type, i.e. all service types share the same number space.**

**The logical channel number does not take into account the transmission standard, i.e. services transmitted on DVB-T and DVB-T2 share the same number space.**

| Syntax | No. of bits | Type |
|---|---|---|

| Syntax | No. of bits | Type |
|---|---|---|
| `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` | 5 | bslbf |
| `logical_channel_number` | 10 | uimsbf |
| `}` | | |
| `}` | | |

Table 29: Syntax of the logical channel descriptor

### 7.3.1.1. Descriptor_tag

This shall be assigned to be 0x83.

### 7.3.1.2. Service_id

This is a 16 -bit field which serves as a label to identify this service from any other service within the network. The service_id is the same as the program_number in the corresponding program_map_section. Services shall be included irrespective of their running status.

### 7.3.1.3. Visible_service_flag

When set to '1', this 1-bit field indicates that the service is normally visible and selectable (subject to the service type being suitable, etc.) via the receiver service list. When set to '0' this indicates that the receiver is not expected to offer the service to the user in normal navigation modes. However, the receiver should provide a mechanism to access these services (for example, by direct entry of the logical channel number).

See also Receiver rules.

Support by receivers of the visible_service_flag is MANDATORY.

### 7.3.1.4. Reserved

All "reserved" bits shall be set to '1'.

### 7.3.1.5. Logical_channel_number

This is a 10 -bit field which indicates the broadcaster preference for ordering services. Its use is defined in the following table:

| logical_channel_number | Description |
|---|---|
| 0 | Service not suitable for selection by the user a) |
| 1 - 999 | logical_channel_number |
| 1000 - 1023 | rfu – not usable |
| a ) For example, the value zero may be used for data services only intended for selection from interactive applications or for firmware download services, etc. | |

Table 30: Logical channel number

Any service with LCN=0 shall be ignored.

See also Receiver rules.

### 7.3.2. The Logical Channel Numbers (LCN)

The role of the LCN is to enable user presentation of service numbers in a convenient and familiar form.

To avoid conflicting allocation of LCNs:
- The logical_channel_number should be unique across all the networks that cover the same geographical region.
- The same logical channel number should be reused only in non-adjacent regions,
- Regional variants of a service may nevertheless use the same logical channel number.

Receivers need to have a mechanism for handling conflicting LCN allocations either within the same country or on the borders of confining countries (see below).

### 7.3.3. Network operator rules

Network operators and content providers operating within Italy have elected to choose a service numbering scheme between them, in collaboration with the appropriate coordinating authorities.

This specification defines the logical channel number concept for conveying such service numbering information to receivers. Network operators should obey the following specification rules in order for receivers to be able to properly operate.

Logical channel numbers allocated should be usable directly as service numbers in a receiver.

Services with the same triplet (original_network_id/transport_stream_id/service_id) shall have the same logical_channel_number. Within the scope of one network (as defined by the network_id), logical channel numbers shall be allocated uniquely.

When defining regional variants of a service, the same logical_channel_number may be used (for example in neighbouring networks). This facilitates defining a consistent and compact national/regional/local channel numbering scheme, as well as indicating to the receiver that services with the same logical_channel_number are similar (regional variants).

Proper usage for their networks by Italian and confining broadcasters of NIT network_id values in the ranges officially assigned by DVB to the respective DTT networks (see Annex F) allows receivers to understand which LCNs belong to which country and then to give priority in case of conflicts to those from the country selected at first installation time.

#### 7.3.3.1. Multiples LCNs for a single service

Network operators and/or service providers may allocate up to four LCNs to a single service. This allows the service to be identified and associated with other services according to different criteria, such as local service, with pay elements, belonging to a specific bouquet and being of specific thematic content.

Only handling first LCN per service is mandatory.

#### 7.3.3.2. Invisible services

It is recommended to allocate high service numbers to services marked as invisible to avoid accidental collision of service numbers with those of visible services when they are being automatically or manually reallocated.

### 7.3.3.3. Service number zones

The service numbers are divided into two zones:
   1- 99: the Preferences Zone
100-999: the Assignment Zone

Service numbers (LCNs) may be pre-assigned in both zones.

Furthermore, a specific range, the Main Overflow (or "Garbage Collector"), has been defined to host services without LCN and services which have lost LCN conflict for another position.

The Main Overflow occupies service numbers 850 to 999. In case Main Overflow space would get filled up, free positions from 849 backwards SHALL be used.

## *7.3.4. Receiver rules*

Receivers SHALL provide an automatic service numbering facility on the basis of logical channel numbers with the rules set out below.

It SHOULD be possible for the user to select, in the set up menu, the possibility to switch off and on this automatic ordering possibility. Default setting SHALL be ON.

### 7.3.4.1. General rules

The receiver SHALL be able to associate with one service (i.e. with a unique triplet) at least the first logical channel number set by the broadcaster in the LC descriptor associated with that service. Support of other possible LCNs (up to 4) associated to the same service is OPTIONAL.

When a viewer uses the channel up-down arrows, the receiver SHALL skip all service numbers which are not allocated or are allocated to "invisible" services.

In the following sections a comprehensive specification for LCN handling by receivers is provided. This specification is meant to
- Accommodate possible LCN conflicts while minimizing the risk of discarding potentially useful services thanks to the reservation of a "safe" overflow range
- Leave the user the ultimate freedom to override any broadcaster-defined LCN
- Cope with network evolution (e.g. new services on-air; LCNs introduced later for services already on-air)
- Cope with possible (likely) cross-border LCN conflicts

It is offered to manufacturer just as a reference implementation. Manufacturers are free to provide their own alternate implementations provided that the above principles are anyway met.

### 7.3.4.2. Definitions

#### *7.3.4.2.1 Scan List*

This is the full list of services created on the basis of the services found by doing a frequency scan. It shall include the Logical Channel Number(s) requested by each service.

#### *7.3.4.2.2 Service List*

This is the ordered list based on the requested LCNs and after the resolution of the eventual conflicts in the requests. The only user intervention allowed to this list is during resolution of conflicts.

#### *7.3.4.2.3 Master User List*

Initially, if the user has chosen automatic channel ordering at (re)installation time, equal to the Service List (with maybe the exception of invisible services – see below), this list includes subsequent manual modifications by the user.
This is the default list of services that is used by the user.

### 7.3.4.2.4  User Favourite List(s)

It is recommended that manufacturers implement some form of "favourite channel" list(s) in which the user has full control over channel adding, deleting, ordering and numbering, including the possibility to leave out services even when they have been allocated a valid service number.

### 7.3.4.3.  Logical channel number zero

Services associated to logical channel number 0 should be disregarded as part of the process below (irrespective of the value of the visible_service_flag). These services are not intended to be presented as part of the viewer's service list. These services are not intended to be selectable by viewers.

### 7.3.4.4.  Invisible services

- Receivers shall support a "default" mode in which they will not show services marked "invisible" in their user service list or selectable in normal P+/P - browsing.

- The receiver shall ignore the presence of "invisible" services when (re-) allocating services to service numbers requested by "invisible" services.

- Receivers shall support a mode (for example as a service mode or as an installation option) in which it will allow direct selection of all services (irrespective of being marked invisible) by the user. This mode may display all services also as part of the Service List in this mode.

- It is a manufacturer option to combine the two modes mentioned above, by allowing direct selection of "invisible" services while not showing them as part of the Master User List.

- Usually, "invisible" services should not be allocated a Logical Channel Number, and thus should be positioned in the Overflow Range.

### 7.3.4.5.  Service List management

### 7.3.4.5.1  First initialisation

When a receiver is first initialised or reinitialised (e.g. because the user applied for a factory reset), it is expected that a user will be present in front of the receiver.

The receiver shall perform in accordance with the following rules:

a) It should give the user the possibility to choose between automatic (LCN-driven) and manual (based on discovery) service numbering (see above).

b) If automatic service numbering has been selected the receiver shall attempt to allocate in the Service List each service with associated LCN(s) to the service number(s) equal to the LCN(s) requested for that service. This rule implies that if there is only one service with a particular logical_channel_number request, it shall be allocated to that service number.

c) In the case of the presence of the same service (identical DVB triplet - ON_id, TS_id & S_id) on two different frequencies, the conflict shall be resolved as described in [**7.6.5.2. Handling of duplicate services**].

d) In presence of a conflict between different services that request the same logical channel number the receiver shall first check if the conflict would arise between a service from a network from the country selected at first installation time, i.e. from a network whose network_id comes from the range assigned to that country by DVB, and a service from another country. In that case the requested service number will be allocated to the former and the latter will be moved in the Main Overflow.
Otherwise the receiver shall:

- present the viewer with a menu allowing to select which channel to maintain at the requested position; automatic resolution of the conflict, either based on signal power or first/last found during scan, shall never be performed
- allocate the other service(s) to the next unallocated number(s) in the Main Overflow.

e) If a service does not have an associated logical_channel_number, it shall be allocated an available number in the Main Overflow.

The detailed expected behavior for cross-border LCN conflicts resolution is the following:
- if a particular LCN position is claimed by only 1 service, it will be granted that position regardless of its network_id (NID) and of the position claimed (i.e. including LCNs in Main Overflow range)
- if more services are competing for the same LCN position
    - if only 1 service has its NID within the range 0x3001 - 0x3100 (if Italy has been selected as Country at installation time,) it will automatically get the requested position
    - if more services have their NIDs within the range 0x3001 - 0x3100, the conflict resolution amongst such services is left up to the customer. Possible competing services whose NIDs is outside the range 0x3001 - 0x3100 will be automatically moved to Main Overflow range (850-999)
    - if all competing services have their NIDs outside the range 0x3001 - 0x3100, the conflict resolution is left up to the customer
    - whatever the above case, all the other services which haven't got the requested position will be moved to Main Overflow range (850-999)

### 7.3.4.5.2 Adding new services

When adding services to the Service List as a result of an update scan (whether manual or automatically, in stand-by or in operate mode), the receiver shall first try to allocate each new service to the number(s) indicated in the LC descriptor, if any. That applies also to each service which is already in the Service List but at a position different than the LCN itself. Should such position be actually free, the receiver will move the subject service there in the Service List, to cope with services which didn't have an LCN at the time when they were first tuned.

In case of conflict (i.e. the number is already occupied by a "non-invisible" service or is requested by several services), the receiver shall proceed with the same rules given above for first initialisation (§7.3.4.5.1).

In particular, after signalling to the user that new services are available (as in the procedure described in 7.6.5), the receiver shall display a pop up menu for each case of conflict, to allow the viewer to select which service to allocate to the requested service number. If there is already a service at the requested number, that service shall be the first in the list.

### 7.3.4.5.3  Removing a service

If, during an automatic of a manual update scan, the receiver decides that a service can be removed from the Service List, it will exclude the service and its service number from the Service List and the Master User List. The service number shall continue to be considered allocated until full confirmation of the deletion of the service by the network operator or by the viewer.

A service will be considered as removed in case it's no longer present in the NIT actual and the SDT actual. In any case, a service cannot be considered as removed due to the possible temporary absence of the RF signal or in case SI Tables are incomplete/missing (e.g. due to the transmission of a PRBS signal).

It should also be noted that the (possibly temporary) inability to receive a service as such cannot be the sole reason for a receiver to delete a service from the Service List: in general, additional user intervention is recommended in such a case.

This retention mechanism also improves the robustness of the receiver against network SI errors or otherwise unintentionally removed services.

## 7.3.4.6.  Master User List Management

### 7.3.4.6.1  Creating the Master User List

Once the Service List is created or rebuilt, the Master User List shall be created/rebuilt, equal to the Service List.

### 7.3.4.6.2  Modifying the Master User List

The user is free to modify the names in the Master User List, to delete services, and to move services from one number to any another.
If the requested number was unoccupied it will be attributed to the service being moved (the original service number becoming available).
It the requested number is occupied, there shall be a switch of service numbers (whether determined by LCN requests, manually or automatically) between the services.

### 7.3.4.6.3  Updating the Master User List

When new services are added to the Service List, they shall also be added to the Master User List, with the same service number as in the Service List, but with the following complementary rules:
- If a service number (as it appears in the Service List) is occupied in Master User List by a user modified service, the service shall be allocated the next available number in the Main
- User deleted services shall be reintroduced in the Master User List only when there has been a modification in the Service List due to the service being available on a new frequency.

### 7.3.4.6.4  Renewing the Master User List

It is strongly recommend that the user shall have the possibility, at any time, to re-create the Master User List by importing the Service List.

## 7.3.4.7.  User Favourite List(s)

Those lists are created and modified at the request of the user. They are not automatically modified by the update of the Service List or of the Master User List.

## 7.3.4.8.  The Preferences Zone

In the Preferences Zone (service numbers 1-99), all services numbers (already occupied by a service or "empty") are available for placing a preferred channel, by the user.

When a service carrying a LC descriptor, requests an already occupied service number, the user shall be able to select which service to allocate to the requested number; the other service shall be assigned the first available service in the Main Overflow.

### 7.3.4.9. The Assignment Zone

In the assignment zone, only occupied numbers need to be available to the user to modify the numbering scheme (pre-assigned or done by the receiver).

The receiver shall manage a Main Overflow range, at the high end of the available numbers.

> **Overflow Range ("Garbage collector")**: the service numbers in this range are assigned to services whose type cannot be identified or is patently erroneous, and to services which cannot find an available number in their category's range.

In the absence of a LC descriptor, a receiver shall not try to allocate automatically services to another zone than the Overflow Range, where the services need not be sorted by service type.

In case the receiver implements separate lists for TV, radio and application services, a Main Overflow (with the same numbering range) should be included for each service type.

In case of conflict in the Assignment Zone (a LCN carrying signal requesting an already used number), the user shall be given the possibility to choose which signal to allocate to the specified service number. The other service shall be redirected to the Main Overflow.

## 7.3.5. Service variation options

### 7.3.5.1. Service regionalisation

When a service dynamically become regional (e.g. for regional news) it is recommended that the regional transmissions at all times be identified as separate services (different DVB triplets). In this case the service may have the same LCN descriptor: this allows the user in zones common to two or more regionalized services to select which one to allocate to the requested service number.

### 7.3.5.2. Network re-configuration

For major network reconfigurations, it is recommended that the user proceed with a re-installation, even at the risk of losing his/her custom numbering, if any.

When the receiver detects a service offer change, which includes the addition and deletion of multiple services and/or networks it shall first remove all services which it can determine positively (see Removing a service) to be removed permanently from the service list, and then add the new services.

### 7.3.5.3. Change of LCN numbering scheme

Any re-arrangement by the broadcasters of LCN numbering of services will be treated as above under network re-configuration. This implies that user changes and non-default allocation of services to service numbers by the receiver should be preserved as much as possible unless a re-installation is done.

## 7.3.6. HD Simulcast Logical Channel Descriptor

*The HD Simulcast Logical Channel Descriptor provides a means to override the default channel number label of services for an HD receiver. This information is quasi-static.*

*The HD simulcast logical channel descriptor may be inserted in the second descriptor loop of the NIT. The descriptor may appear more than once in this location.*

*The constraints on uniqueness are the same as those for the logical channel descriptor.*

| Syntax | No. of bits | Type |
|---|---|---|
| `HD_simulcast_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` | 5 | bslbf |
| `logical_channel_number` | 10 | uimsbf |
| `}` | | |
| `}` | | |

Table 31: Syntax of the HD simulcast logical channel descriptor

### 7.3.6.1. Descriptor_tag

*This shall be assigned to be 0x88.*

### 7.3.6.2. Service_id

*This is a 16 -bit field which serves as a label to identify this service from any other service within the network. The service_id is the same as the program_number in the corresponding program_map_section. Services shall be included irrespective of their running status.*

### 7.3.6.3. Visible_service_flag

*When set to '1', this 1-bit field indicates that the service is normally visible and selectable (subject to the service type being suitable, etc.)  via the receiver service list. When set to '0' this indicates that the receiver is not expected to offer the service to the user in normal navigation modes. However, the receiver should provide a mechanism to access these services (for example, by direct entry of the logical channel number).*

*See also Receiver rules.*

*Support by receivers of the visible_service_flag is mandatory.*

### 7.3.6.4. Reserved

*All "reserved" bits shall be set to '1'.*

### 7.3.6.5. Logical_channel_number

*This is a 10-bit field which indicates the broadcaster preference for the ordering of services. This descriptor shall only be interpreted by receivers that are able to decode an advanced codec HD digital television service. The channel number label assignment defined by this descriptor overrides the channel number label assignment defined by the Logical Channel Descriptor that is located in the same network_id. The rules for the set of channel number labels used by this descriptor is the same as the rules for the set of channel number labels used by the Logical Channel Descriptor.*
*In the case where this descriptor assigns to a service (service A) a channel number label which is already assigned to another service (service B) (perhaps by the Logical Channel*

*Descriptor), the receiver shall treat the original service (service B) as having no assigned channel number label and assign one automatically in the normal manner.*
*This descriptor is intended to be used for HD services broadcast in simulcast with the same service in SD so that the HD service appears at the primary channel number label on HD capable receivers while the SD service appears at that label for SD-only capable receivers.*

### 7.3.6.6.  HD simulcast LCN operation

*Expected receiver behaviour is outlined in the following flow chart.*
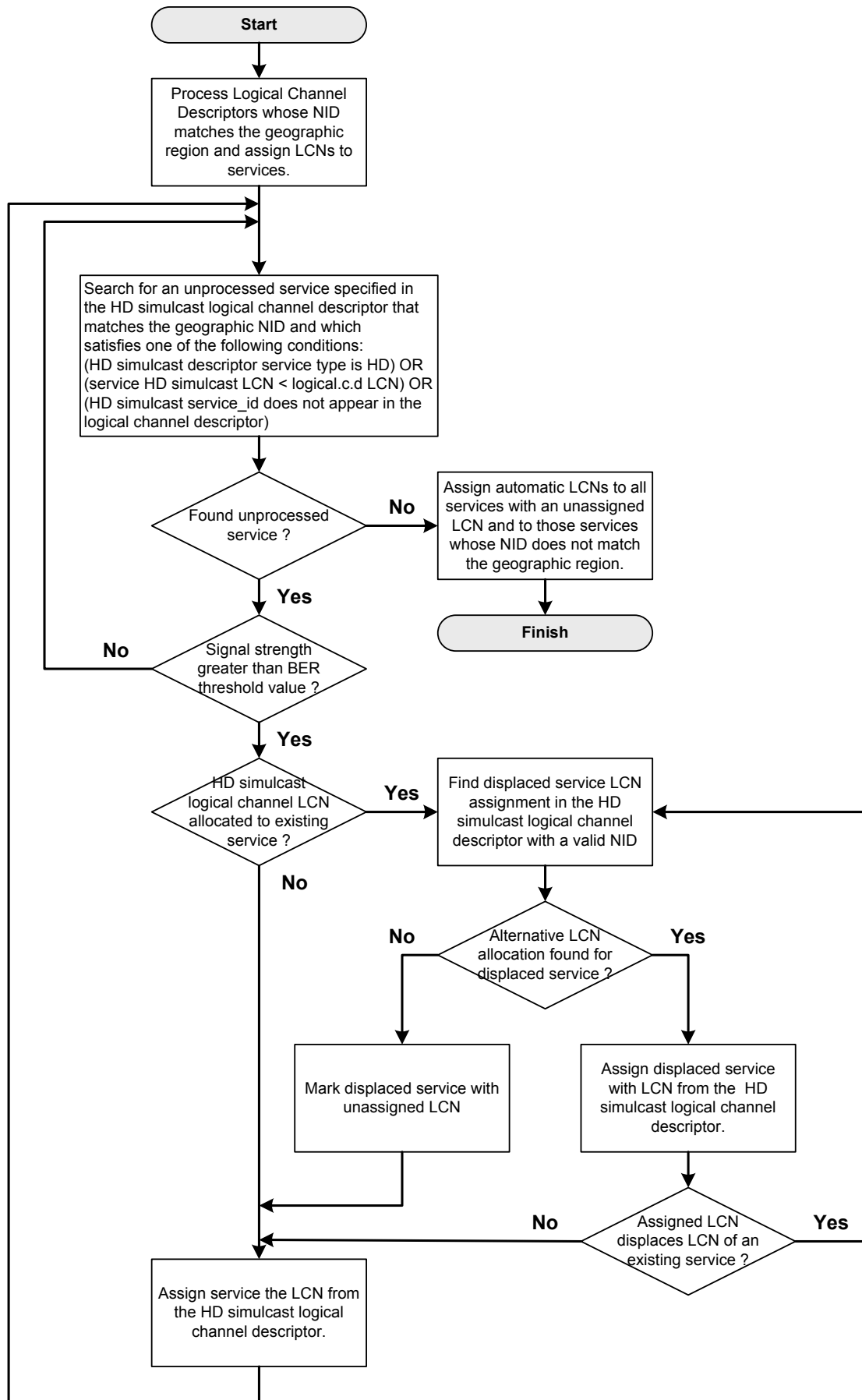
Figure 6: HD_simulcast_LCN operation

## 7.4. Service-variation options

The receivers shall follow the rules presented above (§7.3.1).

## 7.5. Receiver functions

### 7.5.1. Service Change

When changing service, parameters need to be set to deal with video formats, languages and unexpected failures in service selection. The minimum requirements for receiver behaviour during service change are outlined in the following paragraphs.

#### 7.5.1.1. Audio language

It is assumed that the user has entered one or more language preferences during the receiver installation process. If the selected service has audio tracks in more than one language, the language is selected according to the user preferences.

- If preferred languages do not match any of the available languages, then the receiver shall automatically select the "undefined" ("und" code of the ISO_639_Language_descriptor) audio stream.
- If "undefined" stream is absent, the stream with the lowest PID (lowest numerical value - unsigned integer) in the specified program shall be selected.
- In case no language descriptor is specified the audio stream with the lowest PID shall be selected.

In addition to this automatic soundtrack selection, it shall always possible for the user to manually select any of the available languages.

#### 7.5.1.2. CA controlled services

Where a component cannot be presented due to the presence of scrambling, an error message shall be displayed. Otherwise the receiver shall present the component, even in the presence of a CA descriptor.

### 7.5.2. Service Not Available

If the video component within a video service, the audio component in a radio service or the data component in a data service can not be presented because it is no longer accessible on the registered parameters (PID, etc), an error message is shown to the user indicating that the service can not currently be accessed.  In case secondary components are missing, the receiver shall present the main component of the service: e.g. a video service with no audio component shall be presented anyway with no error message.

The receiver shall present all the components of a service it can present.

### 7.5.3. Active Format Descriptor

**Transmission of this description by the broadcaster is optional, but, when present, use of this description by the receiver is mandatory.**

As explained in Annex B of ETSI TS 101 154 [9] "The Active Format Description (AFD) describes the portion of the coded video frame that is "of interest". It is intended for use in networks that deliver mixed formats to a heterogeneous receiver population. The format descriptions are informative in nature and are provided to assist receiver systems to optimize their presentation of video.

"[…] The AFD is intended for use where there are compatibility problems between the source format of a programme, the format used for the transmission of that programme, and the

format of the target receiver population. For example, a wide-screen production may be transmitted as a 14:9 letter-box within a 4:3 coded frame, thus optimized for the viewer of a 4:3 TV, but causing problems to the viewer of a wide screen TV.

The appropriate AFD may be transmitted with the video to indicate to the receiver the "area of interest" of the image, thereby enabling a receiver to present the image in an optimum fashion (which will depend on the format and functionality of the receiving equipment combined with the viewer's preferences). […]

The AFD itself does not describe the aspect ratio of the coded frame (as this is described elsewhere in the MPEG-2 video syntax)."

The use, by the broadcaster, of this description allows it to optimize the presentation of its program for both 4:3 and 16:9 displays. Therefore, by default, the receiver shall make use of this descriptor. However, the manufacturer may implement a manual override and/or a manual disable.

### 7.5.3.1.  Syntax and Semantics

For standard definition programs, the receiver shall recognize AFD transmitted according to [9] Annex B.2.2.

*In case of HDTV compatible receiver, the receiver shall recognize AFD transmitted according to [9] Annex B.3.2.*

### 7.5.3.2.  Valid Values for Descriptor

All values referenced in [9] Annex B "table B.2 active_format" are valid in the broadcast signal.

### 7.5.3.3.  Behaviour of receiver in presence of AFD

The receiver shall behave in accordance with "The DTG Receiver Implementation Guidelines" [35].

NB: AFDs supplement and qualify - but do not replace - the aspect ratio flag carried in the MPEG sequence header of digital broadcasts. Receivers must interpret both the aspect ratio flag and the AFD in order to present the image in the correct manner.

### 7.5.3.4.  Analogue output of the receiver

The receiver should reinsert WSS data in analogue standard definition outputs according to what is specified in [35].

### 7.5.3.5.  AFD and HDMI

*Receivers with HDMI output are recommended to provide at least one of the following methods to process aspect ratio and AFD information for video output on HDMI:*

- *Provide a reformatting function for the video to match the aspect ratio of the display based on AFD, aspect ratio and user preference as per section 6.4.3.5 in [35] (for16:9 displays). Support for scaling to 4:3 aspect ratio for HDMI is optional (since consumer HD displays are 16:9). Aspect ratio signaling in the HDMI AVI Infoframebits R0..R3, M0, M1 (see CEA-861) shall be set in accordance with the properties of the video on the output.*
- *Pass the video to the HDMI output unprocessed with respect to AFD and aspect ratio scaling, and pass AFD and aspect-ratio signaling in the video to the HDMI output as part of the AVI Infoframe bits R0..R3, M0, M1 (see CEA-861)*

## 7.6. Network Connection (Tuning)

A general principle is that any scanning procedure shall make accessible to the user all the services available at a given location.

New multiplexes will be started over the time both nationally and locally. This is due to the specific organisation of frequency allotment in Italy, based on secondary trading with the full right to move from the allocation from analogue to digital television.

It is important to make it very easy for the user to enjoy all the new channels and services that are broadcast in DTT, as soon as they are on air, without any need for a manual rescan of the spectrum. This will be the best and most effective way to inform the viewer that new channels and services are available. This will improve the viewer experience and, as a consequence, help the DTT platform to succeed.

The receivers should be able to automatically and regularly update the channel and service list without the need of direct intervention by the viewer. This will make much easier for the final user to install the receiver and to keep the receiver updated with all the new channels and services that can be received in his coverage area.

Obviously, the viewer has to be able to perform a complete scan at any moment, either manually or automatically. Furthermore, the viewer must have the possibility to disable the automatic channel and service list update procedure.

### 7.6.1. General Requirements

In order to make receivers capable of managing the situations previously described, the following functions shall be implemented:

- **manual full scan**: the procedure, initiated by the user, performs a full (automatic) scan of the spectrum and can be used to **update** the channel and service lists or to **re-install** everything from scratch;
- **manual scan (single channel)**: a manual tuning procedure allowing the user to manually select and tune a single VHF/UHF channel (giving for example the channel number)
- **automatic full scan**: the procedure is initiated automatically by the receiver and performs a full (automatic) scan of the spectrum with the only purpose being to update the lists;

**T2-IRDs SHALL provide a single list containing both DVB-T and DVT-2 services.**

For all the described tuning procedures, receivers shall scan the following spectrum bands: III-VHF (BW=7 MHz with European channel raster), IV-UHF and V-UHF (BW=8 MHz).

### 7.6.2. First Installation Procedure

- At first installation the receiver shall perform an automatic scan over all the spectrum bands (VHF-UHF), searching for all the digital services available.
- At the end of the scan, all the channels and services found (audio/video/data) are stored in the channel and service list
- If automatic ordering of channels and services mechanism is active (based on a LC numbering scheme) the resulting lists will be organised according to the criteria described in section 7.3.4.5. Otherwise the list will be organised according to frequency scan order.
- The receiver shall provide an interface allowing the user to access the list and move, rename, discard or restore services from the list.

- When the user discards a service from the list, the service is no longer visualized in the list. It is just stored in the "discarded service list" from which it can be retrieved in any moment by using the "service restore" function.
- When either the manual or automatic scan procedure is started for updating the service list, those services that are included in the discarded services list shall not be re-introduced in the main channel list. In case the service list is reinstalled, both the main service list and the discarded service list shall be re-initialized.

### 7.6.3. Manual Full Scan Procedure

#### 7.6.3.1. Update

The receiver shall:
- update (where necessary) in the list those services which were already existing; for example:
  - o the receiver shall detect a "service_name" change of a given service and update it unless it was manually edited by the end user;
  - o if automatic ordering is active, the receiver shall move, if possible based on the rules given in §7.3.4.5 for allocation and conflict resolution, an existing service to the new position indicated by the LCN;
- insert newly available channels or services (audio/video/data) in the relevant list:
  - o if they carry an LCN and automatic ordering is active, the rules given in §7.3.4.5 for allocation and conflict resolution apply;
  - o if they don't carry any LCN or if automatic ordering is not active, they will be appended at the end of the list.

#### 7.6.3.2. Re-install

Same as §7.6.2.

### 7.6.4. Manual Scan Procedure (Single Channel)

Same as §7.6.3.1 on single channel.

### 7.6.5. Automatic full scan (Automatic service list update)

To maintain an up to date service list, the receivers should implement an automatic service list update procedure, in accordance with the following requirements:

1. The receiver should perform an automatic scan at regular intervals (at a specified hour and with a specified frequency) to search for new services.
2. The automatic scan can be performed both in standby mode (recommended) and in operate mode (optional). Refer to the following table for automatic channel scan default settings.
3. The automatic scan in either mode can be disabled – separately - by the user, but, as a default setting, it is active only in stand-by mode. In case user would decide to disable automatic search for new channels in standby mode he/she should be warned that this way the capability of automatically tracking evolution of networks and services will be hindered. For this purpose a message like "Warning! After disabling this feature the receiver won't be anymore able to keep your channel list automatically updated with respect to services on-air" (Italian translation: "Attenzione! Disabilitando questa funzione il ricevitore non sarà più in grado di aggiornare automaticamente la lista canali in base a quelli effettivamente trasmessi") should be presented.
4. When the receiver performs the scan, looking for new channels, it compares any single service found with the list of services already registered. This comparison will be based on frequency, Ts_ID, On_ID and service_id of the services. The comparison shall take into account all services including those that were

discarded by the user from the channel/service list and are listed in the "discarded channel list".

5. If any service is found with frequency, TS_id, On_id or Service_id different from those of the channels already registered, it will be added to the channel list (in its own category group) according to the following rules:
   o if new service carries an LCN and automatic ordering is active, the rules given in §7.3.4.5 for allocation and conflict resolution apply
   o if new service doesn't carry any LCN or if automatic ordering is not active, it will be appended at the end of the list.

6. If any new service is found a message will be shown on screen when the receiver is switched on (if it was in standby mode) and will be left on screen until the user presses the OK key. The message will be something like: "New channels were found and added to the channel list" (Italian Translation: "Sono stati trovati nuovi canali in onda. I nuovi canali sono stati aggiunti alla lista canali").

7. In case both the "search for new channels in standby mode" and the "search for new channels in operate mode" options are set on "YES", than the receiver must start the automatic scan at the time indicated for performing the channel search in operate mode.

8. In case the "search for new channels in operate mode" is available and set on "YES", at the time specified for starting the procedure, a 30 seconds countdown will appear on screen with a message like the following: "The receiver will start looking for new channels in … seconds". Italian translation: "Il Box Interattivo comincerà la ricerca di nuovi canali entro … secondi" (mutatis mutandis for IDTV sets). The user will be able to press "OK" for letting the procedure start immediately or "exit" for aborting the procedure. In case the user will choose "exit", the procedure will be aborted and will not be performed again until the next scheduled time.

9. In case the "search for new channels in standby mode" option is set on "YES", but the "search for new channels in operate mode" option is available and set on "NO" (or was aborted – refer to previous point), the receiver shall start the scanning procedure 1 hour after being put in stand by mode (in case the receiver is put in standby mode more than once a day, this procedure has to be performed only once daily).

### 7.6.5.1. Default settings for automatic scan

| N. | Settings / Italian Translation | Mandatory default settings |
|---|---|---|
| 1 | "Automatic search for new channels in standby mode" / "Ricerca automatica di nuovi canali in standby" | YES / SI' |
| 2 | "Automatic search for new channels in operate mode" / "Ricerca automatica di nuovi canali a decoder acceso" | NO / NO  (if available) |
| 3 | "Time" / "Ora" | 04:30 AM |
| 4 | "Repetition" / "Frequenza" | "Daily" / "Quotidiana" = default ("Weekly" / "Settimanale" – other options possible) |

Table 32: Default setting for automatic scan

### 7.6.5.2. Handling of duplicate services

In presence of the same service available on different frequencies/Transport Streams, the Receiver shall behave as follows:

When identical services (i.e. with the same original_network_id, transport_stream_id and service_id triplet) are received on different frequencies (obtained from different transmitters or generated by the MATV system), the receiver should present to the user all of the

instances of the service (i.e. including duplicates). In the channel list, the position associated with the lowest ordinal number should be given to the service with the best QoS. Extra instances of services should be regrouped at the end of the list.

The minimum requirement is that only the instance with best C/N out of the services with the same DVB triplet found during scan shall be kept, provided that the situation is revisited at each automatic or manual rescan.

In the context of interactive applications (e.g. an EPG) the (unique) DVB Locator of duplicate services shall refer to the one with the best QoS. (In case of equivalent QoS, it shall refer to the service first discovered).

### 7.6.5.3. Handling of analogue TV services

When the receiver can also tune in to analogue TV channels, the receiver shall allow:
- manual selection and tuning of a single VHF/UHF channel giving the channel number and
- addition of the programme to the list of available channels. The analogue channels will  be added in the first empty positions in Main Overflow
- When an analogue channel carries PDC information, it may be allocated a (manufacturer) predefined position if empty; otherwise it shall be moved to the Main Overflow
- If the LCN of a subsequently acquired digital service is occupied by an analogue service (manufacturer or user assigned), the situation shall be treated as described in [7.3.4.5.2]

### 7.6.5.4. Automatic Ordering of Channels and Services in absence of LC descriptor acquisition

If the off-the-air LC descriptor acquisition mechanism is not activated in the receiver, the services shall appear in the order they have been detected (taking into account the procedure described in 7.6.2) and grouped into three categories in the following order:

- TV channels
- Radio channels
- Channel independent Interactive Services (un-bound interactive services)

Interactive services linked to TV or Radio services shall not be shown.

### 7.6.6. Network evolution

As specified in Table 32: Default setting for automatic scan, the receiver shall implement, by default, an automatic scanning procedure, to adapt the receiver to the evolution of the network.

As specified in 6.1.1.1, changes in modulation parameters of existing services shall be automatically detected.

### 7.6.7. Default channel numbering of services

No default service numbering shall be implemented by manufacturers, except for analogue channels (based on PDC) where applicable.

## 7.7. User interface to the SI carried data

This clause describes the minimum set of views of the SI information that receivers shall (M), should (R) or may (O) be able to present to the user.

The minimum lengths for text fields (if present) that shall be displayed by receivers are defined in the following table. Note that the figures given are for the number of displayable

characters (including spaces) required to represent the text field. The number of bytes required will depend on the use of control codes and whether one or two byte character representation is used.

| Field name | Field length in displayable characters | M/R/O | Comments and examples |
|---|---|---|---|
| Network Name | 24 | O | "Operator X" |
| Service Provider Name | 20 | O | "Media Company Y" |
| Service Name or Preferred Name | 32 | M | "Italia International" Full name for display on set-up menus |
| Short Name of Service | 8 | O | "It.Int" A short version for display on browse and listing display. Possibly shortened by broadcasters from full name by use of escape characters as defined in TR 101 211. Otherwise the full length Service Name should be displayed. |
| Event Name | 40 | M | "La Grande Zia" Individual broadcasters are free to add an episode title to the title within the space, for example "Lo Zio: la Storia Segreta" |
| Short Event description | 200 | M | "Un giorno, Zio esce per cercare sigarette. Torna venti anni dopo." Broadcasters must ensure that the text does not overflow the maximum descriptor size. |
| Extended Event Text | 3984 | O | The extended event text complements the short event description. |
| Component description | 32 | O | "In alta definizione" |

Table 33: Text Field Lengths

### 7.7.1. Timer

Must be locked to the Time & Date Table (TDT) and adjusted by the Time Offset Table (TOT), if broadcast.

### 7.7.2. Access to the Service list

Access to the Service List shall be provided through a dedicated key (recommended) or by a resident menu. This list shall present TV Channels, Radio Channels, and Independent Interactive services (i.e. when they are not bound to a TV or a Radio service, or another Interactive Service) following the indication of the associated LC descriptor.

If the LCN acquisition mechanism is not active, the Service List shall be grouped by:
- TV services,
- Radio services and
- Interactive Services.

Within Interactive Services, only those who appear in an SDT with "service_type=0x10" (DVB MHP service) shall be listed.

### 7.7.3. Access to the list of service-bound MHP applications

When tuned to a specific TV or Radio service or to an Independent Interactive Service, access to the list of MHP applications associated to that service (usable by the receiver) shall be provided through a dedicated key (recommended) or by a resident menu.

# 8. Resident Software and API

Enhanced and interactive television services are an essential part of the DTTV proposition. Receivers must fully support all specified functionality.

The receiver shall access all Italian broadcast digital terrestrial television, radio and interactive services, based on MHP standard 1.1.3. Receivers shall implement the most current version of the specification, to take advantage of bug corrections.

This shall include the capability to: efficiently handle Digital Text and Enhanced Broadcast elements of all services; display subtitles (where broadcast) if requested by the viewer; handle both widescreen and 4:3 picture formats as required for the connected display.

## 8.1. Services

### 8.1.1. Video Dripping

The receiver shall support Video Dripping as specified in the MHP Standard: ETSI TS 101 812, # 7.1.3 [25]. This is used to visualise dynamic graphical applications (e.g. slide shows).

### 8.1.2. Teletext

Teletext [12] is an important medium in Italy. Not all analogue Teletext services will immediately be converted to MHP applications. Thus there is a need to maintain compatibility with DVB Teletext [11].

The DVB Teletext signal shall be decoded and presented within the receiver and displayed using graphical functions (so-called Teletext Mode 2). That's particularly true for STBs as (analogue) VBI Teletext signal cannot be carried across (digital) HDMI interface. At least level 1.5 Teletext, as defined in ETS 300 706 [12], shall be supported.

One single remote control is then sufficient to view audiovisual services and Teletext using the "Text" key.

In order to preserve customers' investments in TV sets with advanced Teletext features, Teletext signal shall be anyway reinserted on the TV SCART and RCA (if present) VBI lines. Insertion shall conform to ITU-R BT.653-2 [31]. Teletext data will be inserted from lines 6 to 22 and 320 to 335.

It is recommended that VBI data, including Teletext, be reinserted on the VCR SCART (including the Y/C signals) when present (see 6.1.4.2), even if many VCRs will not be able to replay this data. Insertion shall conform to ITU-R BT.653-2 [31]. Teletext data will be inserted from lines 6 to 22 and 320 to 335.

### 8.1.3. Subtitling

Concerning subtitling, and generally speaking, it is expected that broadcasters will follow the EBU recommendation on subtitling in digital services [7]. However, compatibility must also be maintained with subtitling through Teletext.

As a consequence, the receiver SHALL implement DVB Subtitling and Teletext subtitling.

#### 8.1.3.1. DVB Subtitling

DVB Subtitling [18] shall be implemented in conformance with the MHP Standard [25].

*HD Subtitling shall be implemented according to EICTA Advanced E-Book [28].*

*A Display Definition Segment shall only be included in the subtitle stream when the video is HD. The maximum display_width shall be 1919 and the maximum display_height shall be 1079. It is recommended that receivers support Display Definition Segments.*

### 8.1.3.2. Teletext Subtitling

Teletext subtitling is part of both Teletext modes described above. Information about the presence of Teletext subtitles shall be obtained from the teletext descriptor and this information shall be made available to the user, at his request (e.g. when pressing the "Sub" key, or through a banner).

It is acceptable to make the user select the relevant teletext page for viewing subtitles, as long as a clear message on the availability and modality of access to the subtitles is presented to the user (e.g. a channel banner).

Where possible, receivers should be able to display both subtitles and interactive graphics simultaneously. However, not all receivers may be able to do this: in that case, when an application is activated, it shall be able to suspend the rendering of teletext (see also section §13.5.2 Relation to graphics in the MHP Specification [25]).

## 8.2. Resident Software

### 8.2.1. Resident Manufacturer Specific Applications

#### 8.2.1.1. Navigator

It shall be present. It is defined by the manufacturer. Ref.: [1]

##### 8.2.1.1.1 Handling of input events by the Navigator

When the receiver is in TV Viewing Mode (see definition §4.1), it is expected that any running application shall release input keys VK_0 to VK_9. The Navigator shall always be able to handle those input events.

The Navigator must also handle all the other keys used for TV viewing (e.g. channel list, volume, and channel up/down). Those keys are different from the keys of the "Interactive Pad" (see §6.2 on the Remote Control, in the D Book [36]).

### 8.2.2. Parental Control

The receiver shall provide a PIN-controlled Parental Control menu to perform the following functions:

1)  setting age thresholds (at least for 14 and 18 years) for viewing single events

2)  changing the PIN value

3)  activating/deactivating PIN checking on 1), 2), 3) above and on the menu itself

From the receiver Parental Control menu it shall be possible setting an age threshold to be matched against the value set by broadcasters, on a per event basis, in the Parental_rating_descriptor of the EIT. If this value is equal or greater than the age threshold set, the current event can be viewed only entering a PIN. Such PIN is the same as the receiver's Parental Control PIN (if any). The PIN protection can be enabled/disabled by means of an appropriate receiver menu. At least the 14 and 18 years thresholds must be present.

The receiver shall exercise parental control at event level only if there is an EIT associated to it, with a meaningful Parental_rating_descriptor carrying the same country code as the one set in the receiver at installation time.

From the receiver Parental Control menu it shall be possible changing the associated PIN value. The default value of this PIN for an out-of-the-box receiver could be either set in the factory by the manufacturer or by the customer at installation time. Reset of the PIN to the default value can only be achieved through an overall receiver reset to the out-of-the-box status.

By default the receiver shall be set to block all events and/or channels flagged with an 18 years threshold.

Locking/unlocking single services could be also optionally offered by manufacturers. In this case from the Parental Control menu it will be possible to lock one or more specific services so that they can be viewed only entering a PIN. Such PIN is the same as the receiver's Parental Control PIN (if any). The PIN protection can be enabled/disabled by means of an appropriate receiver menu.

## 8.3. Multimedia Home Platform (MHP)

### 8.3.1.  MHP Profile

***Manufacturers shall implement the latest version of the specification (presently MHP 1.1.3 [25] with the relevant extensions defined hereafter) and shall provide timely update patches/updated builds for the installed base****.*

*Minimum requirement for both STBs and iDTVs is Interactive Broadcast Profile. DVB-HTML support is RECOMMENDED[9].*

*Minimum required graphics capability is 1 HD or SD HGraphicsDevice (front) in conjunction with 1 HD or SD HBackgroundDevice and 1 HD or SD HVideoDevice.*
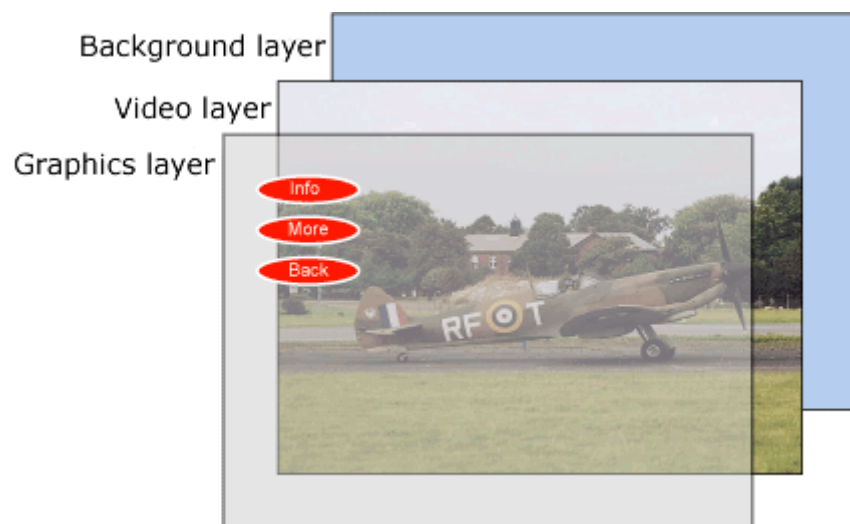


Figure 7: Graphics, video and background layers

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[9] DVB-HTML is the only well specified HTML profile for TV currently defined by DVB.

*Support of 1280x720 and 960x540 HD graphics resolutions is MANDATORY, as per MHP 1.1.3 Minimum Platform Capabilities ([25] §G.1). Support of 1920x1080 graphics resolution is OPTIONAL.*

*Until a suitable MHP 1.1.3 test suite becomes available, manufacturers shall provide a self-declaration stating that all MHP 1.1.3 functionalities have been implemented.*

### 8.3.2.  Application Manager

Application Manager is the resident software module in charge of interpreting AIT signalling, loading/offloading, starting, pausing, killing resident and downloaded applications. It is also responsible for presenting to the user information about applications which may be relevant to him/her, like the list of available applications and possible error messages.

Only applications signalled by broadcasters as visible to users (visibility='11' in AIT's Application descriptor) SHOULD be listed to users through APP key or the like.

*In particular, if Application Manager cannot download an application or an AIT file over the interaction channel because of network problems (e.g. Ethernet cable disconnected), a message like "Verificare la connessione di rete" ("Check network connection") SHALL be displayed, regardless of receiver's Application Autostart settings.*

#### 8.3.2.1.  Auto-start Applications

In case an application is signalled as "auto-start", all the standard TV functions shall be accessible as normal, and their use shall not cause an interruption to the MHP application downloading.

When application autostart is ON, progress loading bars or other icons SHALL NOT be displayed while applications signalled as "autostart" are being loaded or started. Such bars and icons, as well as possible error messages, SHALL instead be displayed in case applications are manually started (because autostart has been switched OFF by the customer or applications are signalled as "present").

In case a proprietary STB menu is presented on screen that kills any running MHP application, the auto start application shall be re-loaded after the GUI is closed/disappears. Otherwise the MHP application in auto start mode shall be downloaded and started in the background; it shall be shown immediately after the proprietary STB menu/GUI is closed/disappears (see §6.4).

#### 8.3.2.2.  Interaction between Resident and Downloaded Applications

When a resident application is called by the user or automatically (whether it is an MHP application or a low level manufacturer defined application such as volume level, a list, a set-up menu, etc.) it SHALL NOT kill the active loaded MHP application  (see §6.4).

Similarly a running resident MHP application SHALL NOT be killed by the launch of another resident low level application (see §6.4 Interaction between (proprietary) receiver GUI and MHP applications).

### 8.3.3.  SDRAM Memory Management

In case the maximum amount of available SDRAM memory (see §6.1.3 for minimum memory requirements) is exceeded by the latest started application, the previously loaded and paused MHP applications (if any) shall be purged from memory and the latest loaded application shall be given priority.

In case an MHP application in auto start mode is already loaded in memory, this application shall never be automatically purged from SDRAM memory.

### 8.3.4. Receiver properties

In real-life operation, expecially in horizontal markets like Italy (but not necessarily only there), the population of receivers reached by MHP applications is far than homogeneous. Different receiver models and different software versions (for whatsoever reason) of the same receiver model receive in a given area at a certain point in time the same MHP application.

There could be situations, like functional limitations or bugs in a particular model and/or software release, where an MHP application should behave differently when executing on a particular receiver model with a specific software version.

Even though java system properties supposedly exposed by receivers through MHP's System.getProperty() method would be useful for this purpose

1) they're not necessarily present in any receiver model
2) the number and type of properties is different for each receiver model
3) the name of the same property (e.g. software version) is different for each receiver model

For the above reasons it's mandatory exposing through MHP's System.getProperty(), both to signed and unsigned applications, at least the following receiver characteristics (in parenthesis the recommended property name)

- manufacturer name (system.hw.manufacturer)
- hardware release (system.hw.version)
- model name (system.hw.model)
- *MAC Address system.hw.macaddress (in hex format with ":" separators)*[10]
- software release (system.sw.version)
- loader release (system.loader.version)
- receiver type (system.hw.type="TV" for iDTVs)

Certain applications, e.g. those declared in an AIT file, might need to know the service which they were started from, for instance to return there when exiting. For this purpose middleware SHALL maintain a new persistent user preference `org.dvb.user.GeneralPreference` named "Last Locator" containing last (previous) service locator. Read access by applications to this user preference SHALL always be granted.

### 8.3.5. Behaviour with mixed SD/HD applications

*It can be envisaged that the following kind of applications will be on-air at the same time on different services:*

1. *Native HD (16:9) applications associated to HD services*
2. *Legacy SD (4:3) applications associated to SD (16:9) services*
3. *Legacy SD (4:3) applications associated to HD simulcast of SD services*

*By exposing/implementing the relevant properties/methods mandated by the standard (e.g.* `dvb.display.aspect_ratio`*), an HD receiver will allow "well-designed" applications to optimize their behaviour in any of the above cases. Scaling of legacy SD applications to high definition graphics resolution, if required by current TV settings, SHALL be performed by the receiver itself.*

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[10] *For receivers with multiple MAC addresses (e.g. for Ethernet and WiFi interfaces ) any of them can be used*

### 8.3.6. Guidelines for AIT URL

*The scenario where application signaling comes from the interaction channel rather than the broadcast channel is specified in Section 9.6.1 of MHP 1.1.3 [25]. The following further requirements apply.*

*Same as specified for stored services in Section 9.6.2 of MHP 1.1.3 [25], when service selection to an AIT URL is made, any previously running streamed media decoders SHALL continue to run. It is the responsibility of applications to stop them if so required. Any resources used by such streamed media decoders shall have the lowest possible priority in any resource conflicts.*

*Due to the fact that an application signalled in AIT file can be started only by another application signalled in broadcast AIT or by a resident application which know its URL, Application Autostart settings in the receiver SHALL not affect applications signalled in AIT file. In other words, applications signalled in AIT file as "Autostart" SHALL always be autostarted regardless of receiver's settings, which are then relevant only for applications signalled in broadcast AIT.*

*For the same reason, progress loading bars or other icons SHALL always be displayed when applications signalled in AIT file are being loaded or started, regardless of receiver's Application Autostart settings.*

### 8.3.7. Inter-Xlet Communication (IXC) API

*Inter-Application and Inter-Xlet Communication API defined in [25] (section 11.7.3) doesn't put any a priori restriction on the kind of Xlets actually communicating. Under the basic conditions which make communication between 2 (or more) Xlets possible, implementations SHALL then equally support, just to make a few examples, IXC between 2 broadcast applications (i.e. delivered over an object carousel), 2 broadband applications (i.e. delivered over an IP connection), 1 broadcast and 1 broadband application, etc..*

*Nevertheless there are situations where IXC is not applicable, like for instance when a broadcast application would like to exchange some data with an application signalled in AIT file (in this case service context is changed to AIT file and broadcast applications cannot be signalled in AIT file to possibly make them survive).*

*To circumvent this limitation, implementations SHALL allow any application to access, with read&write rights, a new persistent* `org.dvb.user.GeneralPreference` *named "IXC". The minimum amount of persistent storage reserved for this user preference SHALL be 1 kbyte.*

### 8.3.8. Advanced graphics API

*In order to facilitate the development of applications with advanced 3D graphic effects,*

> *the Java bindings for OpenGL API specified in [56] SHALL be supported in STBs*
> *the Java bindings for OpenGL API specified in [56] SHOULD be supported in iDTVs*

## 8.4. Application Environment(s) for broadband media delivery

### 8.4.1. Procedural Application Environment

*The Procedural Application Environment (PAE) SHALL be implemented according to the specifications defined above in §8.3 with the clarifications, extensions and restrictions defined in the corresponding clauses below.*

### 8.4.1.1. APIs for Streamed CoD

*In addition to what is specified in Section 11.11.12 of [25] the following classes SHALL support the HTTP protocol:*

- *The constructor for* `javax.media.MediaLocator` *- for referencing media files intended to be played while downloading*
- *Methods on* `javax.media.Manager` *accepting* `javax.media.MediaLocator` *as input parameters - for constructing JMF players for media files intended to be played while downloading.*

*Implementations SHOULD support also custom player creation by applications through a custom* `DataSource` *(*`javax.media.protocol.DataSource`*) and a* `SourceStream` *(*`javax.media.protocol.SourceStream`*).*

*When creating a JMF player, Media Locators which reference files whose MIME-types have been defined in Table 6 will create a player which will play the content while downloading it. If the content cannot be found then such players will never enter the Prefetched state.*

*If an MPD manifest file is referenced in the Media Locator used by an application to create a JMF player, the player will perform all the relevant operations (manifest parsing, switching from one representation to another based on certain conditions, …) without any application involvement.*

*Implementations will rely upon MIME-types returned by the server in HTTP responses to determine the container of the content being streamed or downloaded, according to the values listed in Table 5. In case of missing MIME-type, implementations will do their best to tell the container format from the file itself. In the case of "Download CoD," MIME-types will be stored elsewhere to be used when consuming downloaded media contents. If the container format cannot be determined then such players will never enter the Prefetched state.*

*Media locators containing the question mark character ("?") SHALL be accepted by implementations.*

*The following controls SHALL be supported for the above mentioned players:*

- `javax.media.Controller` *and its associated* `javax.media.ControllerEvent`
- `org.davic.media.LanguageControl`
- `org.davic.media.AudioLanguageControl`
- `org.davic.media.SubtitlingLanguageControl`
- `javax.tv.media.MediaSelectControl`
- `javax.tv.media.AWTVideoSizeControl`
- `org.dvb.media.VideoPresentationControl`
- `org.dvb.media.BackgroundVideoPresentationControl`
- `org.dvb.media.SubtitlingEventControl`
- `org.dvb.media.VideoFormatControl`
- `org.dvb.media.DVBMediaSelectControl`
- `org.davic.media.MediaTimePositionControl`

*The following methods SHALL be supported for the above mentioned players:*

- `javax.media.Player.start`
- `javax.media.Player.stop`
- `javax.media.Player.setRate`
- `javax.media.Player.setMediaTime`
- `javax.media.Player.getMediaTime`
- `javax.media.Player.getDuration`

- `javax.media.Player.setStopTime`
- `javax.media.Player.realize`
- `javax.media.Player.prefetch`

The clock rates (0.0) and (1.0) SHALL be supported for the `javax.media.setRate` method. Any other rate is OPTIONAL.

As per JMF specification, time passed to and received from JMF controls is expressed in seconds.

### 8.4.1.1.1 Player operations

Typical operations associated with playing of progressive download contents will be performed using the following APIs:

- PLAY - STOP:
  - `javax.media.Player.start()` and `javax.media.Player.stop()` (automatic procedure)

    or
  - `javax.media.Player.realize()` and `javax.media.Player.prefetch()` and `javax.media.Player.start()` and `javax.media.Player.stop()` (step-by-step procedure)

- PAUSE - RESUME:
  - `javax.media.setRate(0.0)` and `javax.media.setRate(1.0)`

- SEEK:
  - `javax.media.Player.setMediaTime()` or `org.davic.media.MediaTimePositionControl.setMediaTimePosition()`

- SKIP:
  - `javax.media.Player.getMediaTime()` or `org.davic.media.MediaTimePositionControl.getMediaTimePosition()` then `javax.media.Player.setMediaTime()` or `org.davic.media.MediaTimePositionControl.setMediaTimePosition()`

- STOP AT TIME x:
  - `javax.media.Player.setStopTime(time x)`

- CHANGE STOP TIME from x to y:
  - `javax.media.Player.setStopTime(Clock.RESET)` then `javax.media.Player.setStopTime(time y)`

- CONTENT DURATION/LENGTH:
  - `javax.media.Player.getDuration()` or `javax.media.CachingControl.getContentLength()`

To allow Streamed CoD of files which have not yet been closed (e.g. ongoing recordings), implementations SHALL try to playback files with zero or invalid content length.

### 8.4.1.1.2 Time-setting operations

When the methods involved in changing the current media time, i.e. `javax.media.Player.setMediaTime()` and `org.davic.media.MediaTimePositionControl.setMediaTimePosition()`, are invoked implementations will achieve the result expected by applications, transparently to the

*applications themselves. The way the result is actually achieved is implementation-dependant and may also depend upon the server (e.g. lack of HTTP Range header support) and/or the content (fixed vs adaptive rate). After the player has successfully retrieved the part of the file containing the indicated media-time and the player has re-entered the Started state a* `javax.media.MediaTimeSetEvent` *will be generated.*

*In case of MP4 files, implementations will best match time values passed to the above mentioned methods to the random access points defined in those files.*

*In case of MPEG-2 TS and audio-only files, implementations will do their best to set meaningful time values based on the stream itself (e.g. by treating all media just as if they were fixed rate).*

### 8.4.1.1.3  Audio language

*If the selected container has audio tracks in more than one language, the track corresponding to the user preferences, as set during the receiver installation process, will be used by default.*

- *If preferred languages do not match any of the available languages, then the receiver shall automatically select the "undefined" ("und" code of the ISO_639_Language_descriptor) audio stream.*
- *If "undefined" stream is absent, the first listed stream (MP4 case) or the stream with the lowest PID (TS case) in the specified program shall be selected.*

*In addition to this automatic soundtrack selection, applications can always allow users to manually select any of the available languages through* `org.davic.media.LanguageControl.`

### 8.4.1.1.4  Streamed CoD control

*For the purpose of exposing to applications information about underlying Streamed CoD operations, in particular (but not only) for the Adaptive Streaming case, the "Streaming monitoring API", which has been drafted within DVB for inclusion in GEM, has been adopted (see Annex K). It SHALL be supported by receivers.*

### 8.4.1.2.  APIs for Download CoD

*If content download is supported, the "Content download API" specified by OIPF (clause 11.3.4 and Annex E in [46]) SHALL be implemented.*

*The content access descriptor therein specified is required only if a DAE is present in the receiver.*

### 8.4.1.3.  DRM APIs

*Whatever DRM is supported by the receiver for protecting contents delivered over IP (outside the scope of this document), it SHALL be made accessible to applications through the generic DRM API (*`org.oipf.drm`*) defined by OIPF's PAE Annex G [46].*

*In that context the "DRM system name" strings returned by getAgents() method SHALL be built by prefixing the decimal number format of CA_System_ID [19] with "urn:dvb:casystemid:". For example, being hexadecimal 0x4AF4 assigned as CA_System_ID for "Marlin" by DVB, "Marlin" DRM system name is encoded as "urn:dvb:casystemid:19188". Note that the decimal number format of CA_System_ID SHALL not have leading zeroes.*

### 8.4.1.4. OTT content referencing API

*All the methods listed in MHP [25] clauses 11.11.4.1 (MPEG/DVB specific service) and 11.11.4.2 (Generic service) shall accept or return instances of Objects which describe OTT services addressed by HTTP locators.*

*An HTTPLocator is defined in the Annex L. This locator may reference a media container, an MPD manifest file or an application URL.*

*An HTTP locator can be used also to address content delivered via HTTPS.*

### 8.4.2. Other Application Environments

*Specification of other possible Application Environments and of their integration with the mandatory PAE is outside the scope of this document.*

## 8.5. Resident applications related to broadband media delivery

### 8.5.1. History

*The resident navigator SHOULD provide a feature allowing users to browse the list of most recently used broadband applications, i.e. applications which are transported via interaction channel (Section 10.8.1.3 in [25]), and to possibly select one.*
*Only broadband applications signalled by broadcasters as visible to users (visibility='11' in AIT's Application descriptor) SHALL be stored for history purpose.*

### 8.5.2. Bookmarks

*A specific key on the remote control SHOULD be available for storing a bookmark to the current broadband application. In conjunction with such key, the resident navigator will provide a feature allowing users to browse the list of bookmarks and to possibly select one.*
*Only applications signalled by broadcasters as visible to users (visibility='11' in AIT's Application descriptor) SHALL be stored for bookmark purpose.*

## 8.6. Maintenance and Upgrade

It is very important for the receiver to be able of automatically and regularly look for available software upgrades and to automatically load and install such new software.

The procedure must be designed to guarantee both the manufacturers and the broadcasters that over-the-air software upgrades are received and automatically installed on the receiver in the households. This will also make the viewers sure that their receivers are always updated and fully compliant with the applications on air.

The process of upgrading shall cause minimal disruption to the viewer. However, to minimise the diversity of deployed software builds and to most efficiently use the available broadcast capacity, the receiver must detect and act upon the broadcast of the relevant software download. After a System Software Update has been performed, user settings like services listings (preferred, etc,) shall be preserved, whenever feasible.

Obviously, the viewer has also to be able to perform a manual search for software upgrades in any moment. Further, the viewer has to be allowed to disable the automatic software upgrade procedure.

### 8.6.1. Automatic software upgrade

To allow for a simple user interaction, the receiver shall behave in the following manner:

1. The receiver has to automatically look for available software upgrades over the air.
2. The automatic software upgrade procedure can be disabled by the user.
3. When the receiver looks for available software upgrades, it has to scan all the multiplexes.
4. The software upgrades put over the air need to be model specific so that there is no chance that a software intended for a particular receiver model can be downloaded and installed on a receiver with a model different from that to which the software upgrade was intended, as specified in DVB TS 102 006 [23].
5. If any new software version is found, it will be automatically downloaded, but should only be installed after explicit confirmation by the user (manufacturer option).
6. The automatic software upgrade can be performed both in standby mode (mandatory) and optionally in operate mode (at a specified hour and with a specified frequency). Receivers are not required to perform automatic software upgrade while in low power mode. Refer to the following table for automatic channel scan default settings.
   1. If the "automatic software update in standby mode" option is set to "YES"
   - in supposedly stable standby conditions (e.g. 30 minutes after standby mode has been entered) and anyway before entering low power mode (if available), the receiver has to search for new software;
   - if receiver is switched on while new software search has already started the update procedure will be aborted
   - if receiver is switched on after new software has been found and download or upgrade is ongoing, the update procedure will be duly completed (loader progress messages should help user understanding what's going on)
   2. If the "automatic software update in operate mode" option is available and set to "YES", then:
   - at the specified time and with the specified frequency, if the receiver is on it has to search for new software;
   - at the time the procedure is started, a 30 seconds countdown will appear on screen with the following message: "The receiver will start looking for new software in … seconds". Italian translation: "Il Box Interattivo comincerà la ricerca d'aggiornamenti software entro … secondi".
   - The user will be able to press "OK" for letting the procedure start immediately or "exit" for aborting the procedure. In case the user will choose "exit", the procedure will be aborted and will not be performed again until the next scheduled time.
7. When new software has been installed, then (after the receiver has been automatically rebooted, if necessary, and switched on if it was in standby) a message like the following shall appear on screen: "Your receiver was successfully upgraded. New features are now available." (Italian Translation: "Il Box interattivo è stato aggiornato. Nuove funzionalità sono state aggiunte"). A further message could be displayed briefly describing what functionalities were added to the receiver. This message is up to the manufacturer and is intended for informing the user on what features were added on the receiver. This additional message is not mandatory, but it is strongly recommended. This message will even contain the manufacturer's call centre telephone number (if any) or, at least, a web site where finding the description of such new functionalities.
8. If new software is found and installed the message described above should be displayed and the automatic channel list updating procedure should be skipped. It is absolutely mandatory that the message described above is seen by the viewer.
9. The message will stay on the screen until the viewer presses the OK key.
10. It is strongly recommended that, within the receiver menu, a section is provided for describing the new features of the last downloaded software.

| N. | Settings / Italian Translation | Mandatory default settings |
|---|---|---|
| 1 | "Automatic software upgrade in stand by" / "Aggiornamento automatico del software con Televisore in standby". | YES / SI |
| 2 | "Automatic software upgrade in operate mode" / "Aggiornamento automatico del software con Televisore acceso". | YES / SI (if available) |
| 3 | "Time" / "Ora" | **04:00** AM |
| 4 | "Frequency" / "Frequenza" | "Daily" / "Quotidiana" = default ("Weekly" / "Settimanale" – other option possible) |

Table 34: Default settings for auto software upgrade

### 8.6.2. *Over The Air Software Update*

The manufacturers shall implement the DVB System Software Update (DVB-SSU) as defined in [24], using the Simple Profile of DVB Data Downloading as defined in [23]. The receiver shall be able to find out its own DVB-SSU files without relying on the relevant linkage_descriptor in NIT or BAT.

In order to optimize overall system resources against a multitude of different receivers, support of DVB-SSU Enhanced Profile, based on UNT (Update Notification Table), is recommended.

Manufacturers shall provide appropriate recovery measures to cope with possible receiver failure or hang-up during the OTA update.

### 8.6.2.1. Recommendations for SSU operation

The receiver shall be able to acquire a software update with a minimum speed of 64 kbit/s, in marginal reception conditions. Software update speed will not exceed 512kbit/s.

*For this reason it's highly recommended to keep OTA update size as little as possible. That's particularly true for those receivers based on HD chipsets which rely upon programmable digital signal processing architectures for audio and/or video decoding. The nice feature of possibly fixing/upgrading audio/video codecs even in the field they allow should be rarely used. It's then strongly recommended to organize receiver's software in such a manner that an OTA update can include or not audio/video decoding firmware.*

# 9.  Smart cards and Security

## 9.1. Smart Cards

Smart cards may be used both for CA and non-CA applications (T-government, T-banking, loyalty cards, …).

### 9.1.1.  Conditional Access

Pay TV services or other services with controlled/conditional access are an integral part of the Italian DTTV platform.

No single Conditional Access system has been originally selected by the DGTVi, and it is not expected that all network operators/broadcasters present in Italy will agree on a single system. It is even disputable, for anti-piracy and management reasons, that a single system should indeed be used.

Under this respect, DGTVi, together with CA providers already active on the Italian Market, has developed a policy which ensures the coexistence of more CA systems while maintaining and even improving the security of the receiver as a whole.

Based on both CA providers and manufactures willingness, the CA system(s) adopted by one or more specific operator(s) could be either embedded in the receiver or implemented in a Conditional Access Module (CAM) plugged in a Common Interface (CI) slot.

In this latter case, if a CAM is provided with the digital receiver (e.g. in case of iDTV), the CAM provider and the digital receiver provider guarantee the coexistence of more CA systems in the same manner as embedded CA system(s). The CAM provider and the iDTV vendor guarantee the same security level as for CAS embedded.

### 9.1.2.  Embedded CA(s)

In this case at least one smart card interface conforming to the ISO 7816 standard, levels 1 to 3 (with T=0 and T=1), shall be available.

To improve interoperability and interactions of applications with embedded CA(s), DGTVi has specified a set of CA API Extensions for MHP which are already widely implemented on receivers deployed in Italy. These extensions have been submitted to DVB which on their basis have developed the "Content Purchasing API" MHP extension [40]. Such extension is a backward compatible superset of the original DGTVi specification. DGTVi provides the specification for free to any interested party.

### 9.1.3.  Common Interface

If the receiver implements the Common Interface Version 1 (CIv1) then it shall respect in full EN 50221, the extensions defined in TS 101 699 and the implementation guidelines.

*For HD Pay TV services support of the CIv1 extensions [37] specified by the CI+ Forum is mandatory except for the CI+ Browser which is not required.*

Even though in this document CI is introduced in the context of Conditional Access services, it is duly recognized that CI has been conceived to host also other kinds of expansion modules (e.g. modules providing visual aids to deaf people).

### 9.1.3.1. Physical presentation of the smart card to the reader

The Common Interface Connector and the Module should be implemented in such a way that the smart card shall be inserted with the contact area facing upwards when horizontal. For other implementations manufacturers are invited to check with the DGTVi to ascertain how DGTVi members intend to implement their modules.

### 9.1.3.2. CIv1 host requirements

The following requirements on the CI Host (receiver) features define the DGTVi CIv1 profile , i.e. the minimum common host platform functionality set required by DGTVi:

- The host supports the High Level MMI Interface as specified in [15]

- The host, in the main menu, includes a CAM defined Menu tree.

- The host supports MMI Pop-ups.

- The following requirements apply to MMI pop-ups and CAM menus:
    - at least 5 lines shall be displayed simultaneously
    - in case of pop-ups/menus composed by more than 5 lines the display shall support scrolling.
    - at least 50 characters shall be displayed for each line
- MMI pop-ups shall have control of the Remote Control keys selected by the user until he/she exits the MMI itself.

- RC key supported by the MMI shall be:
    - Numeric keys
    - UP, DOWN, LEFT, RIGHT arrow keys
    - OK key
    - Back/Exit key(s)
- In case a System RC Key (P+, P-, Menu, List, …) is selected by the customer while a pop-up message is displayed, the host shall close the popup and perform the related system action.

- Should the CA(s) associated to the tuned service be supported both at host (embedded) and CAM level, the former shall have the priority as active (descrambling) device.

- During the Channel scanning procedure all the channels found shall be stored by the device independently from the channel scrambling status.

- The host remains on the last tuned frequency after entering in the main menu

- MMI pop-up shall have higher video priority over downloaded MHP applications

- MMI pop-up owns the control of the remote control keys

- Parental Control PIN request message by the host shall precede any possible MMI PIN request by the CAM

To cope with possible CAM malfunctioning without requiring extreme measures by customers, like CAM extraction/insertion and/or iDTV power unplug/plug cycles, the interface shall be powered down when the host is put in stand-by mode by the customer, either via remote control or via some button (if any) on the host itself.

It should be noted that some broadcasters might want to make use of the optional Authentication feature of this standard (see Annex B.1 of the standard). Manufacturers are invited to consult with the broadcasters prior to claiming compatibility with services conditionally accessed through a Common Interface compatible module.

Some recurrent CIv1 interoperability issues are reported in Annex [G.1].

### 9.1.3.3. CI+ host requirements

*For HD Pay TV services support of the CIv1 security extensions [37] specified by the CI+ Forum is MANDATORY.*

*Aforementioned CA API extensions SHALL also be supported in the context of CI+. Mapping of such API on CI+ is specified in [37] Annex M.*

*In order to avoid CI+ CAM authentication would fail because of lack of signal, user experience during iDTV first installation and CI+ CAM authentication procedure SHOULD be as follows:*

1. *User starts first installation using iDTV menu with CI+ CAM inserted (no signal available)*
2. *CI+ CAM asks iDTV to authenticate itself without displaying any message (in background)*
3. *As soon as first installation finishes, iDTV sends to CI+ CAM a RESET command*
4. *CI+ CAM restarts authentication on iDTV, but now all the signals are available and CI+ CAM is ready to be used*

*To avoid iDTV first installation would fail because a CI+ CAM is inserted, iDTV SHALL ignore any MMI message coming from the CAM during first installation process.*

*Any CAM request, through the DVB Host Control resource, of tuning the service with dvb://0.x.y locator SHALL be ignored.*[16]

*When communication between the host and the CI+ CAM has been lost (e.g. because CI+ CAM has been factory reset through its own menu) in order to properly restart communication iDTV SHALL reset the CI+ CAM.*

### 9.1.3.4. MMI-MHP interaction

*When a scrambled service is tuned the following scenarios can be envisaged:*
1. *no CICAM inserted: embedded GUI takes control, MHP application is (likely) never started*

2. *CICAM inserted but no CI SAS resource available (i.e. no CA API support at all): MMI takes control. MHP application is started only if/after the service is descrambled (because proper rights are already on the inserted card or because the event has been bought through MMI)*

3. *CICAM inserted and CI SAS resource available (i.e. CA API support could be available):*

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[16] This requirement is meant to avoid propagation of a CANAL+ OTA exception to general CI+ case

a. *if the service is descrambled (because proper rights are already on the inserted card) then everything will go on like above in case 2). If CA API are implemented on the host side and they are also supported by the CICAM, MHP application(s) associated to service can use them (e.g. to check some information on smart card).*

b. *if the service is not descrambled for whatever reason (card not/wrongly inserted, lack of proper rights, ...) and if the application embedded in the CICAM for the CA system used on the tuned service has been written to use MMI, then everything will go on like above in case 2).*

c. *if the service is not descrambled for whatever reason (card not/wrongly inserted, lack of proper rights, ...) and if the application embedded in the CICAM for the CA system used on the tuned service has been written to use CA API, then MHP application is started. If a CA API session is not successfully opened within x seconds (e.g. 10s), MMI will take control, MHP application will be paused and things will go on again as in case 2).*

### 9.1.4. Non-CA Services

For smart card based non-CA services (T-government, T-banking, loyalty cards, …), the SATSA standard API [34]) introduced in MHP 1.1.2 [25] is required. In particular

- STB receivers are required implementing SATSA
- iDTV receivers are recommended implementing SATSA.

As an early adopter of this specification, DGTVi spotted 2 issues within it:

1. SATSA doesn't provide any means to handle smart card events (card in/out, card upside-down)
2. Even though SATSA would have no fundamental problem playing with non-Java cards and Java cards without an Application ID, like a lot of cards used in Italy are (e.g. national/regional government service cards), it would actually raise an exception and stop working in presence of them

DGTVi fixed these 2 issues with 2 addenda which can be respectively found in Annexes H and I. These fixes were submitted to DVB and they were incorporated in MHP release 1.1.2.

Since MHP 1.1.3 [25] a cleaner fix for issue 1) has been provided by DVB through the new `org.dvb.smartcard` package.

Implementation of either such package or the above addenda in a receiver deeming compliance with smart card based non-CA services is required.

Obviously, smart card based non-CA services require a smart card reader which can come in any of the following receiver configurations:

A/ One (or more) smart card interface(s) conforming to the ISO 7816 standard, levels 1 to 3 (with T=0 and T=1).
B/ A Common Interface slot populated with a smart card reader module (on iDTVs only).

In case A/, switching between service card and conditional access card shall not require re-booting of the receiver or a multi-menu navigation (auto detection and activation of the required protocol is the recommended procedure).
In case B/, the smart card reader shall be provided as a default

## 9.2. MHP Security

a. The receiver shall implement the MHP security framework as described in Section 12 of the MHP specification [25].

b. The default setting of the receiver shall be MHP Security "ON" (see below).

    c. Performance degradation for signed applications when security is ON shall be minimal.

The recommended procedure for the attribution of (application) signing keys for Italy is to be set out in a specific document.

### 9.2.1. MHP Security Framework Issues

Many receivers of the first (2004) generation took too long to authenticate signed application in the secure mode. Therefore at that time, manufacturers and broadcasters have been constrained to incorrectly implement and use the MHP Security Framework (MSF).

In many cases, access to restricted resources such as the return path is granted to unsigned applications. In a way, the MHP Security Framework has been put in an "OFF" mode. This creates a risk for the end user (e.g. abuse, not necessarily voluntary, by "rogue" applications).

*That applies in particular to applications downloaded over the return channel, as it could be the case with MHP 1.1.3. For this reason, a receiver shall accept applications from the return channel only over secure (HTTPS) connections with server authentication.*

Implementation of the MHP Security Framework is required, as it is mandatory per the MHP specification. The Security Framework shall be maintained for the extended APIs used in the Italian profile (e.g. non-CA Smart Card API, see [25] Annex AI).

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# 10. Accessories and Setup

Receivers must be both easy to install and use. An existing viewer of analogue services needs to be able to complete a basic digital installation, i.e. just for viewing, using only what has been supplied with the receiver. In addition, on-screen information must be provided in a clear and consistent manner both to aid installation and (if required) to enable an easy dialogue with any support staff, e.g. call-centre

## 10.1. Receiver Accessories

The manual should contain at least the following information:
1. Advice on the verification and eventual adaptation of reception equipment
2. The modes of connection of other peripheral appliances (TV, VCR, DVD, other STB)
3. Mode of connection to the broadband network
4. Set up and tuning of the receiver
5. Description of the functions of the remote control keys
6. Options and accessories (e.g. Infra-red Keyboard, etc…)
7. Troubleshooting
8. Information on a call centre number to resolve connection problems.

| Accessory | Presence |
|---|---|
| 1 Power Cable | Mandatory |
| 1 RF Cable (Male / Female) | Recommended for STBs without analogue tuner. Not applicable to iDTVs. |
| Handbook in Italian language | Mandatory |

Table 35: Accessories

## 10.2. Power Supply / Voltage

220V AC + 15%; 50 + 2 Hz (Low Voltage recommendation 73/23/CEE e 93/68/CEE. Law n° 971/1977).

## 10.3. Low-power mode

In order for receivers supporting a low-power standby feature, based on mandatory or voluntary EU ecodesign requirements, to meet operators' needs (e.g. rights refresh for Pay TV services, spot software upgrade campaigns), the following recommendations/constraints apply:
1. It SHOULD be possible disabling/enabling low-power standby mode through a dedicated menu option
2. before entering low-power standby mode receivers SHALL perform, if currently enabled, automatic channel list update and software upgrade
3. transition from normal to low-power stand-by mode SHOULD take at least 1 hour
4. low-power standby mode SHOULD NOT last longer than 23 consecutive hours before normal stand-by is entered; after house keeping (point 2) is performed and proper transition time waited (point 3), low-power standby mode will be entered again.

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# 11. Default settings

The following is a list of the overall default settings of the receiver. These requirements are intended to provide to all receivers on the market a very similar behaviour when they are installed or restored to factory defaults.

Those strictly related to broadcasters' services and applications (Application Autostart, Parental Control, Automatic OTA Update, Automatic Channel Update, LCN) shall be compliant with the table below. The rest should be considered by manufacturers just as a suggestion.

| Feature | Specification | Status | Note |
|---|---|---|---|
| **Auto-start Application** | Default option (if any) should be "YES" | Mandatory | When application autostart is ON, progress loading bars or other icons SHALL NOT be displayed while applications are being loaded or started. *This provision doesn't apply to applications signalled in AIT file.* Such icons SHALL instead be displayed in case application autostart has been switched OFF by the customer. |
| **Present and Next banner** | | | |
| • Duration | Less or equal to 4 sec. | Mandatory | |
| • Current Time | Active | Optional | |
| • Channel number | Active | Mandatory | |
| • Service name | Active | Mandatory | Long "channel name" label |
| • Volume indicator | Active | Optional | If the receiver allows to locally control volume, the volume bar shall be present |
| **Country** | As per after the first installation | Mandatory | After first installation the default country shall be Italy |
| **Language options** | | | |
| • Language | As per after the first installation | Mandatory | After first installation the default language shall be Italian |
| • Primary Audio | As per after the first installation | Mandatory | |
| • Subtitles | Not Active | Mandatory | |
| • Primary Subtitles language | As per after the  first installation | Mandatory | |
| **Automatic Channel Numbering** | Active | Mandatory | This is a toggle active/inactive |

| Feature | Specification | Status | Note |
|---|---|---|---|
| **TV settings** | | | |
| •   Screen Format | 16:9 | Mandatory | |
| •   HDMI output format | As per after the first installation | Mandatory | |
| •   TV SCART output | RGB | Mandatory | |
| •   VCR SCART output | CVBS | Mandatory | when available |
| •   3D Display | Y/N | Mandatory | Information gathered from HDMI VSDB overrides any manual setting |
| **Parental Control settings** | | | |
| PIN protected events | PIN shall be asked for any event with rating value equal or greater than 18 years in Parental_rating_descriptor | Mandatory | |
| **Automatic software upgrade** | | | |
| In Stand by mode | Active* | Mandatory | |
| In Operate mode | Active* | Optional | |
| Time | 4:00 am | Mandatory | |
| Repetition | Daily | Mandatory | |
| **Automatic channel list update** | | | |
| ..in Stand by mode | Active | Recommended | |
| ..in Operate mode | Not Active | Optional | |
| Time | 4:30 am | Mandatory | |
| Repetition | Daily | Mandatory | |

Table 36: Default settings summary table

* The automatic software upgrade shall be ON to avoid users missing the necessary upgrades. However, if an automatic upgrade feature is present, this must be clearly indicated to the user so that, at set up, he/she may choose to deactivate it. In that case, the information on availability of new software for the receiver shall be presented to the user.

# Annexes

# A DVB-T2 Performance Tables[17]

## A.1 FEF and Auxiliary streams

To test that FEFs do not cause malfunctions the following T2+FEF test signal shall be generated and input to the receiver, with FEF power same as T2 signal and no added noise. The receiver should be able to receive this signal with no errors in the displayed video for PLP#0.

| Property | Value |
|---|---|
| **Overall** | |
| FFTSIZE | 32k |
| GI | 1/16 |
| Lf | 62 |
| SISO/MISO | SISO |
| PAPR | TR-PAPR |
| Frames per superframe ($N_{T2}$) | 6 |
| Bandwidth | 8MHz |
| Extended Bandwidth Mode | Yes |
| Pilot Pattern | PP4 |
| L1 Modulation | 64QAM |
| FEF Type | 0 |
| FEF Length (samples) | 588000 |
| FEF Interval | 6 |
| FEF P1: S1 Value | 2 |
| FEF P1: S2 Value | 1 |
| L1 Repetition | 0 |
| **PLP #0** | |
| Type | 1 |
| Modulation | 256QAM |
| Rate | 3/5 |
| FEC Type | 64800 |
| Rotated QAM | Yes |
| FEC blocks per interleaving frame | 200 |
| TI blocks per frame (N_TI) | 3 |
| T2 frames per Interleaving Frame (P_I) | 1 |
| Frame Interval (I_JUMP) | 1 |
| Type of time-interleaving | 0 |
| Time Interleaving length | 3 |

Table 37: FEF test signal

To test that the presence of Auxiliary streams does not cause malfunctions the following test signal shall be generated and input to the receiver, with no added noise. The receiver, with Auxiliary streams enabled, should be able to receive this signal with no errors in the displayed video for PLP#0.

---

[17] All data specified in this Annex are preliminary because DVB-T2 experience in real operations is very limited, especially in case of SFN

| Property | Value |
|---|---|
| *Overall* | |
| FFTSIZE | 32k |
| GI | 1/16 |
| Lf | 62 |
| SISO/MISO | SISO |
| PAPR | TR-PAPR |
| Frames per superframe ($N_{T2}$) | 6 |
| Bandwidth | 8MHz |
| Extended Bandwidth Mode | Yes |
| Pilot Pattern | PP4 |
| L1 Modulation | 64QAM |
| FEFs | Not used |
| L1 Repetition | 0 |
| *PLP #0* | |
| Type | 1 |
| Modulation | 256QAM |
| Rate | 3/5 |
| FEC Type | 64800 |
| Rotated QAM | Yes |
| FEC blocks per interleaving frame | 200 |
| TI blocks per frame (N_TI) | 3 |
| T2 frames per Interleaving Frame (P_I) | 1 |
| Frame Interval (I_JUMP) | 1 |
| Type of time-interleaving | 0 |
| Time Interleaving length | 3 |

Table 38: Auxiliary streams test signal

## A.2  C/N Performance

Values in the following Table are derived from implementation guidelines [48] and take into account: power loss due to pilot boosting, real channel estimation and variable implementation margin (0.2-0.8 dB for QPSK, 0.3-1.0 dB for 16QAM, 0.7-2.9 dB for 64QAM, 1.7-5.0 for 256QAM).

| Modulation | Code rate | C/N performance (dB) | | | |
|---|---|---|---|---|---|
| | | *Profile 1: Gaussian Channel (AWGN)* | *Profile 2: Ricean Channel (F1)* | *Profile 3: Rayleigh Channel (P1)* | *Profile 4: 0 dB echo channel @ 90% GI* |
| QPSK | 1/2 | 1,7 | 2,1 | 3,2 | 4,1 |
| QPSK | 3/5 | 3,0 | 3,4 | 4,8 | 5,6 |
| QPSK | 2/3 | 3,8 | 4,3 | 6,1 | 6,9 |
| QPSK | 3/4 | 4,8 | 5,3 | 7,4 | 8,1 |
| QPSK | 4/5 | 5,4 | 6,0 | 8,4 | 9,1 |
| QPSK | 5/6 | 5,9 | 6,5 | 9,2 | 10,0 |
| 16-QAM | 1/2 | 6,8 | 7,2 | 8,9 | 9,8 |
| 16-QAM | 3/5 | 8,4 | 8,8 | 10,7 | 11,6 |
| 16-QAM | 2/3 | 9,7 | 10,1 | 12,2 | 13,0 |
| 16-QAM | 3/4 | 10,8 | 11,4 | 13,8 | 14,7 |
| 16-QAM | 4/5 | 11,6 | 12,2 | 15,1 | 16,1 |
| 16-QAM | 5/6 | 12,2 | 12,8 | 16,0 | 17,1 |
| 64-QAM | 1/2 | 11,3 | 11,8 | 14,0 | 15,1 |
| 64-QAM | 3/5 | 13,4 | 13,9 | 16,1 | 17,2 |
| 64-QAM | 2/3 | 14,9 | 15,4 | 17,7 | 18,8 |
| 64-QAM | 3/4 | 16,5 | 17,0 | 19,8 | 20,9 |

| Modulation | Code rate | C/N performance (dB) | | | |
|---|---|---|---|---|---|
| | | Profile 1: Gaussian Channel (AWGN) | Profile 2: Ricean Channel (F1) | Profile 3: Rayleigh Channel (P1) | Profile 4: 0 dB echo channel @ 90% GI |
| 64-QAM | 4/5 | 17,5 | 18,2 | 21,3 | 22,8 |
| 64-QAM | 5/6 | 18,2 | 18,8 | 22,3 | 25,0 |
| 256-QAM | 1/2 | 15,7 | 16,3 | 18,8 | 20,1 |
| 256-QAM | 3/5 | 18,6 | 19,0 | 21,5 | 22,8 |
| 256-QAM | 2/3 | 20,3 | 20,8 | 23,3 | 24,7 |
| 256-QAM | 3/4 | 22,5 | 23,0 | 25,8 | 27,1 |
| 256-QAM | 4/5 | 23,8 | 24,4 | 27,8 | 30,2 |
| 256-QAM | 5/6 | 24,5 | 25,1 | 29,0 | 32,5 |

Table 39: Example of maximum required C/N for QEF reception at TS output (with 1/8 guard interval, PP2 and FFT size 32K)

Profile 1:    Gaussian noise (N) is applied together with the wanted carrier (C) in a signal bandwidth of a DVB-T2 signal. No echo is applied.

Profile 2:    The Ricean channel is defined according to the following table (derived from Table B.1 of [13]).

Profile 3:    The Rayleigh channel definition is derived from the following table as well by removing path #0 and re-normalising amplitude values.

| # | normalised $\rho_i$ [dB] | $\tau_i(\mu s)$ | $\theta_i(deg)$ |
|---|---|---|---|
| 0 | -0,4 | 0,000 | 0 |
| 1 | -24,0 | 0,074 | 122 |
| 2 | -27,5 | 0,144 | 226 |
| 3 | -36,8 | 0,154 | 63 |
| 4 | -27,5 | 0,194 | 198 |
| 5 | -26,4 | 0,204 | 63 |
| 6 | -21,6 | 0,430 | 340 |
| 7 | -18,8 | 0,519 | 336 |
| 8 | -22,8 | 0,603 | 215 |
| 9 | -24,1 | 0,641 | 191 |
| 10 | -22,6 | 0,849 | 36 |
| 11 | -23,4 | 0,924 | 210 |
| 12 | -35,8 | 1,003 | 278 |
| 13 | -35,2 | 1,017 | 311 |
| 14 | -22,7 | 1,369 | 23 |
| 15 | -29,7 | 1,381 | 162 |
| 16 | -19,0 | 1,936 | 9 |
| 17 | -21,4 | 2,752 | 127 |
| 18 | -20,1 | 3,229 | 175 |
| 19 | -25,7 | 3,325 | 331 |
| 20 | -26,1 | 5,422 | 196 |

Table 40: Ricean channel definition

### A.2.1     SFN Pre-echoes

The receiver SHALL provide the reference BER (QEF) when the DVB-T2 channel contains two (or more) static paths with relative delay from 1 $\mu$s up to 95% of the guard interval length, independently of the relative amplitude and phases of the paths. No noise is added.

### *A.2.2    SFN in presence of echoes outside the guard interval*

Reception in case of two or more SFN static paths inside the guard interval length and in presence of (at least) one SFN static path outside the double of the guard interval length (and in any case at more than 550µs after the first path) SHALL be possible, for example in case of FFT 32k, 256QAM, CR 2/3, Tg=224µs, with a C/I value of 22 dB. No noise is added.

A possible test set-up for these scenarios is the following:

| Path (tap) | Delay (µs) | Relative attenuation (dB) |
|---|---|---|
| 1 (useful) | 0 | 6 |
| 2 (useful) | 50 | 0 (reference -60 dBm) |
| 3 (useful) | 180 | 10 |
| 4 (interference) | 590 | 22 |

Table 41: Test set-up for pre-echoes and echoes outside the guard interval

# B Remote control

## B.1 The need for specifications

Source :　　ETSI TR 102 308 V1.1.1 (2004-02) *Technical Report*
**User Group;**
**User interoperability criteria**

- ● Specific recommendations for interoperability improvement

Specific claims for interoperability improvement have been identified in the following areas. Any progress on these issues is expected to improve the user confidence in standardization to ensure interoperability. Such examples can be taken as first implementation areas of the generic recommendations given in clause 6. These specific recommendations provided by particular users are generally supported by the vast majority of them but some of them have slightly different views on some particular ones (e.g. T2, T3, A3, HI).

- • Terminals

**Rec#T1 Keyboard layout:** The current terminals have different keyboard layout hence hindering easy use and service access. A standardized layout (same or "subset-compatible") should be used for the same service when applicable, particularly for "special" characters, like '+', '*', '#', etc.

Tactile screens making feasible a customized keyboard layout could help to fulfil this requirement (VHE principle).

When applicable, the pips for blind people should always be on the right places (e.g. number 5).

UNICODE and ES 202 130 [26] should be used as far as possible to cope with the character sets of the various languages.

## B.2 Keys and Key Events

### B.2.1　The MHP minimum specification

| Input event |
| --- |
| |
| VK_0 to VK_9 |
| VK_UP |
| VK_DOWN |
| VK_LEFT |
| VK_RIGHT |
| VK_ENTER |
| VK_TELETEXT |
| VK_COLORED_KEY_0 |
| VK_COLORED_KEY_1 |
| VK_COLORED_KEY_2 |
| VK_COLORED_KEY_3 |

Table 42: Minimum set of input events (G3)

NOTE 1: They are not guaranteed to be available to any one MHP application because another application running at the same time may have one of these events exclusively reserved. The application with focus (if any) always receives all of these events unless another application within the same Service has requested and been granted exclusive access to one or more events. The process for event distribution for DVB-J applications is described in more detail in annex J, "(normative): DVB-J event API" on page 367.

NOTE 2:   The user input device for an MHP terminal may support more events than this however this is implementation dependent. If more events than this are supported, it is equally implementation dependent whether the additional events are sent to MHP applications or sent to the MHP navigator. Events which are always sent to the MHP navigator may not be visible at all to MHP applications. For example, an MHP receiver using a conventional remote control will probably have program up/program down keys which are only ever sent to the navigator and cause service selection when received there.

NOTES included in ETSI 101 802

## B.2.2    E-Book ver. 1

IEC 62216-1: "Digital terrestrial television receivers for the DVB-T system – Part 1: Baseline receiver specification" (E-Book, v.1)

**Remote controllable functions**
Description of the minimal functions of the remote control

| Function | Comment |
|---|---|
|  |  |
| power on/stand-by |  |
| digital keys : 0,1, …, 9 |  |
| Menu |  |
| up, down, right, left arrows | display the television function menu |
| Validation | validation of the choice |
| Back | one level back in menu |
| quit, escape | exit from the menu |
| Guide | access to the EPG |
| Information | display the current program information |

Table 43: E-Book v.1.9

NB: This specification is no longer present in the E-Book v.1.9 or in the German specification D-Book minimum requirements.

## B.2.3    DTG UK
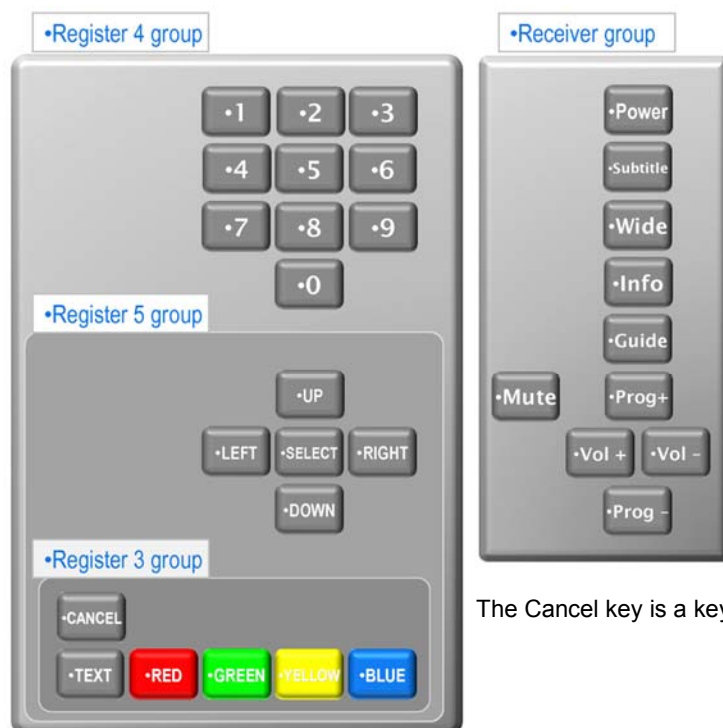


The Cancel key is a key available to applications (programmable)

Figure 8: Remote Control Function Group

## B.2.4    The CEI Specification

| Caratteristiche | Specifica tecnica (minima) | |
|---|---|---|
| Spaziatura e dislocazione tasti | Tasti critici distanziati | |
| Tasti colore e sequenza | 4 colori, conforme alle specifiche DVB, con l'ordine: rosso, verde, giallo e blu. | |
| Scrittura di testi alfanumerici tipo GSM | Utilizzo dei tasti alfanumerici da 0 a 9 (tipo cellulare) | |
| Tasti previsti anche dalla TV analogica | Tasti 'Programma +', 'Programma –' | |
| | Tasti 'Volume +', 'Volume –', 'Mute' | |
| | Tasto 'AV' (per input da SCART) | |
| | Tasto 'Set-Up' | |
| Tasti aggiuntivi | Tasto 'Info' | Attiva il navigatore |
| | Tasto 'iTv' o 'Interactive' | Attiva la lista dei servizi disponibili |
| | Tasti freccia | Pagina precedente/successiva e navigazione all'interno di programmi/servizi |
| | Tasto 'OK' | Lancio/conferma selezioni e impostazioni |
| | Tasto 'Exit' | Interruzione/uscita da selezione attiva |
| | Tasti colore | Scelta delle funzionalità disponibili all'interno dei programmi/servizi del broadcaster |
| | Tasto 'text' | Visualizzazione teletext qualora la decodifica dello stesso avvenga nel ricevitore. |

Table 44: CEI Specification; CT 100, Progetto di Guida

### B.2.5    The NorDig Unified Specification

#### B.2.5.1        The Remote Control and Remote Keyboard

Basic TV Function

The NorDig IRD's remote control should include the following keys for basic TV functionality. If present, they shall have the following functionality:

- Power on/off – turns the IRD on and off
- Programme up/down – function to switch between programmes
- Volume up/down – function to adjust the volume output level
- TV – function that puts the IRD directly into conventional television state, i.e. only audio, video and subtitling
    16.2.3 Digital TV Functions

The NorDig IRD's remote control shall include the following keys for digital TV functions:

- A navigation or pointing system for navigation on the OSD
- OK – a function that selects or confirms current choice or statement
- Multifunctional keys – four colour-coded keys for non-dedicated functions. The colours shall (1) be red, green, yellow and blue
- Back –This function exits from the current menu or "page" and returns to the previous state. (1)
- Text –This function displays the teletext as defined in section 14.1 or a Digital Super Teletext if present. (1)

| Note 1: Optional for NorDig I |
| --- |

In addition the NorDig IRD remote control should include the following keys for digital TV functions:

- Navigator – this function starts the "Navigator", as specified in chapter 13.
- Application – this function signals to the application that the user wants to interact with the default application that is connected to the current event.
- EPG/Guide – this function displays an Electronic Programme Guide.

Table 45: The NorDig Unified Specification; B.2.5.



Figure 9: Conceptual illustration of the NorDig IRD remote control (16,1)

| Key | KeyEvent |
|-----|----------|
|  |  |
| 0-9 | VK_0 to VK_9 |
| UP | VK_UP |
| DOWN | VK_DOWN |
| LEFT | VK_LEFT |
| RIGHT | VK_RIGHT |
| OK | VK_ENTER |
| TEXT | VK _TELETEXT |
| BACK | VK_F9 |
| EPG | VK_GUIDE |
| APPLICATION | VK_F1 |
| RED | VK_COLORED_KEY_0 |
| GREEN | VK_COLORED_KEY_1 |
| YELLOW | VK_COLORED_KEY_2 |
| BLUE | VK_COLORED_KEY_3 |

Table 46: The NorDig IRD Key Events table (par 16,2,5: Mapping of Key Events)

## B.3　Summary of proposals for Undo/Exit keys

| Source | Proposal |
|--------|----------|
| e-Book v.1 | • « back » key, with hard wired function [one level back in the menu]<br>• « quit » or « escape » key with hard wired function [exit from the menu] |
| e-Book v. 2 (draft) | • Nothing specified |
| German DVB-T « Wünschliste » | • Nothing specified |
| D-Book (UK) | • « Cancel » key available to application developer |
| CEI CT100 | • « exit » with hardwired function: [interruption of active selection] or [exit from active selection] |
| NorDig Unified | • « TV » key hardwired [conventional TV state, i.e. video audio and sub-titles]<br>• « back » available to applications [return to the previous state] |

## B.4　Easy TV

### B.4.1　Easy-TV: a research by the ITC, Methodology

**Extensive quantitative research** over 1333 people aged between 13 and 94 years (mean age = 53 years; S.D. = 19.07; 30 cases with exact age data missing). A **questionnaire of 118 items** was submitted to these people in order to identify and quantify clusters of users and attitude toward technology.

**Practical trial** over 40 people recruited according to the clusters emerged from first phase analysis. The method chosen was **paired comparison**.

**In depth interviews** completed the research and collected verbalizations of trial participants. The method chosen was **focus group**.

### B.4.2      Easy-TV: Most common issues with the remote control

**First,** the remote control can be difficult to handle if the keys are:
- too small,
- wrongly shaped,
- narrowly spaced,
- poorly located,
- hard to see against the background, especially in terms of colour and contrast.

**Second**, it can be difficult to find the right key to press due to:
- excessive number of keys,
- the labelling rubbing off,
- inconsistent use of terminology,
- confusing symbols,
- the need for complex sequences of key presses for simple functions.

# C Additional optional feature for mobile interaction channel

| Feature | Specification | Comment |
|---|---|---|
| Multi Application Access | Contemporaneous access to the network of multiple applications | |
| Advanced Messaging | SMS<br>MMS of Video Rich Class with file size > 30 kB<br>Wireless Village Instant Messaging Client<br>POP3 and IMAP4 Compatible Mail Client | |
| OTA addressability | WAP Push | Can also be used for fully automatic configuration. See Annex |
| SIM Application Toolkit | Full support, including Bearer Independent Protocol (optional "class e" in the specification) | |
| J2ME | Support of MIDP 2.0 applications<br>Support of Socket http, https and autostart of Midlets | |
| SIM-J2ME Dialogue | Through APDU | Cf. JSR 177 [34] |
| Micro Browser | WAP 2.0, or<br>http | |
| Multimedia Object Download | | For applications, games, images, video |
| DRM Agent | Following OMA specification, with handling of the following protected objects<br>Forward Lock<br>Combined Delivery<br>Separate Delivery | |
| Video Player | 3 GPP encoded content<br>MPEG4-10 encoded content | |
| Memory Card Slot | Secure Digital Multimedia Memory Card (SD/MMC) | To exchange data with radio mobile terminals |

Table 47: Optional features for mobile interaction channel

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# D GPRS Interaction Channel: Local Configuration procedures

## D.1 Basic conditions to fulfil

- The solution must open, i.e.
- shall not be proprietary to a specific phone operator or a specific broadcaster
- shall not prevent a user from changing phone operator or broadcast platform
- must be independent of the broadcast platform (satellite or terrestrial)
- Manufacturers will look at compatibility with the operational rules based on GSM/GPRS ETSI/3GPP specs, of all (European)
- Mobile phone operators
- Broadcast network operator/platforms
- The same approach should be applied to STB with EDGE or UMTS return channel, when available.
- Closed platform operators (e.g. pay TV) will want to be able to choose/install only their specific phone operator.

## D.2 The configuration data18

- Messaging service center
- To send SMS, as a mobile number, e.g. « +39 335 960 9600 »
- Short number
- To send messages to service center, e.g. « 44123  »
- Configuration string
- Alphanumerical, e.g. « AT+cgdcont=1,"IP","APN","0.0.0.0",0,0; »
- Dial up
- GPRS number, e.g. « *99# or *99***CID# »
- APN
- Alpha, e.g. « dvb.tim.it»
- Phone N° of SIM card
- Normally same as below
- Log on
- Usually phone n° of SIM card  ([19])
- Password
- 6 to 8 n°, user specific  ([20])

## D.3 Configuration Procedures

- 3 possible procedures have been identified:
- Manual Configuration by Menu
- User enters all necessary data
- Mobile over the air (OTA) assisted configuration
- User only enters the (short) numbers for the messaging center and the service center

---

[18] These are the field the the customer has to fill in. In any case all the GPRS fields considered in the 3GPP specs shall be available to the embedded radio system
[19] this field could be also set to " void "
[20] this field could be also set to " void "

- Broadcast assisted configuration through an MHP application
- User selects the mobile link provider from a menu.
- In the following diagrams, fields in ⬜ have to be filled in by User, fields in ⬜ are auto-filled.
- User will also need a feed-back on signal strength to identify connection issues.

## D.4  Configuration by menu

- Minimum necessary for an open system
- Need some form of virtual keyboard, or advanced remote control, for alpha numericals
- Data insertion is error prone
- Access to this menu must be lockable for e.g. pay-tv platform operators
- Extra data needed for EDGE and UMTS

| GPRS configuration menu |
|---|
| STB phone n°:………………… |
| Messaging center:……………… |
| Service center:…………………… |
| Configuration:…………………….. |
| Dial up:…………………………… |
| APN:…………………………….. |
| Logon:…………………………… |
| Password:……………………….. |
| Signal strength ▉▉▉ |

Figure 10: Typical manual configuration menu

## D.5  OTA Assisted configuration

OTA refers to OTA capability via the GSM/GPRS link

- Requires OTA capability by the STB, which is not available on all GSM/GPRS implementations
- Might limit the number of chip makers able to provide one chip STB with integrated GPRS functionality
- All (European) phone operators use the same standard (3GPP/OMA) for OTA procedures

| GPRS configuration menu |
|---|
| STB phone n°:………………….. |
| Messaging center:……………. |
| Service center:…………………. |
| Configuration:…………………….. |
| Dial up:……………………………. |
| APN:………………………………. |
| Logon:…………………………….. |
| Password:………………………… |
| Signal strength |
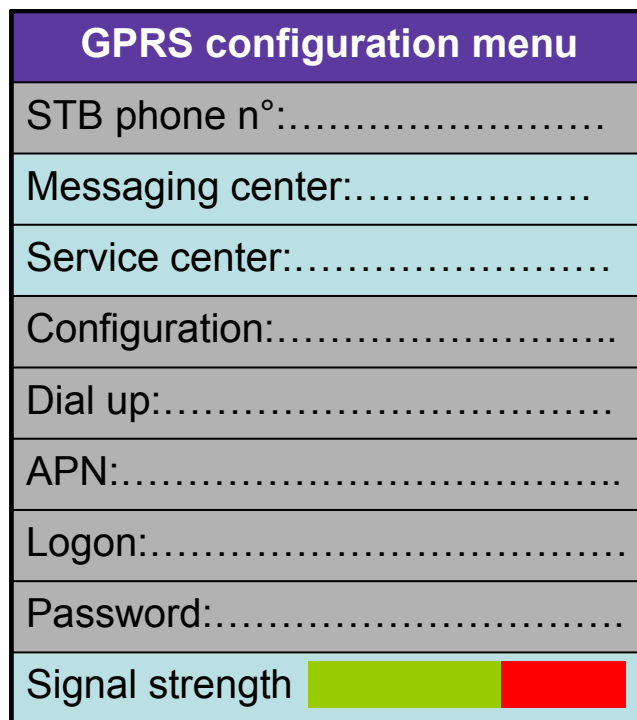
Figure 11: Typical OTA Configuration Menu

## D.6 OTA Configuration Flow

**SERVICE CENTER**

- Returns a SMS with operator specific configuration data. (5)
- Acknowledges the test connection (10)

**USER**

- User Inserts a) N° of messaging service center; b) Short n° of service center (3)
- Confirms acceptance of data. Chooses Pass Word if needed (7)

**RECEIVER**

- Insert SIM card (1)
- Connection Set-up Menu (autolaunch on insertion of new SIM card ?) (2)
- Sends a SMS to short number, requesting configure-tion data (4)
- Acquires the configuration data via an OTA procedure (6)
- Transfers data GRPS configuration (8)
- Initiates a test connection. (9)

## D.7 MHP Automatic Configuration

- Configuration is MHP application driven
- MHP engine and the SIM must be able to communicate
- Data for mobile operators offering STB service must be on air
- Application and data must be accessible for all STB receiving at least one digital mux
- Application and data must be very low bit rate (cost issue)

| GPRS configuration menu |
|---|
| STB phone n°:…………………… |
| Select operator: |
| Messaging center:…. |
| Service center:……… |
| Configuration:……………………. |
| Dial up:………………………… |
| APN:………………………………. |
| Logon:………………………… |
| Password:…………………… |
| Signal strength |

1 – TIM
2 – Wind
3 – Voda
4 – 3

Figure 12: Typical Automatic Configuration Menu

## D.8  MHP Configuration Flow

| STB | USER | SERVICE CENTER |
|---|---|---|
| Insertion of the SIM (1) | | |
| Acquires GPRS configuration application from DVB-T stream. (2) | | |
| | Calls the GPRS configuration menu. (3) | |
| Displays menu with a list of names of the mobile phone operator offering the service. (4) | | |
| | Selects his phone network operator from the list (5) | |
| | Inserts data which might not be acquirable automatically: - pass word if required (6) | |
| Extracts selected operator's data from the DVB-T stream (7) | | |
| | OKs the insertion of the data (8) | |
| Initiates a test connection (9) | | |
| | | Acknowledges the test connection (10) |

# E  Text entry sample class

**(the most important items are in bold)**

```
import java.awt.event.*;
import org.dvb.ui.*;
import org.dvb.event.*;
import org.havi.ui.*;
import org.havi.ui.event.*;
import org.davic.resources.*;
import javax.tv.xlet.*;
public class HSinglelineEntryExample implements Xlet, HActionListener, HKeyListener,
UserEventListener, FocusListener,ResourceClient {
public synchronized void initXlet(XletContext context) {
}
public synchronized void pauseXlet() {
}
public synchronized void destroyXlet(boolean flag) {
}
public synchronized void startXlet() {
// .......
textField = new HSinglelineEntry();
textField.addFocusListener(this);
textField.addKeyListener(this);
//.......
repository = new UserEventRepository("Keys");
repository.addKey(KeyEvent.VK_F9);
// .......
addUserEvent();
}
synchronized void addUserEvent() {
if (!eventRegistered) {
System.out.println("Add user event\n");
EventManager.getInstance().addUserEventListener(
this, this, repository);
eventRegistered = true;
}
}
synchronized void removeUserEvent() {
if (eventRegistered) {
System.out.println("Remove user event\n");
EventManager.getInstance().removeUserEventListener(this);
eventRegistered = false;
}
}
public void actionPerformed(ActionEvent e) {
System.out.println("Action performed\n");
// .......
}
public void userEventReceived(UserEvent e) {
if (e.getType() == HRcEvent.KEY_PRESSED) {
```

```
if (e.getCode() == KeyEvent.VK_F9) {
// .......
}
}
}
public void focusGained(FocusEvent e) {
if (e.getSource() == textField) {
System.out.println("Focus gained\n");
removeUserEvent();
}
}
public void focusLost(FocusEvent e) {
if (e.getSource() == textField) {
// The text field lost focus (e.g. UP/DOWN key is pressed
// in the text field)
// Register VK_F9 again.
System.out.println("Focus lost\n");
addUserEvent();
}
}
public void keyPressed(KeyEvent e) {
System.out.println(" --> "+ e.getKeyChar());
if (e.getSource() == textField) {
if (e.getKeyCode() == KeyEvent.VK_F9 &&
textField.getTextContent(0).length() == 0) {
// VK_F9 is pressed when the text field is empty.
// Do the required behavior(pass the focus to parent Component) and add user event again.
textField.getParent().requestFocus();
addUserEvent();
}
}
}
public void keyReleased(KeyEvent e) {
}
public void keyTyped(KeyEvent e) {
}
public void notifyRelease(ResourceProxy proxy) {
}
public void release(ResourceProxy proxy) {
}
public boolean requestRelease(ResourceProxy proxy, Object requestData) {
return false;
}
HSinglelineEntry textField;
UserEventRepository repository;
boolean eventRegistered = false;
}
```

Table 48: Text Entry Sample Class

# F Allocation and usage of SI codes in Italy

## F.1 Allocation of SI codes

As explained the Italian DTT environment is "*multi-network*" and "*multi-operator*". According to DVB  SI Specification EN 300 468) and SI Guidelines (TR 101 211):

- a **network** is a collection of MPEG-2 Transport Stream (TS) multiplexes transmitted on a single delivery system (e.g. all digital channels on a specific cable or **terrestrial** system)
- a **service** is uniquely identified by the following parameters (the DVB locator):
  - o **original_network_id (ON_ID):** unique identifier of a network
  - o **transport_stream_id (TS_ID):** unique identifier of a TS within an original network.
  - o **service_id (S_ID):** unique identifier of a service within a TS

The network_id (N_ID) is not part of this path.

The following figure shows the service delivery model for digital broadcasting:
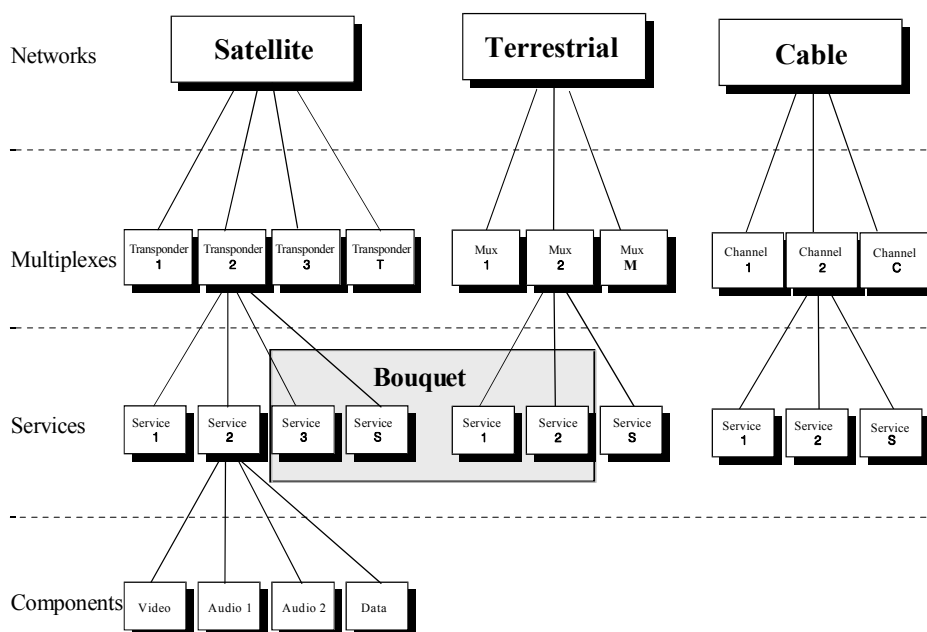


Figure 13: Service delivery model

The unique identification of a service cannot be guaranteed if each operator allocates these codes on arbitrary basis. A policy needs to be defined in order to avoid potential situations of conflict

## F.2 Original_network_id

Allocation of original_network_ids is presently handled by the DVB Project Office, on behalf of the ETSI.

The value of already pre-assigned ON_ID codes for terrestrial services is 0x2000 + 3-digit country code. Then for Italy the original_network_id value that should be allocated is: 0x217C (380dec - 0x17Chex is the country code for Italy).

The registration of this value shall be formally requested, by the competent authority to the DVB Project Office, in order to obtain afterwards the formal registration by ETSI in the Register of Service Information (SI) Codes.

It is recommended that all terrestrial operators in Italy use this value for ON_ID to avoid potential conflicts with other networks in the same area or in neighbouring countries.

Operators that have been allocated, by the DVB, a value for ON_ID and operators with services that originate from a satellite network may keep their allocated ON_ID or the ON_ID used on the satellite network.

# F.3  Transport_stream_id

The ON_ID value is not meant to be used to distinguish multiplexes of different operators.

Therefore, TS_ID and S_ID are the two parameters that are used to distinguish terrestrial multiplexes and services.

The Transport_Stream_ID has 65535 possible values (for each ON_ID): a unique value can be assigned to each and every national, regional or local multiplex. Every network operator shall be granted one or more values, as he requests and depending on the configuration of his network (number of transmitters).

### F.3.1     Recommended allocation of codes

DGTVi recommends the following allocation of codes:

| transport_stream_id | Use |
|---|---|
| 0x0000 | Reserved |
| 0x0001 – 0x03FF | Range usable for national networks (1023 values) |
| 0x0400 – 0x0FFF | Reserved for extension of national codes (3072 values) |
| 0x1000 – 0xB7FF | Range usable for regional/local networks (43008 values) |
| 0x1000 – 0x17FF | Region 1 (Piemonte) – 2048 values |
| 0x1800 – 0x1FFF | Region 2 (Valle d'Aosta) – 2048 values |
| 0x2000 – 0x27FF | Region 3 (Lombardia) – 2048 values |
| 0x2800 – 0x2FFF | Region 4 (Trentino) – 2048 values |
| 0x3000 – 0x37FF | Region 5 (Veneto) – 2048 values |
| 0x3800 – 0x3FFF | Region 6 (Friuli Venezia Giulia) – 2048 values |
| 0x4000 – 0x47FF | Region 7 (Liguria) – 2048 values |
| 0x4800 – 0x4FFF | Region 8 (Emilia Romagna) – 2048 values |
| 0x5000 – 0x57FF | Region 9 (Toscana) – 2048 values |
| 0x5800 – 0x5FFF | Region 10 (Umbria) – 2048 values |
| 0x6000 – 0x67FF | Region 11 (Marche) – 2048 values |
| 0x6800 – 0x6FFF | Region 12 (Lazio) – 2048 values |
| 0x7000 – 0x77FF | Region 13 (Abruzzo) – 2048 values |
| 0x7800 – 0x7FFF | Region 14 (Molise) – 2048 values |
| 0x8000 – 0x87FF | Region 15 (Campania) – 2048 values |

| transport_stream_id | Use |
|---|---|
| 0x8800 – 0x8FFF | Region 16 (Puglia) – 2048 values |
| 0x9000 – 0x97FF | Region 17 (Basilicata) – 2048 values |
| 0x9800 – 0x9FFF | Region 18 (Calabria) – 2048 values |
| 0xA000 – 0xA7FF | Region 19 (Sicilia) – 2048 values |
| 0xA800 – 0xAFFF | Region 20 (Sardegna) – 2048 values |
| 0xB000 – 0xB7FF | Reserved for future use |

Table 49: Allocation of TS_IDs in Italy

### F.3.2    National Codes already in use

Following codes are compatible with the recommended allocation.

| transport_stream_id | Use | Operator |
|---|---|---|
| 0x0001 | In use | Rai |
| 0x0002 | In use | Rai |
| 0x0003 | In use | Rai |
| 0x0004 | In use | Rai |
| 0x0005 | In use | Rai |
| 0x0006 | In use | Rai |
| 0x0009 | In use | Rai |
| 0x0200 | In use | Telecom Italia Media |
| 0x0201 | In use | Telecom Italia Media |
| 0x0202 | In use | Telecom Italia Media |
| 0x0204 | In use | Telecom Italia Media |
| 0x0384 | In use | D-Free |
| 0x0385 | In use | Mediaset |
| 0x0389 | In use | Mediaset |
| 0x03AC | In use | Mediaset |
| 0x03B6 | In use | Mediaset |
| 0x03C0 | In use | Mediaset |

Table 50: National TS_IDs in use

## F.4  Service_id

Because of the uniqueness of TS_ID assigned to every multiplex, the allocation of Service_IDs (65535 possible values) can be left to each multiplex operator. Receivers shall distinguish services with the same service_id (and ON_ID) but different TS_ID.

## F.5  Network_id

The DVB *network_id* is defined by ETSI TR 101 162 [19] which allocates the identifiers on a geographical basis to ensure that no conflict in adjacent network identities occurs in different geographic regions. The allocation is typically referred to as the DVB color map as shown in the following figure.
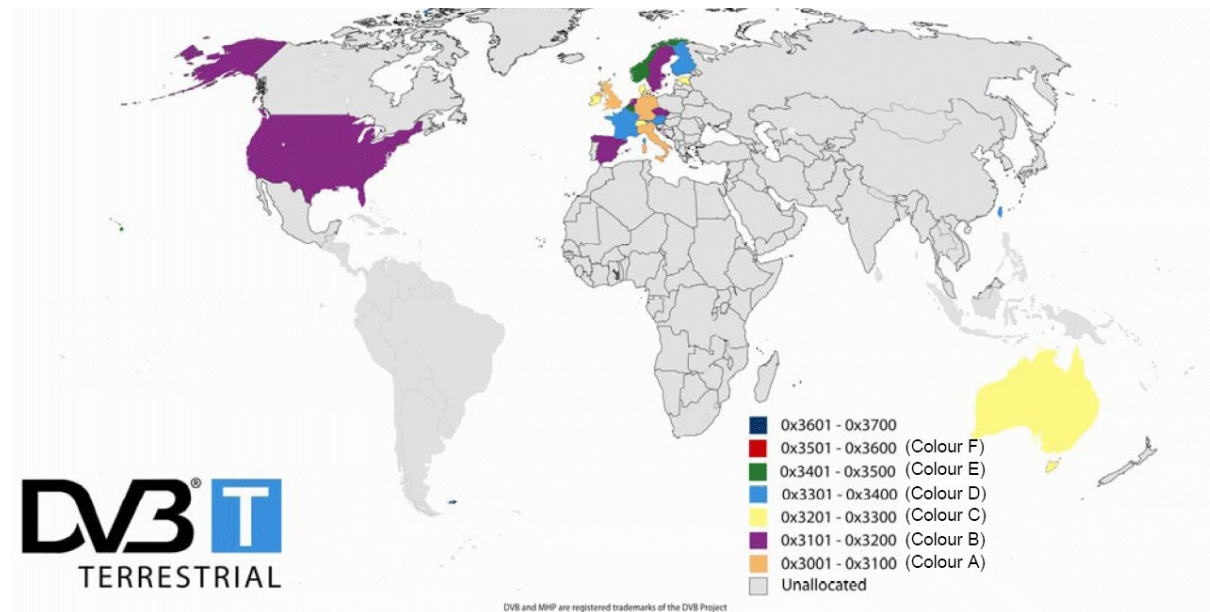
Figure 14: Colour map for allocating network_ids in terrestrial networks

The allocation of the network_id for countries in the European region comprising Italy is shown in the following table:

| Country | network_id |
|---------|------------|
| Austrian Digital Terrestrial Television | 0x3301 ÷ 0x3400 |
| French Digital Terrestrial Television | 0x3301 ÷ 0x3400[21] |
| Italian Digital Terrestrial Television | 0x3001 ÷ 0x3100 |
| Slovenia Digital Terrestrial Television | 0x3201 ÷ 0x3300 |
| Spanish Digital Terrestrial Television | 0x3101 ÷ 0x3200 |
| Swiss Digital Terrestrial Television | 0x3201 ÷ 0x3300 |

Table 51: Network_ids of interest

Network_ids shall not be used to uniquely identify a service.

Network_ids shall instead be used to identify the country which a network belongs to for the purpose of LCN conflicts (see §7.3). In particular, if Italy has been selected as "Country" at first installation time, all networks whose network_id fits in the 0x3001÷0x3100 range shall be considered as belonging to Italy.

## F.6  Network Name

No assumption is or shall be made for this parameter.

---

[21] France will likely go on using as single network_id for the whole country the same value assigned by DVB to French DTT as original_network_id (0x20FA)

# G    CIv1 common interoperability issues

## G.1    Purpose

The purpose of this Annex is to list some recurrent interoperability issues stemming from wrong implementations of DVB-CI and/or PCMCIA standards in receivers and to explain manufacturers how to avoid them.

## G.2    Initialisation

### G.2.1    Problem description

The host resets the CAM at start-up. The host doesn't wait enough longer and resets the CAM before its initialization has finished.

### G.2.2    Specification

PCMCIA standard defines in volume 2, section 4.4.6 that the host has to wait 5s that ready signal is set. As a reminder, a specification extract is attached below in italic.

*A card that requires more than 20 ms for internal initialization before access shall negate* **READY** *until it is ready for initial access, a period of time which is not to exceed five seconds following the time at which the* **RESET** *signal is negated (or if no* **RESET** *is implemented,* **VCC** *is stable).*

### G.2.3    Resolution

Host has to wait 5s before it resets the CAM at start-up

## G.3    Mandatory resources

### G.3.1    Problem description

Some hosts don't provide all the expected resources.

### G.3.2    Specification

It has been defined in R206-001:1998 (§9.1):

*The minimum resources that any DVB-compliant host shall provide are all of those described in clause 8 of EN 50221.*

As a reminder, table 57 in EN50221 that list all resources here follows.

Table 57: Resource Identifier values

| Resource | class | type | version | resource identifier |
|---|---|---|---|---|
| Resource Manager | 1 | 1 | 1 | 00010041 |
| Application Information | 2 | 1 | 1 | 00020041 |
| Conditional Access Support | 3 | 1 | 1 | 00030041 |
| Host Control | 32 | 1 | 1 | 00200041 |
| Date-Time | 36 | 1 | 1 | 00240041 |
| MMI | 64 | 1 | 1 | 00400041 |
| Low-Speed Communications | 96 | see §8.8.1.1 | 1 | 0060xxx1 |
| reserved | other values | other values | other values | other values |

### *G.3.3    Resolution*

Support all resources listed in table 57.

# G.4    CA_PMT in clear

### *G.4.1    Problem description*

The CA PMT is not sent on a clear service where it could be used by Italian Pay TV operators for parental control purpose.

### *G.4.2    Specification*

DVB-CI specifications defines in Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications (R206-001:1998) that the host has to send the CA_PMT object even when the selected program is in the clear. As a reminder, a specification extract is attached below in italic.

*CA_PMT is sent by the host even when a programme in clear is selected by the user (typically a programme for which there are no CA_descriptor in the PMT). In this case, the host shall issue a CA_PMT without any CA_descriptors (i.e.: CA_PMT with program_info_length == 0 and ES_info_length == 0).*

### *G.4.3    Resolution*

Hosts have to send CA_PMT even when selected program is in the clear.

# G.5    CA_PMT program number casting

### *G.5.1    Problem description*

The receiver seems to cast the program number over 12 bits instead of 16 bits (refer to the DVB-CI specifications), in the CA PMT. Without the parental control functionality running, the CAM would have descrambled the service anyway. But with this functionality supported, it can not allow the descrambling without making sure that there is no parental control parameter configured for this service in the PAT/PMT and SDT/EIT tables.

### *G.5.2    Specification*

DVB-CI specifications define in EN50221 (§8.4.3.4 ; table 25) that program number shall be over 16 bits.

### *G.5.3    Resolution*

Program number has to be sent to CAM over 16 bits.

## G.6 CA_PMT clear to scrambled / scrambled to clear

### *G.6.1 Problem description*

When a program switches from clear to scrambled and vice versa, the CA_PMT is not sent by the host.

### *G.6.2 Specification*

It has been defined in Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications (R206-001:1998; §9.5.6.2) :
- *When one programme switches from scrambled to clear, there are several possibilities:*

*1.		This change is not signalled in the PMT, but only in the TSC field of the packet header or in the PES_SC field of the PES header. In this case, there is no reason for the host to send a new CA_PMT to remove the programme from the list. The programme remains selected and the host keeps on sending CA_PMT when the version_number of the PMT evolves.*
*2.		This change results in a modification of the PMT. In this case, a CA_PMT is issued by the host.*

* *When one programme switches from clear to scrambled, there are several possibilities:*

*1.		This change is not signalled in the PMT, but only in the TSC field of the packet header or in the PES_SC field of the PES header. In this case, the host does not send a new CA_PMT. The CA application must detect that switch.*
*2.		This change results in a modification of the PMT (e.g.: CA_descriptors are removed). In this case, a CA_PMT is issued by the host.*

*In both cases it is recommended that the CA application attempt to create a user dialogue to inform the user*.

### G.6.3	Resolution
When the host detects a PMT change, it has to send a new CA_PMT to the module.

## G.7	PMT update and new CA_PMT

### G.7.1	Problem description
When the host detects that the PMT version has changed, it has to inform the CAM about this by sending a new CA_PMT. Some hosts provide the information to the CAM by using the CA_PMT_Only object. This action is seen by the CAM as a zapping. This means that it will stop and restart descrambling filter and a black screen will be displayed.

### G.7.2	Specification
It has been described  in R206-001:1998 (§9.5.5.1) that:

*If the host wants to update a CA_PMT of one of the programmes of the list it sends a CA_PMT with ca_pmt_list_management == update. This happens when the host detects that the version_number or the current_next_indicator of the PMT has changed. The CA application in the module then checks whether this change has consequences in the CA operations or not. It also happens when the list of elementary streams of a selected programme changes (e.g.: the user has selected another language). In this case, the host has to resend the whole list of elementary streams of that updated programme.*

### G.7.3	Resolution
When PMT version is changed, the CA_PMT_Update object has to be used in order to avoid black screen.

## G.8	Spontaneous MMI

### G.8.1	Problem description
The host does not allow the display of spontaneous MMIs (like error or download notification). Some hosts allow only MMI when the program is scrambled which is not correct.

Spontaneous MMIs are the only way for the CAM to notify messages to the user e.g. that the smart card is in error, that a new download is available or that the user has no authorisation to access the program (parental control or subscription issue).

### G.8.2      Specification

It has been defined in Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications (R206-001:1998; §9.5.6.1) :

*CA applications currently not active for any current programmes selected by the user may create MMI sessions for user dialogue, for example to warn of an impending PPV event on another programme previously purchased by the user.*

### G.8.3      Resolution

Display all MMI messages sent by CAM. Do not allow automatic MMI closing; let the user close by him/herself the MMI.

## G.9      Transport Stream to CAM

### G.9.1      Problem description

The host does not provide the transport stream to the CAM on a clear service. This has two major impacts:
This means that the availability of a download will be checked not at the first zapping on a new transponder, but at the first zapping on a scrambled service of a new transponder.
The EMM (subscription authorization) cannot be received by the smart card on a clear service. End user has to be tuned to a scrambled service with a black screen.

### G.9.2      Specification

DVB-CI specifications define in EN50221 (§5.4.3) that a transport stream connection has to be established if the module is found as DVB conformant. As a reminder, a specification extract is attached below in italic.

*When a module is not connected the Transport Stream Interface shall bypass the module, and the Command Interface to that module shall be inactive. On connection of a module, the host shall initiate a low-level initialisation sequence with the module. This will carry out whatever low-level connection establishment procedures are used by the particular Physical Layer, and then establish that the module is a conformant DVB module. If successfully completed, the host shall establish the Transport Stream connection by inserting the module into the host's Transport Stream path. It is acceptable that some Transport Stream data is lost during this process.*

### G.9.3      Resolution

Send always the transport stream to the CAM when it has been initialized.

## G.10      Profile reply

### G.10.1      Problem description

The host does not provide the Profile Reply to the CAM that waits for ever this information.

### G.10.2      Specification

DVB-CI specifications define in EN50221 (§8.4.1.1) that when a profile enquiry is sent by host or module, a profile reply has to be sent by module or host. As a reminder, a specification extract is attached below in italic.

*When a module is plugged in or the host is powered up one or perhaps two transport connections are created to the module, serving an application and/or a resource provider.*

*The first thing an application or resource provider does is to request a session to the Resource Manager resource, which is invariably created since the Resource Manager has no session limit. The Resource Manager then sends a Profile Enquiry to the application or resource provider which responds with a Profile Reply listing the resources it provides (if any). The application or resource provider must now wait for a Profile Change object. Whilst waiting for Profile Change it can neither create sessions to other resources nor can it accept sessions from other applications, returning a reply of 'resource non-existent' or 'resource exists but unavailable' as appropriate.*

### G.10.3    Resolution

Reply to profile enquiry object.

# G.11    Remote control / MMI_Enq()

### G.11.1    Problem description

Some receivers don't send the right parameters after a remote control action by user. Most common errors are: bad implementation of numeric keypad, blind answer and length of answer. In some cases errors are related to Enq() object answer text.

### G.11.2    Specification

These features are described in DVB-CI specifications EN50221 in chapter 8.6.5.2. Table 47 (as shown below).

**Table 47: Enq object coding**

| Syntax | No. of bits | Mnemonic |
|---|---|---|
| enq () { | | |
|     enq_tag | 24 | uimsbf |
|     length_field() | | |
|     reserved | 7 | bslbf |
|     blind_answer | 1 | bslbf |
|     answer_text_length | 8 | uimsbf |
|     for (i=0;i<enq_length-2;i++) | | |
|         text_char | 8 | uimsbf |
| } | | |

**blind_answer** : set to 1 means that the user input has not to be displayed when entered. The host has the choice of the replacement character used (star, ...).

**answer_text_length** : expected length of the answer. Set to hex 'FF' if unknown by the Application.

**text_char**
Text information is coded using the character sets and methods described in [4].

Correct behaviour has been defined in Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications (R206-001:1998; §9.8.5.4) :
The answ object returns a string of characters in response to an enq object. Each object can specify the character code tables used per DVB SI.

The code table used by the answ object shall be the same as that used by the enq object.

This dialogue is primarily provided to allow PIN entry. So, hosts are only required to allow input of the numbers 0-9. The minimum input character coding required is ISO 6937:1994 (DVB SI's default character table). Thus, all hosts shall, as a minimum, support input of the characters 0-9 coded on the character codes 0x30-0x39 per ISO 6937.

### *G.11.3 Resolution*

Receivers shall handle well blind answer and answer_text length in order to avoid user to enter more number than expected (host has to close the MMI when the expected char number is reached). Character code in text_char shall respect ISO 6937:1994.

## G.12 Remote control / MMI_answ()

### *G.12.1 Problem description*

Some receivers don't send the right parameters after a remote control action by user. Most common error is CANCEL instead of OK.

### *G.12.2 Specification*

These features are described in DVB-CI specifications EN50221 in chapter 8.6.5.3. As a reminder, values of Answ_id are attached in table below.

### *G.12.3 Resolution*

Receivers shall handle well Answ() object.

## G.13 Remote control / MMI_Menu answ()

### *G.13.1 Problem description*

Some receivers don't send the right parameters after a remote control action by user. Most common errors are bad 1 instead of 2 etc…

### *G.13.2 Specification*

These features are described in DVB-CI specifications EN50221 in chapter 8.6.5.5. As a reminder, choice_ref explanation is attached below in italic.

***choice_ref:*** *the number of the choice selected by the user. If the object was preceded by a menu object, then choice_ref = 01 corresponds to the first choice that had been presented by the application in that object (first choice text after the bottom text in the menu object) and choice_ref = 02 corresponds to the second choice text presented by the application. choice_ref = 00 indicates that the user has cancelled the preceding menu or list object without making a choice.*

### *G.13.3 Resolution*

Receivers shall handle well Menu_answ().

## G.14 MMI Module Name

### *G.14.1 Problem description*

Some receivers don't display the module name given in application_info() object. They display a generic name like module or DVB-CI CAM. This may confuse the end user.

### *G.14.2 Specification*

This feature is described in DVB-CI specifications EN50221 in chapter 8 4.2.2. Please find below an extract in italic.

*menu_string_length*
*All applications have a user menu tree, of which this is the top-level entry point, and it is made available as a subtree somewhere in the host's own menu tree. It is followed by a*

*sequence of characters which is the title of the menu entry. The host is free to decide the structure of its own menu tree but it may use the application_type field to group menu entries of similar applications. The 'menu' may in fact be a simple display with no user interaction, or it may be a complex set of menu screens to allow sophisticated user interaction.*

### G.14.3    Resolution

Display the right name of module in MMI menu.

## G.15   MMI – Text length

### G.15.1    Problem description

Some receivers truncate the text sent by the module, then, the information is not comprehensible by the user.

### G.15.2    Specification

The Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications (R206-001:1998; §9.8.4.1) specify that:

*High level mode*
*When responding to enq, menu or list objects all hosts shall be able to communicate to the user at least the first 40 characters of any string and shall be able to tolerate (possibly by truncation) strings of any length. All hosts shall be able to communicate to the user menu and list objects where the number of menu/list items is in the range 0 to 20.*

*The choice_nb = 0xFF and item_nb= 0xFF permit the application to not know the length of the list at the time that it outputs the first MENU_more or LIST_more object. The host, therefore, is required to count the menu/list items until a "last" object is received indicating the end of the list.*

*All hosts shall support entry of strings of up to 40 characters in response to a enq object.*

*If, when responding to an enq object, the user attempts to enter more characters than the host is able to accept (or more characters than the parameter answer_text_length) then the host should give a clear indication to the user.*

### G.15.3    Resolution

Display a minimum of 40 characters for any string. DGTVi extra requirement is that a minimum of 50 characters have to be displayed for any string.

## G.16   MMI – Menu or list object

### G.16.1    Problem description

Some receivers don't display sub title or bottom text. They may include important information to the end user and have to be displayed.

### G.16.2    Specification

This feature is described in DVB-CI specifications EN50221 in chapter 8 6.5.4 and 8.6.5.6. An extract of the standard is shown below in italic.

*A menu is made of one Title, one sub-title, several choices and one bottom line. Text objects with text_length = 0 can be used (e.g. if no sub-title or no bottom text are used).*

*Item_nb = 'FF' means that this field does not carry the number of items information.*

*The way the host has to display the title, sub-title, bottom text and items is manufacturer dependant. For example, the host is free to display the items on several pages and to manage itself the page-down and page-up functions.*

### G.16.3    Resolution

Displays all title, subtitle, choice and bottom text.

# H MHP CA API Implementation Guidelines for non CA smart cards

## H.1 Purpose

Scope of this Annex is to provide implementation guidelines for MHP CA API to be used with a Non-Ca Smart Card.

The reference CA API is version 1.2.
The complete JavaDoc is delivered within a separated file which DGTVi will provide on request to any interested party.

Only classes and methods here defined must be implemented; it's up to the programmer not to use the others.
In the case other classes are instantiated or other methods are called, they should not work, which means *null* should be returned if necessary or no effects should be caused for methods without a return value.
The aim of this specific implementation is to provide a way for MHP applications to know the general status of a smart card reader compliant with ISO 7816 specifications.
This implementation will not interfere with Conditional Access smart cards, which means no critical classes or methods will be required.
In the next sections, used classes, interfaces and methods are defined. In last section, an example is given.
All the exceptions that could be thrown using the required methods should obviously be implemented. Any other class, method, static value or interface not defined in this document should not be implemented.

## H.2 Package it.dtt.ca

### H.2.1 CaManager

In this implementation this class will be used only to monitor smart card reader status.

#### H.2.1.1 Constructor

Requested for implementation.

#### H.2.1.2 getCAProvider

Should return the string "SATSA", in capital letters as typed here.

#### H.2.1.3 getClient

Returns the resource client associated to this object.

#### H.2.1.4 getSlots

This will return an array of Slot objects, each one associated to one physical smart card reader. If only one reader is present, as often happens currently, it must be associated to first position in the array.

### H.2.2 CaManagerFactory

This class is the entry point to interact with the smart card reader.  Only one actor at the same time can have a session opened.

### H.2.2.1 closeSession

Only once the session is closed, another one can be opened.

If this method is called when no session is opened, the exception *NoSessionOpenedException* will be called.

If the ResourceClient passed in as a parameter is not the same that was passed opening the session, the exception *OwnerUnknownException* will be called.

### H.2.2.2 getInstance

This method will enable the process of interacting with the smart card status. In any case communication cannot work before *openSession* is called.

To initialize the MHP CA API to work with a generic ISO 7816 smart card reader, these two parameters as inputs to the method should be used:

provider = "SATSA"

broadcaster = "ANY"

This method will return an instance of *CAManagerFactory* that will allow opening a session.

If the API is not implemented to support a Non-Ca Smart Card, it should throw the exception *NoSuchProviderException*.

The exception *AccessDeniedException* will never be thrown in case of Non-Ca Smart Cards.

### H.2.2.3 openSession

Once the *CAManagerFactory* has been instantiated, this method call will enable a session.

Only one actor at a time can call this method.

Once the session is opened and till it's not closed, any other call to this method will end up with the API throwing *SessionAlreadyOpenedException*.

## H.2.3 CaObject

Requested class.

### H.2.3.1 Constructors

Requested for implementation.

### H.2.3.2 Methods

Requested for implementation.

## H.2.4 CaSession

Requested class.

### H.2.4.1 Constructors

Requested for implementation.

### H.2.4.2 Methods

Requested for implementation.

## H.2.5 Slot

This class represent the physical smart card reader on the Set-Top box.

### H.2.5.1 Constructors

Requested for implementation. If only one reader is present, id 0 should be used.

### H.2.5.2  addSlotListener

Requested.

### H.2.5.3  getSlotID

If only one reader is present, this method call will return 0.

### H.2.5.4  getSmartCard

This method is not required.

### H.2.5.5  getStatus

This method will get current status of the smart card reader.
The possible return values are the ones defined for *SlotEvent*.

### H.2.5.6  removeSlotListener

Requested.

## H.3  Package it.dtt.ca.event

### *H.3.1 CaEvent*

The implementation of this object is required to support the use of its derived class *SlotEvent* only. Other types of events are not requested.

### *H.3.2 SlotEvent*

Any time a change is notified in the smart card reader status, one SlotEvent is thrown.
In the table below, all the possible events are shown with the specific parameters with whom the events should be generated (type, data, description) and the return value for *toString()* method call.
The CARD_ACCESS_DENIED is not used because once a valid smart card is inserted into the reader, the API has not any other way to communicate with a specific smart card provider software (I.e. with a CA Kernel from any Conditional Access provider)

| Type | Data | Description | toString() |
|------|------|-------------|------------|
| **CARD_ERROR:** *this is thrown when the reader is able to communicate with the smart card but the smart card does not reply to a reset command* | | | |
| 352 | Null | "Card Error" | "SlotEvent.CARD_ERROR" |
| **CARD_IN:** *the smart card is inserted into the reader* | | | |
| 350 | Null | "Smart Card inserted" | "SlotEvent.CARD_IN" |
| **CARD_MUTED:** *the reader finds a smart card is inserted but there is no electrical communication* | | | |
| 353 | Null | "Offers on-air update" | "SlotEvent.CARD_MUTED" |
| **CARD_OUT:** *the smart card is removed from the reader* | | | |
| 351 | Null | "Smart Card removed" | "SlotEvent.CARD_OUT" |
| **CARD_VERIFYING:** *the reader is verifying the status* | | | |
| 355 | Null | "Smart Card reader verifying" | "SlotEvent.CARD_VERITYING" |
| **ERROR_UNKNOWN:** *thrown when there is any other error trying to communicate with the smart card reader* | | | |

| 356 | Null | "Generic Smart Card reader error" | "SlotEvent.CARD_UNKNOWN" |

### H.3.3 SlotListener

This interface must be implemented by any application wanting to monitor the status of the smart card reader.

### H.3.4 SlotEventReceived

Requested.

## H.4 Example

This simple example shows how this implementation of the CA API, could be used.

```
public class Example implements SlotListener,
  ResourceClient;

. . .

    CAManagerFactory factory;
    CAManager manager;
    Slot reader;
    Slot[] slots;

. . .
    /* Initialization of the API */
    try {
                            factory =
                              CAManagerFactory.getInstance(
                            "SATSA","ANY");
    } catch (NoSuchProviderException) {
                      System.out.println("This API does not
                        support ISO 7816 generic
                        smart card reader monitoring");
    }

    /* Creation of the manager */
    try {
                            manager =
                              factory.openSession(this);
    } catch (SessionAlreadyOpenedException) {
                      System.out.println("There is already
                        an application using the CA API");
    }

    try {

    /* Getting smart card reader (single reader on the STB) */
    slots = manager.getSlots();
    reader = slots[0];

    /* Checking current status */
    if (slot.getStatus != SlotEvent.CARD_IN)
        System.out.println("There is a problem with the
```

```
          card");

      /* Attaching the listener */
       reader.addSlotListener(this);

      catch (SessionClosedException) {
         System.out.println("The session has been closed");
      }

      . . .

      public void slotEventReceived(SlotEvent event) {
         System.out.println("Error number "+event.getType()+"-"
                            +event.getDescription());
         if (event.getType == SlotEvent.CARD_OUT)
           System.out.println("Card was removed");
       ...}
```

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# I　The new SATSA target

## I.1　Introduction

SATSA's Generic Connection Framework calls for opening a Connection to a Java application, identified by an ID (the AID). The vast majority of the cards issued in Italy, are standard based but unfortunately are not Java cards. Although an Application ID(s) could be, in theory, also set on these cards, this is not mandatory and most cards have issued without. It has been proved under test that any Connector.open("apdu...;target=a0.00...") issued against such cards returns a **ConnectionNotFoundException**. This is because the card has neither an AID set nor is a Java card with such application "listening". It has also been noticed that a Connector.open("apdu...;target=SAT") may also return **NotImplemented** as this is normally used on (U)SIM as defined per SIM Application Toolkit mode and the SATSA layer implemener may have made no provision for it.

The above behaviors result in not being able to extract the data from the card. This is a technical downgrade as far as the OCF previous implementation is concerned, especially for a long awaited and final solution for the DTT smart card realm as the SATSA choice promised to be.

## I.2　Proposed solution

The proposed solution is based upon the following thoughts:

• 　The first step consists in defining a new target, namely CXS, for the Connector.open as in Connector.open("apdu:0,target="CXS") as an example

• 　Only when target=CXS is selected (and only in this case), if the SATSA layer enters into a "no card application" branch, instead of raising a ConnectionNotFoundException, the implemented SATSA layer will return the APDUConnection object successfully (i.e. no exception is raised).

• 　Once the APDUConnection object is returned, the requesting MHP application may initiate and continue to exchange APDUs as usual (exchangeAPDU()) and eventually close the connection.

## I.3　Solution advantages

The proposed solution has the following advantages:

• 　It would not impact any target=SAT implementation, if already in place in the implemented SATSA layer. On the other end it would not call for target=SAT implementation if is not in already in place (this is/could be nice on the SATSA layer implementer side).

• 　It will relief the MHP applications from coding envelope APDUs and the SATSA layer from unpacking envelopes when this is not explicitly needed (this is the case for Italian CNS, CRS and CIE)

• 　It will also work for chip cards which being ISO 7816 compliant have, nevertheless, evolved differently from the e-government cards (namely CNS,CRS or CIE) standards

• 　This approach is also compatible with smart cards which are not Java cards but have or manage Application IDs. In this case both target=CXS and target=a0.00.... (whatever) strings could be used interchangeably

## I.4　An example

Applications running in a SATSA implementation that supports opening a connection with target = CXS, can communicate with the smart card OS by using APDUConnection.
There are various constraints on this type of usage, which are definitively detailed by the DVB and DGTVi relevant documents related to *Security and Trust Services API*

*Specification.* Further limitations may apply within the smart card issuer (i.e. the issuing institution or enterprise) or the smart card manufacturer. Opening a connection using CXS is straightforward. The following example attempts a CXS connection on slot 0.

```
APDUConnection cxs;
cxs = (APDUConnection)Connector.open("apdu:0;target=CXS");
```

Once the connection is established, the application can send APDU commands to the smart card using the exchangeAPDU() method. Use the exchangeAPDU() method to send a command to a card application and receive a response. Pass a byte array containing a command APDU to exchangeAPDU(). The command is sent to the card. When the card sends its response APDU, this method returns the response as another byte array. A variety of exceptions might be thrown if communications failures or other disasters occur.

```
byte[] apdu = {
(byte)0x00, (byte)0x20, (byte)0x00, (byte)0x82, (byte)0x04,
(byte)0x01, (byte)0x02, (byte)0x03, (byte)0x04, (byte)0x00
};
byte[] response = cxs.exchangeAPDU(apdu);
```

The exchangeAPDU() method blocks until a response is received from the card application. To close an APDUConnection, simply call its close() method as shown in the following example.

```
cxs.close();
```

If you close a connection that is being used by other threads to exchange APDUs, the connection is closed immediately and the exchangeAPDU() methods in other threads throw InterruptedException.

# J  EIT schedule compression

## J.1  Introduction

In order to allow efficient transmission of schedule data spanning more than just a couple of days, a private compressed version of EIT schedule tables has been introduced in §7.2.6.4.

## J.2  Compression algorithm

For compressing EIT schedule tables the ZLIB algorithm, as specified in RFC 1950 [49], is applied to the event loop in event_information_sections. Section_length and CRC_32 are updated accordingly.

The receiver SHALL support the Deflate compression algorithm as specified in RFC 1951 [50]. The receiver is not required to support other compression algorithms.

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# K Streaming monitoring API[22]

## K.1 Introduction

Streaming monitoring API is used to expose to applications information about streamed CoD played by JMF `Player`. This API is applicable with Adaptive Streaming as well as to non-adaptive streams and allows an application to be notified about changes in buffer status and quality of played stream.

The API is composed from the following classes and interfaces:
- `MonitoringControl`
- `MonitoringEvent`
- `StreamQualityChangeEvent`
- `StreamQualityInfo`
- `VideoStreamQualityInfo`
- `BufferingStatusEvent`
- `MonitoringListener`

The `MonitoringControl` is a new `Control` and its implementation shall be returned by JMF `Player` (`javax.media.Controller.getControl()`, `javax.media.Controller.getControls()`) used to play OTT media streams independently from whether the system supports adaptive streaming. By using this `Control` an application has access to information about played stream. Application is able to check audio and video format, current quality of a stream being presented to the user as well as all available qualities describes in a manifest file passed as a `Locator` to the `Player`, current download bitrate of a stream and line rate. It is also able to set a quality of the associated CoD.

Manifest file tells the receiver that several alternative representations are available on the server for the same content, e.g. more files corresponding to encodings at different bit rates of the same content which the receiver can seamlessly switch to based on varying network conditions.

`MonitoringEvent` is a base class for any event related to changes in the properties of playing media. At the current state `StreamQualityChangeEvent` and `BufferingStatusEvent` can occur.

`BufferingStatusEvent` shall be used when some changes in buffering status appear, e.g. buffer is underrun or network connection has been lost and buffer is not filling anymore. To prevent implementations from being overloaded, buffering status events should not be sent faster than one per seconds.

`StreamQualityChangeEvent` shall be used when JMF `Player` is switching to another stream defined in media's manifest file due to changes in network conditions (Adaptive Streaming).

`StreamQualityInfo` is a class used to encapsulate necessary information about each stream described in media's manifest file.

---

[22] This Annex is based on an advanced DVB Draft. Possible changes in final version SHALL be duly taken into account by implementors.

`VideoStreamQualityInfo` is a subclass of `StreamQualityInfo` class. It is dedicated to encapsulate information specific for video streams.

To receive `MonitoringEvent` events, an object must implement the `MonitoringListener` interface and use `MonitoringControl.addMonitoringListener()` method to register its interest in media property's events. All events are posted to each registered listener.

# K.2 Package org.dvb.media.monitoring

**Description**

Provides DVB specific extensions to the Java Media Framework.

| Class Summary | |
|---|---|
| **Interfaces** | |
| `MonitoringControl` | A control allows applications to get information associated with the Streamed CoD being presented to the user. |
| `MonitoringListener` | The listener used to receive MonitoringEvents. |
| **Classes** | |
| `BufferingStatusEvent` | Event signalling a change in the buffer status. |
| `MonitoringEvent` | The base class for all other events related to changes in associated CoD. |
| `StreamQualityChangeEvent` | Event signals that quality of the associated CoD has been changed. |
| `StreamQualityInfo` | Represents information about quality of a CoD stream. |
| `VideoStreamQualityInfo` | Represents information about CoD stream's video. |

## K.2.1 MonitoringControl

**Declaration**

`public interface` **`MonitoringControl`** `extends javax.media.Control`

**All Superinterfaces:**

`javax.media.Control`

**Description**

A MonitoringControl allows applications to get information associated with the Streamed CoD being presented to the user.

Additionally `MonitoringControl` allows applications to control quality of CoD by setting bitrate of downloaded CoD.

**Methods**

-----------------------------------------------------------------------

***addMonitoringListener***

`void` **`addMonitoringListener`**`(MonitoringListener l)`

Adds a listener for `MonitoringEvent`.

**Parameters:**

       `l` - the listener to add

-----------------------------------------------------------------------

***getAudioFormat***

```
java.lang.String getAudioFormat()
```

> ```
> throws java.lang.IllegalStateException
> ```

Get the audio format of the associated CoD.

Formats are encoded as MPEG-7 term IDs as extended by the DVB IPI handbook, e.g. MPEG-1 layer 3 audio is encoded as "3.3".

**Precognitions:**

> Information is available after prefetching

**Returns:**

> Audio format of the associated CoD

**Throws:**

> `java.lang.IllegalStateException` - thrown if Player is neither in Prefetched nor Started state

-------------------------------------------------------------------------

### *getAvailableStreamQualities*

```
StreamQualityInfo[] getAvailableStreamQualities()
```

> ```
> throws java.lang.IllegalStateException
> ```

Get all available qualities of streams in associated CoD. In case of video CoD an array of VideoStreamQualityInfo shall be returned.

**Precognitions:**

> Information is available after prefetching

**Returns:**

> All available qualities of associated CoD

**Throws:**

> `java.lang.IllegalStateException` - thrown if Player is neither in Prefetched nor in Started state

-------------------------------------------------------------------------

### *getCurrentLineRate*

```
long getCurrentLineRate()
```

Get the current speed (in bits per second) with which the bits are sent onto the wire

**Returns:**

> Current speed with which the bits are sent onto the wire

-------------------------------------------------------------------------

### *getStreamQuality*

```
StreamQualityInfo getStreamQuality()
```

> ```
> throws java.lang.IllegalStateException
> ```

Get the current quality of associated CoD. It is the quality at which associated CoD is being downloaded and presented to the user. In case of video CoD an instance of VideoStreamQualityInfo shall be returned.

**Precognitions:**

Information is available after prefetching

**Returns:**

Quality of stream at which associated CoD is being downloaded and presented to the user.

**Throws:**

`java.lang.IllegalStateException` - thrown if Player is neither in Prefetched nor Started state

---------------------------------------------------------------------------

### *getVideoFormat*

`java.lang.String` **`getVideoFormat`**`()`

> `throws java.lang.IllegalStateException`

Get the video format of associated CoD.

Formats are encoded as MPEG-7 term IDs as extended by the DVB IPI handbook, e.g. MPEG-2 video, main profile, main level is encoded as "2.2.2".

**Precognitions:**

Information is available after prefetching

**Returns:**

Video format of the associated CoD or null if CoD does not have video stream

**Throws:**

`java.lang.IllegalStateException` - thrown if Player is neither in Prefetched nor Started state

---------------------------------------------------------------------------

### *removeMonitoringListener*

`void` **`removeMonitoringListener`**`(MonitoringListener l)`

Remove a listener for `MonitoringEvent`.

**Parameters:**

`l` - the listener to remove

---------------------------------------------------------------------------

### *setFixedStreamQuality*

`void` **`setFixedMediaQuality`**`(StreamQualityInfo streamQuality)`

> `throws java.lang.IllegalArgumentException,`
>
> > `java.lang.IllegalStateException`

Set fixed quality of associated CoD. It allows application to force downloading CoD with a given quality, and thus disable        adaptive        streaming        support        for        associated        CoD.

Application can check CoD's available quality using `getAvailableStreamQualities()` method.

**Precognitions:**

Method can be called in Prefetched state only

**Parameters:**

`streamQuality` - the stream quality of CoD

**Throws:**

`java.lang.IllegalArgumentException` - thrown if CoD does not support given quality

`java.lang.IllegalStateException` - thrown if Player is not in the Prefetched state

--------------------------------------------------------------------------

### setInitialStreamQuality

void **setInitialStreamQuality**(StreamQualityInfo streamQuality)

    throws java.lang.IllegalArgumentException,

        java.lang.IllegalStateException

Set initial quality of associated CoD. After Player starts, a quality could be changed by Adaptive Streaming.

Application can check CoD's available qualities using `getAvailableStreamQualities`() method.

**Precognitions:**

Method can be called in Prefetched state only

**Parameters:**

`streamQuality` - the stream quality of CoD

**Throws:**

`java.lang.IllegalArgumentException` - thrown if CoD does not support given quality

`java.lang.IllegalStateException` - thrown if Player is not in the Prefetched state

## K.2.2 StreamQualityInfo

**Declaration**

public class **StreamQualityInfo** extends java.lang.Object

java.lang.Object
  |
  +--**org.dvb.media.monitoring.StreamQualityInfo**

**Direct Known Subclasses:**

VideoStreamQualityInfo

**Description**

Represents information about quality of a CoD stream. It contains information about stream bitrate (bits per second).

## Constructors

--------------------------------------------------------------------------

### StreamQualityInfo

public **StreamQualityInfo**(long bitrate)

Construct a stream quality entity.

**Parameters:**

`bitrate` - stream bitrate in bits per second

## Methods

--------------------------------------------------------------------------

### *getStreamBitrate*

```
public long getStreamBitrate()
```

Get stream's bitrate (bits per second) of a CoD.

**Returns:**

Bitrate of a CoD

## *K.2.3 VideoStreamQualityInfo*

**Declaration**

```
public class VideoStreamQualityInfo extends StreamQualityInfo
```

```
java.lang.Object
  |
  +--org.dvb.media.monitoring.StreamQualityInfo
     |
     +--org.dvb.media.monitoring.VideoStreamQualityInfo
```

**Description**

Represent information about video CoD stream. It contains information about video resolution and stream bitrate (bits per second).

Instance of this class shall be returned by `MonitoringControl.getAvailableStreamQualities()` and `MonitoringControl.getStreamQuality()` in case when video stream is playing. Additionally, in this case an instance of this class shall be passed to `MonitoringControl.setFixedStreamQuality(StreamQualityInfo)` and `MonitoringControl.setFixedStreamQuality(StreamQualityInfo)` methods.

## Constructors

--------------------------------------------------------------------------

### *VideoStreamQualityInfo*

```
public VideoStreamQualityInfo(java.awt.Dimension videoResolution, long bitrate)
```

Construct a video stream quality entity.

**Parameters:**

`videoResolution` - video resolution

`bitrate` - stream bitrate in bits per second

## Methods

--------------------------------------------------------------------------

### *getVideoResolution()*

```
public java.awt.Dimension getVideoResolution()
```

Get video resolution of a CoD.

**Returns:**

> Video resolution of a CoD

### *K.2.4 MonitoringListener*

**Declaration**

```
public interface MonitoringListener
```

**Description**

The listener used to receive MonitoringEvent.

**Methods**

------------------------------------------------------------------------

*receiveMonitoringEvent*

```
void receiveMonitoringEvent(MonitoringEvent anEvent)
```

Receive a MonitoringEvents

**Parameters:**

> anEvent - the MonitoringEvent that has been received

### *K.2.5 MonitoringEvent*

**Declaration**

```
public class MonitoringEvent extends java.util.EventObject
```

```
java.lang.Object
  |
  +--java.util.EventObject
       |
       +--org.dvb.media.monitoring.MonitoringEvent
```

**All Implemented Interfaces:**

```
java.io.Serializable
```

**Direct Known Subclasses:**

```
MonitoringStreamQualityChangeEvent, MonitoringBufferingStatusEvent
```

**Description**

The base class for all other events related to changes in associated CoD.

**Constructors**

------------------------------------------------------------------------

*MediaPropertyEvent (Object)*

```
protected MediaPropertyEvent(java.lang.Object source)
```

Constructs the event.

### *K.2.6 StreamQualityChangeEvent*

**Declaration**

```
public class StreamQualityChangeEvent extends MonitoringEvent
```

```
java.lang.Object
  |
  +--java.util.EventObject
      |
      +--org.dvb.media.monitoring.MonitoringEvent
          |
          +--org.dvb.media.monitoring.StreamQualityChangeEvent
```

**All Implemented Interfaces:**

```
java.io.Serializable
```

**Description**

Event signalling that quality of the associated CoD has been changed. This event shall occur when adaptive streaming changes played stream to another stream with a different quality because of changing network conditions.

## Constructors

----------------------------------------------------------------------

### *StreamQualityChangeEvent*

```
public StreamQualityChangeEvent(java.lang.Object source, StreamQualityInfo newStreamQuality)
```

Construct the event.

**Parameters:**

> `source` - the source of the event. The platform shall always pass in the JMF Player presenting the media whose property has been changed
>
> `newStreamQuality` - the new value of quality of the stream

## Methods

----------------------------------------------------------------------

### *getStreamQuality()*

```
public StreamQualityInfo getStreamQuality()
```

Get the new quality of associated CoD.

**Returns:**

> The new stream's quality

## K.2.7 BufferingStatusEvent

**Declaration**

```
public class BufferingStatusEvent extends MonitoringEvent
```

```
java.lang.Object
  |
  +--java.util.EventObject
      |
      +--org.dvb.media.monitoring.MonitoringEvent
          |
          +--org.dvb.media.monitoring.BufferingStatusEvent
```

**All Implemented Interfaces:**

```
java.io.Serializable
```

**Description**

Event signalling a change in the buffer status.

Events are sent when a JMF Player is in the Started state.

To prevent implementations from being overloaded, `BUFFERING_STATUS_UNDERRUN` and `BUFFERING_STATUS_BACK_TO_NORMAL` events should not be sent faster than one per seconds.

## Fields

------------------------------------------------------------------------

### *BUFFERING_STATUS_BACK_TO_NORMAL*

`public static final int` **`BUFFERING_STATUS_BACK_TO_NORMAL`**

Indicates that buffering status back to a normal state from `BUFFERING_STATUS_UNDERRUN` or `BUFFERING_STATUS_STOPPED` states.

------------------------------------------------------------------------

### *BUFFERING_STATUS_UNDERRUN*

`public static final int` **`BUFFERING_STATUS_UNDERRUN`**

Indicates that buffering status is underrun. It means that coding rate is too high compared with network line rate.

------------------------------------------------------------------------

### *BUFFERING_STATUS_STOPPED*

`public static final int` **`BUFFERING_STATUS_STOPPED`**

Indicates that buffering has been stopped. It means that network connection has been lost.

## Constructors

------------------------------------------------------------------------

### *BufferingStatusEvent*

`public` **`BufferingStatusEvent`**`(java.lang.Object source, int bufferingStatus)`

      `throws java.lang.IllegalArgumentException`

Constructs the event.

**Parameters:**

      `source` - the source of the event. The platform shall always pass in the JMF `Player` presenting the media whose property has been changed

      `bufferingStatus` - the status of the buffer

**Throws:**

      `java.lang.IllegalArgumentException` - thrown if bufferingStatus is out of range

## Methods

------------------------------------------------------------------------

### *getBufferingStatus*

```
public int getBufferingStatus()
```

Get buffering status

**Returns:**

      Status of the buffer.

# L  OTT content referencing API[23]

## L.1  Package org.dvb.locator.ott

**Description**

Contains transport dependent locators for access to OTT services.

| Class Summary | |
|---|---|
| **Classes** | |
| HTTPLocator | Represents a reference to an IP service accessed via HTTP. |

### *L.1.1  HTTPLocator*

**Declaration**

```
public class HTTPLocator extends org.davic.net.Locator

java.lang.Object
  |
  +--org.davic.net.Locator
        |
        +--org.dvb.locator.ott.HTTPLocator
```

**All Implemented Interfaces:**

```
javax.tv.locator.Locator
```

**Description**

This class represents a reference to an IP service accessed by HTTP.

**Constructors**

```
-----------------------------------------------------------------------
```

**HTTPLocator(String)**

```
public HTTPLocator(java.lang.String url)

throws MalformedURLException
```

Creates a `HTTPLocator` from the specified URL.

**Parameters:**

> `url` - an "HTTP:" url.

**Throws:**

> `java.net.MalformedURLException` - if the url is not a correct "HTTP:" url.

**HTTPLocator(String, int)**

```
public HTTPLocator(java.lang.String url, int serviceID)

throws MalformedURLException, IllegalArgumentException
```

Creates a `HTTPLocator` from the specified URL.

**Parameters:**

> `url` - an "HTTP:" url.

---

[23] This Annex is based on an advanced DVB Draft. Possible changes in final version SHALL be duly taken into account by implementors.

`serviceID` - a DVB-SI serviceID or MPEG program number to identify one service in a multi-program transport stream.

**Throws:**

`java.net.MalformedURLException` - if the url is not a correct "HTTP:" url.

`java.lang.IllegalArgumentException` - if the service ID is less than 0 or greater than 0xffff.

## Methods
------------------------------------------------------------------------

**getServiceID()**

`public int` **`getServiceID`**`()`

Returns the serviceID specified when this `HTTPLocator` was constructed.

**Returns:**

the serviceID specified when this `HTTPLocator` or -1 if no serviceID was specified

# M 2D service compatibility within 3DTV

## M.1 Introduction

*Starting from the work done in DVB (Annex B to [58]), this Annex provides implementation guidelines on possible modes of operation of frame compatible plano-stereoscopic 3DTV services that provide service compatible operation with 2D (HDTV) services under certain conditions. This kind of service backward compatibility is enabled by the HDTV decoder capability of extracting one of the frame-packed views of the frame compatible plano-stereoscopic 3DTV service video stream, and up-scaling it to simulate the reception of an HDTV service.*

*Two H.264/AVC video layer signalling fields are used for this purpose [59]:*
- *Cropping Rectangle which describes the active part of a decoded picture;*
- *Sample Aspect Ratio (SAR) within the Video Usability Information (VUI) which provides the needed scaling to generate the output image.*

*Such service compatible modes give service providers the chance to transmit a single service that provides both frame compatible plano-stereoscopic 3DTV video and reduced-resolution (halved) HDTV video concurrently, whereas normally HDTV coverage with the same source content would be provided with a separate dedicated HDTV service.*

## M.2 3DTV use cases

*The following Figure 15 depicts the predominant use cases for the reception of frame compatible plano-stereoscopic 3DTV services, and the co-existence of frame compatible plano-stereoscopic 3DTV compliant receivers with existing HDTV (i.e. non-3DTV) equipment, taking into account the various capabilities with respect to 3DTV and the different kind of receivers (e.g. STB or iDTV).*
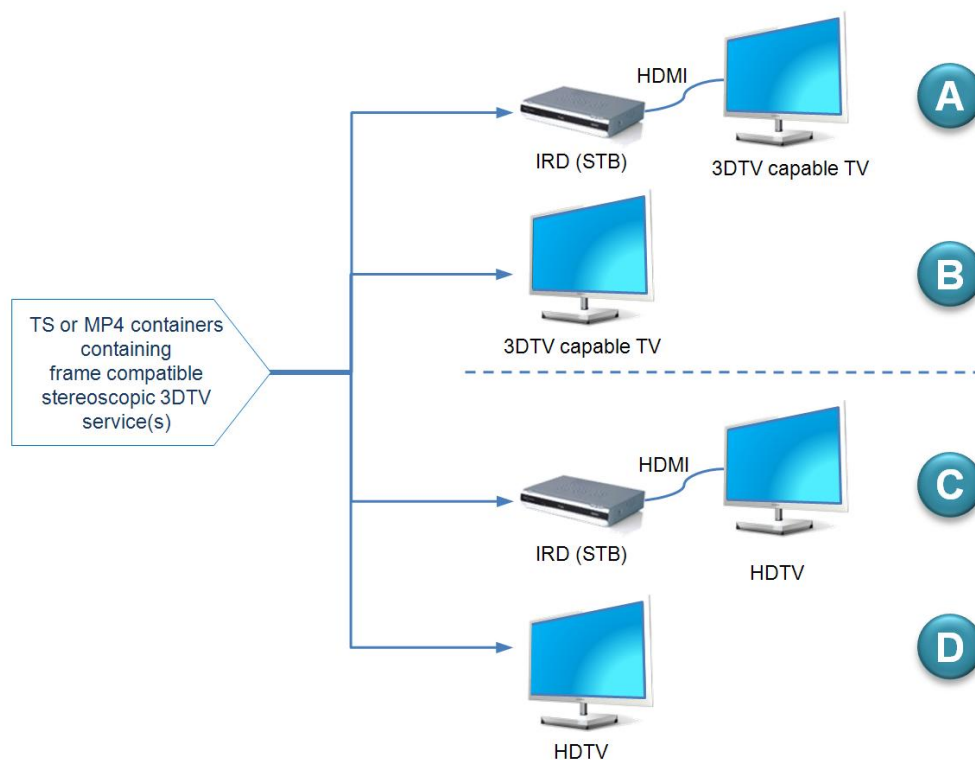


Figure 15: Frame compatible plano-stereoscopic 3DTV IRD use cases

**Legenda:**
***3DTV IRD use case A:*** *An IRD (STB) compliant with this specification is connected via HDMI to a 3DTV capable display device (qualified as such by the 3D_present flag being set to 1 in HDMI VSDB [54] or because manually set by the user). The user receives frame compatible 3DTV services via the STB.*
***3DTV IRD use case B:*** *A 3DTV IRD (iDTV) compliant with this specification receives frame compatible 3DTV services directly from the delivery channel.*
***3DTV IRD use case C:*** *An IRD (STB) compliant with this specification is connected via HDMI to a non-3DTV compliant HDTV set (or which doesn't qualify itself as such e.g. because 3D_present flag in HDMI VSDB is set to 0). Naturally, due to TV set limitation, it is not possible for the user to properly view the 3DTV services as in the 2 previous use cases but, thanks to this specification, he/she will be at least able to see them in 2D mode (halved HD resolution) if operators would transmit them in a 2D-compatible form.*
***3DTV IRD use case D:*** *An HDTV IRD (i.e. a non-3DTV compliant iDTV) compliant to this specification receives frame compatible 3DTV services directly from the delivery channel. Again, in this scenario it is not possible for the user to properly view the 3DTV services, but, thanks to this specification, he/she will be at least able to see them in 2D mode (halved HD resolution) if operators would transmit them in a 2D-compatible form.*

*Note that no additional PSI/SI signalling is needed, compared to that already defined for Frame Compatible Plano-stereoscopic 3DTV, in order to realize service compatibility for use cases C and D.*

## M.3 Implementation of 2D service compatibility

*At H.264/AVC video layer signalling a 2D-compatible 3DTV signal will include the following information [59]:*
*- frame packing information within H.264/AVC SEI*
*- frame cropping information*
*- SAR information*

*To apply the cropping rectangle feature, the field frame_cropping_flag of the H.264/AVC seq_parameter_set_data() shall be set to '1'.*

*Table below provides the settings of frame cropping offsets and the sample aspect ratio for the frame compatible plano-stereoscopic 3DTV video formats that are suitable for application of this signalling[24]. Top-and-Bottom formats are not included and shall not be used with these service compatible modes, due to inherent limitations with the ability to perform vertical upscaling in many IRD implementations. The fields frame_crop_top_offset and frame_crop_bottom_offset take the same values as would be used for HDTV video.*

| Frame compatible plano-stereoscopic 3DTV video format | Frame crop left offset | Frame crop right offset | Sample aspect ratio |
|---|---|---|---|
| 1920 x 1080i Side-by-Side | 0 | 960 | 2:1 |
| 1280 x 720p Side-by-Side | 0 | 640 | 2:1 |

Table 52: H.264/AVC signalling for service compatible modes of frame compatible plano-stereoscopic 3DTV services

*In presence of 2D-compatible 3DTV signals, in the different use cases introduced above, IRDs SHALL behave as summarized in the following Table[25]:*

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[24] *This signalling calls for cropping and upscaling capabilities of HDTV (i.e. non-3DTV cognisant) IRDs that exceed the minimum requirements currently defined by DVB in [9].*
[25] *Ignoring cropping and SAR information requires non-compliant H.264/AVC behaviour of frame compatible plano-stereoscopic 3DTV IRDs for the rendering of the 3DTV service. Such non-compliant behaviour might be overcome via suitable amendments of relevant specifications.*

| Use cases | STB (if present) behaviour | TV behaviour |
|---|---|---|
| A | • frame packing information is recognized within SEI and signalled over HDMI<br>• frame cropping offsets and sample aspect ratio combinations used for service compatible modes are ignored | • frame packing information is recognized over HDMI and duly applied |
| B | | • frame cropping offsets and sample aspect ratio combinations used for service compatible modes are ignored<br>• frame packing information is recognized within SEI and duly applied |
| C[26] | • frame packing information within SEI is ignored<br>• frame cropping offsets and sample aspect ratio combinations used for service compatible modes are normally interpreted | • full frame 2D signal received over HDMI is displayed |
| D | | • frame packing information within SEI is ignored<br>• frame cropping offsets and sample aspect ratio combinations used for service compatible modes are normally interpreted<br>• full frame 2D signal is displayed |

Table 53: Expected IRD behaviour for 2D service compatible 3DTV transmissions

*Above behaviour is expected for both broadcast and broadband delivery of H.264/AVC 3DTV service components as well as for both the containers (TS and MP4) used for broadband delivery of H.264/AVC 3DTV service components.*

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[26] *An IRD (STB) compliant with this specification when connected via SCART to any TV set is expected to behave as in this use case, presenting on SCART the downscaled version of full frame 2D decoded signal*