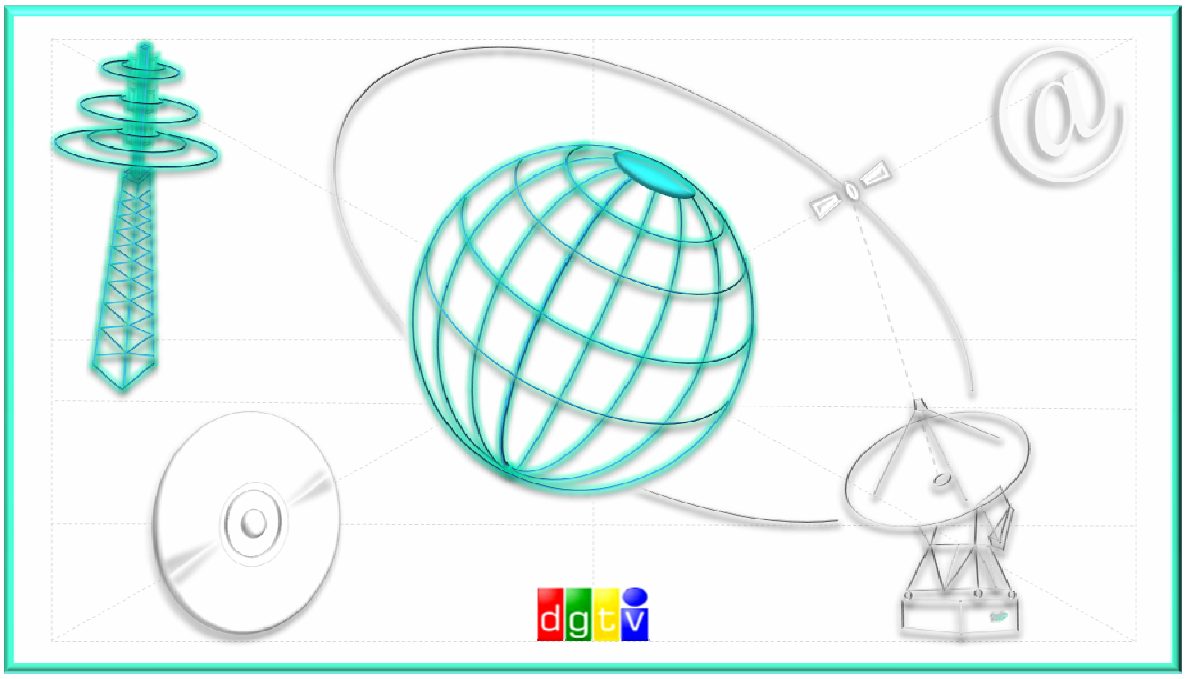
HD Book
DTT platform

(Digital Terrestrial Television)

Compatible High Definition receivers for the Italian market: baseline requirements



Final 1.0

HD FORUM ITALIA

Compatible High Definition receivers for the Italian market: baseline requirements

DTT platform
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HD FORUM ITALIA

HD Book collection *Volume 1*

dgtvi Support for Digital Terrestrial Television

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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, except some terrestrial HDTV trials in ASO[1] regions, is still all in standard definition format (SD), with 4/3 aspect ratio and interlaced scanning.
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 (HD ready).
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 will be the standard definition of tomorrow"*[2]. Based on this sentence, it is important to define as quicker as possible a migration route from SD to HD, aiming to promote the widespread diffusion of free to air HDTV programming matching the increased quality of large screen displays and TV sets.
Appealing hi-quality content productions, like those necessary for a successful launch of an innovative technology like HDTV, require huge investments. A viable approach towards the complete turnover of SD programmes into HD ones, is represented by simulcasting both of them. SD/HD simulcast[3] is a viable way to enrol a mix of genuine HDTV productions programming with up-scaled SD contents already available on standard TV transmissions. It would allow broadcasters to easily re-use existing contents from their huge archives of movies, fictions, documentary and so on.

Market outlook

European CE industry is particularly committed to boost sales of large screen 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.

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 loosing relevant market quotes in the promotions of Italian culture, in an industrial context where large European and extra-European entities are rapidly progressing.

[1] ASO: Analogue Switch-Off
[2] 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.
[3] Simulcast: the concurrent broadcasting of same TV programming in different formats (analogue and digital, SD and HD)
[4] EICTA: European Industry Consumer Technical Association

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 by event transmissions, without subscription), the creation of new national digital networks through frequency trading, a taut timing for switch off, are all specific to our country. In a few months, 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.

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 this HD-Book DTT has been 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 have been taken into account. Such developments will be likely incorporated in a forthcoming D-Book new revision.

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:

[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).

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 better many points of the specification. Let them be thanked here.

October 2008

2. Document History

Document	Revision	Changes	Date	Editor
HD-Book 0.6	1	1° Interim Draft *(preliminary version presented to Industry Plenary Conference on July 18th. 2008)*	18/7/2008	G. Venuti
HD-Book 0.7	1	- All changes agreed after analyzing industry's feedback - Note on France added to Annex F	16/9/2008	G. Venuti
HD-Book 0.8	1	Final Draft after 26/9/08 review meeting	29/9/2008	G. Venuti
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For the purposes of this HD-Book, the following references apply:

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[2] AGCOM "Il Libro Bianco sulla televisione digitale terrestre" (White Book) (2000)

[3] AGCOM Delibera n. 399/03/CONS "Approvazione del piano nazionale integrato di assegnazione delle frequenze per la radiodiffusione televisiva terrestre in tecnica digitale (PNAF DVB-T)"

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

[5] 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

[6] CEN WS/EFIN N 007: Embedded Financial Transactional IC Card Reader

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

[8] Decreto 25 luglio 1997, n. 307 "Regolamento recante le specifiche tecniche relative al sintonizzatore-decodificatore per ricezione di segnali numerici televisivi, sonori e dati, in chiaro o criptati, via cavo e via satellite, denominato «set top box»."

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

[10] DVB Blue Book A066 "MHP Mark Licensing"

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

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

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

[14] ETSI TS 101 154 V1.8.1: Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream

[15] ETSI EN 300 468 V1.9.1: "Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems

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

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

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

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

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

[21] 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"

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

[23] ETSI ETS 300 743: “Digital Video Broadcasting (DVB); Subtitling systems”

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

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

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

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

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

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

[30] ETSI TS 102 812 V1.3.1: “Digital Video Broadcasting (DVB); Multimedia Home Platform (MHP) Specification 1.1.3” most current version except when otherwise specified

[31] IEC 13818-1: “Information technology - Generic coding of moving pictures and associated audio information: systems”

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

[33] 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 superseeded by [13]. It is referenced only for information purposes.

[34] IETF RFC 1334: “PPP Authentication Protocols”

[35] IETF RFC 1994: “PPP Challenge Handshake Authentication Protocol (CHAP)”

[36] ITU-R BT.653-2 Teletext systems

[37] JSR 177: Security and Trust Services API for J2METM

[38] 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

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[40] DTG Implementation and User Group, “Digital Receiver Implementation Guidelines and Recommenden Receiver Reaction to Aspect Ratio Signalling in Digital Video Broadcasting”, Issue 1.2.1, Feb. 2001

[41] DGTVi D-Book, “Compatible DTTV receivers for the Italian market, sept 2004

[42] CI+ Forum, CI+ Specification. Content Security Extensions to the Common Interface

[43] HDMI Licensing, LLC, “High-Definition Multimedia Interface”, rev.1.3

[44] Intel, “High-Bandwidth Digital Content Protection System”, rev 1.3

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

[46] C.Poynton, “Digital Video and HDTV. Algorithms and Interfaces”, Morgan Kaufmann Publishers

4. Definitions and abbreviations

4.1. Definitions

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.

Channel: a television or a radio service, with its linked applications. Includes independent MHP applications that are accessed independently of a television or a radio service. Also the physical frequency block of 7 or 8 MHz over which the DVB-T transport stream is broadcast/transmitted.

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.

Drop call: A phone calls, started by the user in response to an interactive application, where the semantics of the user's response stays within the dialed phone number itself; on the server side in order to collect users' responses it's sufficient to answer the phone call and immediately after drop it without setting up an IP connection

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…).

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 [15]. 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

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. Symbols

TBA if necessary

4.3. Abbreviations

AAC	Advanced Audio Coding
AC-3	Audio Coding 3
ADSL	Asymmetric Digital Subscriber Line
AGCOM	Autorità per le Garanzie nelle Comunicazioni
CEN	Comité Européen de Normalisation
CHAP	Challenge Handshake Authentication Protocol
CI	DVB Common Interface
DHCP	Dynamic Host Configuration Protocol
DTS	Digital Theater Systems
DTTV	Digital Terrestrial Television
DTV	Digital Television
DVB	Digital Video Broadcasting
EACEM	European Association of Consumer Electronics Manufacturer
EDID	Extended Display Identification Data
EICTA	European Information and Communication Technology Association
ETSI	European Telecommunications Standards Institute
FTTH	Fiber To The Home
GPRS	General Packet Radio System
GUI	Graphic User Interface
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
iDTV	Integrated Digital TV Set
ISO	International Organization for Standardization
i-TV	Interactive Television
MPEG	Moving Picture Experts Group
MHP	Multimedia Home Platform
OMA	Open Mobile Alliance
OTA	Over The Air
PAP	PPP Authentication Protocol
PDC	Program Delivery Control
PNAF	Piano Nazionale di Assegnazione delle Frequenze
POP	Point Of Presence
PPP	Point-to-Point Protocol
PPPoE	PPP over Ethernet
PSTN	Public Switched Telephone Network
SD	Standard Definition
SIM	Security Identity Module
STB	Set Top Box
USB	Universal Serial Bus
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, Aethra, Euroscena, Eutelsat, Fastweb, Fondazione Ugo Bordoni, Fracarro, Frame, IDS Multimedia, Mediaset, RAI, SBP, Sky Italia, Sony, STMicroelectronics, Telsey, Telecom Italia Telecom Italia Media.
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 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) 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.)

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:

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

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

Refer to an HD-specific feature (italic)

The different TV formats are represented in the document according to the following notation [46]:

<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. Linkage with other organizations

Where available and compatible with the Italian situation, the specification contained in this document refer to standards developed by standards setting organisations (DVB; ETSI; EICTA; NorDig, MPEG; ISO; CEI, CEN). Furthermore, it follows the Italian legislation in force concerning DTTV and reception equipment for Digital Terrestrial Television[6].

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 does not endorse 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.

5.3. 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.

[6] Specifically the Italian Communication Authority Deliberation n° 216/00/ Cons.

6. Detailed hardware 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. Front End & Signal Decoding

The receiver shall support the following signal characteristics:

6.1.1.1. Mandatory features

Feature	Specification	Comment
Channel Bandwidth	- 7 MHz in Band III (both Italian and European VHF channel allocation) - 8 MHz in Band IV-V (UHF)	As 7MHz bandwidth in Band III with European channel allocation has been confirmed at the Regional Radio Conference GE06, receivers shall be ready for the forthcoming migration by supporting both Italian and European rasters (See Annex A for details of present Italian VHF use.)
Digital demodulation	COFDM DVB-T (EN 300 744)[7].	Ref. : [4]
Transmission mode	2k and 8k	Ref.: [4]
Constellation Combinations	QPSK, 16-QAM, 64-QAM, hierarchical 16-QAM, hierarchical 64-QAM)	Ref.: [4]
Code rates	1/2, 2/3,3/4, 5/6 or 7/8	Ref.: [4]
Guard Interval	1/4, 1/8, 1/16 or 1/32	Ref.: [4]
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.: [18]
Noise Figure (NF)	Better than 8 dB	Ref.: [4] Same as #12.7.3 in E-Book [13]
Implementation Margin	Better than 3 dB. In modes 64 QAM 5/6 and 7/8 can be greater.	Ref.: [4]

[7] *DVB-T2 is considered for future use. The next releases of the HD-Book DTT will define the relevant technical characteristics.*

Feature	Specification	Comment
Maximum Signal Level	Greater than -28 dBm (80 dBmV 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 (White Book of the Authority [2]) there could be levels reaching the receiver of -35dBm (73 dBmV on 75 ohm) and of the order of -25, -30 dBm. 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." Ref.: [4]
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 [4]	
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 is the minimum requirement if one wants the receiver to also operate in a Single Frequency Network as well. The minimum performance and test profile are those presented in E-Book *[33]*, # 12.7.8
Behaviour in the presence of short echoes	In the presence of echoes of matching levels, the demodulator operates with an extra implementation margin of 3.5 decibel when the channel profile corresponds to that reported in EN 300 744 [18]. 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 de-modulator operates with QEF performance in the 64 QAM mode and code rate 2/3. (Rice and Ray-lights profiles using the six strongest rays.)	Ref: [18] [4] The minimum performance and test profile are those presented in E-Book *[33]*, # 12.7.8
Demultiplexing	MPEG-2 System Transport Stream	Ref.: [14]
Video Decoder (SD mode)	*MPEG-2 Video Main Profile @ Main Level and* *H.264/AVC High Profile @ Level 3 (576i25) shall be supported.* *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)* *Ref. : [14], [4]*

Feature	Specification	Comment
Audio Decoder (SD and HD modes)	*The following standards shall be supported:* *- MPEG-1 Audio Layer I & II* *- HE-AACv1 up to level 2 for stereo and level 4 for multichannel (5.1)* *- AC-3 (aka Dolby Digital)* *- Enhanced AC-3 (aka Dolby Digital Plus) up to 5.1 channels* *Receivers are required to support audio description in the following formats as per [15]:* *- MPEG-1 L2 broadcaster mix* *- MPEG-1 L2 receiver mix* *- HE-AACv1 or Enhanced AC3 receiver mix* *Receivers may support other modes of audio description.* *Receiver may support "clean-audio" in broadcaster-mix format.*	*Ref.: [14]* *Full decoding of stereo transmissions is mandatory for any of the standards listed aside.* *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.* *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.* *Presentation of the transcoded or native AC-3 signal on SPDIF output (if present) is mandatory.*
Video Decoder (HD mode)	*H.264/AVC High Profile @ Level 4 (1080i25) support is mandatory*[8]*.* *H.264/AVC High Profile @ Level 3.1 (720p25) support is mandatory*[9]*.* *H.264/AVC High Profile @ Level 3.2 (720p50) support is mandatory.*	*Ref.: [13], [14]*
Audio Multi-Language	Language shall be selectable.	Behaviour as specified in [7.5.1.1 Audio Language]
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.

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).

[8] *As soon as H.264/AVC High Profile @ Level 4.2 (1080p50) will become part of the DVB toolbox, its support will be considered in next releases of the HD-Book DTT.*
[9] *This profile includes also supporting 576p50 (Enhanced Definition TV), a format which broadcasters can consider for new H.264/AVC SD services.*

Feature	Recommended value	Comment
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

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. *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, is deemed important for HD receivers. Therefore

- STB receivers shall have at least one wireline interaction channel and
- iDTV receivers should have one wireline interaction channel.

Two families of interaction channel implementations are in fact considered[10]:

- 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.

6.1.3. 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.

[10] 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

Feature	Specification	Comment
Ethernet	IEEE 802.3 10/100 Mbit/s autosense	
IP address	Obtained either: • via DHCP or • 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

Table 4: Wireline interaction channel features

6.1.4. Mobile interaction channel

Any advanced packet-switched mobile connections (e.g. GPRS over EDGE, HSDPA, …) can be used as mobile interaction channel. See Annex 0 and D as an example of assisted and manual configuration in the GPRS case.

6.1.5. 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 [30] 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 5: Interaction channels values

6.1.5.1. 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

6.1.6. 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 8 Mbyte 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 6: Memory capacity requirements

6.1.7. 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.

6.1.7.1. 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
Output RF connector (pass-through)	IEC 60169 Male	"Loop through" facility. Only applicable to STBs. Necessary to transmit the signal from the receiving antenna to a VCR, and/or to a TV set. In presence of the RF modulator ,this output carries also, on a user selectable channel, the digital (decoded) signal
SCART Connector (Primary)	Peritelevision standard [7] • RGB • CVBS: PAL Out • Audio Output A/V Control Pin 8	For connection to the TV set. Only applicable to STBs As an option, the user menu may offer the possibility to output a Y/C signal instead of the RGB signal. *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).* *The stereo output pins will carry one of the following:* *• a mono or stereo signal, in the case of the received audio component being mono or stereo;* *• a two channel downmixed signal, in the case of the received audio component being multi-channel.*

Connector	Specification	Comment
Output SPDIF Connector	As per [32]: • Electrical (RCA connector) or • 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.
Output HDMI Connector with HDCP content protection	*Type A (Female) [43]* *Automatic audio/video sync is required.* *HDCP [44] must be ON by default.* *720p50 is the recommended default output format.*	*For digital connection of STBs to HD Ready TV or HD Ready 1080p sets.* *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.* *For these reasons, the dynamic output mode shall be available in user menus but not necessarily as the default value.* *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) [43]* *E-EDID support, including HDMI VSDB (Vendor-Specific Data Block) Lipsync-related fields, is required.* *HDCP [44] must be ON by default.*	*For digital connection of STBs to HD Ready or HD Ready 1080p TV sets.*
Ethernet Port	*RJ 45 Connector*	*Mandatory for STBs with wireline interaction channel also in case they provide (in-house) wireless access*[11]*.*
Smart card slot	ISO 7816 1,2,3 with T=0 and T=1	For CA and non-CA applications
Common Interface (CI+)	*EN 50 221, as explained in section 9.1.1.2, with extensions by CI+ Forum [42]*	*Applicable and mandatory only for iDTVs with screen diagonal over 30cm (13").*

Table 7: Mandatory connectors table

[11] 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 STB with USB port will be considered compliant with this requirement only if the aforementioned adapter would come bundled with the receiver itself.

6.1.7.2. 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) [43]* *Automatic audio/video sync is required.* *HDCP [44] must be ON by default.*	*For digital connection to other external equipment (e.g. Home Theater, Video Projector).*
SCART Connector (Secondary)	• CVBS: PAL Out • Audio: Output • 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. *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).* *The stereo output pins will carry one of the following:* *• a mono or stereo signal, in the case of the received audio component being mono or stereo;* *• a two channel downmixed signal, in the case of the received audio component being multi-channel.*
SCART In Connector (1)	Peritelevision standard [7] • RGB In • CVBS: PAL In • Audio In • A/V Control Pin 8	Applicable only to iDTVs, for connecting legacy SD devices.
SCART Connector (Primary)	Peritelevision standard [7] • RGB • CVBS: PAL Out • Audio Output A/V Control Pin 8	For connection to external legacy SD equipment. As an option, the user menu may offer the possibility to output a Y/C signal instead of the RGB signal. *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).* *The stereo output pins will carry one of the following:* *• a mono or stereo signal, in the case of the received audio component being mono or stereo;* *• a two channel downmixed signal, in the case of the received audio component being multi-channel.*

Connector	Specification	Comment
RCA Connectors (Composite)	• 1 Video • 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.* *The stereo output connector will carry one of the following:* *• a mono or stereo signal, in the case of the received audio component being mono or stereo;* *• 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* • *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.* *The stereo output connector will carry one of the following:* *• a mono or stereo signal, in the case of the received audio component being mono or stereo;* *• a two channel downmixed signal, in the case of the received audio component being multi-channel.*
Ethernet Port	RJ 45 Connector	Recommended for IDTVs. See note 11
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 11).
Mobile high gain antenna connector	One of three possible standards • RP TNC female • RP MC Card female • RP SMA female	For receivers with mobile interaction channel.
Serial data port (RS-232) 9-pin	D-sub connector Female	

Table 8: Optional connectors table

6.1.7.3. 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:

	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*

	HDMI	SCART	RCA	SPDIF
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 9: 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.1 and ref. [26]).

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.3). 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.2.1).

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.2). 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:

- 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.4.2).

Figure 1: Typical Remote Control

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*[12]. Longer time out length is perceived as misfunctional or annoying by users (see Easy-TV research findings in Annex B.3)

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) [21]. 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

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

[12] 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)

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.

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.

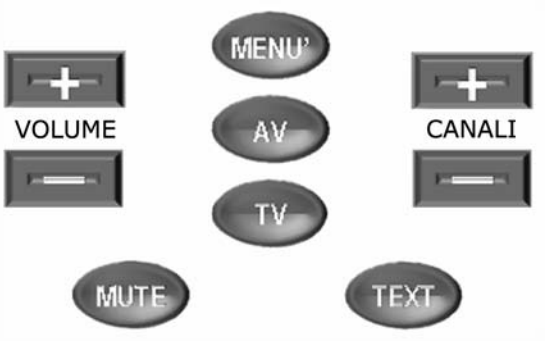

Figure 4: The TV Pad

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 10: 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 11: 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 (1).
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 12: 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 13: 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 14: 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 proprietary menu GUI. In that case, any running/loading/paused MHP application may be killed, but it is mandatory that, as soon as the menu GUI disappears from the screen, any MHP autostart application 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.3.

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 [30]:

- 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;
  - For multi-key press entry (as used in some mobile phones), the keys pressed before the final value is resolved.
  - 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 [30].

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
abc 2	Mandatory	a b c 2 à A B C
def 3	Mandatory	d e f 3 è D E F
ghi 4	Mandatory	g h i 4 ì G H I
jkl 5	Mandatory	j k l 5 J K L
mno 6	Mandatory	m n o 6 ò M N O
pqrs 7	Mandatory	p q r s 7 P Q R S
tuv 8	Mandatory	t u v 8 ù T U V
wxyz 9	Mandatory	w x y z 9 W X Y Z
— 0	Mandatory	0 “space” “new line”

Table 15 : 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 16: 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 next section.
D	Focus gained/lost	When the user moves the focus to a text entry field it shall become immediately active without any need 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 17: 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

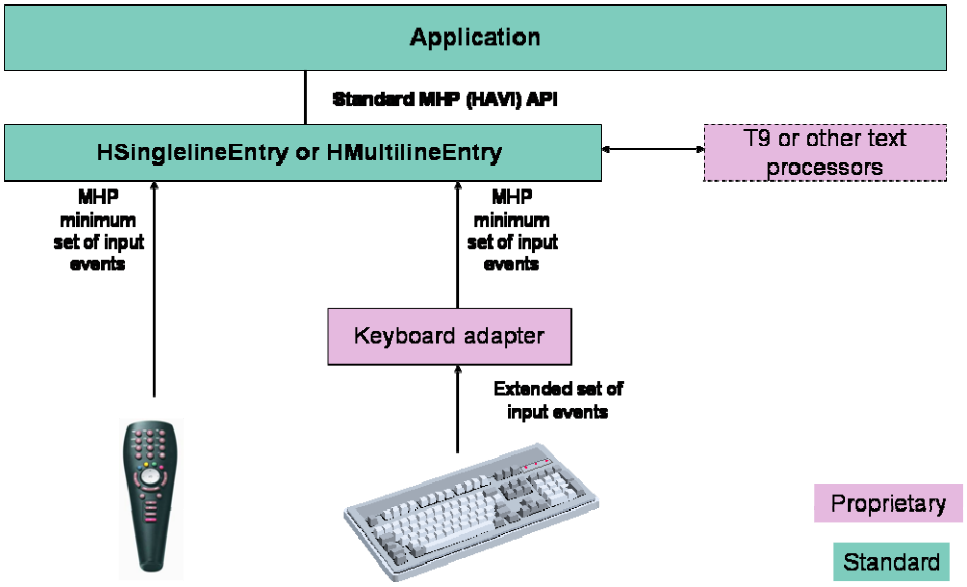

Figure 5: Text Entry Layering Schematic

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 [13]. But the compatibility of all EICTA recommendations with the Italian landscape has not been fully verified. The elements still to confirm are marked as (To be validated).

However, a receiver specification cannot put any constraints on the broadcast signal – 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 [13]) 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 18: 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 19: 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

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

Table 20: 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 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 [14] revisions.

7.2.2.3.2 Enhanced AC-3 solution

Compliance with the behaviour specified in [14] §6.2.2.2 is required.

7.2.3. Network Information Table (NIT)

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 21: Network descriptors (NIT first loop)

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*
*Receiver shall ignore the majority of the fields of this descriptor, see below § 7.2.3.2			

Table 22: 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 following parameters (when present):
- 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 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)

Descriptor	Tag	Status	
		Actual	Other
Service_descriptor	0x48	M m	O m
Country_availability_descriptor	0x49	O m	O
CA_identifier_descriptor	0x53	C m	C m
Private_data_specifier_descriptor	0x5F	C	C
Preferred_name_list_descriptor	0x84	O	O

Table 23: 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.

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, that 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

According to DVB SI [15], 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; a channel, as presented to the viewer, can instead be a mix of SD and HD contents, according to the behavior specified in 7.2.6.4.

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 courtesy banner
running_status = 4, running -> normal behaviour

7.2.6. Event Information Table (EIT)

7.2.6.1. Event Information Descriptors

The EIT shall carry the following descriptors to meet the requirements of EN 300 468 [15] and TR 101 211 [24]:

Descriptor	Tag	Status			
		Present/Following		Schedule	
		Actual	Other	Actual	Other
Linkage descriptor	0x4A	O m	O m	C	C
Short event descriptor	0x4D	M m	M m	M	M
Extended event descriptor	0x4E	C m	C m	O	O
Component descriptor	0x50	M	M	O	O

Descriptor	Tag	Status			
		Present/Following		Schedule	
		Actual	Other	Actual	Other
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	Om	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
It is optional for broadcasts to include EIT schedule information. However, if EIT schedule information is present, it should be as specified here. Receiver should be able to interpret data as indicated in the above table					

Table 24: 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.

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. SD/HD simulcast handling[13]

It's likely that broadcasters will introduce HD services which, to a lesser or greater extent, are a simulcast of an existing SD service. Often there are one or more events which are simulcast between the two services but there are also frequent periods when different content is being transmitted.

Three scenarios have been identified:

[13] *Text in this section is based on EICTA formal submission to DVB. Possible changes agreed in DVB will be duly incorporated.*

1. Regional SD service with simulcast event on a national HD service.

Viewers with HD receivers may be watching the national HD service or a regionalized SD service. In the latter case, the broadcaster would like to be able to direct the viewer to the HD service when there is a simulcast event. SD receivers should remain on the SD service as they would be unable to decode the HD version of the event.

2. National HD service with regional opt-out.

The national HD service will not carry the regional opt-out events, which could be provided as temporary (HD or SD) services or could be part of permanent regionalized SD services. The broadcaster would like to be able to direct the viewer who is watching the national HD service to the regional event at the appropriate time.

3. Multiple SD services with partial simulcast of event on the HD service.

The viewer may be watching an SD service where part of the HD event is being simulcast (perhaps the simulcast in SD of the HD event is split across multiple services for scheduling reasons). The broadcaster would like to direct the viewer to the HD service during this simulcast period, which is identified by the event on the SD service and not the longer event on the HD service.
In all three cases the receiver should return to the original service when the simulcast period has finished.

The only tool currently available in DVB to provide this type of linking between services is the linkage descriptor with linkage_type 0x05 (service replacement service). However this is intended to signal a complete service replacement when the current service is not available, which is not the case here.

For this reason a new linkage_type 0x0D called "simulcast event" has been defined by EICTA. This linkage_type, which will be submitted to DVB for endorsement, would only be used in the EIT and would be interpreted by an HD receiver only. Some further parameters in the linkage descriptor would be required to provide full functionality:

`if (linkage_type == 0x0D){`		
`user_confirmation`	1	bslbf
`return_table`	1	bslbf
`target_listed`	1	bslbf
`event_info_source`	1	bslbf
`service_name_source`	1	bslbf
`reserved_future_use`	2	bslbf
`message_present`	1	bslbf
`if (message_present == 0x1) {`		
`ISO_639_language_code`	24	bslbf
`to_text_length`	8	uimsbf
`for (j=0;j<N1;j++){`		
`to_text_char`	8	uimsbf
`}`		
`from_text_length`	8	uimsbf
`for (j=0;j<N2;j++){`		
`from_text_char`	8	uimsbf
`}`		
`}`		
`for (i=0;i<N;i++){`		
`private_data_byte`	8	bslbf
`}`		
`}`		

user_confirmation: *This bit indicates whether the user should be asked whether the link should be followed (user_confirmation is '1') or not (user_confirmation is '0').*

return_table: *When this bit is '1', the receiver shall return to the original service when the present event shown in the $EIT_{p/f}$ for the target service (carried in the target multiplex) changes to a new event.*

When this bit is '0', the receiver returns when the linkage descriptor (pointing to the currently selected target service) is removed from the "present" event in the $EIT_{p/f}$ for the original service (cross-carried from the multiplex of the original service in the case that the two services are in different multiplexes).
NOTE: Receivers should be aware that the $EIT_{p/f}$ signaling and content play-out in the multiplex of the original service and the multiplex of the target service (when different) may not be closely synchronized.

target_listed: *The service that is being linked to may or may not appear in the SDT of that multiplex. When target_listed is set to '1', the receiver can expect to find the service in the appropriate SDT and does not have to follow the link if the service is not listed there. However, when the bit is set to '0', the receiver should ignore the SDT and look directly in the PAT. In this case, the receiver may assume the following:*

- *the service is decodable by an advanced codec HD receiver;*
- *$EIT_{p/f}$ information is available in the target multiplex;*
- *the service is running;*
- *if the service is scrambled, the CA system will allow the receiver access to it.*

event_info_source: *The receiver may have the ability to display the event information for the viewer. When this bit is set to '0', the receiver shall use the event information from the EIT_{act} (i.e. for the present event on the service that has been linked to). Otherwise, the receiver shall use the event information for the present event on the original service (in EIT_{act} or EIT_{oth} as appropriate). If EIT is not being cross-carried (i.e. the receiver is unable to extract EIT_{oth} from the TS), the receiver shall assume that this bit is '0'.*

service_name_source: *The receiver may have the ability to display the service information for the viewer. When this bit is set to '0', the receiver shall use the service information for the service that has been linked to, otherwise it shall use the service information for the original service. If target_listed is '0' (i.e. target service is not listed in the SDT), service_name_source shall always be '1' (i.e. use the service information from the original service).*

message_present: *When this bit is '1', text messages (in different languages) shall be provided in this descriptor.*

ISO_639_language_code: *This 24-bit field identifies the language of the following text fields. The ISO_639_language_code contains a 3-character code as specified by ISO 639-2. Both ISO 639-2/B and ISO 639-2/T may be used. Each character is coded into 8 bits according to ISO/IEC 8859-1 and inserted in order into the 24-bit field.*

NOTE: Multiple instances of the linkage descriptor with linkage_type of 0x0D may occur in the same descriptor loop as long as they have different ISO_639_language_code values. Receivers shall pick one of the descriptors based on this field and act appropriately.

to_text_length: *This is an 8-bit field specifying the length in bytes of the to_text text. This field may be 0.*

to_text_char: *This is an 8-bit field. A string of "to_text_char" fields specify the text to be displayed by the receiver when the link is taken to the target service. Text information is coded using the character sets and methods described in annex A.*

from_text_length: *This is an 8-bit field specifying the length in bytes of the from_text text. This field may be 0.*

from_text_char: *This is an 8-bit field. A string of "from_text_char" fields specify the text to be displayed by the receiver when it returns to the original service. Text information is coded using the character sets and methods described in annex A.*

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
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	O
Time and date table	M m	N/A
Time offset table	R m	N/A
Running status table	U	N/A

Table 25: List of mandatory tables

7.3. Private Data

This chapter consolidates the DGTVi LCN specification with latest developments in EICTA to cope with possible cross-border LCN conflicts.

When private descriptors are present in a broadcast, a private data specifier descriptor shall 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 26: 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.

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 27: 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 optional

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 28: 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 (except for Successor Services).

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.

Further more, two specific ranges have been defined:
- the Preferences Overflow,
- the Main Overflow (or “Garbage Collector”).

The Preferences Overflow occupies service numbers 75 to 99.
The Main Overflow occupies service numbers 850 to 999.

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 2 “safe” overflow ranges
- 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. However, it shall also be possible to have a fully automatic procedure. This means that, at any point where a user interaction is requested, there shall be a time-out and an automatic selection procedure.

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; and
- if the conflict is in the Preferences Zone, allocate the other service to the next unallocated number in the Preferences Overflow. In case there is no unallocated number in that range, the service shall be allocated to the next unallocated number in the Main Overflow.
- if the conflict is in the Assignment Zone, allocate the other service to the next unallocated number in the Main Overflow

e) in case the viewer does not select a service in the menu within the given time out the first service in the list shall be automatically selected. The ordering of conflicting services should not be based on the order of discovery, but should be random.

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

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, excepting Successor Services), the receiver shall proceed in the following manner:

The receiver, after signalling to the user that new services are available (as in the procedure described in 7.6.5), 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.)
The pop up menu shall have a time out. In case no channel is selected, the first service in the list shall be automatically selected.
Non selected service(s) shall be allocated the next available number(s) in the Preferences Overflow if the conflict is in the Preferences Zone. In case there is no available number in that range, the service shall be allocated an available number in the Main Overflow in the Main Overflow in all other cases.

In the absence of a LCN request, the service shall be allocated the next available number in the Main Overflow. 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**], and the unselected service shall be allocated to the Main Overflow.

7.3.4.5.3 Removing a service

If, during an automatic of a manual update scan, the receiver decides 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; but it shall preserve the information about the removed service in case a Successor Service is found later (see below) to allow such a Successor Service to take the place of the removed service in the service 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 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.

7.3.4.5.4 Successor Services

However, the more common case is that a suitable Successor Service will be available at the same time a service is removed

In case such a new service requesting the same Service Number allocation, is available, this shall not give rise to a conflict of service number requests: this new service shall be considered a Successor Service.

As the deletion of the former service from the NIT actual and SDT actual is a positive confirmation of its deletion by the network operator, the Successor Service shall be allocated the service number present in its LCN descriptor.

Earlier registered services, with at the time conflicting requests (processed during earlier scans), shall not be considered as Successor Services.

In case no Successor Service is available (and the service is no longer present in the NIT actual and in the SDT actual), the viewer shall be asked whether to delete the service from the Master User List or not. This is irrespective from the presence (or not) of a LCN descriptor in the deleted service. The default response shall be “Yes”, and a time out shall select the default response in case the viewer takes no action.

Of course, a viewer shall always be able to cancel/remove a service from the Master User List.

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 Preferences Overflow if the number is in the Preferences Zone, and in the Main Overflow in all other cases or if there is no available number in the Preferences Overflow
- 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.

- A Successor Service to a deleted service shall be reintroduced in the Master User List, at its Service Position (subject to the first complementary rule).

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, and it is not a Successor Service, 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 number in the Preferences Overflow. If no number is available in that range, it shall be assigned an available service number 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. Successor Services

In case of conflict, the receiver shall first attempt to find suitable Successor Services (i.e. occupying a personalized channel number or having a conflicting allocation with a service that the receiver has not been able to identify positively as removable) according to the following rules:

a) The receiver shall first try match a new service (Successor Service) to a logical_channel_number and network_id and original_network_id from a service previously removed from the service list.
b) Any remaining new services shall be allowed to replace services of other networks no longer available (match only on logical_channel_number and original_network_ id)

Any new services that remain after Successor Service rules have been applied shall be assigned in accordance with the service number allocation rules mentioned above for resolving conflicts by the viewer, but shall not change already existing service number allocation.

7.3.5.2. 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.

7.3.5.3. Network re-configuration

For major network reconfigurations, it is recommended that the user proceed with a re-installation, even at the risk of loosing 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.

Where possible, the receiver shall attempt to find suitable Successor Services (i.e. occupying a personalized channel numbering or having a conflicting allocation with a service that the receiver has not been able to identify positively as removable) according to the following rules:

a) The receiver shall first try match to a new service (successor service) to a logical_channel_number and network_id and original_network_id from a service previously removed from the service list.
b) Any remaining new services shall be allowed to replace services of other networks no longer available (match only on logical_channel_number and original_network_ id)

Any new services that remain after successor service rules have been applied shall be assigned in accordance with the service number allocation rules as mentioned above, but shall not change already existing service number allocation.

Such services may take any free position in the service list, thereby potentially using the service number of a removed service that might be replaced later and thus blocking such a future successor. Receiver manufacturers should attempt to minimise such events. It is suggested to mark (for example using an alternate colour or an icon) those services with changed status (added, deleted, or changed) in order to indicate the changes to the user.

7.3.5.4. 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[14]

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 29: 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.

[14] The current text is based on latest E-Book 2.0 Draft and it's being still discussed within EICTA. It will be aligned to the final version when available.

Support by receivers of the visible_service_flag is optional

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.

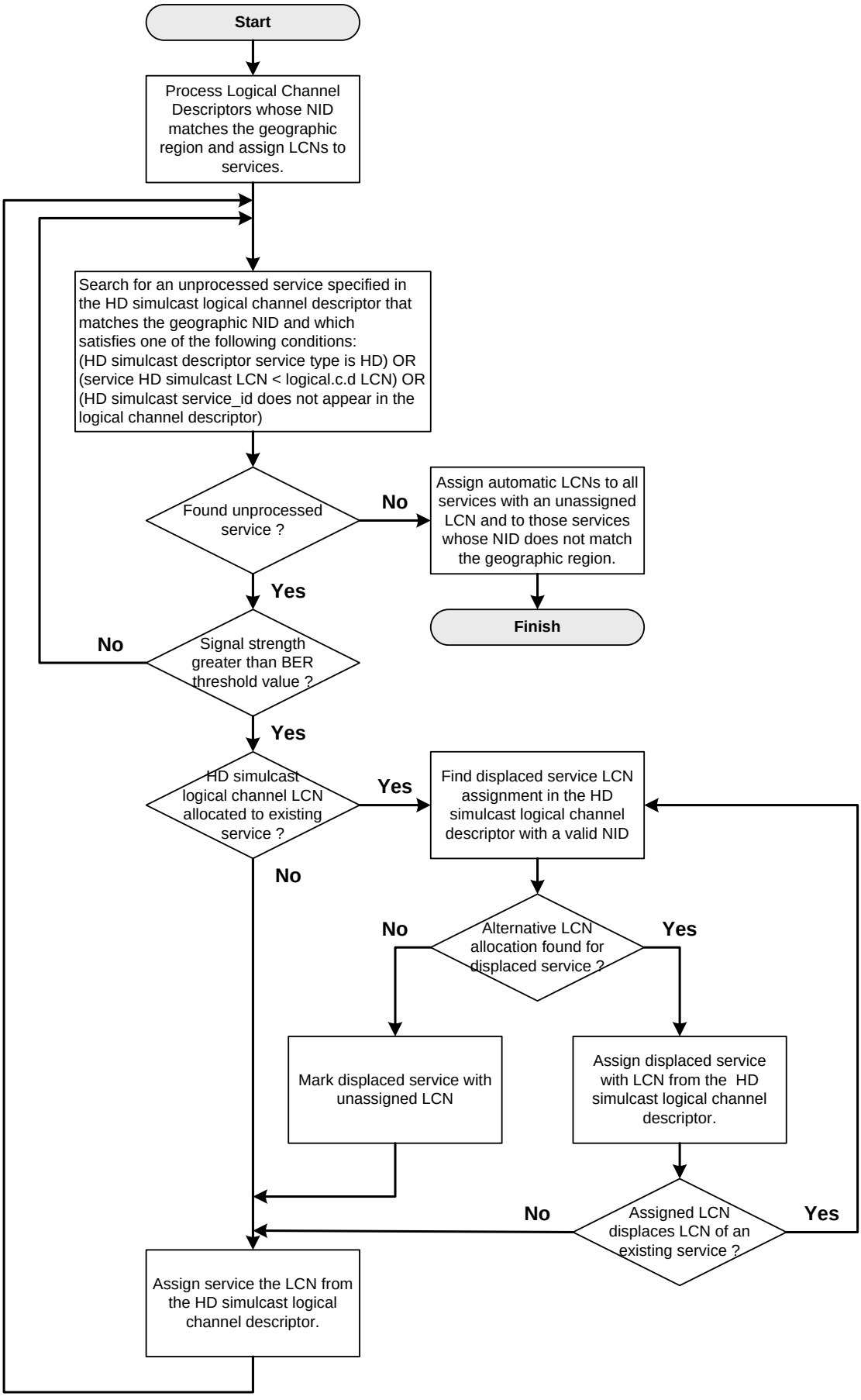

Figure 6: HD_simulcast_LCN operation

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.

7.5.1.3. MHP services

The receiver shall present all of the components of the service in accordance with the user preferences (limited only by its ability to actually present the components).

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 STB 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 [14] “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 [14] Annex B.2.2.

In case of HDTV compatible receiver, the receiver shall recognize AFD transmitted according to [14] Annex B.3.2.

7.5.3.2. Valid Values for Descriptor

All values referenced in [14] Annex B “table B.2 active_format” are valid value 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” [40].

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 [40].

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 [40] (for16:9 displays). Support for scaling to 4:3 aspect ratio for HDMI is optional (since consumer HD displays are 16:9). Aspect ratio signalling in the HDMI AVI Infoframebits R0..R3, M0, M1 (see CEA-861) shall be set in accordance with the properties ofthe video on the output.*
- *Pass the video to the HDMI output unprocessed with respect to AFD and aspect ratioscaling, and pass AFD and aspect-ratio signalling 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;

For all the described tuning procedures, receivers shall scan the following spectrum bands: III-VHF (BW=7 MHz with both Italian and European channel raster), IV-UHF (BW=8 MHz) 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:
  - the receiver shall detect a “service_name” change of a given service and update it unless it was manually edited by the end user;
  - 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:
  - if they carry an LCN and automatic ordering is active, the rules given in §7.3.4.5 for allocation and conflict resolution apply;
  - 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.
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: “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 the following message: “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’

N.	Settings / Italian Translation	Mandatory default settings
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 possibile)

Table 30: 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. (In case of equivalent QoS, this position shall be assigned to the service first discovered). 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 Preferences 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 Preferences 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]

7.6.6. 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.

7.6.7. Network evolution

As specified in Table 30: 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.

7.6.8. 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.

Field name	Field length in displayable characters	M/R/O	Comments and examples
Extended Event Text	3984	O	The extended event text complements the short event description.
Component description	32	O	“In alta definizione”

Table 31: 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 [30]. This is used to visualise dynamic graphical applications (e.g. slide shows).

8.1.2. Teletext

Teletext [17] 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 [16].

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 [17], 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 [36]. 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 6.1.7.2), even if many VCRs will not be able to replay this data. Insertion shall conform to ITU-R BT.653-2 [36]. 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 [12]. 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 [23] shall be implemented in conformance with the MHP Standard [30].

HD Subtitling shall be implemented according to EICTA Advanced E-Book [33].

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 [30]).

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 [41]).

8.2.2. Resident Broadcaster Defined Applications

Those applications shall be resident applications. If not fully implemented as MHP downloadable applications, manufacturers should be aware that there is a need to provide maintenance and upgrade facilities until the specification is fully confirmed through operational use.

It is expected that after 36 months of operation, this level of stability will be reached.

The following resident applications are being considered:

- Return Channel and other Receiver Services Manager
- User Profile and Persistent Memory Storage Manager
- Electronic Programme Guide

(The two latter are mentioned only for information purposes.)

8.2.2.1. Security and Access to Resources

As specified in the MHP Specification [30] (# 12.6):
"The resource access policy depends on two factors

- The access rights requested by the broadcaster through the signalling,
- The access rights granted by the user.

The ultimate access rights that are granted to the applications are the intersection of the access rights requested by the broadcaster and the access rights granted by the user.
Unsigned applications have limited access to platform resources.
Unless specified elsewhere in this specification, signed applications have the same access rights as unsigned applications. […]
The way the user grants rights to the downloaded applications is implementation dependant […]."

The following paragraphs complement the MHP specification and gives mandatory guidelines for the implementation of the receiver security policy and of user grants.

For the implementation of MHP Security in Compatible DTTV Receivers, see # 9.2.

8.2.2.2. Return Channel Manager

For access to the return channel, the receiver shall allow the user to choose among three levels of Access:

a. No security: any signed MHP application may access the return channel directly without confirmation by the end user;
b. Confirmation: any signed MHP application may access the return channel only after the end user gives a confirmation through a STB proprietary GUI;
c. PIN: any signed MHP application may access the return channel only after the end user inserts a security PIN.

Non signed applications shall not have access to the return channel. In case, MHP Security has been disabled on the receiver, only options b.) and c.) shall be presented to the end user.

8.2.2.3. Access to the Smart Card Reader for non-CA applications

For access to the smart card reader for non-CA applications, the receiver shall allow the user to choose among three levels of Access:

a. No security: any signed MHP application may access the smart card reader directly without confirmation by the end user;
b. Confirmation: any signed MHP application may access the smart card reader only after the end user gives a confirmation through a STB proprietary GUI;
c. PIN: any signed MHP application may access the smart card reader only after the end user inserts a security PIN.

Non signed applications shall not have access to the smart card reader. In case, MHP Security has been disabled on the receiver, only options b.) and c.) shall be present to the end user.

8.2.2.4. Implementing Access to the R C and to the S C Reader

The choice of Access level shall be through a menu in the receiver set up menu. Modification of the Access level shall be protected by a password.

The PIN used when option c.) is selected should preferably the same for Access to the Return Channel and Access to the Smart Card Reader. It could also be the same as for Receiver Block and/or Parental Control, if these are implemented. In any case, all receiver services sharing the same PIN shall be presented together to the end-user.

When Access level is set to b.) or c.), the receiver proprietary GUI shall interact with any MHP application GUI in conformance with # 6.4.

When Access Level is set to b.) or c.),

- for Return Channel Access, user confirmation shall be necessary for each new access request;
- for Smart Card Reader Access, user confirmation shall be valid for the whole life cycle of the application that requested access.

8.2.3. 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 event 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

***Manufacturers shall implement the latest version of the specification (presently – September 08 - MHP 1.1.3 [30] with the relevant extensions defined hereafter and in the D-Book) and shall provide timely update patches/updated builds for the installed base**.*

Minimum requirement for STBs is Interactive Broadcast Profile. DVB-HTML support is recommended[15]*.*

Enhanced Broadcast Profile is required for iDTVs without interaction channel.
Minimum requirement for iDTVs with interaction channel is Interactive Broadcast Profile. DVB-HTML support is recommended.

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.

8.3.1. 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. 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. Interaction between Resident and Broadcast 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.) this shall **not kill** the active loaded MHP application.

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 # 6.1.6 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.

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

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 give 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)
- model name (system.hw.model)
- hardware release (system.hw.version)
- software release (system.sw.version)
- loader release (system.loader.version)

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.

8.4. 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.

8.4.1. 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 [28].
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). Refer to the following table for automatic channel scan default settings.
7. If the “automatic software update in operate mode” option is available and set to YES, then:
   - at a specified time and with a specified frequency, the receiver has to search for new software, notwithstanding if the receiver is on or in standby mode;
   - 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.
   - When new software has been installed, then (after the receiver has been automatically rebooted, if necessary) a message 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.
   - 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.
- The message will stay on the screen until the viewer presses the OK key.
- It is strongly recommended that, within the receiver menu, a section is provided for describing the new features of the last downloaded software.

8. If the "automatic software update in operate mode" option is available and set to "NO" (or the operation was aborted), then the procedure as described in the previous point shall be performed 45 minutes after the receiver has been switched to standby mode (obviously only if the “automatic software upgrade in standby mode” option is set to “YES”). If new software is found and installed, the same message as described in the previous point shall be displayed when the receiver is switched on. In case the receiver is put in standby mode more than once a day, the procedure has to be performed only once.

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 possibile)

Table 32: Default settings for auto software upgrade

8.4.2. Over The Air Software Update

The manufacturers shall implement the DVB System Software Update (DVB-SSU) as defined in [29], using the Simple Profile of DVB Data Downloading as defined in [28]. 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.

8.4.2.1. 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 are already being or planned to be used on Italian DTTV platform 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.

9.1.1.1. *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 [45]. Such extension is a backward compatible superset of the original DGTVi specification. DGTVi provides the specification for free to any interested party.

9.1.1.2. *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 [42] 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).

9.1.1.2.1 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.

9.1.1.2.2 DGTVi 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 [20]
- 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 host find out that more than one device supports the CA(s) (e.g. embedded CA, CI port 1, CI port 2) associated to the tuned service, it shall select the active (descrambling) device according to the following priorities:
    - Embedded CA connected with a compatible SC
    - CAM on CI 1 connected with a compatible SC
    - CAM on CI 2 connected with a compatible SC
    - ….

- Compatible Embedded CA without a valid SC
- Compatible CAM on CI 1 not connected with a compatible SC
- Compatible CAM on CI 2 not connected with a compatible SC
- ….
- Non-compatible CAM empty CI slot 1
- Non-compatible CAM empty CI slot 2
- ….

- 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 than the downloaded MHP
- MMI pop-up owns the control of the remote control keys

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].

9.1.1.2.3 CI+ host requirements

For HD Pay TV services support of the CIv1 security extensions [42] specified by the CI+ Forum is mandatory.

The so-called "CI+ Browser" is not required in the host and it could be removed to save memory.

Aforementioned CA API extensions shall also be supported in the context of CI+. Mapping of such API on CI+ is specified in [42] Annex M.

9.1.2. Non-CA Services

For smart card based non-CA services (T-government, T-banking, loyalty cards, …), the SATSA standard API [39]) introduced in MHP 1.1.2 [30] 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 [30] 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 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 # 12 of the MHP specification [30].

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. The root certificate(s) used by the receiver to authenticate the server will be provided over the air.

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 [30] Annex AI).

The MHP specification does not specify the interaction with the user to define the access permissions granted to the different applications. This lack of specification leads to some uncertainty in the process and can make learning by the end user and support by broadcaster and network operators unnecessarily difficult. Furthermore, the type of permission requests to be made from the end user are not fully covered.

This issue is recognized with the DVB MHP maintenance process, and it has begun to address the problem, at least concerning the return channel.

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 telephone system (If applicable)
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 33: Accessories

10.2. Power Supply / Voltage

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

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	
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
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

Feature	Specification	Status	Note
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	
Return Channel Access Control	ON, level b.) (see D-Book,# 8.2.2.2)	Mandatory in case of presence of return channel	End-user confirmation of authorization to access return channel, for each new session

Table 34: 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 disactivate it. In that case, the information on availability of new software for the receiver shall be presented to the user.

Annexes

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A Italian use of VHF

Italian Channels			European Channels	
	Channel	*Channel limits (MHz.)*	*Channel*	*Channel limits (MHz.)*
Band III	D	174 ÷ 181	5	174 ÷ 181
	E	182,5 ÷ 189,5	6	181 ÷ 188
			7	188 ÷ 195
	F	191 ÷ 198	8	195 ÷ 202
	G	200 ÷ 207	9	202 ÷ 209
	H	209 ÷ 216	10	209 ÷ 216
	H1	216 ÷ 223	11	216 ÷ 223
	H2	223 ÷ 230	12	223 ÷ 230

Table 35: VHF Channels allocation in Italy and Europe

Potentially active channels		
	Channel	*Channel limits (MHz.)*
Band III	D=5	174 ÷ 181
	6	181 ÷ 188
	E	182,5 ÷ 189,5
	7	188 ÷ 195
	F	191 ÷ 198
	8	195 ÷ 202
	G	200 ÷ 207
	9	202 ÷ 209
	H=10	209 ÷ 216
	H1=11	216 ÷ 223
	H2=12	223 ÷ 230

Table 36: VHF Channels to be scanned in Italy until ASO

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 37: 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 ESTI 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)

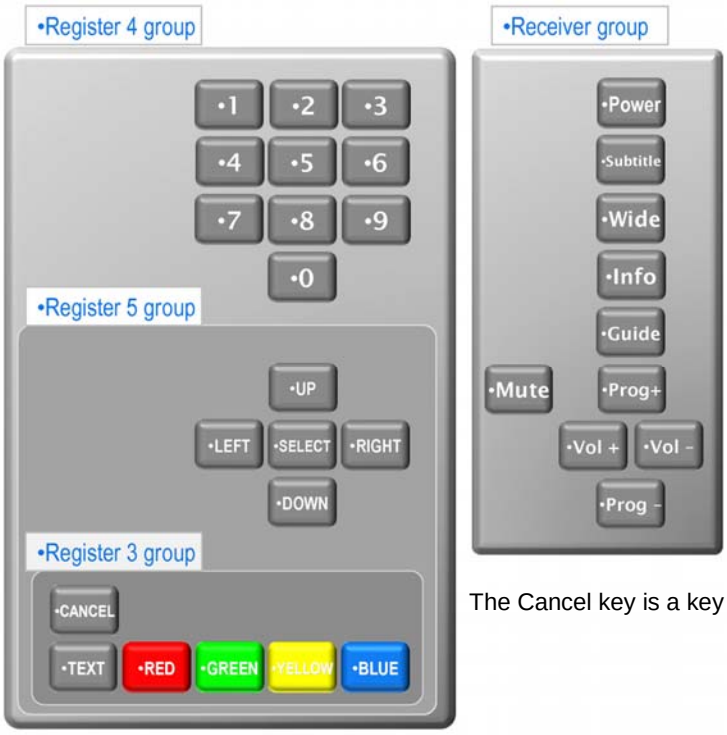
Remote controllable functions
Description of the minimal functions of the remote control

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 38: 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: 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 receiver

Table 39: CEI Specification; CT 100, Progetto di Guida

B.2.5 The NorDig Unified Specification

B.2.5.1 The Remote Control and Remote Keybord

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 40: The NorDig Unified Specification; B.2.5.

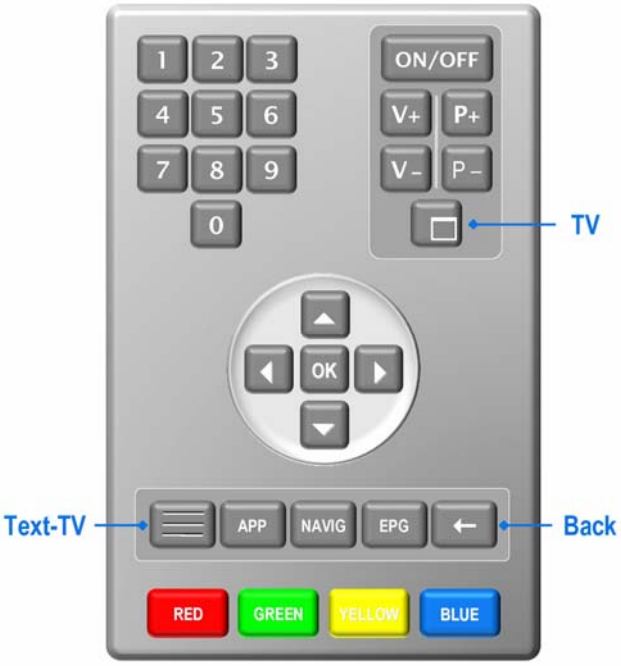


Figure 7: Conceptual illustration of the NorDig IRD remote control (16,1)

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 41: 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] • « 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] • « 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 MMS of Video Rich Class with file size > 30 kB Wireless Village Instant Messaging Client 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 Support of Socket http, https and autostart of Midlets	
SIM-J2ME Dialogue	Through APDU	Cf. JSR 177 [37]
Micro Browser	WAP 2.0, or http	
Multimedia Object Download		For applications, games, images, video
DRM Agent	Following OMA specification, with handling of the following protected objects Forward Lock Combined Delivery Separate Delivery	
Video Player	3 GPP encoded content MPEG4-10 encoded content	
Memory Card Slot	Secure Digital Multimedia Memory Card (SD/MMC)	To exchange data with radio mobile terminals

Table 42: Optional features for mobile interaction channel

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 data1

- Messenging 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 ([2])
- Password
- 6 to 8 n°, user specific ([3])

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

[1] 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
[2] this field could be also set to “ void “
[3] 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

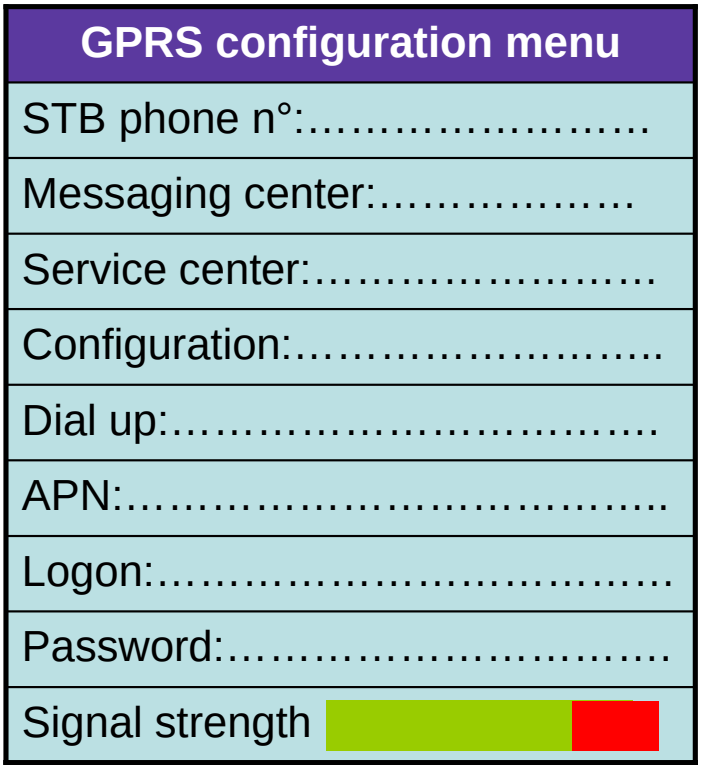


Figure 8: Typical manual configuration menu

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

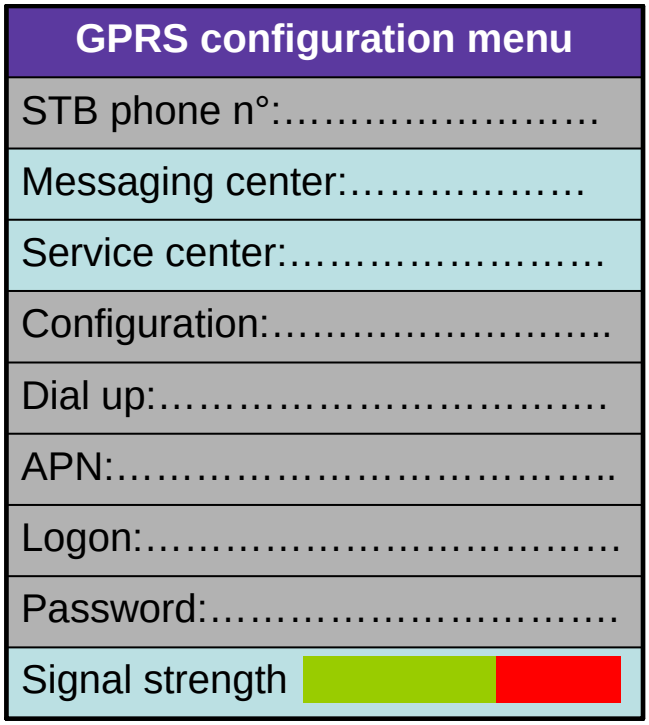
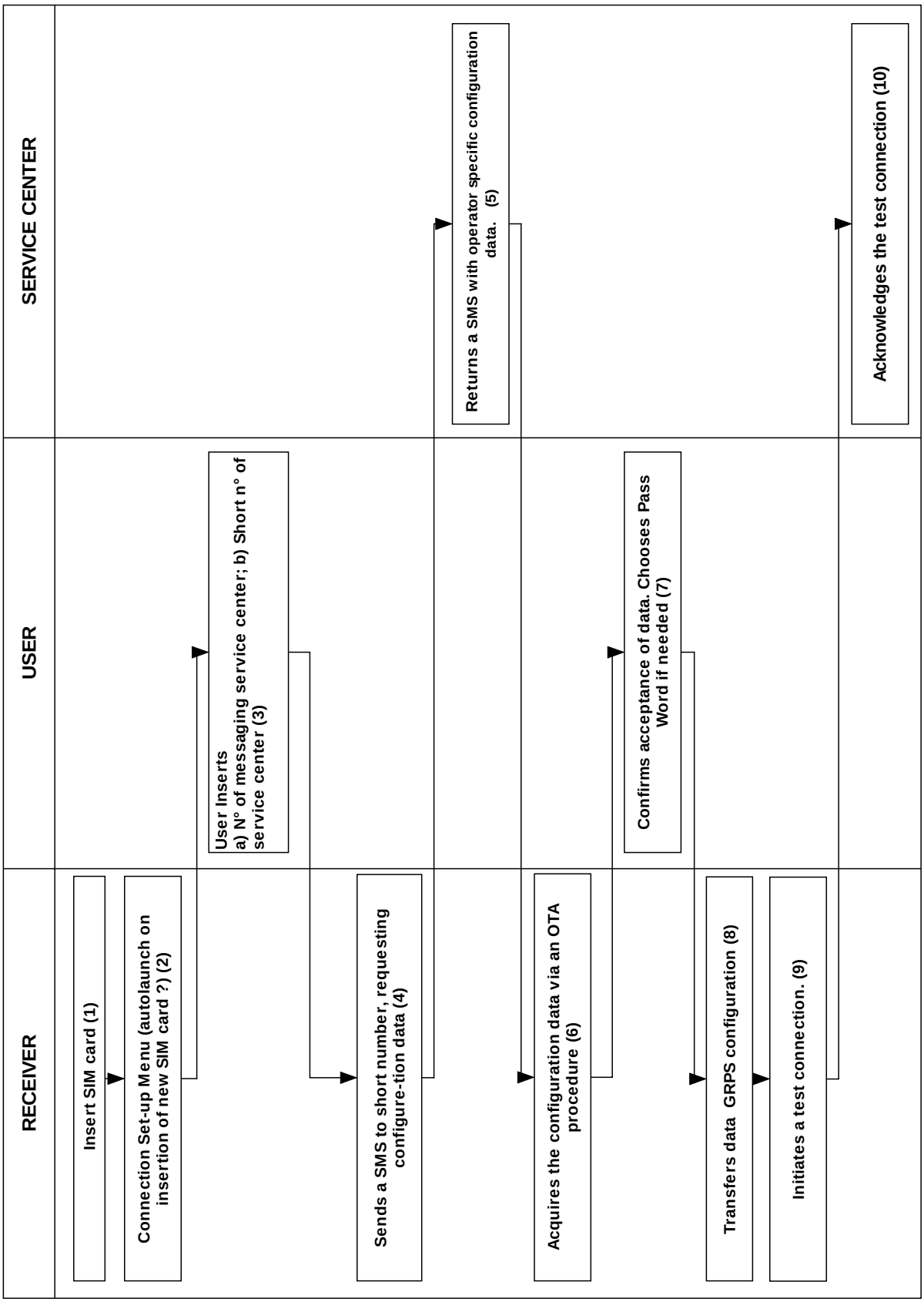


Figure 9: Typical OTA Configuration Menu

D.6 OTA Configuration Flow



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)

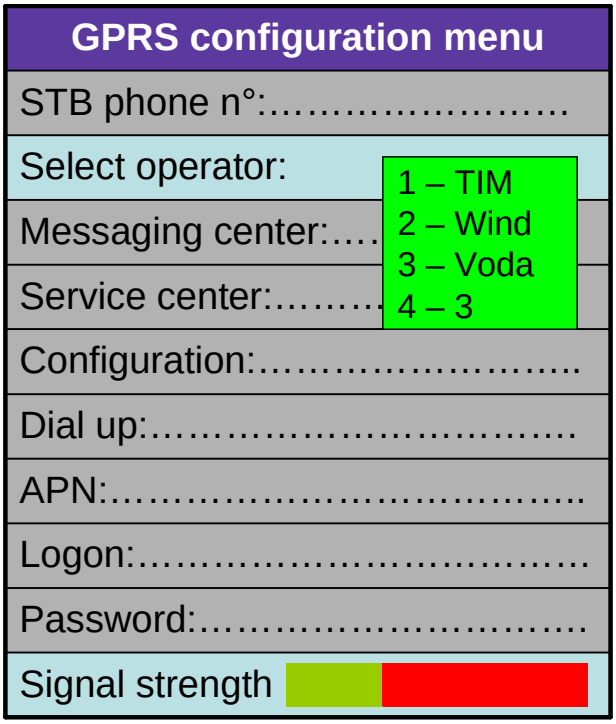
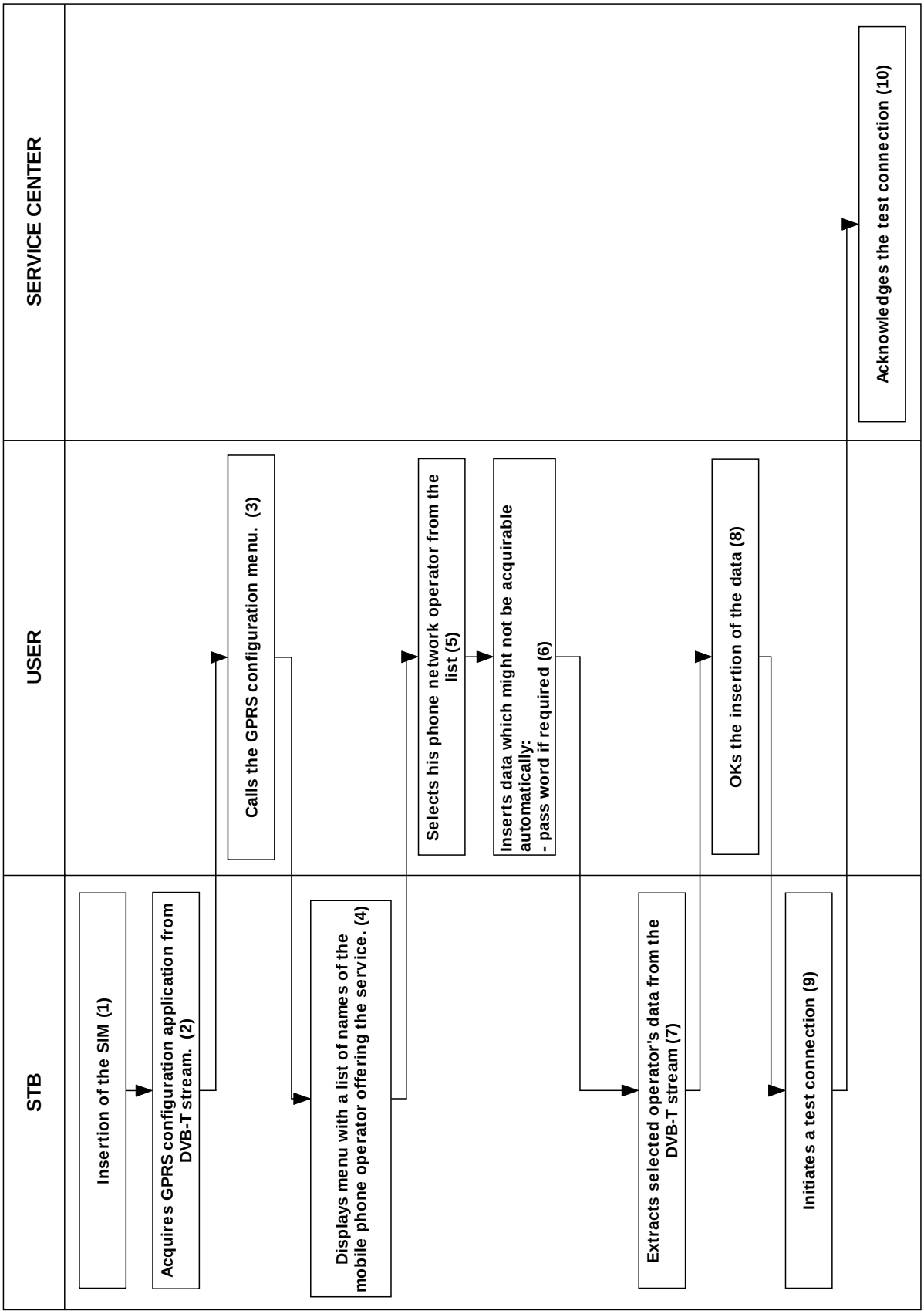


Figure 9: Typical Automatic Configuration Menu

D.8 MHP Configuration Flow



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 43: 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):
    - **original_network_id (ON_ID):** unique identifier of a network
    - **transport_stream_id (TS_ID):** unique identifier of a TS within an original network.
    - **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:

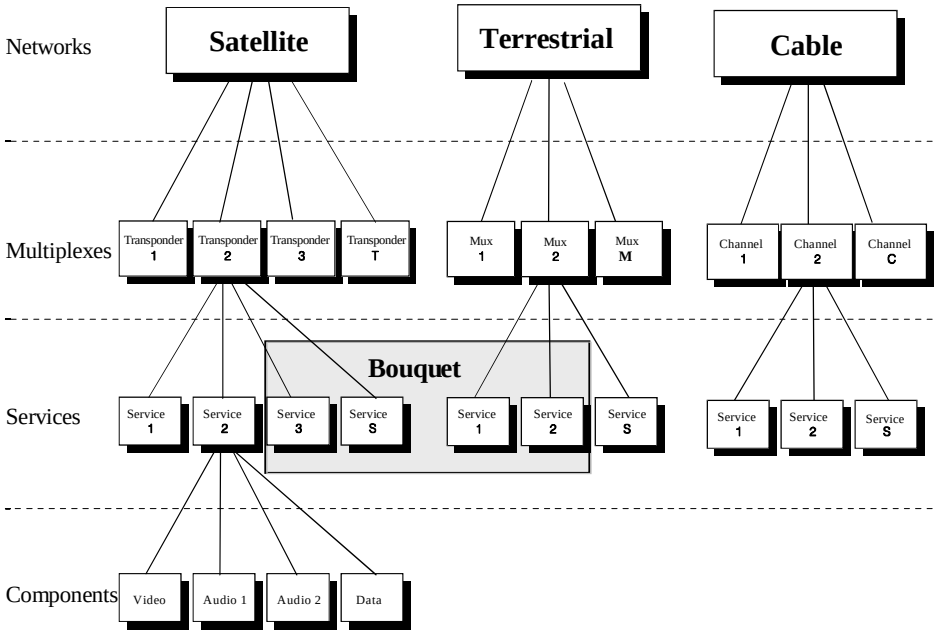


Figure 10: Service delivery model

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	Operator
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	
…	….	
0xB000 – 0xB7FF	Region 21 (…..) – 2048 values	
0xB800 – 0xFFFF	Reserved for future use	

Table 44: 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
0x0003	In use	Rai
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

Table 45: 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 [24] 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 colour map as shown in the following figure.

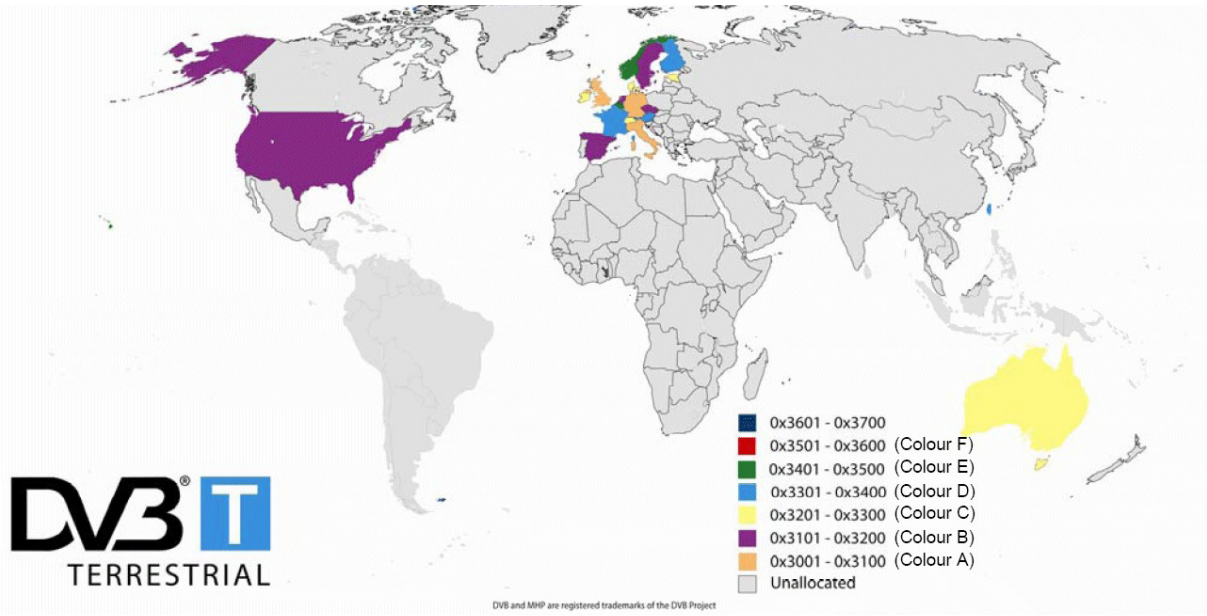


Figure 11: Colour map for allocating network_ids in terrestrial networks

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[19]
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 46: 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 descriptor.

[19] 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.

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) :

G.6.2.1 Switch from scrambled to unscrambled and vice-versa

- *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 beed 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).

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.3.1 SlotListener

This interface must be implemented by any application wanting to monitor the status of the smart card reader.

H.3.1.1 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”);
 ...}
```

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 implementer 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.

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