



IEC 62216

Edition 1.0 2009-05

INTERNATIONAL STANDARD

Digital terrestrial television receivers for the DVB-T system

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XF**

ICS 33.160.25

ISBN 2-8318-1044-1

CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope and object.....	11
2 Normative references	11
3 Abbreviations and symbols.....	13
4 Receiver capabilities	15
4.1 Frequency spectrum.....	15
4.2 Conditional access	15
4.3 Return path	15
4.4 EPG (SI)	15
4.5 Auto installation.....	16
4.6 Teletext carried in digital streams.....	16
4.7 Content protection/copy management.....	16
4.8 Services	16
4.9 API.....	16
4.10 Over-air software update	16
4.11 Audio and video codecs	16
4.12 Future versions of this standard	17
5 Video system characteristics	17
5.1 General.....	17
5.2 Essential requirements.....	17
5.2.1 Standard services.....	17
5.2.2 Advanced services	17
5.3 Constraints and extensions	17
5.3.1 Support for rapid channel acquisition.....	17
5.3.2 Picture types	18
5.3.3 Compatibility.....	18
5.3.4 User data	19
5.3.5 Video alignment.....	19
5.3.6 Chroma sampling location	20
6 Video display formatting	21
6.1 General.....	21
6.2 Video format.....	21
6.2.1 General	21
6.2.2 Requirements for DVB compliance	21
6.3 Recommendations for signalling in the video stream	22
6.3.1 Sequence header	22
6.3.2 Sequence display extension	22
6.3.3 Constraints on the use of the picture display extension	23
6.3.4 Format switching	23
6.4 Video format signalling extensions	24
6.4.1 General	24
6.4.2 MPEG signalling.....	24
6.4.3 DVB signalling.....	24
6.4.4 Active format description	24
6.5 Recommendations for ISO/IEC 13818-1 signalling.....	32

6.6	Alignment of SD video and graphics	32
6.6.1	Video with graphics	32
6.6.2	Uncertainty of position of graphics over video	32
6.7	Alignment of HD video and graphics	33
7	Audio system characteristics	33
7.1	General	33
7.2	Essential requirements	33
7.2.1	Requirements	34
7.2.2	Synchronisation	34
7.2.3	Audio metadata	34
7.2.4	Decoding requirements	34
7.3	Constraints and extensions	35
7.3.1	Digitally coded	35
7.3.2	Surround sound	35
7.3.3	AC-3 and Enhanced AC-3 audio	35
7.3.4	ISO/IEC 14496-3 audio	36
7.3.5	Receiver downmix	36
7.3.6	Digital audio output	36
7.4	Audio description	36
7.4.1	Background	36
7.4.2	Receiver implementation minima	37
7.4.3	Receiver mix AD signalling	37
7.4.4	Constraints on audio description stream coding	41
7.4.5	Receiver mix AD implementation notes	41
7.4.6	SI/PSI signalling	43
7.5	Audio only services	45
8	Multiplex and transport stream characteristics	45
8.1	Scope	45
8.2	Essential requirements	45
8.2.1	Multiplexing	45
8.2.2	Demultiplexing	46
8.3	Constraints and extensions	46
8.3.1	Multicomponent programs	46
9	Service and program specific information	47
9.1	General	47
9.1.1	General requirements	47
9.1.2	General receiver requirements	47
9.1.3	General broadcaster requirements	48
9.1.4	Notation	49
9.2	SI and PSI specification	49
9.2.1	Summary	49
9.2.2	Program association table	51
9.2.3	Program map table	51
9.2.4	Conditional access table	53
9.2.5	Network information table	54
9.2.6	Bouquet association table	56
9.2.7	Service description table	56
9.2.8	Event information table	59
9.2.9	Time and date table and time offset table	62

9.2.10	Running status table.....	62
9.2.11	Private data.....	62
9.2.12	Overview of service-variation options	68
9.3	Receiver functions.....	69
9.3.1	Information typically available to the user	69
9.3.2	Service change.....	69
9.3.3	Parental control	72
9.3.4	Receiver behaviour when a service stops	72
9.4	Establishing and maintaining the network connection	73
9.4.1	Use of SI identifiers	73
9.4.2	Auto installation.....	74
9.4.3	Network evolution.....	76
9.4.4	Logical channel numbers (LCN).....	78
9.4.5	Recommendation for robust SI acquisition.....	82
9.5	User interface.....	84
9.5.1	Presentation of text	84
9.5.2	Information presentation.....	85
9.5.3	Service navigation	87
9.5.4	Display of time.....	88
9.6	Recording devices.....	88
9.6.1	General	88
9.6.2	Programming.....	88
9.6.3	Execution of recording.....	88
9.6.4	Control of analogue recorders	89
10	Subtitles	89
10.1	General.....	89
10.2	Broadcast specifications.....	89
10.2.1	DVB subtitles.....	89
10.2.2	Signalling	90
10.2.3	DDS	90
10.2.4	Recommendation.....	90
10.3	Receiver functions.....	90
10.3.1	Background	90
10.3.2	User control of receiver behaviour	91
10.3.3	Support for DDS	91
11	VBI based services.....	91
11.1	General.....	91
11.2	Broadcast specifications.....	91
11.3	Receiver functions.....	92
11.3.1	Processing capabilities	92
11.3.2	Control	92
11.4	Extended VBI format support.....	92
11.4.1	VPS.....	93
11.4.2	WSS.....	93
11.4.3	Teletext and teletext subtitles	93
12	RF-part and channel decoder	93
12.1	General.....	93
12.2	Frequencies and channel bandwidth.....	93
12.3	DVB-T modes.....	93

12.4	Tuning procedure	94
12.5	Change of modulation parameters	94
12.6	Connector	94
12.7	Performance.....	94
12.7.1	Failure point criteria.....	94
12.7.2	C/N performance	94
12.7.3	Minimum receiver signal input levels	95
12.7.4	Maximum input level.....	95
12.7.5	Immunity to analogue and/or digital signals in other channels.....	95
12.7.6	Immunity to co-channel interference from analogue TV signals.....	96
12.7.7	Guard interval utilisation in single frequency networks.....	97
12.7.8	MFN multipath performance.....	97
13	Conditional access and the common interface	98
13.1	General.....	98
13.2	Minimum requirements	98
13.2.1	Analogue Copy Protection Resource	98
14	System software update	99
14.1	General.....	99
14.2	Minimum requirements	99
14.3	Recommendations for SSU operators	99
15	Application Programming Interface (API).....	99
16	Connectors.....	100
16.1	Standard receivers	100
16.2	Advanced receivers.....	100
16.2.1	Without display.....	100
16.2.2	With display.....	101
Annex A (normative)	SI character set.....	102
Annex B (normative)	DVB-SI PDC descriptor	111
Annex C (normative)	Subtitling	113
Annex D (informative)	An example of frequencies and offsets.....	130
Annex E (informative)	Noise model	131
Annex F (informative)	An example of C/N-performance with a practical transmitter.....	132
Annex G (informative)	Practical 6-path channel models for fixed and portable channels.....	133
Annex H (informative)	Interfering analogue signals	134
Bibliography	135
Figure 1	– Relationship between digital video and analogue video	19
Figure 2	– Receiver and display format processing reference model	26
Figure 3	– HD Receiver and display format processing reference model	27
Figure 4	– Uncertainty of positioning graphics over video.....	33
Figure 5	– Illustration of control of audio level.....	38
Figure 6	– Mapping of pan byte onto sound presentation	41
Figure 7	– Example of PMT extract for main programme audio	44
Figure 8	– Example of PMT extract for audio description	44
Figure 9	– Service regionalisation	79
Figure C.1	– High level bitstream organisation.....	114

Figure C.2 – Region depth selection	116
Figure C.3 – Mapping code strings to pixels in “requested” depth region.....	117
Figure C.4 – Mapping code strings to pixels.....	118
Figure C.5 – Subtitle reference decoder model	120
Figure C.6 – The two modelled decoding phases	121
Figure C.7 – Detail of data decoding phase	122
Figure C.8 – Disruption to display at start of new epoch.....	122
Figure E.1 – Tuner noise model	131
Figure H.1 – PAL interfering signals.....	134
Figure H.2 – SECAM L interfering signal.....	134
Table 1 – Broadcast overscan flags	20
Table 2 – Receiver overscan behaviour	20
Table 3 – Overscan signalling on HDMI	20
Table 4 – Horizontal scaling where format is signalled by the sequence header alone	22
Table 5 – Pan scan window	23
Table 6 – Non “full screen”	23
Table 7 – Formats described by the active_format description	25
Table 8 – Processing by STB connected to 4:3 TV.....	28
Table 9 – User options for displaying 16:9 on 4:3.....	29
Table 10 – User options for displaying >16:9 on 4:3.....	29
Table 11 – Processing by STB connected to 16:9 TV.....	30
Table 12 – WSS codes for aspect ratio	31
Table 13 – Values for other WSS bits	31
Table 14 – Audio description descriptor	38
Table 15 – Illustration of PES packet header	40
Table 16 – Key to symbols.....	49
Table 17 – Summary of required tables.....	50
Table 18 – Program descriptors	51
Table 19 – Elementary stream descriptors	51
Table 20 – Network descriptors (first loop).....	54
Table 21 – Transport stream descriptors (second loop).....	55
Table 22 – Service descriptors.....	57
Table 23 – Event information descriptors	60
Table 24 – Time offset table descriptors	62
Table 25 – Private SI recognised by this standard	63
Table 26 – Syntax of the eacem stream identifier descriptor	63
Table 27 – Syntax of the logical channel descriptor	64
Table 28 – Logical channel number	65
Table 29 – Syntax of the preferred name list descriptor	65
Table 30 – Syntax of the preferred name identifier descriptor	66
Table 31 – HD simulcast logical channel descriptor	67
Table 32 – Subtitle preference modes defined	70

Table 33 – Receiver response to missing SI tables	83
Table 34 – Text field lengths	85
Table 35 – Delta values between picture failure point and reference BER	94
Table 36 – C/N (dB) for reference BER	95
Table 37 – Immunity to analogue signals on other channels	96
Table 38 – Immunity to digital signals on other channels	96
Table 39 – Immunity to co-channel interference from analogue signals	96
Table 40 – Long echo test profile	97
Table 41 – Short echo test profile	97
Table A.1 – Allowed character codes in SI text fields	103
Table B.1 – Syntax of the PDC descriptor	111
Table C.1 – Additional display update budget for page/region operations	123
Table C.2 – Example subtitle system performance	126
Table F.1 – C/N (dB) for reference BER	132
Table G.1 – Approximate 6-tap channel for fixed reception (Ricean channel)	133
Table G.2 – Approximate 6-tap channel for portable reception (Rayleigh channel)	133

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIGITAL TERRESTRIAL TELEVISION RECEIVERS
FOR THE DVB-T SYSTEM**
FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62216-1 has been prepared by technical area 1, Terminals for audio, video and data services and contents, of IEC technical committee 100: Audio, video and multimedia systems and equipment

The text of this standard is based on the following documents:

CDV	Report on voting
100/1449/CDV	100/1541/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

Television has evolved over the last half century from an up-market entertainment medium to becoming the major information tool around the world. Television is available to virtually all people around the globe, be it individually or in a community setting.

The advent of the “personal computer”, enabling global reach and instant interaction has escalated the demand for more and more information and the ability to respond to it instantly. It is thus that the broadcasters and content providers set out to seek new means of delivering higher levels of content, be it in volume or quality using existing or new transport mechanisms available.

Digitalisation, taken from the world of information technology was the obvious choice. It further brought the added benefits of efficient use of spectrum and energy. Terrestrial television has to migrate from analogue to digital in order to survive in the new information society.

Governments are keen to switch off the inefficient analogue broadcasts for a number of obvious reasons, but only will be able to do so when consumers are confident that the new proposition is attractive and affordable.

Due to the multitude of communities, sometimes single operators, often on a country by country basis dealing with the parameters and standards options of launching Digital Terrestrial services based on DVB, there is a natural tendency to create a variety of incompatible platforms tied to particular TV operators, and this in turn does not allow for economy of scale for all parties concerned, be it content providers, broadcasters, network providers or equipment manufacturers.

In 2000, after over two years of requirement capture in DigiTAG (Digital Television Action Group) EACEM (European Association of Consumer Electronics Manufacturers), which has evolved into EICTA (European Information, Communications and Consumer Electronics Technology Industry Associations), decided to address this situation by developing a basic specification as a minimum platform, providing secure reception of broadcast content and associated services. This resulted in the first revision of this standard. It has been used as a basis in many countries to deploy Digital Terrestrial TV (DTT) with great success.

In 2007, with a new wave of High Definition services being considered to be launched due to the availability of MPEG4 components, EICTA and the French “Forum HD” decided to collaborate to create an update for High Definition, and make some minor adjustments that were due after 7 years of practice with Standard Definition terrestrial TV in the market. The new standard improvements are taking into account contributions and comments from a.o. UK DTG (draft HD D-Book), Nordig and DGTVi. This standard does not yet address new generations of channel coding (DVB-T2) now being considered by DVB. Extensions of this standard in this domain may be foreseen in the future.

DIGITAL TERRESTRIAL TELEVISION RECEIVERS FOR THE DVB-T SYSTEM

1 Scope and object

This International Standard specifies both Standard Definition and High Definition receivers for the DVB-T system.

It concerns:

- broadcasters, and
- receiver manufacturers.

The objective is to define:

- how to provide broadcasts that are understood by all receivers and enable receivers to provide good facilities to their users;
- the behaviour required from receivers to work well with these broadcasts and to be attractive to consumers.

To avoid doubt, the words “shall”, “should”, etc. are used in the traditional way to distinguish issues that are mandatory versus those that are optional. A baseline receiver will support the mandatory features but not all the optional features in this standard. Inclusion of optional features is part of the marketing strategy of the manufacturer.

Subtitling and teletext are considered to be components of TV services. Standalone teletext services (without associated video content) are not part of this standard.

This standard primarily addresses terrestrial delivery of digital transmissions.

This standard primarily addresses deployment in countries that use European Latin script based languages.

Two types of systems are considered:

- standard systems where services are all SD and use well-established codecs. Standard receivers which can decode standard services are suitable for these systems;
- advanced systems where some services may use advanced codecs, for example to provide HD video. Advanced receivers which can decode advanced services are suitable for these systems.

Where the term “receiver” or “broadcast” is used without a qualifier, the statement is applicable equally to both types of systems.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61169-2, *Radio-frequency connectors – Part 2: Sectional specification – Radio frequency coaxial connectors of type 9,52*

IEC 60958-1, *Digital audio interface – Part 1: General*

IEC 61937 (all parts), *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958*

ISO/IEC 6937, *Information technology – Coded graphic character set for text communication – Latin alphabet*

ISO/IEC 8859-9, *Information technology – 8-bit single-byte coded graphic character sets – Part 9: Latin alphabet No. 5*

ISO/IEC 11172-2, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s – Part 2: Video*

ISO/IEC 13818-1, *Information technology – Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-2, *Information technology – Generic coding of moving pictures and associated audio information: Video*

ISO/IEC 13818-3, *Information technology – Generic coding of moving pictures and associated audio information: Audio*

ISO/IEC 14496-3, *Information Technology – Coding of audio-visual objects –Part 3: Audio*

ISO/IEC 14496-10, *Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding*

ISO 639-2, *Codes for the representation of names of languages – Part 2: Alpha-3 code*

ITU-R BS.775-2, *Multichannel stereophonic sound system with and without accompanying picture*

ITU-R BT.470-7 *Conventional television systems*

ITU-R BT.1119-2, *Wide-screen signalling for broadcasting (Signalling for wide-screen and other enhanced television parameters)*

ITU-R BT.1359-1, *Relative timing of sound and vision for broadcasting*

EN 50049-1, *Domestic and similar electronic equipment interconnection requirements: Peritelevision connector*

EN 50221, *Common Interface Specification for Conditional Access and Other Digital Video Broadcasting Decoder Applications*

EN 300 294, *Television Systems – 625-line television Wide Screen Signalling (WSS)*

EN 300 468, *Digital Video Broadcasting (DVB) – Specification for Service Information (SI) in DVB systems*

EN 300 472, *Digital Video Broadcasting (DVB) – Specification for conveying ITU-R System B Teletext in DVB bitstreams*

EN 300 743, *Digital Video Broadcasting (DVB) – Subtitling systems*

EN 300 744, *Digital Video Broadcasting (DVB) – Framing structure, channel coding and modulation for digital terrestrial television*

EN 301 775, *Digital Video Broadcasting (DVB) – Specification for the carriage of Vertical Blanking Information (VBI) data in DVB bitstreams*

ETR 162, *Digital broadcasting systems for television sound and data services; Allocation of Service Information (SI) codes for Digital Video Broadcasting (DVB) systems*

Note that the allocation of identifiers is handled by DVB; up-to-date information on DVB identifiers can be obtained from <www.dvb.org>.

ETR 289, *Digital Video Broadcasting (DVB) – Support for use of scrambling and Conditional Access (CA) within digital broadcasting systems*

ETS 300 231, *Television systems; Specification of the domestic video Programme Delivery Control system (PDC)*

ETS 300 706, *Enhanced Teletext specification*

R206-001, *Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications*

TS 101 154, *Digital Video Broadcasting (DVB); Implementation guidelines for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream*

TR 101 211, *Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)*

TS 101 699, *Digital Video Broadcasting (DVB); Extensions to the Common Interface Specification*

TS 102 006, *Digital Video Broadcast (DVB); Specification for System Software Update in DVB systems*

TS 102 366, *Digital Audio Compression (AC-3, Enhanced AC-3) Standard*

CEA 770.3, *High Definition TV Analog Component Video Interface*

CEA 861, *A DTV Profile for Uncompressed High Speed Digital Interfaces*