



Digital television—Terrestrial broadcasting

Part 1: Characteristics of digital terrestrial television transmissions



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 - Australian Communications and Media Authority
 - Australian Digital and Telecommunications Association
 - Australian Industry Group
 - Australian Information Industry Association
 - Australian Subscription Television and Radio Association
 - CHOICE
 - Commercial Radio Australia
 - Community Broadcasting Association of Australia
 - Consumer Electronics Suppliers Association
 - Department of Communications
 - Free TV Australia
 - Media Access Australia
 - Ministry of Business, Innovation and Employment, New Zealand
 - Telecommunications Users Association of New Zealand
-

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Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

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Australian Standard[®]

Digital television—Terrestrial broadcasting

Part 1: Characteristics of digital terrestrial television transmissions

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PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee CT-002, Broadcasting and Related Services, to supersede AS 4599.1—2011. After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian, rather than an Australian/New Zealand Standard.

This Standard was prepared in conjunction with the ACMA and the television broadcasting industry to ensure consistency of terrestrial broadcasting transmissions, and to enable the design of digital transmission equipment and television receivers. The ACMA has published a set of digital terrestrial television planning parameters in the *Technical Planning Guidelines* and *The Digital Terrestrial Television Broadcasting Planning Handbook*, which references this Standard.

The objective of this Standard is to provide television transmission equipment, and receiver manufacturers and broadcasters, with the technical specification for the Australian digital terrestrial television transmission system, in order to achieve interoperability and optimization of transmission choices for digital terrestrial television broadcasting (DTTB) and reception. This Standard reflects the technical specifications post-analog television and the operation of digital terrestrial television services in the bands 174 MHz–230 MHz and 526 MHz–694 MHz.

This Standard is part of a group of terrestrial television Standards, including AS 4933, *Digital television—Requirements for receivers—VHF/UHF DVB-T television broadcasts including ancillary services*, AS/NZS 1367, *Coaxial cable and optical fibre systems for the RF distribution of digital television, radio and in-house analog television signals in single and multiple dwelling installations* and AS 1417, *Receiving antennas for radio and television in the VHF and UHF broadcast bands*, which are related to this Standard.

The objective of this revision is to update the reference documents and bring the Standard into line with current practice.

The Australian implementation of the DVB-T system uses the technical content of relevant ETSI Standards.

The development of standards within the EBU DVB project is a dynamic process. Reviews of existing and development of new ETSI standards are underway at DVB. End users of this Standard are encouraged to keep up to date with DVB reviews by contacting the DVB Project Office directly at the following address:

DVB Project Office
C/- European Broadcasting Union
17A Ancienne Route
CH-1218 Grand-Saconnex/Geneva
Switzerland
Phone: +41 22 717 27 19
Facsimile: +41 22 717 27 27
Email: dvb@dvb.org

They can also be contacted by visiting the DVB website (<http://www.dvb.org>).

In previous versions of this Standard, to maintain consistency with the referenced documents, a comma was frequently used in this Standard when referring to a decimal marker, particularly in tables. This is no longer the case in this version and a decimal marker is now used.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Digital television—Terrestrial broadcasting

Part 1: Characteristics of digital terrestrial television transmissions

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for digital terrestrial television transmissions in Australia, including the video, audio, data and closed captions coding, the characteristics of the transport stream, the channel coding, and the modulation system to be used.

This document includes consideration of revisions to standards related to terrestrial television broadcasting. In this update of AS 4599.1, references are included for application programming interfaces.

1.2 APPLICABLE STANDARDS

This Standard shall be read in conjunction with the referenced international standards detailed in Clause 1.4.

Digital terrestrial television broadcasting in Australia is based on the DVB specifications published in the ETSI Standards referenced in this Standard.

This Standard is set out in Sections, which deal with specific topics in ETSI Standards. These are summarized below:

Addressed Standards		
Section	Title	ETSI Standard
2	Coding	ETSI TS 101 154 V 1.11.1 (2012/11) Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications based on the MPEG-2 Transport Stream
3	Teletext/ subtitles	ETSI EN 300 472 V1.3.1 (2003-05) Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams
		ETSI EN 300 706 V1.2.1 (2003-04) Enhanced Teletext specification
		ETSI EN 301 775 V 1.2.1 (2003-05) Digital Video Broadcasting (DVB); Standard for the carriage of Vertical Blanking Information (VBI) data in DVB bitstreams
		ETSI EN 300 708 V1.2.1 (2003) Television systems; Data transmission within Teletext

1 This Standard is referenced by ACMA in the Broadcasting Services (Technical Planning) Guidelines 2007.

Addressed Standards		
Section	Title	ETSI Standard
4	Service information	ETSI EN 300 468 V 1.13.1 (2012/08) Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB Systems
		ETSI TS 101 211 V1.11.1 (2012/04) Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)
		ETSI TS 101 162 V1.5.1 (2012/01) Digital Video Broadcasting (DVB); Allocation of Service Information (SI) and Data Broadcasting Codes for Digital Video Broadcasting (DVB) Systems
		ETSI TS 102 323 V1.5.1 (2011/01) Digital Video Broadcasting (DVB); Carriage and signalling of TV-Anytime information in DVB transport streams
		ETSI TS 102 006 V1.3.2 (2008/07) Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems
		ETSI EN 301 192 V1.4.2 (2008-04) Digital Video Broadcasting (DVB); DVB Specification for data broadcasting
		ETSI TR 101 202 V 1.2.1 (2003-01) Digital Video Broadcasting (DVB); Implementation guidelines for Data Broadcasting
5	Data	ETSI TS 102 006 V1.3.2 (2008-07) Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems
		ETSI EN 301 775 V1.2.1 (2003-05) Digital Video Broadcasting (DVB); Specification for the carriage of Vertical Blanking Information (VBI) data in DVB bitstreams
		ETSI EN 300 744 V1.6.1 (2009-01) Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television
		ETSI TS 101 191 V1.4.1 (2004-06) Digital Video Broadcasting (DVB); DVB mega-frame for Single Frequency Network (SFN) synchronization
		ETSI TR 101 190 V1.3.2 (2011/05) Digital Video Broadcasting (DVB); Implementation guidelines for DVB terrestrial services; Transmission aspects
6	Modulation/ system Design	ETSI TS 100 289 V1.1.1 (2011-09) Digital Video Broadcasting (DVB); Support for Use of Scrambling and Conditional Access (CA) within Digital Broadcasting Systems
		ETSI TS 101 197 V1.2.1 (2002/02) Digital Video Broadcasting (DVB); DVB SimulCrypt; Head-end architecture and synchronization
		ETSI TS 103 197 V1.5.1 (2010/08) Digital Video Broadcasting (DVB); Head-end implementation of DVB SimulCrypt
		ETSI TR 102 035 V1.1.1 (2002-04) Digital Video Broadcasting (DVB); Implementation Guidelines of the DVB Simulcrypt Standard
		ETSI TS 101 197 V1.2.1 (2002/02) Digital Video Broadcasting (DVB); DVB SimulCrypt; Head-end architecture and synchronization
7	Conditional access	ETSI TS 100 289 V1.1.1 (2011-09) Digital Video Broadcasting (DVB); Support for Use of Scrambling and Conditional Access (CA) within Digital Broadcasting Systems
		ETSI TS 101 197 V1.2.1 (2002/02) Digital Video Broadcasting (DVB); DVB SimulCrypt; Head-end architecture and synchronization
		ETSI TS 103 197 V1.5.1 (2010/08) Digital Video Broadcasting (DVB); Head-end implementation of DVB SimulCrypt
		ETSI TR 102 035 V1.1.1 (2002-04) Digital Video Broadcasting (DVB); Implementation Guidelines of the DVB Simulcrypt Standard
		ETSI TS 101 197 V1.2.1 (2002/02) Digital Video Broadcasting (DVB); DVB SimulCrypt; Head-end architecture and synchronization

Addressed Standards		
Section	Title	ETSI Standard
8	Extended functionality	ETSI TS 102 796 V1.2.1 (2012/11) Hybrid Broadcast Broadband TV
		ETSI TS 102 851 V1.3.1 (2012-01)
		Digital Video Broadcasting (DVB); Uniform Resource Identifiers (URI) for DVB Systems
		AS/NZS 13818.6
		Information Technology—Generic coding of moving pictures and associated audio information, Part 6: Extensions for digital storage media command and control DSM-CC.
		ETSI ES 202 184 V2.3.1 (2013-01) MHEG-5 Broadcast Profile
		ETSI TS 102 034 V1.4.1 (2009/08) Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks
		ETSI TS 102 005 V1.4.1 (2010/03) Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols
		ETSI TS 102 539 V1.3.1 (2010/04) Digital Video Broadcasting (DVB); Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)
		ETSI TS 102 542 V1.2.1 (2008/04) Digital Video Broadcasting (DVB); Guidelines for the implementation of DVB-IPTV Phase 1 specifications
9	Copy protection, copy management	ETSI TS 102 826 V1.2.1 (2009/11) DVB-IPTV Profiles for TS 102 034
		ETSI TS 102 809 V1.1.1 (2010-01) Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments.
10	Measurement	ETSI TS 102 825-1 V1.2.1 (2011/03) Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB CPCM); Part 1: CPCM Abbreviations, Definitions and Terms
Appendices		
A	Appendix	Teletext based closed captions in SDTV and HDTV transmissions
B	Appendix	Implementation of single frequency networks (SFN)
C	Appendix	Spurious and out-of-band emissions limits
D	Appendix	Service quality performance targets

1.3 APPLICATION OF DTTB IN AUSTRALIA

DVB specifications allow a range of possible operations. The variations specific to Australia include, but are not limited to, the following at the time of publication:

- (a) DVB-T signals in 7 MHz channels are terrestrially transmitted using both VHF (Band III) and UHF (Bands IV/V) (i.e. covering Australian channels 6-12 (174 MHz to 230 MHz) and 28-51 (526 MHz to 694 MHz).^{1,2,6}
- (b) Transmissions are in DVB-T 8K coded orthogonal frequency-division multiplexing carrier mode. This does not preclude 2K mode operation.
- (c) Australian terrestrial television broadcasters' transmissions are as specified in this Standard.
- (d) Currently Australian DVB-T services include MPEG-2 encoded video at 25 frames, 50 fields and 50 frames per second. The video formats broadcast are up to 1920 pixels by 1080 lines (interlaced). Transmission of MPEG-4/advanced video coding video coding is under consideration and referenced in this Standard.³
- (e) Television services transmitted in MPEG-2 standard-definition television will include, at a minimum, a MPEG-1 Layer II audio stream.⁴
- (f) Australian terrestrial television broadcasters' transmissions of Audio Coding-3 are as specified in Recommendation ITU-R BS.1196-3, Appendix 3.
- (g) Transport streams will include closed captions based on world system teletext (ITU R—System B teletext, as specified in ETSI EN 300 706 and encoded for MPEG in ETSI EN 300 472).
- (h) Transmissions might include data broadcasting as specified in ETSI EN 301 192.
- (i) Transmission filter masks for Australia's 7 MHz channel spacing have taken into account adjacent channel terrestrial digital audio broadcasting and DVB-T in VHF Band III. The same masks are applied in UHF Bands IV and V for DVB-T.
- (j) Refer to Appendix C of this Standard for spurious and out-of-band emissions limits.
- (k) Any single-frequency networks (SFN) implemented by Australian broadcasters, are in accordance with ETSI TS 101 191. Also refer Appendix B of this Standard.
- (l) Australian terrestrial television broadcasters implement on-channel repeaters (OCR) within their network planning.
- (m) Australian DVB-T television transmissions are planned for fixed reception.
- (n) Some Australian broadcasters' transmissions have a ± 125 kHz frequency offset.
- (o) Australian broadcasters have implemented a scheme for network identification coding.⁵ Further information can be obtained from Australian broadcasters.
- (p) Australian broadcasters' transmissions include Australian regulatory requirements for parental guidance, program content, local time offset and logical channel numbers.⁶

NOTE: Also refer to Appendix B of this Standard.

1 It should be noted the channels used in cabled systems in Australia might use frequencies up to 862 MHz (refer to AS 1367).

2 It is proposed that from 1 January 2015 all terrestrial television services in Australia will be assigned channel allocations below 694 MHz.

3 For reception of all free-to-air digital TV broadcast formats in Australia, refer to AS 4933.

4 For reception of all free-to-air digital TV broadcast formats in Australia, receivers need to have the capability of decoding both MPEG-1 Layer II and AC-3 audio streams. For more information, refer to AS 4933.

5 Refer to Free TV OP-40 (<http://www.freetv.com.au>).

6 Refer to Free TV OP-41 (<http://www.freetv.com.au>).

1.4 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

4933 Digital television—Requirements for receivers

AS/NZS

2632 Codes for the representation of names of countries and their subdivisions

2632.1 Part 1: Country codes

2632.2 Part 2: Country subdivision codes

13818 Information technology—Generic coding of moving pictures and associated audio information

13818.3 Part 3: Audio

13818.6 Part 6: Extensions for DSM-CC digital storage media command and control

ISO/IEC

8859 Information technology—8-bit single-byte coded graphic character sets

8859-1 Part 1: Latin alphabet No. 1

11172 Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s

13818 Information technology—Generic coding of moving pictures and associated audio information

13818-2 Part 2: Video

14496 Information technology—Coding of audio–visual objects

14496-3 Part 3: Audio

14496-10 Part 10: Advanced Video Coding

62002 Mobile and portable DVB-T/H radio access

62002-1 Part 1: Interface specification

ETSI

EN 300 468 V1.13.1 Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems

EN 300 472 V1.3.1 Digital Video Broadcasting (DVB); Specification for conveying ITU—R System B Teletext in DVB bitstreams

EN 300 706 V1.2.1 Enhanced Teletext specification

EN 300 708 V1.2.1 Television systems; Data transmission within Teletext

EN 300 744 V1.6.1 Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television

EN 301 192 V1.4.2 Digital Video Broadcasting (DVB); Specification for data broadcasting

EN 301 775 V1.2.1 Digital Video Broadcasting (DVB); Specification for the carriage of Vertical Blanking Information (VBI) data in DVB bitstreams

TS 102 851 V1.3.1 Digital Video Broadcasting (DVB); Uniform Resource Identifiers (URI) for DVB Systems

EN 302 296-2 V1.2.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); Transmitting equipment for the digital television broadcast services, Terrestrial (DVB-T); Part 2: Harmonized EN under article 3.2 of the R&TTE Directive

ETSI

ES 202 184 V2.3.1	MHEG-5 Broadcast Profile
TS 100 289 V1.1.1	Digital Video Broadcasting (DVB); Support for use of Scrambling and Conditional Access (CA) within Digital Broadcasting Systems
TR 101 190 V1.3.2	Digital Video Broadcasting (DVB); Implementation guidelines for DVB terrestrial services; Transmission aspects
TR 101 202 V1.2.1	Digital Video Broadcasting (DVB); Implementation guidelines for Data Broadcasting
TR 101 290 V1.2.1	Digital Video Broadcasting (DVB); Measurement guidelines for DVB systems
TS 102 005 V1.4.1	Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in DVB services delivered directly over IP protocols
TS 102 034 V1.4.1	Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks
TR 102 035 V1.1.1	Digital Video Broadcasting (DVB); Implementation Guidelines of the DVB Simulcrypt Standard
TS 101 211 V1.11.1	Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI)
TS 102 539 V1.3.1	Digital Video Broadcasting (DVB); Carriage of Broadband Content Guide (BCG) information over Internet Protocol (IP)
TS 102 542 V1.2.1	Digital Video Broadcasting (DVB); Guidelines for the implementation of DVB-IPTV Phase 1 specifications
TS 102 796 V1.2.1	Hybrid Broadcast Broadband TV
TS 102 826 V1.2.1	Digital Video Broadcasting (DVB); DVB-IPTV Profiles for TS 102 034
TS 101 154 V1.11.1	Digital Video Broadcasting (DVB); Implementation Guidelines for the use of MPEG-2 Systems, Video and Audio in satellite, cable and terrestrial broadcasting applications
TS 101 162 V1.5.1	Digital Video Broadcasting (DVB); Allocation of Service Information (SI) and Data Broadcasting Codes for Digital Video Broadcasting (DVB) Systems
TS 101 191 V1.4.1	Digital Video Broadcasting (DVB); DVB mega-frame for Single Frequency Network (SFN) synchronization
TS 101 197 V1.2.1	Digital Video Broadcasting (DVB); DVB SimulCrypt; Head-end architecture and synchronization
TS 102 006 V1.3.2	Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems
TS 102 323 V1.5.1	Digital Video Broadcasting (DVB); Carriage and signalling of TV-Anytime information in DVB transport streams
TS 102 809 V1.2.1	Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in Hybrid broadcast/broadband environments

ETSI

- TS 102 825-1 V1.2.1 Digital Video Broadcasting (DVB); Content Protection and Copy Management (DVB CPCM); Part 1: CPCM Abbreviations, Definitions and Terms
- TS 103 197 V1.5.1 Digital Video Broadcasting (DVB); Head-end implementation of DVB SimulCrypt
- TS 102 685 V1.1.1 Digital Video Broadcasting (DVB); High-level Technical Requirements for QoS for DVB Services in the Home Network
- TS 102 770 V1.1.1 Digital Video Broadcasting (DVB); System Renewability Messages (SRM) in DVB Systems
- TS 102 824 V1.2.1 Digital Video Broadcasting (DVB); Remote Management and Firmware Update System for DVB IPTV Services (Phase 2)
- TS 102 905 V1.1.1 Digital Video Broadcasting (DVB); Technical Specification for DVB Services in the Home Network Phase 1

Free TV

- OP-39 Issue 5 DVB content descriptor
- OP-40 Issue 3 DVB original network ID and network ID assignments for Australia
- OP-41 Issue 7 Logical Channel Descriptor
- OP-42 Issue 4 Distribution, Transmission, and Monitoring of Closed Captions on line 21/334
- OP-43 Issue 3 Service Replacement Service Procedures
- OP-44 Issue 5 Implementation of Electronic Service Guide Information
- OP-45 Issue 4 Application of Time Related Tables in Australian DVB-T Systems
- OP-46 Issue 2 Implementation of System Software Upgrades in Australian DVB-T Systems Using Simple Profile
- OP-58 Issue 2 Implementation Guide for DVB EIT Schedule Information (EITschedule_{actual})
- OP-59 Issue 2 Measurement and Management of Loudness in Soundtracks for Television Broadcasting
- OP-61 Implementation of Hybrid Broadcast Broadband TV by Australian Free-to-air Television Broadcasters

SMPTE

- RP 155—004 Audio Levels for Digital Audio Records on Digital Television Tape Recorders

ITU-R Recommendation

- BS 1196-3 Audio coding for digital broadcasting
- BS 1770-3 Algorithms to measure audio programme loudness and true-peak audio level
- BS 1864 Operational practices for loudness in the international exchange of digital television programmes

ACMA

- DTTB Handbook PlanningThe Digital Terrestrial Television Broadcasting Planning Handbook, including technical and general assumptions
- Technical Guidelines PlanningTechnical Planning Guidelines

The version numbers of the intended referenced Standards are listed above. Throughout the remainder of this Standard, only the publication number (followed by a number in square brackets) will be quoted, indicating that the reference is the precise version number.

1.5 REFERENCED ORGANIZATIONS

Within this Standard, organizations referred to by acronyms include:

- (a) Australian Communications and Media Authority ACMA.
- (b) Digital Video Broadcasting..... DVB.
- (c) Digital Television Group DTG.
- (d) European Broadcasting Union.....EBU.
- (e) European Telecommunications Standards Institute..... ETSI.
- (f) Free TV Australia Free TV.
- (g) International Electrotechnical Commission IEC.
- (h) International Organization for Standardization..... ISO.
- (i) International Telecommunication Union ITU.
- (j) Society of Motion Picture and Television Engineers SMPTE.

SECTION 2 CODING

2.1 INTRODUCTION

This Section includes technical content from the current version of ETSI TS 101 154, which provides implementation guidelines for the use of audio-visual coding in satellite, cable and terrestrial broadcasting distribution systems that utilize MPEG-2 systems to ensure they meet the Australian requirements. Both standard-definition television (SDTV) and high-definition television (HDTV), for 25 Hz implementations, are covered.

ETSI TS 101 154 includes both MPEG-2 (ISO/IEC 13818-2) and MPEG-4 Part 10 (ISO/IEC 14496-10), video coding systems up to and including encoder level 4.0 which may be used in Australia. An example set of transmitted luminance resolution formats for Australian requirements has also been included in Table 2.1.

The following audio coding systems—MPEG-1/MPEG-2 Layer II, AC 3, MPEG-4 HE-AAC (v1), simple AAC as per ISO/IEC 14496-3 and MPEG-4 HE-AAC v2 are included as the Australian requirements for DVB-T transmissions.

To meet Australian requirements the recommended level for reference tones for transmission of MPEG-1 Layer II and AC-3 is 20 dB below clipping level, in accordance with SMPTE RP 155.

NOTE: Australian terrestrial television broadcasters' transmissions comply with the recommended loudness considerations of Recommendation ITU-R BS.1770-3.

The Clauses of ETSI TS 101 154 which have been modified or are under consideration are listed below followed by the corresponding clause numbers in this Standard.

Referenced ETSI clause number	Status	Clause title	Reference to this Standard
6	Modified	Audio	Clause 2.2
Annex A	Modified	Examples of full screen luminance resolutions for SDTV and HDTV	Clause 2.3
Annex B	Not being considered for implementation	Auxiliary data in the video elementary stream	Nil
Annex C	Not being considered for implementation in Australia at this time	Implementation of ancillary data for MPEG audio	Nil
Annex D	Not being considered for implementation in Australia at this time	Coding of data fields in the private data bytes of the adaptation field	Nil
Annex E	Not being considered for implementation in Australia at this time	Supplementary audio services	Nil
Annex F	Not being considered for implementation in Australia at this time	Encoding guidelines to enable trick play support of H.264/AVC streams	Nil
Annex G	Not being considered for implementation in Australia at this time	Random access point considerations for scalable video coding	Nil
Annex H	Not being considered for implementation in Australia at this time	Frame compatible plano-stereoscopic 3DTV	Nil
Annex I	Not being considered for implementation in Australia at this time	Considerations for encoding and random access for multi view coding stereo video	Nil

2.2 AUDIO (modification to ETSI TS 101 154)

2.2.1 Introduction

This Clause references Clause 6 of ETSI TS 101 154 which has been researched and modified to ensure it meets Australian requirements. It describes the encoding for MPEG-1 Layer II audio in DVB broadcast bit-streams. Additional audio coding systems and metadata, of relevance to Australia is AC-3, which is described in ETSI TS 101 154.

2.2.2 Guidelines for audio encoding

Australian terrestrial television transmissions include MPEG-1 Layer II and AC-3 audio bitstreams. The recommended level for reference tones for transmission of MPEG and AC-3 audio is 20 dB below clipping level, in accordance with SMPTE RP 155.

Australian terrestrial television transmissions observe ITU-R recommendation BS 1770 as the reference for loudness characteristics of soundtracks on television programs.

NOTE: Refer Free TV OP-59 for advice on implementation of ITU-R Recommendation BS 1864.

2.3 EXAMPLES OF TRANSMITTED RESOLUTIONS FOR SDTV AND HDTV (ANNEX A IN ETSI TS 101 154)

2.3.1 Introduction

This Clause contains Australian recommended definitions of full screen luminance resolutions for SDTV and HDTV.

The following definitions for MPEG 2 coding are applied as indicated in ISO/IEC 13818-2:

- (a) For all DVB compliant MPEG encoding schemes, a high definition television signal shall be defined as having a sample rate range greater than 10 368 000 samples per second and less than 62 668 800 samples per second (Main Profile @ High Level—MP@HL).
- (b) For all DVB compliant MPEG encoding schemes, a standard definition television signal shall be defined as less than or equal to 10 368 000 samples per second (Main Profile @ Main Level—MP@ML).

These sample rates are in accordance with the examples listed in Annex A of ETSI TS 101 154.

2.3.2 Examples of transmitted luminance resolutions for SDTV and HDTV formats for Australian DTTB

TABLE 2.1
EXAMPLES OF MPEG-2/H.262 AND MPEG-4 PART 10 (AVC)/H.264
TRANSMITTED RESOLUTION

Vertical_size value	Horizontal_size value	Aspect_ratio information	Frame_rate code	Progressive or interlace	Picture format
1080	1920	16:9	25(50i)	I	HD
1080	1440	16:9	25(50i)	I	HD
1080	1920	16:9	25 (film mode)	P	HD
1080	1440	16:9	25 (film mode)	P	HD
720	1280	16:9	50	P	HD
720	1280	16:9	25 (film mode)	P	HD
576	720	16:9	25(50i)	I	SD
576	720	16:9	25 (film mode)	P	SD
576	544	16:9	25	I	SD
576	480	16:9	25	I	SD
576	352	16:9	25	I	SD

NOTE: Transmissions are in a 4:2:0 luma/chroma format which gives chroma samples at half the luma samples.

SECTION 3 CLOSED CAPTIONS

3.1 INTRODUCTION

Australian DTTB transmissions broadcast¹ EBU/WST² teletext and closed captions in teletext format in the MPEG-2 packetized transport stream, in accordance with ETSI EN 300 472 V1.3.1.

3.2 ENHANCED TELETEXT SPECIFICATION (ETSI EN 300 706)

This Standard includes the historic details of teletext encoding and transmission in an analog SDTV environment. The data encoding parameters remain the same within SDTV and HDTV digital television environments. The Australian teletext transmissions are based on ETSI EN 300 706, modified to deal with the handling of time-filling (dummy) headers for closed captions for the hearing impaired, which is detailed in the Free TV OP-42³ and Appendix A (normative).

3.3 DIGITAL VIDEO BROADCASTING (DVB)—SPECIFICATION FOR CONVEYING ITU-R SYSTEM B TELETEXT IN DVB BIT STREAMS (ETSI EN 300 472)

Australian DTTB transmissions shall be broadcast in accordance with ETSI EN 300 472.

3.4 DIGITAL VIDEO BROADCASTING (DVB)—SPECIFICATION FOR THE CARRIAGE OF VERTICAL BLANKING INFORMATION (VBI) DATA IN DVB BIT STREAMS (ETSI EN 301 775)

Australian DTTB transmissions shall be broadcast in accordance with ETSI EN 301 775.

1 Broadcasters are required by regulation to provide closed captioning at certain times on some digital services.

2 WST refers to World System Teletext, as specified in ETSI EN 300 706 and ETSI EN 300 708.

3 Refer to Free TV OP-42 (<http://www.freetv.com.au>).

SECTION 4 SERVICE INFORMATION

4.1 INTRODUCTION

This Section includes technical content from ETSI EN 300 468, ETSI TR 101 211 and ETSI TS 101 162, which have been modified to meet the Australian requirements for service information.

4.2 DIGITAL VIDEO BROADCASTING (DVB)—SPECIFICATION FOR SERVICE INFORMATION (SI) IN DVB SYSTEMS (ETSI EN 300 468)

4.2.1 Scope

This Clause contains the Australian modifications to ETSI EN 300 468.

The Australian implementation of DVB service information includes modifications as listed in Table 4.1, which include the logical_channel_descriptor, and is used with approval. Further information on Australian implementation is available in Free TV Operational Practice OP-41.

The modified ETSI clauses are listed below along with the corresponding Clause numbers in this Standard.

Referenced ETSI clause number	Status	Clause title	Reference in this Standard
6.1	Modified	Descriptor identification and location	Clause 4.2.2
6.2.9	Modified	Content descriptor	Clause 4.2.3
6.2.19	Modified	Linkage descriptor	Clause 4.2.5
6.2.20	Modified	Local time offset descriptor	Clause 4.2.6
None	Additional	Semantics for the local time offset descriptor	Clause 4.2.7
6.2.28	Modified	Parental rating descriptor	Clause 4.2.10
6.2.33	Modified	Service descriptor	Clause 4.2.8
5.2.4, 6.2.15 and 6.2.37	Modified	Event information table	Clause 4.2.12

4.2.2 Descriptor identification and location (Clause 6.1 in ETSI EN 300 468)

This Clause contains the Australian modifications to Clause 6.1 of ETSI EN 300 468 which is presented in Table 4.1.

Table 4.1 lists the descriptors defined within the present document, giving the descriptors-tag values and the intended placement within the SI tables. The intended usage is marked by an asterisk¹. This does not imply that their use in other tables is restricted. Modified descriptors listed below are in bold type.

TABLE 4.1
POSSIBLE LOCATIONS OF DESCRIPTORS*
(Table 12 in Clause 6.1 of ETSI EN 300 468)

Descriptor	Tag value	NIT	BAT	SDT	EIT	TOT	PMT	SIT (see Note 3)
network_name_descriptor	0x40	*	-	-	-	-	-	-
service_list_descriptor	0x41	*	*	-	-	-	-	
stuffing_descriptor	0x42	*	*	*	*	-	-	*
satellite_delivery_system_descriptor	0x43	*	-	-	-	-	-	-
cable_delivery_system_descriptor	0x44	*	-	-	-	-	-	-
VBI_data_descriptor	0x45	-	-	-	-	-	*	-
VBI_teletext_descriptor	0x46	-	-	-	-	-	*	-
bouquet_name_descriptor	0x47	-	*	-	-	-	-	*
service_descriptor	0x48	-	-	*	-	-	-	*
country_availability_descriptor	0x49	-	*	*	-	-	-	*
linkage_descriptor (see Note 1)	0x4A	*	*	*	*	-	-	*
NVOD_reference_descriptor	0x4B	-	-	*	-	-	-	*
time_shifted_service_descriptor	0x4C	-	-	*	-	-	-	*
short_event_descriptor (see Note 2)	0x4D	-	-	-	*	-	-	*
extended_event_descriptor (see Note 2)	0x4E	-	-	-	*	-	-	*
time_shifted_event_descriptor	0x4F	-	-	-	*	-	-	*
component_descriptor	0x50	-	-	*	*	-	-	*
mosaic_descriptor	0x51	-	-	*	-	-	*	*
stream_identifier_descriptor	0x52	-	-	-	-	-	*	-
CA_identifier_descriptor	0x53	-	*	*	*	-	-	*
content_descriptor	0x54	-	-	-	*	-	-	*
parental_rating_descriptor	0x55	-	-	-	*	-	-	*
teletext_descriptor	0x56	-	-	-	-	-	*	-
telephone_descriptor	0x57	-	-	*	*	-	-	*
local_time_offset_descriptor	0x58	-	-	-	-	*	-	-
subtitling_descriptor	0x59	-	-	-	-	-	*	-
terrestrial_delivery_system_descriptor	0x5A	*	-	-	-	-	-	-

(continued)

¹ Australian television broadcasters' application of these descriptors is available at the Free TV website <http://www.freetv.com.au>.

TABLE 4.1 (continued)

Descriptor	Tag value	NIT	BAT	SDT	EIT	TOT	PMT	SIT (see Note 3)
multilingual_network_name_descriptor	0x5B	*	-	-	-	-	-	-
multilingual_bouquet_name_descriptor	0x5C	-	*	-	-	-	-	-
multilingual_service_name_descriptor	0x5D	-	-	*	-	-	-	*
multilingual_component_descriptor	0x5E	-	-	-	*	-	-	*
private_data_specifier_descriptor	0x5F	*	*	*	*	-	*	*
service_move_descriptor	0x60	-	-	-	-	-	*	-
short_smoothing_buffer_descriptor	0x61	-	-	-	*	-	-	*
frequency_list_descriptor	0x62	*	-	-	-	-	-	-
partial_transport_stream_descriptor (see Note 3)	0x63	-	-	-	-	-	-	*
data_broadcast_descriptor	0x64	-	-	*	*	-	-	*
scrambling_descriptor	0x65	-	-	-	-	-	*	-
data_broadcast_id_descriptor	0x66	-	-	-	-	-	*	-
transport_stream_descriptor (see Note 4)	0x67	-	-	-	-	-	-	-
DSNG_descriptor (see Note 4)	0x68	-	-	-	-	-	-	-
PDC_descriptor	0x69	-	-	-	*	-	-	-
AC-3_descriptor	0x6A	-	-	-	-	-	*	-
ancillary_data_descriptor	0x6B	-	-	-	-	-	*	-
cell_list_descriptor	0x6C	*	-	-	-	-	-	-
cell_frequency_link_descriptor	0x6D	*	-	-	-	-	-	-
announcement_support_descriptor	0x6E	-	-	*	-	-	-	-
application_signalling_descriptor	0x6F	-	-	-	-	-	*	-
adaptation_field_data_descriptor	0x70	-	-	-	-	-	*	-
service_identifier_descriptor	0x71	-	-	*	-	-	-	-
service_availability_descriptor	0x72	-	-	*	-	-	-	-
default_authority_descriptor	0x73	*	*	*	-	-	-	-
related_content_descriptor	0x74	-	-	-	-	-	*	-
TVA_id_descriptor	0x75	-	-	-	*	-	-	-
content_identifier_descriptor	0x76	-	-	-	*	-	-	-
time_slice_fec_identifier_descriptor	0x77	*	-	-	-	-	-	-
ECM_repetition_rate_descriptor	0x78	-	-	-	-	-	*	-
S2_satellite_delivery_system_descriptor	0x79	*	-	-	-	-	-	-
enhanced_AC-3_descriptor	0x7A	-	-	-	-	-	*	-
DTS descriptor	0x7B	-	-	-	-	-	*	-
AAC descriptor	0x7C	-	-	-	-	-	*	-
XAIT location descriptor	0x7D	*	*	*	*	*	*	*
FTA_content_management_descriptor	0x7E	*	*	*	*	-	-	-
extension descriptor	0x7F	*	*	*	*	*	*	*
user defined	0x80 to 0x82							

(continued)

TABLE 4.1 (continued)

Descriptor	Tag value	NIT	BAT	SDT	EIT	TOT	PMT	SIT (see Note 3)
logical_channel_descriptor*	0x83	*						
User defined	0x84 to FE							
forbidden	0xFF							

NOTES:

- 1 Refer to Clause 4.2.5 in this Standard for information on the linkage_descriptor.
- 2 For information on the Australian implementation of the extended_event_descriptor, refer to Free TV OP-44.
- 3 This is only found in partial transport streams. The selection information table (SIT with a fixed packet identifier of 0x001F) is included in this Table for alignment with ETSI EN 300 468 Table 12, but is not applicable to transmission.
- 4 This is only in the TSDT (transport streams description table).

4.2.3 Content descriptor (Clause 6.2.9 in ETSI EN 300 468)

This Clause contains the Australian modifications to Clause 6.2.9 of ETSI EN 300 468, which are presented below in Table 4.2.

The intention of the content descriptor is to provide classification and descriptive information for an event.

TABLE 4.2
CONTENT DESCRIPTOR
 (Table 27 in Clause 6.2.9 of ETSI EN 300 468)

Syntax	No. of bits	Identifier
content_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
for (i=0; i<N; i++)		
content_nibble_level_1	4	uimsbf
content_nibble_level_2	4	uimsbf
user_byte	8	uimsbf
}		
}		

4.2.4 Semantics of the content descriptor**4.2.4.1 content_nibble_level_1**

This 4-bit field represents the first level of a content identifier. This field shall be coded according to Table 4.3.

4.2.4.2 content_nibble_level_2

This 4-bit field represents the second level of a content identifier. This field shall be coded according to Table 4.3.

4.2.4.3 user_byte

This 8-bit field is defined by the broadcaster.

TABLE 4.3
Content_nibble LEVEL 1 AND 2 ASSIGNMENTS¹
(Replacement of Table 28 in Clause 6.2.9 of ETSI EN 300 468)

Content_nibble_level_1 default values	Content nibble 1 and 2 values		Description
	Content_nibble_level_1 values	Content_nibble_level_2 values	
0x0	0x0	0x0–0xF	undefined content
0x1			Movie
	0x1	0x0	movie (general)
	0x1	0x1–0xE	reserved for future use
	0x1	0xF	user defined
0x2			News
	0x2	0x0	news (general)
	0x2	0x1–0xE	reserved for future use
	0x2	0xF	user defined
0x3			Entertainment
	0x3	0x0	entertainment (general)
	0x3	0x1–0xE	reserved for future use
	0x3	0xF	user defined
0x4			Sport
	0x4	0x0	sport (general)
	0x4	0x1–0xE	reserved for future use
	0x4	0xF	user defined
0x5			Childrens
	0x5	0x0	childrens (general)
	0x5	0x1–0xE	reserved for future use
	0x5	0xF	user defined
0x6			Music
	0x6	0x0	music (general)
	0x6	0x1–0xE	reserved for future use
	0x6	0xF	user defined

(continued)

¹ Refer to Free TV OP-39 (<http://www.freetv.com.au>).

TABLE 4.3 (continued)

Content_nibble_level_1 default values	Content nibble 1 and 2 values		Description
	Content_nibble_level_1 values	Content_nibble_level_2 values	
0x7			Arts/culture
	0x7	0x0	arts/culture (general)
	0x7	0x1–0xE	reserved for future use
	0x7	0xF	user defined
0x8			Current affairs
	0x8	0x0	current affairs (general)
	0x8	0x1–0xE	reserved for future use
	0x8	0xF	user defined
0x9			Education/information
	0x9	0x0	education/information (general)
	0x9	0x1–0xE	reserved for future use
	0x9	0xF	user defined
0xA			Infotainment
	0xA	0x0	infotainment (general)
	0xA	0x1–0xE	reserved for future use
	0xA	0xF	user defined
0xB			Special
	0xB	0x0	special (general)
	0xB	0x1–0xE	reserved for future use
	0xB	0xF	user defined
0xC			Comedy
	0xC	0x0	comedy (general)
	0xC	0x1–0xE	reserved for future use
	0xC	0xF	user defined
0xD			Drama
	0xD	0x0	drama (general)
	0xD	0x1–0xE	reserved for future use
	0xD	0xF	user defined

(continued)

TABLE 4.3 (continued)

Content_nibble_level_1 default values	Content nibble 1 and 2 values		Description
	Content_nibble_level_1 values	Content_nibble_level_2 values	
0xE			Documentary
	0xE	0x0	Documentary (general)
	0xE	0x1–0xE	reserved for future use
	0xE	0xF	user defined
0xF	0xF	0x0–0xF	user defined

4.2.5 Terrestrial delivery system descriptor (refer to Clause 6.2.13.4 ETSI EN 300 468)

Under the terrestrial delivery system descriptor (Clause 6.2.13.4 Table 42), the other_frequency_flag may be set to '0'. If the other_frequency_flag is set to '0' then a frequency_list_descriptor (Clause 6.2.17) is not transmitted.

NOTES:

- 1 By not transmitting the frequency_list_descriptor, the other_frequency_flag set to '0' indicates to a receiver not to look for a similar transport stream available to the viewer.
- 2 Although all parameters under the terrestrial delivery system descriptor should be ignored by receivers as the service has already been decoded by way of channel frequency search and transmission parameter signalling information, the information supplied by these parameters is a worthwhile record to identify the conditions under which the transport stream has been decoded.

4.2.6 Linkage descriptor (Clause 6.2.19 in ETSI EN 300 468)

In Australia, the implementation of the linkage descriptor applies to specific applications.

Linkage type 0x05 shall be where the linkage descriptor is located in the service description table for service replacement service applications.¹

Linkage types 0x09 and 0x0A shall be where the linkage descriptor is located in the network information table and update notification table for system software update applications (refer to ETSI TS 102 006 and, for Australian implementation, Free TV OP-46).

The linkage_descriptor is an optional descriptor for implementation in Australia. Some broadcasters have adopted the linkage_descriptor for service replacement service applications in accordance with Free TV OP-43.

4.2.7 Local time offset descriptor (Clause 6.2.20 in ETSI EN 300 468)

This Clause contains the Australian modifications to Clause 6.2.20 of ETSI EN 300 468 which are presented in Tables 4.4 and 4.5.

The local time offset descriptor may be used in the time offset table to describe country specific dynamic changes of the local time offset relative to universal time, coordinated (UTC). It is intended that all transmissions will follow the specifications in Free TV OP-45.²

¹ Refer to Free TV OP-43 (<http://www.freetv.com.au>).

² Refer to Free TV OP-45 (www.freetv.com.au).