

AS 5362:2024



Requirements for receivers for VHF/UHF DVB-T2 television broadcasts including ancillary services



AS 5362:2024

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- Australian Subscription Television and Radio Association
- Community Broadcasting Association of Australia
- Consumer Electronics Suppliers Association
- Engineers Australia
- Free TV Australia
- Special Broadcasting Service

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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.

The objective of this document is to specify the requirements for receivers for VHF/UHF DVB-T2 television broadcasts including ancillary services. This includes an extensive range of new specifications beyond those found in DVB-T specifications within AS 4933:2024. These are specified with sufficient detail to allow receiver manufacturers to design and manufacture DVB-T2 receivers to meet Australian technical and regulatory requirements, including the following:

- (a) DVB-T2 Multiple Physical Layer Pipes, which allow separate adjustment of the robustness of each delivered service within a channel to meet the required reception conditions (e.g. in-door or roof-top antenna).
- (b) DVB-T2 Single Frequency Network implementation, which allows an efficient management of frequency utilization and permits an extension of the *coverage* area.
- (c) Increased bit rate efficiency with High Efficiency Video Coding (HEVC), Leading edge High Dynamic Range/High Frame Rate picture formats and multi-channel immersive AC-4 audio coding.
- (d) Australian regulatory requirements such as program classification codes, e.g. for parental guidance and time zone different to those applicable in Europe.

This document references specifications produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalization ELEctrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

Within the European Broadcasting Union, the Digital Video Broadcasting Project (DVB) is an industry-led consortium of broadcasters, manufacturers, network operators, software developers, regulatory bodies, content owners and others committed to designing global standards for the delivery of digital television and data services within the minimum DVB specifications for Integrated Receiver Decoder (IRD) functionality.

Standards Australia is a member of the DVB Project, with the status of Observer, which allows Standards Australia to support the development of Australian digital television standards, which are focused on the adoption of ETSI/DVB standards.

This document also references NorDig specifications which have been used since 2011 by many consumer electronics manufacturers in the design of DVB system digital television receivers deployed in Australia.

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Specifications set out using the verb form “shall” are requirements that need to be met to claim conformance to this document. All other statements are recommendations (set out using the verb form “should”) or additional information and are provided for guidance only.

The terms “normative” and “informative” are used in Standards to define the application of the appendices 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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Introduction

Digital Terrestrial Television Broadcasting (DVB-T) officially began in Australia on 1 January 2001. The transmissions are based on the DVB-T system; however, it should be noted that the international DVB Standards and related ETSI, IEC, ISO and ITU-R documents provide for a range of operational systems.

Consumers in Australia expect to have access to a wide choice of receiving equipment, ranging from fully integrated receivers with inbuilt displays to modular set-top box receivers designed to be connected to a separate display and sound reproduction system. In addition, the various broadcasters in Australia use different brands of encoding and transmission equipment. Manufacturers who are supplying the Australian market are obliged, therefore, to ensure that their equipment will operate satisfactorily under the relevant Australian conditions.

This document aims to assist manufacturers by providing the information necessary to ensure that any digital terrestrial television receiving equipment made for the Australian system will operate satisfactorily to receive current and proposed Australian digital terrestrial television broadcast transmissions.

The international ETSI DVB Standards, through recognition in other standards, e.g. ISO/IEC 14496-26, specify implementation guidelines and *conformance points* for the use of technologies utilizing MPEG-2 systems in satellite, cable and terrestrial broadcasting systems and in IP-based networks, including coding for adaptive bitrate delivery over IP-based networks. These *conformance points* place some implementation constraints on technologies, while achieving interoperability between design of manufacturers' Integrated Receiver Decoders (IRDs).

In the decade leading up to development of this document, a number of studies became available which have informed standards development organisations (SDOs) on improvements to DVB-T2 receiver design. These include the following:

NOTE The documents listed below are provided for the purposes of historical background.

- (a) IEC 61937 (series), *Digital audio – Interface for nonlinear PCM Encoded audio bitstreams applying IEC 60958*.
- (b) ISO/IEC 23008-2:2020, *Information technology – High efficiency coding and media delivery in heterogeneous environments – Part 2: High efficiency video coding*.
- (c) ETSI EN 303 340 V1.2.1 (2020-09), *Digital Terrestrial TV Broadcast Receivers; Harmonized Standard for access to radio spectrum*
- (d) ETSI EN 303 560 V1.1.1 (2018-05), *Digital Video Broadcasting (DVB); TTML subtitling systems*.
- (e) ITU-R BT.2036-4 (06/2021), *Characteristics of a reference receiving system for frequency planning of digital terrestrial television systems*.
- (f) ITU-R BT.2033-2 (01/2022), *Planning criteria, including protection ratios, for second generation of digital terrestrial television broadcasting systems in the VHF/UHF bands*.
- (g) ITU-R BT.2254-5 (11/2021), *Frequency and network planning aspects of DVB-T2*.
- (h) ITU-R BT.2269-2 (11/2021), *Typical frequency sharing characteristics for digital terrestrial broadcasting systems in the frequency band 174-230 MHz*
- (i) ITU-R BT.2341-1 (11/2014), *TV receiver subjective picture failure thresholds and the associated minimum quasi error free levels for good quality reception*.
- (j) ITU-R BT.2383-4 (03/2022), *Typical frequency sharing characteristics for digital terrestrial television broadcasting systems in the frequency band 470-862 MHz*.
- (k) ITU-R BT.2386-3 (10/2020), *Digital terrestrial broadcasting: Design and implementation of single frequency networks (SFN)*.

- (l) ITU-R BS.2466-0 (07/2019), *Guidelines for the use of the ITU-R ADM Renderer.*
- (m) ITU-R BT.2467-1 (03/2021), *Methods for the evaluation of the quality of service of second generation DTTB systems.*
- (n) ITU-R BT.2468-1 (03/2021), *Guidance for selection of system parameters and implementation of second generation DTTB systems.*
- (o) ITU-R BT.2469-2, *Typical frequency sharing characteristics for digital terrestrial broadcasting systems in the frequency band 174-230 MHz.*

Australian Standard®

Requirements for receivers for VHF/UHF DVB-T2 television broadcasts including ancillary services

Section 1 Scope and general

1.1 Scope

This document specifies the baseline television receiver requirements for reception of free-to-air (FTA) terrestrial VHF/UHF DVB-T and DVB-T2 broadcast television.

This document applies to baseline television receivers capable of receiving existing DVB-T services (refer to AS 4933 for relevant requirements) and DVB-T2 services and encoding technologies.

Within a DVB-T2 environment, where receiver requirements are separately referenced for DVB-T in AS 4933:2024, Australian television broadcasters have implemented MPEG-2/MPEG-4 AVC video coding along with AC-3, MPEG-1 Layer II, MPEG-4 AAC and MPEG-4 HE AAC audio codecs. National television broadcasters, ABC and SBS, also have radio services within their transmissions.

This document specifies requirements for DVB-T2 with H.264/AVC, H.265/HEVC video coding, a HDR picture format and AC-4, MPEG-4 AAC, MPEG-4 HE AAC V1 and V2, AC-4 and E-AC-3 audio coding.

The international ETSI DVB Standards and related ETSI, ISO/IEC, ITU-R and NorDig Unified Requirements documents provide for various implementation systems. This document specifies the choices available in Australia and references Australian adaptations of these international Standards where appropriate.

This document covers the requirements for subscription television receivers that can also access the free to air broadcasts.

This document does not specify the final presentation characteristics of picture (display) and sound or associated services, which may be provided as features individually in consumer electronics products.

1.2 Application

1.2.1 General

The primary purpose of this document is to identify the minimum essential requirements for equipment intended to receive, demodulate and decode television broadcasts that conform to DVB specifications for Integrated Receiver Decoder (IRD) functionality and the Australian implementation of DVB-T2 and referenced ISO/IEC and ETSI Standards. However, because there are a range of optional features that receiver manufacturers may provide, additional information and recommendations are provided to clarify the preferred or required (as applicable) operation or facility in such cases.

Under the minimum requirements set out in [Section 2](#), equipment shall be capable of simultaneously decoding from the Transport Stream (TS) a video stream, an associated audio stream and associated closed captions. The decoded information shall be presented in a time-synchronized manner suitable for a display device and sound reproduction system subject to the mandatory implementation of the parental lock function. Another purpose of this document is to provide specifications for high quality picture formats.

If necessary, the video may be required to be converted ("scaled"), as the received format may be different from the display format. Correspondingly, the received audio channels may need to be processed or downmixed to suit the available sound reproduction equipment.

1.2.2 Application to baseline television receivers

The baseline television receiver shall have capability for reception of existing DVB-T SD and HD services and capability for reception of new DVB-T2 services in accordance with [Section 2](#). [Section 2](#) sets out the minimum requirements for Australian DVB-T2 television receivers to operate satisfactorily in the Australian environment to receive Australian FTA terrestrial VHF/UHF DVB-T and DVB-T2 broadcasts.

Manufacturers may provide television receivers with optional features in excess of the baseline television receiver requirements.

[Section 3](#) provides a comprehensive list of receiver specifications and features, indicating whether they are mandatory (baseline), recommended or optional. The optional features additional to the baseline requirements referred to in this document include interactive middleware and audio decoding choices, such as surround and multilingual sound, as well as interfaces for ancillary equipment, including —

- (a) Hybrid Broadcast Broadband TV (HbbTV); and
- (b) other additional features as determined by market and changing technology.

NOTE 1 HbbTV is adopted by Australian broadcasters to provide integration between broadcast and on-demand services.

NOTE 2 Australian broadcasters and Freeview Australia provide HbbTV interactive services for television receivers that have implemented network capability and HbbTV functionality.

1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents for informative purposes are listed in the Bibliography.

AS 4933:2024, *Digital television — Requirements for receivers for VHF/UHF DVB-T television broadcasts including ancillary services*

IEC 60958-4:2016, *Digital audio interface – Part 4-4: Professional applications – Physical and electrical parameters*

IEC 61169-2:2007, *Radio-frequency connectors – Part 2: Sectional specification – Radio frequency coaxial connectors of type 9,52*

IEC 61169-24:2009, *Sectional specification – Radio frequency coaxial connectors with screw coupling, typically for use in 75 Ω cable networks (type F)*

IEC 61937:2022 all parts), *Digital audio – Interface for non-linear PCM encoded audio bitstreams applying IEC 60958 (2016)*

IEC 62216:2009, *Digital terrestrial television receivers for the DVB-T system*

ISO/IEC 11172-3:1993, *Information technology — Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s — Part 3: Audio*

ISO/IEC 13818-1:2019, *Information technology – Generic coding of moving pictures and associated audio information – Part 1: Systems*

ISO/IEC 13818-3:1998, *Information technology — Generic coding of moving pictures and associated audio information — Part 3: Audio*

ISO/IEC 14496-3:2019, *Information technology — Coding of audio-visual objects — Part 3: Audio*

ISO/IEC 14496-10:2020, *Information technology — Coding of audio-visual objects — Part 10: Advanced video coding*

ISO/IEC 23008-2:2020, *Information technology — High efficiency coding and media delivery in heterogeneous environments — Part 2: High efficiency video coding*

ETSI TR 101 202 V1.2.1 (2003-01), *Digital Video Broadcasting (DVB); Implementation guidelines for Data Broadcasting*

ETSI TR 101 290 V1.4.1 (2020-06), *Digital Video Broadcasting (DVB); Measurement guidelines for DVB systems*

ETSI TS 101 154 V2.8.1 (2023-07), *Digital Video Broadcasting (DVB); Specification for the use of Video and Audio Coding in Broadcasting Applications*

ETSI TS 101 211 V1.13.1 (2021-05), *Digital Video Broadcasting (DVB); Implementation and usage of Service Information (SI)*

ETSI TS 102 323 V1.5.1 (2012-01), *Digital Video Broadcasting (DVB); Carriage and signalling of TV-Anytime information in DVB transport streams*

ETSI TS 102 366 V1.4.1 (2017-09), *Digital Audio Compression (AC-3, Enhanced AC-3) Standard*

ETSI TS 102 809, *Digital Video Broadcasting (DVB); Signalling and carriage of interactive applications and services in hybrid broadcast/broadband environments*

ETSI TS 102 831 V1.2.1 (2012-08), *Digital Video Broadcasting (DVB); Implementation guidelines for a second generation digital terrestrial television broadcasting system (DVB-T2)*

ETSI TS 103 190-1 V1.2.1 (2015-06), *Digital Audio Compression (AC-4) Standard; Part 1: Channel based coding*

ETSI TS 103 190-2 V1.2.1 (2018-02), *Digital Audio Compression (AC-4) Standard; Part 2: Immersive and personalized audio*

ETSI EN 300-468 V1.17.1 (2022-10), *Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems*

ETSI EN 300-472 V1.4.1 (2017-01), *Digital Video Broadcasting (DVB); Specification for conveying ITU-R System B Teletext in DVB bitstreams*

ETSI EN 300-744 V1.6.2 (2015-10), *Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television*

ETSI EN 303-560, V1.1.1 (2018-05), *Digital Video Broadcasting (DVB); TTML subtitling systems*

ETSI EN 301-192, V1.7.1 (2021-08), *Digital Video Broadcasting (DVB); DVB specification for data broadcasting*

ETSI EN 302-755 V1.4.1 (2015-07), *Digital Video Broadcasting (DVB); Frame structure channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)*

NorDig. *NorDig Unified Requirements for Integrated Receiver Decoders for use in cable, satellite, terrestrial and managed IPTV based networks version 3.1.2* (April 2021)

NorDig. *NorDig Unified Test Plan for Integrated Receiver Decoders for use in cable, satellite, terrestrial and managed IPTV based networks version 3.1.2* (April 2021)

ITU-R Recommendation BT.601-7 (03/2011), *Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios*

ITU-R Recommendation BT.709-6(06/2015), *Parameter values for the HDTV standards for production and international programme exchange*

ITU-R Recommendation BT.2020-2 (10/2015), *Parameter values for ultra-high definition television systems for production and international programme exchange*

ITU-R Recommendation BT.2100-2 (07/2018), *Image parameter values for high dynamic range television for use in production and international programme exchange*

Consumer Electronics Association (CEA). Intel: HDCP, "High- Bandwidth Digital Content Protection System", v1.4, v2.2 or v2.3

SMPTE RP 155 (2014), *SMPTE Recommended Practice – Reference Levels for Analog and Digital Audio Systems*

RADIO EQUIPMENT DIRECTIVE E.U. 2014/53/EU – <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0053>

1.4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

1.4.1

may

indicates the existence of an option

1.4.2

shall

indicates that a statement is mandatory

1.4.3

should

indicates a recommendation

Section 2 Essential requirements for receivers

2.1 Introduction

This section sets out the minimum functions and operating parameters that a digital TV receiver shall have in order to operate satisfactorily in the Australian FTA digital television environment.

2.2 Essential receiver requirements

[Table 2.2](#) sets out the minimum requirements for digital TV receivers intended to be used in Australia to receive Australian FTA terrestrial television broadcasts. These requirements are essential for satisfactory operation and are derived from the comprehensive details given in [Section 3](#).

Table 2.2 — Essential receiver requirements

Item	Description
1	Channel frequencies and bandwidth The receiver shall tune and operate in 7 MHz VHF and UHF digital channel allocations (see Table C.1) within the frequency range of 174 MHz to 230 MHz and 519 MHz to 820 MHz to accommodate over the air broadcast services up to 694 MHz and services provided by cabled distribution systems up to 820 MHz. The centre frequency of some transmissions may be offset by plus or minus 125 kHz (see Clause A.2.2). Higher-powered adjacent channels may be present (see Appendix B). NOTE 1: Refer to https://www.acma.gov.au/publications/2019-10/rules/embargo-45.
2	Demodulation The receiver shall be capable of correctly demodulating all modes specified in ETSI EN 302 755 V1.4.1 (2015-07), with exceptions found in <i>NorDig Unified Requirements</i> ver. 3.1.2 Clause 3.4.3, and all modes specified in ETSI EN 300 744 v1.6.2 (2015-10).
3	Tuning and scanning DVB-T and DVB-T2 COFDM parameters Receivers shall be able to scan the required spectrum to detect valid DVB-T and DVB-T2 transmissions. The receiver should ignore non-compatible transmissions while scanning and only store decodable services. Requirements for DVB-T are set out in AS 4933:2024. Receivers shall have a user accessible full auto-tune function that completely erases the tuning and related databases, including “favourites”, prior to the rescan. The factory reset function is not a substitute for this requirement. Tuning shall be in accordance with Clause 3.2.2.4 and <i>NorDig Unified Requirements</i> ver. 3.1.2 Clause 3.4.4.
4	Adapt to changes in transmission DVB-T and T2 COFDM parameters Receivers shall automatically be able to continue reception of a transmission if the transmission's RF T2 COFDM parameters are changed. A receiver shall demodulate and decode the data to determine the transmission's COFDM parameters for DVB-T (refer to AS 4933:2024) and DVB-T2, such as the layer one L1 signalling as defined in ETSI EN 302 755 V1.4.1 (2015-07). If a previously receivable Transport Stream (TS) and its service(s) are lost, it shall reset to the new operating parameters in order to restore reception of the TS. This shall be in accordance with <i>NorDig Unified Requirements</i> ver. 3.1.2 Clause 3.4.3.
5	Operate in the presence of multipath signals and SFNs Receivers shall be able to operate in SFN and multipath environments and do so with either pre-echoes or post-echoes within the nominal guard interval range. This shall be in accordance with Appendix B of this document and <i>NorDig Unified Requirements</i> ver. 3.1.2 Clause 3.4.10.9. Also refer to ITU-R Report BT.2386-3.
6	Decoding video service format types Receivers shall be capable of decoding services from the TS. The decoded picture, sound and other information shall be presented (scaled appropriately) in a time-synchronized manner. Receivers shall be capable of decoding for display the following 25/50 Hz frame/field rates and interlace / progressive picture scanning video formats from both DVB-T and DVB-T2 transmissions:

Table 2.2 (continued)

Item	Description
	(a) SD SDR (Standard Dynamic Range) video streams at 720 × 576 × 25p/50i using MP@ ML MPEG-2 video. (b) HD SDR video streams at 1920 × 1080 × 25p/50i MP@HL MPEG-2 video. (c) SD SDR video streams at 720 × 576 × 25p/50i MPEG-4 Part 10 at level 3. (d) HD SDR video streams at 1920 × 1080/25p/50i/50p/MPEG-4 Part 10 at level 4.2. (e) SDR SDTV video streams at 960 × 540 25p/50p using HEVC Main Profile, Main Tier up to level 4.1. (f) SDR HDTV video streams at 1920 × 1080 25/50p using HEVC Main Profile, Main Tier up to level 4.1. (g) HDR (High Dynamic Range) HDTV video streams at 1920 × 1080 50p using HEVC Main 10 Profile, Main Tier up to level 4.1. (h) SDR UHD TV video streams at 3840 × 2160 50p using HEVC Main 10 Profile, Main Tier up to level 5.1. (i) HDR UHD TV video streams at 3840 × 2160 50p using HEVC Main 10 Profile, Main Tier up to level 5.1. The following is an optional capability for receivers: HDR HFR (High Frame Rate) UHD TV video streams at 3840 × 2160 100p HEVC Main 10 Profile, Main Tier up to level 5.2. Decoding video service format types shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) clauses specified in Appendix E of this document. NOTE 2: Manufacturers may choose to display video with other frame/field rates such as 24p, 30p and 60p. NOTE 3: High Frame Rates: Australian television broadcasters may adopt High Frame Rate transmissions in the future, e.g. 100p, for which encoded streams are “backwards compatible”, e.g. to produce an acceptable 50p output.
7	Audio formats AC-4, AC-3, E-AC-3, MPEG-1 Layer II, MPEG-4 AAC and HE AAC v2 Receivers shall be capable of decoding audio streams from both DVB-T and DVB-T2 transmissions in AC-3, AC-4, MPEG-1 Layer II, E-AC-3, MPEG-4 AAC and HE AAC v2 up to level 4 formats. Decoding audio streams shall be in accordance with Appendix F of this document. If a program service has more than one associated audio stream, the receiver shall provide a method by which the user can select which audio stream is presented.
8	Audiovisual synchronization Receiver manufacturers should note that Australian television broadcasters ensure within their transmissions that the alignment of the sound and vision is to within ± 20 ms. This reference of the transmitted sound and vision alignment is as signalled in the PTS (presentation timestamp). Where receivers present audio outputs in encoded digital form, this audio stream should be advanced with respect to vision in order to maintain audio/video synchronization when decoded. The presentation of the decoded audio bitstream in receivers should follow the alignment of the sound and vision to within ± 20 ms. This does not take account of any delay which may be introduced in loop through to other devices. Further information can be found at Clause 3.4.6.9.
9	Access audio only (radio) program streams Receivers shall decode audio only (radio) services in any of the standard audio formats specified. Audio stream coding service types shall be in accordance with ETSI EN 300 468 V1.17.1 (2022-10) Clause 6.2.33.
10	PSI and SI changes

Table 2.2 (continued)

Item	Description
	In the currently selected TS the Program Map Tables shall be monitored on selection of a different service. A change shall be implemented within 5 s of reception of the change. For the purposes of discovery of added or changed services, receivers shall detect and respond to changes in the Program Specific Information (PSI) and Service Information (SI) in the Transport Stream (TS) by checking for service changes at intervals not exceeding 24 hours. An exception to this is where the receiver is continuously powered on and tuned to a single transport stream within the 24-hour period, in which case only changes in the tuned transport stream shall be monitored. This monitoring shall include the Program Association Table (PAT), Service Description Table (SDT) and Network Information Table (NIT) set of tables and may be while the receiver is in active or standby modes (see Clause 3.5.2.3). Program and elementary stream descriptors for video, including HEVC, and audio, including AC-4, shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 4.1.8. See Appendices E and F for further information.
11	PID numbering Receivers shall be so configured that no sequenced or ordered numbering of the PID values of various components of a service is assumed. PID numbering shall be in accordance with ETSI EN 300 468 V1.17.1 (2022-10) Clause 5.1.3.
12	Presentation Time Stamp and Decoding Time Stamp Occurrence Receivers shall observe the specifications for the decoding for Program Elementary Streams for H.264/AVC and H.265/HEVC bitstreams found in ETSI TS 101 154 V2.8.1 (2023-07) Clause 4.1.6.10.
13	Use of Logical Channel Numbers for services Receivers shall use the broadcast Logical Channel Number (LCN) of services for channel selection. The LCNs are found in the NIT as a transport descriptor within the transport stream loop. For DVB-T2 the descriptor shall be transmitted with a tag of 0x83 (see Clause 3.5.4.3). Information on Australian use of LCNs for DVB-T and DVB-T2 may be found in Clauses 3.5.4 and C.3.31 of this document.
14	Subtitles including Closed Captions (CCs) Currently Australian television transmissions apply DVB Teletext for closed captioning. In the future Australian television transmissions may apply timed text markup language. Some Australian television transmissions may provide multilingual subtitling. DVB-T2 receivers should also support DVB Subtitles. For DVB-T2, subtitles including Closed Captions shall be in accordance with Appendix D and NorDig Unified Requirements ver. 3.1.2 Clause 7.
15	Audio description ETSI TS 101 154 V2.8.1 (2023-07) Annex E provides specifications for DVB compliant Broadcast/Receiver mix bitstreams. Further information can be found at Clause F.3.
16	Time zone region selection The receiver shall provide a menu setup for a user to choose their Australian time zone region by a state and territory list, in accordance with the time zones listed in Clause 3.5.1.4 (also see Clause C.3.6). The receiver shall then access the information for that time zone in the transmitted TOT for any time display or related functions in the receiver. NOTE 4: This is essential for correct times (including daylight saving) in EPG displays.
17	Parental guidance codes Receivers shall utilize parental guidance information for a program (where provided) and shall display this information in the format indicated in the Australian-specific Look-Up Tables. Parental guidance codes shall be in accordance with Clause 3.5.5 and Appendix C. Parental guidance information is transmitted in the EIT.
18	Parental lock Refer to the ACMA's Broadcasting Services (Parental Lock) Technical Standard 2020 for regulatory requirements relating to parental lock capabilities of receivers. This regulation can be found at the Federal Register of Legislation (legislation.gov.au).

Table 2.2 (continued)

Item	Description
19	Mains operated receivers Mains operated receivers shall be designed to operate at a nominal mains input of 230 V a.c., 50 Hz (further information can be found at Clause 3.6.2 for range of voltages). NOTE 5: Australian regulatory requirements that apply to receivers include (but are not limited to) safety, EMC (electromagnetic compatibility), MEPS (Minimum Energy Performance Standards) and energy rating labelling standards.

Section 3 Receiver features

3.1 General

The provisions in this section relating to the operation of Digital Terrestrial Television Broadcasting (DTTB) reception equipment are based on the Australian adaptation of the DVB Standards for DVB compliant Integrated Receiver Decoder (IRD) functionality and digital television terrestrial transmissions for manufacturers and suppliers of Australian DTTB consumer equipment.

This document also follows specifications for DVB-T2 receivers within the *NorDig Unified Requirements* as a primary design reference. The NorDig specifications are identified along with referenced Clauses in *NorDig Unified Requirements* ver. 3.1.2 (13 April 2021) and the *NorDig Unified Test Plan* ver. 3.1.2 (13 April 2021).

[Clauses 3.2](#) to [3.5](#) specify the *conformance requirements* for DVB-T2 receivers capable of receiving Australian DTTB transmissions and also requirements that apply to optional (non-essential) features of such receivers. These clauses reference ETSI/DVB-T2 Standards and specify requirements to allow for reception of FTA (free-to-air) transmissions in Australian conditions.

NOTE Semantic elements of the PSI and SI syntax code, such as descriptors, are printed in a sans serif font (e.g. “linkage_descriptor = 0x05”).

3.2 DVB-T2 RF tuning performance and reception

3.2.1 DVB-T2 receivers

Terrestrial tuner and demodulator specifications for DVB-T2 receivers shall be in accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.

The receiver shall be able to receive, decode and present an FTA television service from a correctly constituted Australian DVB-T2 Transport Stream (TS) irrespective of other services (that might be encrypted) or Generic Streams included in that TS.

In situations where there is a mixture of FTA services and encrypted services in a TS or FEF data present in a T2 transmission, the receiver shall be able to decode the FTA services without the need for any decryption mechanism or decoding of the FEF frames.

Receivers shall conform to the requirements of [Appendix A. Clauses 3.2.2](#) to [3.2.5](#) summarize the requirements of [Appendix A](#) for the receiver's RF performance and the methods for measurement requirements, where [Appendix A](#) takes precedence.

For information and specifications on RF input and output connectors, see [Clause 3.12.1](#) and [Clauses A.5](#) and [A.6](#).

3.2.2 RF performance

3.2.2.1 7 MHz transmission channel bandwidth

The Australian transmission channel bandwidth is 7 MHz. Receivers shall be able to operate on 7 MHz channel spacing at both VHF and UHF.

Frequencies and signal bandwidths shall be in accordance with [Clause A.2](#)

Receivers with tuners designed to operate with either 7 MHz or 8 MHz channel assignments at UHF should be preset to 7 MHz as detailed in [Table A.2](#).

3.2.2.2 RF input channel loading allowance

Digital receivers shall be able to operate with scenarios of RF input connectors identified in [Clause 3.12.1.1](#) and [Clause A.7](#).

In addition to the TV VHF and UHF channel loading, RF signals including FM and DAB radio, and VHF and UHF land mobile, should be design considerations when assessing channel loading.

3.2.2.3 Receiver sensitivity

Receiver sensitivity requirements are set out in [Clause A.11](#).

Receiver sensitivity is a function of tuner noise figure and carrier-to-noise threshold as detailed in [Clause A.14.3](#) and *NorDig Unified Test Plan* ver. 3.1.2 Task 3.

The receiver shall conform to the tests for doppler echo performance specified in [Clause A.15](#) and *NorDig Unified Test Plan* ver. 3.1.2 Task 3.

3.2.2.4 Scanning to find services

All receivers shall have a user-initiated scanning capability to identify all receivable services.

DVB-T2 receivers shall identify the DVB triplets (DVB original network ID, transport stream ID and service ID).

A full rescan function shall be provided that completely erases the existing tuning and related databases, including “favourites”, prior to the rescan.

NOTE This is to ensure that changed services are not given multiple listings which may confuse viewers. Reception of duplicate services on different frequencies needs to be sorted as detailed in *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.4.

This scanning capability shall scan all channel frequencies listed in [Table A.2](#).

A full scan of the DTTB broadcast bands should start with VHF Band III channels and proceed through the UHF band channels.

The receiver should display the RF channel number as the scan proceeds. Refer to *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.4.

3.2.2.5 Use L1 Signalling for DVB-T2 transmission discovery

During a scan, it is highly recommended that the tuner accesses the DVB-T2 L1 Signalling data (P1 Symbol) to determine a transmission's COFDM parameters.

The P1 Symbol (i.e. the complex sum of the cells) is differential bi-phase shift keyed (DBPSK) carriers, making its reception more robust. DVB-T2 L1 signalling data shall be in accordance with ETSI TS 102 831 V1.2.1 (2012-08) Clause 4.5.5.

3.2.2.6 Automatic detection of new or changed services

If a receiver does a background scan for new RF transmissions (e.g. in standby), the viewer should be advised of any new transmissions or services found when they next switch on the receiver with the option to include the changes.

Receivers should be able to discover service changes within an existing Transport Stream (TS) and advise viewers of these changes.

After scanning, if the same program service is found on different transmissions (e.g. on a DVB-T2 transmission), the user should be given the option to choose. Detection of new or changed services shall be in accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.4.

3.2.3 DVB-T2 COFDM transmission and performance parameters

3.2.3.1 General

Australian television channels are in a 7 MHz raster as detailed in [Table A.2](#).

DVB-T2 COFDM specifications shall be in accordance with ETSI TS 102 831 V1.2.1 to conform to and achieve the required performance requirements as follows:

- (a) *Carrier to Noise* — The C/N values for Gaussian channels shall meet the specification in *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.10.3 *C/N Performance*.
- (b) *Noise figure (NF)* — The noise figure for supported frequency ranges shall be equal or better to the specification in *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.
- (c) *Bandwidth Normal Mode/Extended Mode* — The Normal and Extended bandwidth for a 7 MHz channel shall meet the specification in *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.
- (d) *Normal/High efficiency mode* — The receiver shall be capable of normal and high efficiency mode.
- (e) *Peak average power algorithms* — The receiver shall enable tone reservation and captured constellation extension.
- (f) *Future extension frames* — The receiver shall be capable of FEF to achieve maximum bit rates.
- (g) *Input/output data formats* — The receiver shall be able to support TS bit rates ≤ 44 Mbit/s.
- (h) *Time interleaving length* — The receiver shall include time interleaving capability, i.e. be capable of T2 frame length optimization.
- (i) *System output* — Normal: SISO Optional: MISO.

NOTE For further information, refer to ETSI TS 102 773 V1.4.1 (2016-03), ETSI TS 102 831 V1.2.1 (2012-08), and ETSI EN 302 755 V1.4.1 (2015-07) Digital Video Broadcasting (DVB).

3.2.3.2 Change in COFDM transmission parameters—acquisition time

The acquisition lock time should be —

- (a) within 2 s when a viewer changes to a service that is on a different RF channel; or
- (b) within 5 s when a broadcaster changes the COFDM transmission parameters of a transmitter as identified by the L1 Signalling data.

Change in COFDM transmission parameters—acquisition time, shall be in accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.5.

3.2.3.3 Operation in a DVB-T2 Single Frequency Environment

Receivers shall be able to operate in SFN environments with either pre-echo or post-echo signals within the guard interval. Refer to *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.10.10.

The measurement of SFN performance of receivers shall be in accordance with Tasks 3.65 to 3.67 Test Cases for DVB-T2 in *NorDig Unified Test Plan* ver. 3.1.2. See [Appendix B](#) for further information.

3.2.4 Immunity to DVB-T/-T2 signals in other channels

In accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.10.6, the terrestrial DVB-T2 receiver shall, for the supported frequency ranges, permit an interfering DVB-T2 signal with a minimum

interference to signal level ratio (I/C) while maintaining QEF reception. See [Appendix A](#) for further information.

3.2.5 Immunity to 700 MHz LTE signals in other channels

3.2.5.1 General

In anticipation of the re-allocation of the 700 MHz band from Broadcasting to Mobile in European countries in 2014, the EU Directive 2014/53/EU required in Article 3.2 that radio equipment be constructed so that it both effectively uses and supports the efficient use of radio spectrum in order to avoid harmful interference. Requirements on the broadcast receivers were specified in the ETSI Harmonized European Standard EN 303 340 V1.2.1 (2020-09). This was taken into consideration in DVB systems receivers.

EN 303 340 V1.2.1 is limited to requirements only for the first adjacent selectivity channel in case of LTE interference, while NorDig adds requirements for the IRD's whole operating frequency range, supplemental downlink and for some cases are slightly stricter. In addition to the NorDig requirements for the IRD's, ETSI EN 303 340 V1.2.1 also includes blocking and overloading.

3.2.5.2 Immunity to 700 MHz LTE signals in Other Channels

In accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 3.4.10.7.2, the terrestrial DVB receiver shall, for the supported frequency ranges, permit an interfering 4G (LTE) 700 MHz signal with a minimum interference to signal level ratio (I/C), while maintaining QEF reception. See [Appendix A](#) for further information.

NOTE 1 *NorDig Unified Requirements* ver. 3.1.2 Table 3.16 specifies minimum required I/C for QEF reception with interfering 700MHz LTE signal on the adjacent and other channels. I/C values are defined for LTE signals having signal bandwidth of 9.015 MHz in 10 MHz LTE system.

NOTE 2 The specification values in the ACMA's 700 MHz band Technical Framework, have been drawn upon in this clause. They can be found at <https://www.acma.gov.au/700-mhz-technical-framework>.

3.3 Video decode and display

3.3.1 General

ETSI/DVB coding specifications, i.e. parameters and values, are specified to constrained limits to achieve interoperability which are in accordance with conformance points.

Provisions, choices and format details for video interfaces and connections to a display shall conform to *NorDig Unified Requirements* ver. 3.1.2 Clause 5 and [Appendix E](#) of this document.

3.3.2 MPEG-2 and MPEG-4 Part 10 video decoding

3.3.2.1 Decode SD MP@ML video formats

The receiver shall decode all valid MPEG-2 (MP@ML) 25 frames/s progressive and 50 fields/s interlaced video formats. These include the following formats (pixels × lines):

- (a) 720 × 576; 544 × 576; and
- (b) 480 × 576; 352 × 576

They also include 720 pixels × 576 lines at 25 frames/s progressive scan ("film mode" or 50 fields/s interlaced).

A decoder may present formats in accordance with those in referenced standards, i.e. ETSI TS 101 154 V2.8.1 Annex A.

3.3.2.2 Decode HD MP@HL video formats

HD streams are able to be identified by information in the MPEG video ES header and in the PMT.

The receiver shall decode all valid MP@HL 25/50 Hz formats as follows:

- (a) 1080 active line formats at —
 - (i) 25 frame/s progressive scan (film mode); or
 - (ii) 50 field/s interlace of 1920 or 1440 or 1280 × 1080 line.
- (b) Progressive formats at 50 frame/s: 1280 × 720 active line “720 p50” and 25p (film mode).

A decoder may present formats in accordance with those in referenced standards, i.e. ETSI TS 101 154 V2.8.1 Annex A.

3.3.2.3 Decoding of MPEG-4 Part 10 AVC

Decoding capability shall be provided for MPEG-4, Part 10 AVC (ITU-T H.264) video in SD and HD 25 Hz/50 Hz formats up to level 4 and decoding of accompanying audio formats.

A decoder may present formats in accordance with those in referenced standards, i.e. ETSI TS 101 154 V2.8.1 (2023-07) Annex A.

The receiver shall be able to decode the following video formats:

- (a) SD: 720 × 576 — 50 field/s interlace or 25 frame/s film mode.
- (b) HD: 1280 × 720 — 25/50p or 1920/1440 × 1080 50p/i formats or film mode.

Decoding of MPEG-4 Part 10 AVC shall be in accordance with [Appendix E](#) of this document, ETSI TS 101 154 V2.8.1 (2023-07) and *NorDig Unified Requirements* ver. 3.1.2 Clause 5.

The following service types shall be supported:

- (i) Type = 0x16, advanced codec SD digital television service.
- (ii) Type = 0x19, advanced codec HD digital television service.

NOTE 1 Australian broadcasters have implemented ITU T H.264/AVC (MPEG-4, Part 10) transmissions.

NOTE 2 If the receiver supports IP delivered video, then additional lower resolution formats should be supported, including “full screen” luminance pixel resolutions of 544 × 576, 480 × 576, 352 × 576 or 352 × 288, or the “less than full screen” resolution of 176 × 144. Less than full screen resolution formats may be displayed in “windows” on HD-type screens.

3.3.3 HEVC decoding

HEVC decoding shall be in accordance with those formats in ETSI TS 101 154 V2.8.1 (2023-07) Annex A as follows:

- (a) SDR HDTV 8 bit.
- (b) HDR (HLG10) HDTV 10 bit.
- (c) SDR UHD TV 10 bit.
- (d) HDR (HLG10) UHD TV 10 bit.
- (e) HDR (PQ HDR10) UHD TV 10 bit.
- (f) HDR (HLG10) HFR UHD TV 10 bit.

NOTE 1 “HLG” is hybrid log-gamma. “PQ” is perceptual quantizer.

The following service types shall be supported:

- (i) Type = 0x1F, HEVC digital television service.
- (ii) Type = 0x20, HEVC UHD digital television service with HDR and/or HFR.

NOTE 2 Accuracy in specifications for HEVC Profile, Tier and Level is in ETSI EN 300 468 V1.17.1 (2022–10), ETSI TS 101 154 V2.8.1 (2023–07) and *NorDig Unified Requirements* ver. 3.1.2 Clause 5. Information is also provided in ETSI TS 101 547–2 (2012–11).

Receivers shall be capable of decoding all the above video formats from both DVB-T and DVB-T2 transmissions.

NOTE 3 Refer to ETSI TS 101 154 V2.8.1 (2023–07) and *NorDig Unified Requirements* ver. 3.1.2 Clause 5.

3.3.4 Picture colorimetry and gamma

3.3.4.1 General

Receivers shall decode the 4:2:0 chroma format.

The Australian broadcast chroma format is 4:2:0, which is identified in the MPEG video header syntax as `chroma_format = 0x01`.

3.3.4.2 Colorimetry and Gamma

The colorimetry and gamma on video outputs to display up to SD 576p shall conform to ITU-R Recommendation BT.601-7 (03/2011).

The colorimetry and gamma on video outputs to display up to 1080p HD shall conform to ITU-R Recommendation BT.709-6 (06/2015).

The colorimetry and gamma on video outputs to display 2160 line UHD shall conform to ITU-R Recommendation BT.2020-2 (10/2015).

The colorimetry and gamma on video outputs to display High Dynamic Range (HDR) pictures shall conform to ITU-R Recommendation BT.2100-2 (07/2018).

3.3.5 Reaction to reception of video formats not supported by the receiver

3.3.5.1 General

A receiver should not attempt to change encoded service formats it does not support. In the case of unsupported services, the receiver should display either a notice that this service cannot be accessed or a blank screen.

NOTE Supported video formats can be found in ETSI TS 101 154 V2.8.1 (2023–07) Annex A and *NorDig Unified Requirements* ver. 3.1.2 Clause 5.

3.3.5.2 Digital output on HDMI

Receivers with an HDMI source [usually a set-top box or PVR (personal video recorder)] should allow the user to set the HDMI output format to the following:

- (a) *Automatic setting* — The digital receiver’s output is set to the best resolution video format that the display supports; the digital receiver obtains the video format from the extended display identification data (EDID) information.

- (b) *Manual setting* —
- (i) 720 × 576p;
 - (ii) 1280 × 720p;
 - (iii) 1920 × 1080p / 1080i, or
 - (iv) 3840 × 2160p.

NOTE Other HDMI primary and secondary video formats may be used.

HDCP on HDMI shall be in accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 8.6.4. For further information regarding the need for HDCP on HDMI refer to *NorDig Unified Requirements* ver. 3.1.2.

Digital output on HDMI shall be in accordance with Clause 3.12.2.1.4, ETSI TS 101 154 V2.8.1 (2023-07) and *NorDig Unified Requirements* ver. 3.1.2 Clause 8.6.

3.3.5.3 Picture shape change button via user navigation

The ability to switch between display formats via a user-selectable function may be provided. This should override any transmitted aspect ratio signalling, which for Australian broadcasters is always 16:9.

3.3.5.4 Identification of 16:9 pictures — MPEG header aspect_ratio_information

Receivers shall decode pictures to the indicated aspect ratio identified by the 4-bit integer aspect_ratio_information “0010” or “0011” found in the MPEG-2 video header information.

It is not proposed to use MPEG’s extra wide-screen 2.21 to 1 aspect ratio format in broadcast transmissions.

For identification of 16:9 pictures, MPEG header aspect_ratio_information shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) and aspect ratio specifications for individual video coding schemes.

3.3.6 Other MPEG video presentation features

Decode of transmitted video stills transmitted as I-frame, usually only at a very low data rate, is optional.

Manufacturers may choose to provide features such as multiview display, either as cycling through available program services or picture-in-picture facilities (where dual or multiple tuners are installed).

MPEG mosaic mode may be carried in a single TS. This is not currently used by Australian broadcasters.

Other MPEG video presentation features shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07).

3.3.7 Signalling in the video stream

3.3.7.1 Advanced Video Coding (AVC)

Support of H.264/AVC decoding shall be in accordance with those formats ETSI TS 101 154 V2.8.1 (2023-07) Clause 5.5.

Specifications for Advanced Video Coding (AVC) are as follows:

- (a) The sequence header shall be as specified in ISO/IEC 14496-10:2020.
- (b) Signalling of overscan shall be in accordance with ISO/IEC 14496-10:2020.

3.3.7.2 High Efficiency Video Coding (HEVC)

Support of HEVC decoding shall be provided in accordance with those formats in ETSI TS 101 154 V2.8.1 (2023-07) Annex A and Clauses given in items (a) to (e) below, for the following specifications:

- (a) *Sequence header* — as specified in ISO/IEC 23008-2:2020 and ETSI TS 101 154 V2.8.1 (2023-07) Clause 5.14.
- (b) *Supplemental Enhancement Information (SEI)* — as specified in ISO/IEC 23008-2:2020 and ETSI TS 101 154 V2.8.1 (2023-07) Clause 5.14.
- (c) *Bit depth* — as specified in ISO/IEC 23008-2:2020 and ETSI TS 101 154 V2.8.1 (2023-07) Clause 5.14.
- (d) *HDR/SDR (and HDR Type: HLG/PQ)* — as specified in Recommendation ITU-R BT.2100 (07/2018) and ETSI TS 101 154 V2.8.1 (2023-07) Clause 5.14.
- (e) *WCG (wide colour gamut)* — as specified in Recommendation ITU-R BT.2100 (07/2018) and ETSI TS 101 154 V2.8.1 (2023-07) Clause 5.5.

Synchronized bit streams for picture, sound and other information — Receivers shall be capable of decoding services from the TS. The decoded picture, sound and other information shall be presented (scaled appropriately) in a time-synchronized manner.

3.3.8 Decoding service format types

Receivers shall be capable of decoding services from the TS. The decoded picture, sound and other information shall be presented (scaled appropriately) in a time-synchronized manner. The TS comprises the following:

- (a) A television service has video formats at a 25/50 Hz frame/field rate, including —
 - (i) SD video streams at $720 \times 576 \times 25p/50i$ using MP@ML MPEG-2 video or MPEG-4 Part 10 at level 3;
 - (ii) HD SDR video streams at $1920 \times 1080 \times 25p/50i$ MP@HL MPEG-2 video;
 - (iii) HD SDR video streams at $1920 \times 1080 \times 25p/50p/50i$ MPEG-4 Part 10 at level 4.2.
- (b) In the future a television service may have —
 - (i) SDR video streams at $960 \times 540 \times 25p/50p$ using HEVC Main Profile, Main Tier, Level 4.1;
 - (ii) SDR HDTV video streams at $1920 \times 1080 \times 25p/50p$ using HEVC Main Profile, Main Tier up to level 4.1;
 - (iii) HDR HDTV or UHD TV video streams at $3840 \times 2160 \times 50p$ using HEVC Main 10 Profile, Main Tier up to level 5.1; and
 - (iv) HDR HFR UHD TV video streams at $3840 \times 2160 \times 100p$ using HEVC Main 10 Profile, Main Tier up to level 5.2.

Decoding service format types shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clauses 5.1, 5.2, 5.6, 5.7.1, 5.7.2, 5.14.1, 5.14.2, 5.14.3 and 5.14.4.

3.4 Audio — Decoding and reproduction

3.4.1 Audio outputs

Manufacturers may choose to include digital outputs in addition to analogue interfaces.

3.4.2 MPEG audio

3.4.2.1 Decode audio MPEG-1 Layer II streams

Receivers shall be able to decode MPEG-1 Layer II audio streams broadcast in single (mono) or joint stereo or stereo modes.

Decoding of picture formats shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.1

3.4.2.2 Decode all MPEG-1 Layer II sampling rates

Receivers shall be able to decode MPEG-1 Layer II audio sampled at 32 kHz, 44.1 kHz or 48 kHz sampling rate.

Decoding of picture formats shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.1.

3.4.2.3 MPEG-1 Layer II transmission bit rate

Receivers shall be able to decode an MPEG-1 Layer II audio stream up to a maximum of 384 kbit/s.

Decoding of picture formats shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.1.

3.4.2.4 Ability to decode MPEG-2 audio formats

The ability to decode MPEG-2 audio formats is an optional feature.

Receivers with MPEG-2 audio decoders shall be able to decode basic stereo MPEG-1 Layer II audio.

Decoding of MPEG-2 audio formats shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.1.

3.4.3 AC-3: Decoding and output

3.4.3.1 Decode AC-3 audio streams

Receivers shall be able to decode AC-3 audio streams.

This is in addition to an MPEG-1 Layer II and other format audio decoders.

Decoding of AC-3 audio streams shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.2 and ETSI TS 102 366 V1.4.1 (2017-09) Clause 5.

3.4.3.2 Decodable AC-3 sampling frequency range

A receiver's AC-3 decoder shall be capable of decoding digital audio sampled at a frequency of 48 kHz.

Decoding of AC-3 audio streams shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.2 and ETSI TS 102 366 V1.4.1 (2017-09) Annex A and *NorDig Unified Requirements* ver. 3.1.2 Clause 6.2.2.

3.4.3.3 Decodable AC-3 bit-rate range

The receiver shall be able to decode AC-3 audio streams at the bit rates up to 448kbit/s.

Decoding of AC-3 audio streams shall be in accordance ETSI TS 101 154 V2.8.1 (2023-07) ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.2, ETSI TS 102 366 V1.4.1 (2017-09) Annex A and *NorDig Unified Requirements* ver. 3.1.2 Clause 6.2.2.

3.4.3.4 Recognition of AC-3 in a DVB MPEG Transport Stream

The presence and PID location of an AC-3 audio stream are identified in a program service's PMT by a stream_type of 0x06 and an AC-3_descriptor with a tag of 0x6A. The MPEG stream_id is set to 0xBD (private stream_1).

NOTE 1 DVB implementation of AC-3 differs from that of ATSC.

NOTE 2 Teletext packets, including Closed Caption (CC) subtitles carried on page 801 teletext (refer to ETSI EN 300 472 v1.4.1 (2017-01)), are also identified as an MPEG stream_type of 0x06.

Decoding of AC-3 audio streams shall be in accordance with ETSI EN 300 468 V1.17.1 (2022-10) [Annex D](#), ETSI TS 101 154 V2.8.1 (2023-07) Clauses 4.1.6 to 4.1.8 and 6.2, and ETSI TS 102 366 v1.4.1 (2017-09) Clauses A1 and A3 (DVB).

3.4.3.5 AC-3 audio outputs

Receiving equipment with AC-3 decoders should be able to downmix to stereo.

Receiving equipment with an HDMI ARC (eARC) or a digital S/PDIF format output capable of feeding an external AC-3 decoder is not required to downmix an AC-3 stream on that output.

AC-3 may be used for stereo, stereo with matrix encoded surround sound, or discrete 5.1 channel surround sound. Dual mono is not supported. Stereo with matrix encoded surround sound may be decoded using phase and spatial difference technology.

Decoding of AC-3 audio streams shall be in accordance with ETSI TS 101 154 V2.8.1 (2023-07) and ETSI TS 102 366 v1.4.1 (2017-09) Clause 5.2.12.

3.4.3.6 E-AC-3 decoding

Receivers shall be able to decode E-AC-3 streams which may have been transcoded from other codecs.

Decoding of E-AC-3 audio streams shall be in accordance with *NorDig Unified Requirements* ver. 3.1.2 Clause 6.2.2.

3.4.4 AC-4: Decoding and output

3.4.4.1 Decode AC-4 audio streams

Receivers shall be able to decode all AC-4 audio streams including up to 7.1.4 Immersive, Audio Description, Alternate Commentaries, and Alternate Languages.

Decoding of AC-4 audio streams shall be in accordance with ETSI TS 103 190-2 V1.2.1 (2018-02), ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.6 and *NorDig Unified Requirements* ver. 3.1.2 Clause 6.2.4.

Receivers shall be capable of decoding all the above audio formats.

3.4.4.2 Decodable AC-4 sampling frequency range

A receiver's AC-4 decoder shall be capable of decoding digital audio sampled at a frequency of 48 kHz. Decoding audio at other rates is not essential for broadcast transmission streams.

Decoding of AC-4 audio streams shall be in accordance with ETSI TS 103 190-2 V1.2.1 (2018-02), ETSI TS 101 154 V2.8.1 (2023-07) Clause 6.6, and *NorDig Unified Requirements* ver. 3.1.2 Clause 6.2.4.

3.4.4.3 Decodable AC-4 bit rate range

The receiver shall be able to decode all AC-4 audio streams up to 576 kbit/s.