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**LIABLE TO ALTERATION—DO NOT USE AS A STANDARD**

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## Digital television—Requirements for receivers Part 1: 7 MHz VHF/UHF DVB-T television broadcasts (Revision of AS 4933.1—2000)

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**Draft for Public Comment**
**Australian Standard**

The committee responsible for the issue of this draft comprised representatives of organizations interested in the subject matter of the proposed Standard. These organizations are listed on the inside back cover.

Comments are invited on the technical content, wording and general arrangement of the draft.

The preferred method for submission of comment is to download the MS Word comment form found at *http://www.standards.com.au/Catalogue/misc/Public%20Comment%20Form.doc*. This form also includes instructions and examples of comment submission.

When completing the comment form ensure that the number of this draft, your name and organization (if applicable) is recorded. Please place relevant clause numbers beside each comment.

Editorial matters (i.e. spelling, punctuation, grammar etc.) will be corrected before final publication.

The coordination of the requirements of this draft with those of any related Standards is of particular importance and you are invited to point out any areas where this may be necessary.

Please provide supporting reasons and suggested wording for each comment. Where you consider that specific content is too simplistic, too complex or too detailed please provide an alternative.

If the draft is acceptable without change, an acknowledgment to this effect would be appreciated.

When completed, this form should be returned to the Projects Manager, **Bala Balakrishnan** via email to **bala.balakrishnan@standards.com.au**.

Normally no acknowledgment of comment is sent. All comments received electronically by the due date will be put before the relevant drafting committee. Because Standards committees operate electronically we cannot guarantee that comments submitted in hard copy will be considered along with those submitted electronically. Where appropriate, changes will be incorporated before the Standard is formally approved.

If you know of other persons or organizations that may wish to comment on this draft Standard, could you please advise them of its availability. Further copies of the draft are available from the Customer Service Centre listed below and from our website at *http://www.standards.com.au/*.

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STANDARDS AUSTRALIA

Committee CT-002—Broadcasting and Related Services

Subcommittee CT-002-02 (CT/2/A) — TB Receiving Equipment

**DRAFT**

# Australian Standard

# Digital television—Requirements for receivers

# Part 1: 7 MHz VHF/UHF DVB-T television broadcasts

**(Revision of AS 4933.1—2000)**

**(To be AS 4933.1—200X)**

This draft proposes to provide television receiver manufacturers with the technical specifications and requirements of digital television receivers in order to achieve successful reception from free-to-air DTTB transmissions that comply with the Australian DTTB transmission Standard AS 4599 (including current Amendments).

Comment on the draft is invited from people and organizations concerned with this subject. It would be appreciated if those submitting comment would follow the guidelines given on the inside front cover.

This document is a draft Australian Standard only and is liable to alteration in the light of comment received. It is not to be regarded as an Australian Standard until finally issued as such by Standards Australia.

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# PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CT 002, Broadcasting and Related Services. It is the result of a consensus among the representatives to the Joint Committee to produce it as an Australian Standard.

The objective of this Standard is to provide television receiver manufacturers with the technical specifications and requirements of digital television receivers in order to achieve successful reception from free-to-air DTTB transmissions that comply with the Australian DTTB transmission Standard:

AS 4599, (including current Amendments) *Digital television—Terrestrial broadcasting—Characteristics of digital terrestrial television transmissions.*

Interoperability issues for DVB-S, DVB-C and Datacasting are not addressed in this part of the Standard.

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. Informative sections are included also in the main body of this standard.

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# FOREWORD

Digital terrestrial television broadcasting (DTTB) in Australia officially commenced on 1 January, 2001. The transmissions are based on the DVB-T[1] system, however, it should be noted that the international DVB Standards and related ETSI, IEC/ISO and ITU-R documents provide a range of operational choices.

Many other implementations of digital television systems around the world operate on pay satellite and cable systems where compatibility between transmission and reception equipment of each system is generally under the control of a single system operator. These are known as 'vertical' markets{xe "Market—'vertical'"}.

In contrast, no single operator will be in control of the Australian implementation of the digital terrestrial television broadcasting system. There are multiple free-to-air services and multiple receiver/decoder manufacturers, as well as subscription television services and datacasting services delivered in the digital television broadcasting environment. Domestic digital television receivers are expected to be available from a wide range of manufacturers through many retail suppliers; this is known as a 'retail' or 'horizontal' market.{xe "Market—'horizontal'"}

Consumers will expect a choice of receiving equipment from many manufacturers, ranging from fully integrated receivers with cathode ray tubes or other display devices to modular set-top-box receivers intended for connection to a separate display and sound reproduction system, (see Appendix B). This equipment will be expected to satisfactorily receive digital terrestrial television broadcasts from a choice of multiple broadcasters (each probably using a different brand of encoding and transmission equipment).

A separate Australian Standard, AS 4599, details information specific to the transmission aspects of the Australian adaptation of the relevant ETSI DVB-T Standards{xe "Australian adaptation of ETSI DVB-T Standards"}. For an overview on DVB documents the reader is referred to the technical report from DVB: TR 101 200 V1.1.1 (1997-09); 'Digital Video Broadcasting (DVB); A guideline for the use of DVB specifications and Standards'.

This Standard aims to provide the necessary information so that any digital terrestrial television receiving equipment made for the Australian system will operate satisfactorily on Australian digital terrestrial television broadcast transmissions.

While some receiver requirements are nominated to be essential, in general, it will be a marketing choice by the manufacturer as to how the various receiver models operate with a variety of conditions.

Conformance testing related to this standard is the responsibility of the manufacturer.

See below for a summary of important DTTB receiver requirements to operate in the Australian environment.

Manufacturers should note that DTTB is a rapidly evolving technological environment and, consequently, this Standard may require revisions and additions. Readers are urged to contact any Standards Australia office or broadcasters regarding such changes.

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1 DVB-T: Digital Video Broadcasting (project) – Terrestrial. The DVB Project Office is co-located at the headquarters of the European Broadcasting Union in Geneva, Switzerland. Their web site is http://www.dvb.org/

## Summary of Minimum DTTB Receiver Requirements for Australia{xe "Receiver requirements for Australia"}{ XE "Summary of minimum requirements" }

(a) The receiver shall operate in a 7 MHz VHF/UHF channel allocation with possibly higher powered analogue PAL signals present in adjacent channels—digital channel allocations range from 174 MHz to 820 MHz, some with 125 kHz offsets;

(b) All COFDM modes, including all COFDM hierarchical modulation modes shall be receivable by both SD-only receivers and receivers that also have HD capabilities. (See Items 4.1 and 4.3 of Clause 3.1);

(c) Receivers shall be able to demodulate and decode the {xe "Transmission Parameter Signalling"}Transmission Parameter Signalling ({xe "TPS"}TPS) data to determine or confirm transmission parameters when an RF transmission is first accessed or when a service on a different RF transmission is selected. As COFDM transmission parameters may change from time-to-time, TPS data should also be accessed if a signal is lost;

(d) Single Frequency Network (SFNs) are in use and all receivers are expected to operate in these environments;

(e) Receivers should use the broadcast Logical Channel Numbering{xe "Logical Channel Numbering"} of services to simplify channel selection. (This is an Australian adaptation from the UK DTG and EACEM definition of Logical Channel Numbering and is found in the NIT 2nd loop with tag of 0 × 83 – See Appendix H, Paragraph 1);

(f) Broadcasters may change COFDM modes and available services in the transport stream from time-to-time, requiring receivers to refresh the 'PAT', 'PMT', 'NIT' and 'SDT' data on a regular (typically 10 sec), basis. Receivers shall check in the PMT, the PID values for video, audio and other components of a service when selected, as these may change from time-to-time. Receivers shall not assume any sequenced or ordered numbering of the PID values of various components of a service;

(g) All receivers shall be capable of decoding 50 Hz based Standard Definition (SD) MPEG-2 picture formats with displayable closed captions and MPEG-1 Layer II sound, and optionally, Dolby Digital® (AC-3) sound. Receivers may also decode a number of 50 Hz based High Definition (HD) picture formats (see preferred interface and scanning details in Appendix G), with additional decoding for up to 5.1 channel Dolby Digital® (AC-3) sound (See Items 7 and 8 of Clause 3.1);

(h) Standard Definition receivers (SD-only), if switched to a HD (MP@HL) service, should not attempt to decode the service and either present a message to the user or a blank screen (See Appendix H Paragraph 6).

(i) Receivers should use Australian specific look-up tables for on-screen display for time-zone region setting using the transmitted Time Offset Table (TOT) and Parental-Guidance codes and Program Content (Genre) codes using the transmitted Event Information Table (EIT);

(j) If a receiver includes an optional Dolby Digital® (AC-3) sound decoder, then the receiver shall operate to a viewer's preset preference or indicate and give a choice to the viewer if a service has other audio channels (sound tracks), which the receiver is able to decode;

(k) Some transmissions will include radio services in MPEG-1 layer-II format, which receivers shall be able to decode;

(l) Receivers shall be able to provide decoding of Closed Captions broadcast in Teletext. Bit-mapped format decoding may also be provided. In the case of set-top-boxes, the teletext shall be added to the VBI on the analogue outputs;

(m) Optionally provide DSM-CC support to enable capability for databroadcasting and system software upgrade (SSU) by over-the-air download, conforming to DVB/ETSI standards;

(n) Optionally provide interactivity conforming to the DVB MHP with optional return channel capability such as an inbuilt modem or a serial data port such as RS232 or USB, capable of supporting a modem;

(o) Optional Common Interface (CI) expandability using one or more 'PCMCIA' sockets and optional 'SmartCard' socket may be provided.

Manufacturers of DTTB receivers incorporating interactive capabilities will need to confirm aspects of the Australian Interactive Digital Television 'Feature Set' which is currently under development.

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STANDARDS AUSTRALIA

# Australian Standard
# Digital television—Requirements for receivers

## Part 1: 7 MHz VHF/UHF DVB-T television broadcasts

## SECTION 1 SCOPE AND APPLICATION

### 1.1 SCOPE

This Standard defines both essential and optional requirements for DVB-T compliant digital broadcast television receivers for Australia with the capability of receiving Standard Definition television and optionally High Definition television via terrestrial broadcasting services. Other optional features include interactivity, datacasting services, surround sound, multi lingual and appropriate interfaces for ancillary equipment. Specifications for subscription/pay services should be obtained from the operators of those services although specifications for the possible addition to a receiver of a Conditional Access system or other features are included.

NOTES:

1 See Appendix G for details on 50 Hz SD and HD scanning and interface parameters.

2 See Appendix H for receiver functionality issues that have attracted attention since the commencement of transmissions.

3 See Appendix I for abbreviations and a glossary of terms used in this Standard.

### 1.2 APPLICATION

Australian digital terrestrial transmissions will include SD pictures at 2 possible line rates and HD TV pictures at 3 possible line rates. The terrestrial transmissions' sound format for SD services will be MPEG-1 (Layer II), or both MPEG-1 (Layer II) and AC-3 (Dolby Digital®), whereas for HD, the sound format will be MPEG-1 (Layer II) or AC-3 (Dolby Digital®), or both.

A range of receiving equipment may be available either in modular or fully integrated forms that extend from low-cost limited-facility with a standard definition video and monophonic sound output to premium full-facility features providing high definition display with full surround sound. Modular equipment may be set-top box style integrated-receiver-decoders or plug-in PC card tuner-decoders.

NOTE: Appendix B gives an example of the components of the architecture of a typical digital terrestrial television receiver and set-top-box.

While this Standard seeks to identify minimum essential requirements for reception, demodulation and decoding of television broadcasts complying with the Australian implementation of DVB-T, additional information and recommendations are provided to clarify preferred implementation if a feature is included in the receiver's design.

As a minimum requirement, equipment must be capable of simultaneously decoding from the transport stream, a video stream, an associated audio stream and associated teletext{xe "Teletext"} subtitles{xe "Subtitles"} and/or bit-mapped subtitle closed captions. The decoded information shall be presented in a time-synchronized manner suitable for a display device and sound reproduction system.

If necessary, the video may be required to be spatially format converted (‘scaled’), as the received format may be different to the display format. For example, if a digital terrestrial set-top-box receiver is connected to a standard 4:3 television display, down-scaling{xe "Down-scaling"} will be required to display a high definition 16:9 program. Correspondingly, the received audio channels may need to be processed or down mixed to suit the available sound reproduction equipment.

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# SECTION 2 REFERENCED DOCUMENTS{XE "REFERENCED DOCUMENTS"}

The following documents are referenced in this Standard. Where no particular edition or version of the referenced document is specified, the latest or current edition or version should be used.

| | |
|---|---|
| AS | |
| 4599<br>plus amendments | Digital television—Terrestrial broadcasting—Characteristics of digital terrestrial television transmissions |
| [XXXX] | Australian Broadcast Teletext{xe "Teletext"} Specifications **(IN PREPARATION)** |
| 4542 | Consumer television interfaces |
| 4542.1 | Part 1: PAL RF |
| 4542.2 | Part 2: Analogue baseband |
| 4542.3 | Part 3: Digital interfaces **(IN COURSE OF PREPARATION)** |
| AS/NZS | |
| 1053 | Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment. |
| 60065 | Approval and test specification—Mains operated electronic and related equipment for household and similar general use |
| 60950 | Approval and test specification—Safety of information technology equipment including electrical business equipment |
| IEC | |
| 48B | Connectors for consumers appliances |
| 60065 | Audio, video and similar electronic apparatus Safety requirements |
| 60169 | Radio-frequency connectors |
| 60169-2 | Part 2: Coaxial unmatched connector |
| 60598 | Digital audio interfaces |
| 60598-4 | Part 4: Professional applications |
| 60950 | Safety of information technology equipment |
| 61937 | Processing of audio bit streams |
| IEC/CENELEC | |
| 62216-1: | Baseline Digital Terrestrial TV Receiver Specification - (formerly EACEM Technical Report - TR-030 version 1.1 ) |
| 62315 | DTV profiles for uncompressed digital video interfaces<br>Draft is being circulated under the TC 100 accelerated procedure. |
| ISO | |
| 7816 | Identification cards Integrated circuit(s) cards with contacts |
| ISO/IEC | |
| 11172 | Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s |
| 11172-1 | Part 1: Systems |
| 11172-2 | Part 2: Video |
| 11172-3 | Part 3: Audio |

| | |
|---|---|
| ISO/IEC | |
| 13818 | Information technology—Generic coding of moving pictures and associated audio information |
| 13818-1 | Part 1: Systems |
| 13818-2 | Part 2: Video |
| 13818-3 | Part 3: Audio |
| CENELEC | |
| R206-001:1998 | Guidelines for Implementation and Use of the Common Interface for DVB Decoder Applications. (Prepared by the Technical Committee CENELEC TC 206) |
| EN50049-1 | Domestic and similar electronic equipment interconnection requirements: Peritelevision connector. |
| EBU | |
| EBU SPB 492 | Teletext specification (625 line television systems) |
| ETSI | |
| EN 300 468 | Digital Video Broadcasting (DVB); Specification for Service Information (SI) in DVB systems |
| EN 300 472 | Specification for conveying ITU-R System B Teletext{xe "Teletext"} in DVB bitstreams |
| EN 300 744 | Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television - A012 Rev. 2 (03/01) |
| EN 301 192 | Digital Video Broadcasting (DVB); Specification for data broadcasting{xe "Data broadcasting"} |
| EN 301 775 | Specification for the delivery of VBI data in DVB bitstreams |
| EN 50221 | Common Interface Specification for Conditional Access{xe "CA—Conditional Access"} and other Digital Video Broadcasting Decoder Applications |
| ETR 289 | Digital Video Broadcasting (DVB); Support for use of scrambling and Conditional Access{xe "CA—Conditional Access"} (CA) within digital broadcasting systems |
| ETS 300 743 | Subtitling systems [refer DVB Blue Book A009] |
| TR 101 154 | Digital broadcasting systems for television; Implementation guidelines for the use of MPEG-2 systems; Video and audio in satellite, cable and terrestrial broadcasting applications: A001 Rev. 6 (05/00) |
| Draft TR 101 162 | Allocation of Service Information (SI) codes for DVB systems (N.B. frequently changed, available on Internet) |
| TR 101 211 | Digital Video Broadcasting (DVB); Guidelines on implementation and usage of Service Information (SI) |
| TR 101 200 | Digital Video Broadcasting (DVB);A guideline for the use of DVB specifications and standards |
| TS 101 191 | Digital Video Broadcasting (DVB); DVB mega-frame for Single Frequency Network (SFN) synchronization |
| TS 101 699 | Digital Video Broadcasting (DVB); Extensions to the Common Interface Specification (EN 50221) |

| | |
|---|---|
| TS 102 006 | Digital Video Broadcasting (DVB); Specification for System Software Update in DVB Systems |
| ETSI | |
| TS 102 201 | Digital Video Broadcasting; Interfaces for DVB Integrated Receiver Decoder (DVB-IRD) |
| TS 101 812 | Digital Video Broadcasting (DVB); Digital Video Broadcasting; Multimedia Home Platform (MHP) |
| TS 102 812 | Multimedia Home Platform (MHP) Specification 1.1 |
| CTVA [2] | CTVA - Commercial Television Australia (formerly Federation of Australian Commercial Broadcast Stations) |
| Operational Practices (OPs) | Reference is made to a number of CTVA OPs. These OPs are documents designed and used by Australian free-to-air broadcasters, which may be regarded by receiver manufacturers as 'informative' but may give a useful insight into how particular aspects of Australian digital TV services and SI are configured. |
| IEEE 802 | |
| 1394 | Standards for a high performance serial bus |
| ITU-R | |
| BT 653-2 | Teletext{xe "Teletext"} Systems (System B) |
| BT 709-3 | Parameter Values for the HDTV Standards for Production and International Programme Exchange |
| BT.1358 | Studio Parameters of 625 and 525 Line Progressive Scan Television Systems |
| BT 1368 | Planning Criteria for Digital Terrestrial Television Services in the VHF/UHF Bands |
| BS 1196-1 | Audio Coding for Digital Terrestrial Television Broadcasting. (Note: DVB implementation differs to that used by the ATSC standards.) |
| Australian Broadcasting Authority | |
| ABA Planning Handbook | Digital Terrestrial Television Broadcasting Planning Handbook, including Technical and General Assumptions; Australian Broadcasting Authority, August 1999 (www.aba.gov.au/ ) |
| Australian Communications Authority | |
| ACA TS 001 | Safety Requirements for Customer Equipment www.aca.gov.au/standards/ |
| AS/ACIF S 002 2001 | Analogue Interworking and Non interference Requirements for Customer Equipment connected to the Public Switched Telephone Network |

[2] CTVA - Commercial Television Australia (formerly Federation of Australian Commercial Television Stations), 44 Avenue Road, Mosman, NSW 2088 (was www.facts.org.au - now www.ctva.com.au)

# SECTION 3 ESSENTIAL AND OPTIONAL REQUIREMENTS

## 3.1 RECEIVER REQUIREMENTS

The details for the operation of DTV reception equipment are based on the Australian adaptation of the DVB-T Standards for digital television terrestrial transmissions and are for the guidance of manufacturers and suppliers of Australian DTTB consumer equipment.

The details are set out in tabular form for ease of reference. Cross references to the information refer to Item numbers, for example Item 14 *Copyright Protection on Outputs*.

The Items are listed in the CONTENTS page under Section Three.

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| Item description | Remarks | Reference Standards | Applicability |
|---|---|---|---|
| **1 BASIC FEATURES** | | | |
| **1.1 Minimum requirements for Terrestrial Reception—{xe "Reception—Mininum Requirements"}Performance[3]** | | | |
| This Item lists the essential conformance requirements for any DVB-T receiver to operate on Australian DTTB transmissions. These are based on ETSI/DVB-T Standards, with the choices applicable to Australia, as identified in the Australian transmission Standard, AS 4599. | The receiver shall be able to receive and decode a free-to-air television service, in a correctly constituted Australian DVB-T transport stream irrespective of other services (that may possibly be encrypted) in that transport stream.<br>A situation may arise on datacasting transmissions, which may carry subscription services using Conditional Access as well as free-to-air television services in their transport stream The receiver shall not require the presence of a decryption enabling mechanism such as conditional access (CA) system and/or a 'smartcard' in order to receive and decode free-to-air television services. | | All receivers |
| | For reception of Standard Definition (SD) broadcasts, basic receivers shall be capable of decoding from the transport stream—<br>1. any Standard Definition (SD) video stream of up to 720 × 576 × 50i MP@ ML MPEG video, and<br>2. an associated audio stream of MPEG-1 Layer II, and<br>3. optionally, an associated audio stream of up to 5.1 channels of Dolby Digital AC-3, and<br>4. teletext closed captions, and<br>5. bit-mapped{xe "Teletext"} subtitles,<br>and present the decoded (and scaled if necessary), picture, sound and other information in a time-synchronized manner.<br>Receivers may optionally provide interactivity conforming to the MHP standards. | | All SD-only receivers |
| | High Definition (HD) capable receivers, in addition to being capable of receiving SD broadcasts with MPEG audio, as defined above, shall be capable of decoding from a High Definition broadcast transport stream—<br>1. any High Definition (HD) video stream of up to 1920 × 1080 × 50i MP@ HL MPEG video, and<br>2. an associated audio stream of up to 5.1 channel of Dolby Digital AC-3, or<br>3. an associated audio stream of MPEG-1 Layer II, and<br>4. teletext closed captions, and<br>5. bit-mapped{xe "Teletext"} subtitles<br>and present the decoded (and scaled if necessary), picture, sound and other information in a time-synchronized manner.<br>Receivers may optionally provide interactivity conforming to the MHP standards. | | All HD capable receivers |

3 Refer to Government regulatory requirements and broadcasters' intentions in Australia.

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|---|---|---|---|
| **1.2 Receive capability for analogue PAL{xe "PAL—receive capability"} transmissions** | For example, integrated receivers operating in areas where PAL services are not yet duplicated on digital. | | Optional, at manufacturer's choice. |
| **Item description** | **Remarks** | **Reference Standards** | **Applicability** |
| **1.3 Australian regulatory and safety requirements** | | | |
| **1.3.1** *Electrical safety* | Mains-powered equipment shall comply with AS/NZS 60065-2000. | AS/NZS 60065 | All receivers |
| | Australian electrical mains supply is nominally 240 V AC 50 Hz.<br><br>Where a modem{xe "Modem"} is incorporated in the digital receiver equipment for wired connection to a public telecommunications network (see Table 5, Clause 16.3), the receiver shall comply with ACA TS 001 and TS 002 safety requirements{xe "Safety requirements"}. If the digital equipment is also supplied with an accessory telephone cable it shall comply to ACA TS008. | AS/NZS 60950 | Receivers with inbuilt modems |
| **1.3.2** *EMC*[4] [5] | To satisfy Australian Communications Authority (ACA) EMC regulatory requirements, equipment shall comply with AS/NZS 1053. | AS/NZS 1053 | All receivers |
| **1.4 Receiver display resolution{xe "Display resolution"} specification** | See Manufacturers and Retailers 'Code of Practice' for receivers and display devices. www.dba.org.au/ and Appendix G. | | Recommended for all receivers |
| **2 POWER ON OPERATIONS** | | | |
| **2.1 First time operation initialization** | See Item 3.3 – in summary, request through on-screen set-up menu to:<br>• set OSD language (Default - English)<br>• set output video type (if required –eg. STB)<br>• set preferred picture aspect shape format<br>• set user PIN and Parental Guidance<br>• enter region for time offset<br>• start frequency scan for available services (or enter tuning details)<br>• enter other stored user data (as required in interactive receivers) | | Recommended all receivers |
| **2.2 Subsequent switch-on** | Return to previous set-up or pre-set preference channel. If previous program stream is not available, then manufacturers should be aware that broadcasters may provide a 'linkage_descriptor' (refer Item 3.4) to take the receiver to a currently operating service. | | Recommended for all receivers |

4 ACA web site www.aca.gov.au/ gives an outline of Australian EMC requirements.

5 Note that Australia uses 7 MHz VHF/UHF channels for *both* analogue and digital broadcasting and that interference is of critical concern, particularly to existing analogue TV receivers caused by digital receiving equipment including set-top-boxes. A further reduction of interference could be achieved by reference to AS 4542.1.

Receiver manufacturers are advised that technologies to reduce 'impulse noise' interference require consideration. Impulse noise interference can be experienced, particularly on VHF digital DVB transmissions and may not be adequately defined by CISPR 13 or CISPR 20.

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| **2.3** | **Identifying new services in current or new location** | All receivers should have a scanning capability to identify all receivable services. This function should be user initiated. Receivers should have an efficient scanning capability taking in note the frequencies in Appendix D. | | Recommended for all receivers |
| **2.4** | **Stand-By Power** [6] | Manufacturers may implement one or more standby modes and should be aware of Australian Government and international concerns regarding excess standby power consumption. | | |
| **3** | **USER OPERATION{XE "USER OPERATION"}** | | | |
| **3.1** | **Operating system** | Manufacturer's choice (underlying basic operating system) (see Item 9). | | Manufacturer's choice |
| **3.2** | **Hardware reset{xe "Hardware reset"}** | Should be easily accessible. This is intended to reset operating system while retaining stored values. A second option of full reset to manufacturer's default start-up settings may be fitted at manufacturer's choice. | | Recommended for all receivers |
| **3.3** | **Initial Set-Up** | | | |
| **3.3.1** | *Set-up Menu and Non-volatile information storage* | The receiver should have a set-up menu for initiating processes such as a tuning scan and for the user to enter data which needs to be retained in non volatile memory.<br><br>Such information may include set-ups for preferred picture format, aspect ratio, language and should include location for correct interpretation and display of the broadcast time information. 'Parental Guidance' set-up and PIN entry should also be provided.<br><br>Receivers that provide interactivity may also need to provide additional data entry and retention of local information as the user wishes for the interactive system. | | Recommended for all receivers |
| **3.3.2** | *Initial tuning scan (Virgin Mode)* | Receivers should do a full scan of the broadcast bands which may commence at the start of VHF Band III.<br><br>There are several more likely combinations of COFDM parameters but each broadcaster may choose a different set and these may change from time-to-time, so the receiver scan should include all possibilities until the transmission is found.<br><br>Decoding the Transmission Parameter Signalling (TPS) is regarded as essential and should expedite the process.<br><br>It is unlikely that tuning details of all stations will be found in the NIT of every broadcaster, i.e. cross-carriage of SI between networks is unlikely.<br><br>Note however that a hierarchical transmission may have NITother information in each transport stream detailing the other stream' parameters and LCNs.<br><br>The ability to rescan the tuning tables should be an easily accessible menu function. | AS 4599<br><br>EN 300 744 | All receivers<br><br>Informative |
| **3.4** | **Assigning Numbering to Services and navigation** | | | |
| **3.4.1** | *Menu List of Services* | A receiver should provide as a minimum, a menu listing of available services | | Recommended all receivers as a minimum |

6 The Australian Government is participating in the Energy Star program.

## 4 USER OPERATION{XE "USER OPERATION"}

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| **4.1.1** *Logical Channel Numbering{xe "Logical Channel Numbering"} (LCN)* | **Logical Channel Numbering{**xe "Logical Channel Numbering"**} (LCN) data** should be used for Menu listing and Remote-Control selection<br><br>During scanning, the receiver should examine the transport stream SI tables and identify the LCN data from the Logical Channel Descriptor (tag value $0 \times 83$) that is included in the cyclic 2nd loop of the NIT.<br><br>For Australian DTT, each service in a transport stream is uniquely identified to a receiver by original_network_id/transport_stream_id/ service_id and to the viewer by its LCN found in the NIT.<br><br>The number selection for a service on the remote control should correspond with that service's LCN unless changed by viewer preferences.<br><br>**Informative:**<br><br>In many receiving locations, especially in some overlapped broadcast areas, after scanning, a receiver might show 50 or more services. To bring some order to this, Australian broadcasters have adopted the system of Logical Channel Numbers (LCNs).<br><br>Information on logical_channel_descriptor syntax is found in Appendix H and AS 4599—2003. It is similar to that specified in the UK's DTG 'D-book' and European IEC/CENELEC 62 216-1 receiver standard.<br><br>There are differences in relation to the associated use of original_network_id with LCNs and further information is detailed in Appendix H.<br><br>Broadcasters are assigning unique LCNs to each TV and radio program and any other service they carry. While this number can be between 1 to 999, Australian broadcasters have agreed to use an 'Operational Practice' convention that assigns LCNs with a correspondence to each broadcaster's 'brand' number.<br><br>CTVA Operational Practice 41 details how broadcasters will allocate LCNs. See also Appendix H. | AS 4599 Section 6, Clause 6.2.8.4 (Aus)<br><br>IEC/CENELEC 62 216-1 | Highly recommended all receivers |
| **4.1.2** *Services without LCNs* | Receivers should allocate services found without LCNs to numbers starting at 350. | CTVA OP41 | Highly recommended all receivers |

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| **4.1.3** *Duplicated LCNs and Service (Channel) list editing.* | If the logical channel descriptor carried by broadcasters is correctly interpreted by receivers, there should be little need to provide alternate means for the viewer to create or edit the logical channel numbering.<br><br>However in overlapped broadcast service areas, a receiver when frequency scanning, may encounter duplicated services, for example, from a translator. This creates the situation where there might be identical services with the same LCN but on different frequency channels.<br><br>In such cases the receiver should provide a choice to the viewer to select the desired source – usually the better signal-quality service, and delete the undesired duplicate or re-insert the desired service from the channel list.<br><br>Receivers should recognise duplicate LCNs in overlapped broadcast service areas and provide choice for deletion and re-ordering for 'favourites'.<br><br>NOTE: The LCN{xe "LCN"} values may change dynamically following changes to the service listed in the NIT and SDT. Refer to AS 4599 Section 6 Clause 6.2.8.4 (Aus). | Refer to Paragraph I3 | Highly recommended all receivers |
| **4.1.4** *Linkage Descriptor* | Australian broadcasters will use the DVB Linkage descriptor, particularly the linkage_type (= '05'), which indicates that a 'service_replacement' service exists.<br><br>Receivers should read and use the Linkage descriptor within the Service Description Table (SDT) for navigating away from 'not_running' services -see Section 6 in this table.<br><br>The broadcasters operational use this descriptor may be found in CTVA OP43.<br><br>Receivers that do not incorporate this feature would require the viewer to manually navigate away from services that have switched to a 'not running' status.<br><br>NOTE: The linkage_type = 0 × 09 is also used with over-the-air data download 'System Software Update' (SSU) operations. | EN 300 468<br><br>TR 101 211 | Recommended All receivers |
| **4.1.5** *Dynamic response to PAT, PMT, NIT and SDT updates*<br><br>• Receivers should be able to use the **other** and **current_next** versions of the NIT and SDT if present. | Check NIT and SDTs at least on a regular 10 second basis as broadcasters may dynamically change available services – eg switch from HD to multichannel/multiview services.<br><br>The receiver should respond to changes to services as identified in the NIT and SDT, by dynamically altering channel lists presented to the consumer in a timely fashion without re-tuning. A maximum latency of 10 seconds is expected.<br><br>The receiver is expected to be capable of switching to new operating parameters advised by 'next' information in the NIT and SDT. | EN 300 468 | Recommended for all receivers |

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| **4.2 Display Electronic Services Guide (OSD) {xe "I-Plate"}and navigation**<br><br>• Information displayed<br><br>• Icons for special features{xe "Navigation"} | The Electronic Services Guide (Sometimes known as 'I-plate'), is the information display presented for a short period when a service is selected. The display is normally across the lower picture area and may be opaque or partly transparent.<br><br>The information derived from the NIT, SDT and EITnow/next typically displayed includes: (recommended minimum)<br><br>Service number (LCN{xe "LCN"}) -3 digits<br>Service name -13 characters<br>Program title -40 characters<br>Extended -200 characters<br>Parental Guidance rating -2 characters<br>Now/Next event start/end times -13 characters<br><br>The receiver may display the time, the network name, service name, program name, and also optionally, at the viewer's choice, short and extended event information.<br><br>Australian broadcasters will be utilising the two event descriptors as follows:<br><br>Short_event_descriptor may be used to identify both the 'Program Title' and in some instances an episode title.<br><br>Extended_event_descriptor may be used to provide a synopsis of the program.<br><br>For further information on how broadcasters will use these descriptors, see CTVA OP44.<br><br>Manufacturers may also choose to display information or icons to indicate other features of a program that the receiver supports such as stereo mode, teletext closed captions or subtitles or other languages. | TR 101 211 Clause 4.6 | Recommended for all receivers |
| **4.3 Signal quality monitor{xe "Signal quality monitor"}** | A menu accessed OSD that shows a combination of signal strength and bit error rate—valuable for ensuring best reception when setting up receiving antenna or identifying reception problems as signal-quality related. Useful for providing feedback to service industries and broadcasters on the difficulty in reception.<br><br>A numerical readout scale is desirable (see Appendix C). | Appendix C | Recommended for all receivers |
| **4.4 Selection of radio services** | Radio services should be easily selectable via menu or direct remote control selection –See Item 6.8 . | | Recommended for all receivers |
| **4.5 Service unavailable—On-screen advice:**<br><br>• Poor or no RF signal, | For no signal or below threshold of decoding - Display 'Loss of signal{xe "Signal loss –OSD"}'. | | Recommended for all receivers |
| • Service selected that has no content or not 'running' | If broadcaster includes a 'linkage_descriptor' , go to linked service – no message necessary. If no linkage or service not 'running', display suitable message See section 6. | | |
| • HD service selected by SD-only receiver | For selection of service outside decode capability of receiver- Display for example 'HD Services not available on this receiver' or any other suitable message. | | SD receivers |
| **4.6 Remote Control** | Where a remote control is provided, if the receiver also provides interactivity or can be expanded to provide interactivity, the remote control should conform with basic requirements such as coloured buttons, as given in Item 10.11.<br><br>Remote controls are **highly recommended** to include a button **for Aspect Ratio control** – See Item 7.8.<br><br>Some portable receivers may implement control via a touch screen. | | Recommended for all receivers |

## 5 RF CHARACTERISTICS, COFDM DEMODULATION AND CHANNEL DECODING

For more detail on RF characteristics, see also Appendix A:
DTTB Receiver RF Specification (Normative)

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|---|---|---|---|---|
| **5.1** | **RF Characteristics** | | | |
| **5.1.1** | *Transmission channel bandwidth* | The transmission channel bandwidth is 7 MHz at VHF and UHF.<br><br>Digital receivers must operate in an environment where both the upper and lower adjacent channel could contain high-level signals such as analogue (PAL) or digital transmissions. | AS 4599 | All receivers |
| **5.1.2** | *Notional receiver noise figure* [7] | Digital receiver noise figure VHF/UHF Bands III, IV and V - better than 6 dB, 7 dB and 8 dB respectively (see Appendix A). | | Recommended for all receivers |
| **5.1.3** | *RF connector* | The tuner RF input connector shall be of a type 75 Ω, IEC Female. | AS 4542.1<br>(IEC 60169-2 | All receivers |
| **5.1.4** | *Digital terrestrial receiver tuner's frequency range*{xe "Receiver tuner's frequency range"} | The digital receiver tuner's frequency range shall nominally cover from VHF Band III, (174-230 MHz), UHF Band IV (519-582 MHz) and UHF Band V, (582-820 MHz), in accordance with the Australian channel tuning table- Appendix D, Table D1 and D2. [8]<br><br>Note that the channel centre frequencies are 3.5 MHz from the channel frequency limits except where an offset is used (see Item 4.1.5).<br><br>Optionally the tuner may also cover the frequency bands for cable and MATV channels given in Appendix D, Table D3. [9] | | All receivers |
| **5.1.5** | *Channel Offsets* | The tuner shall be capable of tuning to transmissions with a channel offset of + or – 125 kHz. (Where required, some stations will operate with this offset – Channels 8 and 29 in Capital cities are examples where +125 kHz is used). | | All receivers |
| **5.1.6** | *COFDM Intermediate Frequency (IF) and Spectrum polarity*{xe "COFDM—spectrum polarity"} | The 1st IF is not specified but is nominally centred near 36 MHz.<br><br>NOTE: DVB-T COFDM emission spectrum is not symmetric. The polarity is as defined by DVB. | EN 300 744 | Informative |

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7 Receiver noise figures are those of a 'notional receiver'. The figure is used for coverage planning (see Appendix B).

8 Bands I and II are not expected to be used in Australia for digital terrestrial transmissions. The ability to tune to the new digital frequencies for Channels 10 and 11 (shift of +1MHz on analogue frequencies) is required for all receivers (see Appendix E).

9 Non-portable receiving equipment is recommended to have a capability to tune to the S-Band (cable) channels to enable access to channel shift in MATV systems (see Appendix D).

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| **5.2 Operation in Single Frequency Network (SFN) Environments** | SFNs are widely used in Australia.<br><br>Receivers shall be able to operate in SFN environments with either pre-echo or post-echo signals within the guard interval.<br><br>When a receiver tunes to a mix of two signals from a SFN, if the received signals are close in amplitude, it is recommended that the receiver selects the earlier signal even when the later signal amplitude is within ±3 dB.<br><br>Note that single frequency network (SFN) performance of receivers is addressed in Appendix A. | See Appendix A | All receivers<br><br>Recommended all receivers |
| **5.3 COFDM modes** [10]<br><br>The receiver shall:<br>• Use Transmission Parameter Signalling (TPS)<br>• Be able to receive 2 k and 8 k<br>• Accept all guard intervals<br>• Accept all code rates<br>• Demodulate all Hierarchical modes{xe "COFDM—modes"} | The receiver shall automatically detect which modulation mode is being used in the selected 7 MHz channel. This may be identified in the TPS carriers.<br><br>The receiver shall be able to receive COFDM 2 K and 8 K carrier modes and all COFDM modulation types up to a possible maximum of 27.71 Mbit/s payload in the 7 MHz channel. The values of the DVB-T COFDM timings are in accordance with the 7 MHz channel bandwidth requirement, which sets the elementary period T to 1/8 μs. These modes are detailed in AS 4599 - Section on Australian variations to ETSI EN 300 744.<br><br>The receiver shall be capable of operating with any DVB-T valid guard interval.<br><br>(Informative: It is suggested that a search sequence of $\Delta/T_U$ = **1/8** first, then **1/16**, then **1/32** and finally **1/4** might reduce tuner search time. For example, 8 K transmissions most probably may use $\Delta/T_U$ = **1/8** or **1/16** and 2 K transmissions $\Delta/T_U$ = **1/8**.).<br><br>The receiver shall observe the TPS data, to confirm the guard interval, code (FEC) rate and the presence of Hierarchical Modulation).<br><br>When tuned to a hierarchical transmission, receivers shall be capable of selecting a service from either priority for COFDM demodulation and subsequent de-multiplexing and MPEG decoding, See Item 4.3.2. | EN 300 744 AS 4599 | All receivers |
| **5.3.1** *COFDM Mode Change Acquisition Time*<br><br>{xe "COFDM—mode change acquisition time"} | Acquisition lock time should preferably be:<br>• within 2 seconds when a viewer changes to a service which is on a different RF channel; or,<br>• within 5 seconds when a broadcaster changes the COFDM transmission mode of a transmitter,<br><br>as identified by TPS signalling or in a $NIT_{next}$.<br><br>This does not apply to 2 K/8 K mode changes. | AS 4599 Section 3 on ETSI EN 300 744 and Appendix E (AUS) - Normative | Recommended All receivers |

10 Different broadcasters may use different COFDM modes and change modes from time to time.

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| **5.3.2** *Reception of Hierarchical Modulation (HM) Transmissions*<br><br>• TPS and NIT can identify the parameters in use<br>• Receivers shall refer to the current_next versions of the NIT and SDT to be aware of a transmission switch to hierarchical.<br>• When tuned to a service on a 'low priority' stream, if reception conditions become worse and change to less than the receiver's capability to demodulate the low priority modulation, the receiver may display a 'lost signal' notice. As an optional feature, the receiver could switch to the first listed service in the high priority stream – which typically might be the main SD program.{xe "Heirarchical transmission reception"} | Receivers shall be capable of demodulation of all DVB-T listed Hierarchical Modulation (HM) modes.<br><br>When tuned to a HM transmission, receivers shall be capable of identifying the transmission as hierarchical via TPS and/or the NIT carried in the high priority QPSK part. Receivers shall be capable of selectively demodulating either of the COFDM's high priority (QPSK) or low priority (2nd QPSK or 16QAM) parts, within the range of the receiver's operational carrier to noise ratio, and passing the demodulated transport stream for subsequent demultiplexing and decoding.<br><br>HM transmissions will use the same 'guard interval' but the 'code_rate' FEC for the low and high priority modulation may be different and these can be identified by the NIT's subloop terrestrial_delivery_system_descriptor (Tag value 0 × 5A) semantics.<br><br>Receivers should look for SI tables such as $NIT_{other}$ in each transport stream, which Broadcasters may include with information on the 'other' transport steam to assist receivers in identifying the services available in both parts of a hierarchical transmission.<br><br>Where a receiver is in a varying signal level environment such as in portable or mobile, if a service in the LP stream has been selected and then at later time, the receiver's signal falls below threshold of decoding of the LP stream, the receiver should display a 'lost signal' type notice.<br><br>**Informative:**<br>Two separate Transport Streams are carried in a HM COFDM transmission, as the COFDM constellation in effect becomes two separate RF parts. The basic QPSK part (known as high priority HP), has inserted on top of it a secondary QPSK or 16QAM part, (known as low priority or LP). Although the resultant constellation appears as though it were 16 QAM or 64 QAM respectively, a COFDM demodulator aware that the transmission is hierarchical will be able to selectively demodulate either the HP QPSK part or the LP part.<br><br>When tuned to a service in the LP stream, a recommendation is given above for receiver action if the signal falls below the receiver's decode threshold.<br><br>An alternative has been suggested where the receiver could revert to a video service in the HP stream, but if there is more than one service in the HP stream, it would be difficult for the receiver to identify which one. Further experience with HM might provide a method using a linkage_descriptor, for example.<br><br>For further background on Hierarchical Modulation, see Appendix I. | AS 4599 Section 3 Clause 4.6.2, Table 9 and EN 300 744 Clause 4.6.2.6<br><br>AS 4599 and EN 300 468 Clause 5.2.1 and<br><br>Clause 6.2.8.3 | All receivers |
| **5.4 Interference immunity** | | | |
| **5.4.1** *Impulse noise rejection{xe "Impulse noise rejection"}* | **Impulse noise is more severe in the VHF band**, as used in Australia. Adoption of noise suppression technology is recommended.<br><br>Note that the impact of impulse noise on VHF digital DVB-T transmissions may not be adequately defined by CISPR 13 or CISPR 20. | | Recommended |

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| **6 MULTIPLEX AND TRANSPORT STREAM** | | | |
| **6.1 PID Filters** | Manage 32 – Simultaneously<br><br>Note: receivers with interactive features may need to increase this figure. | | Informative |
| **7 SERVICE INFORMATION{XE "SI—SERVICE INFORMATION"} (SI) PROCESSING** | | | |
| **7.1 Interpretation of SI variations for Australia{xe "SI variations for Australia"}** | Australian DTTB transmissions have some variations to deal with Australian broadcasters legislative and other requirements.<br><br>Items directly concerning receiver manufacturers include:-<br><br>In the EIT:<br>• Parental Guidance, (see Item 12 and Appendix E)<br>• Content 'Genres', (see Item 6.5)<br><br>In the TDT and TOT:<br>• Time offset zones, (see Item 6.4) and Appendix H<br><br>In the NIT:<br>• Logical Channel Numbers, (see Item 3.4)<br><br>In the SDT:<br>• Linkage_descriptor (see Items .4.5 and 6.3)<br><br>These are identified in Australian coverage of DVB-T documents in AS 4599 and this Standard.<br><br>**Informative:**<br><br>Other information on broadcaster codes for DVB-T such as 'network_id' etc. that are not necessary for receiver design but may be of interest for receiver manufacturers are available from CTVA as 'Operational Practices'. | AS 4599 | All receivers |
| **7.2 Interpretation of MPEG-2, DVB mandatory and DVB optional tables**<br>• Receivers should refer to the PAT, PMT, NIT, SDT, TOT, and EIT$_{now/next}$ information.<br>• Receivers should monitor NIT and SDTs on a regular 10 second basis including both current_and next information | The receiver should be capable of reading and dynamically reacting to changes in the DVB-SI and MPEG tables such as the PAT, PMT, NIT, SDT, TOT, EIT now/next to navigate between various services in any transport stream and adapt to changes in the broadcaster's configuration.<br><br>This includes Australian registration in DVB of original_network_id; network_id; bouquet_id; ca_system_id; private_data_specifier and country/region codes.<br><br>Note: DVB and Australian changes to EN 300 468 Table 12 identify:<br>• VBI data and VBI teletext (SIS-28) (Tag Values $0 \times 45$, $0 \times 46$) - and<br>• AC-3 audio - PMT Tag value $0 \times 6A$. | AS 4599<br><br>EN 300 468 Clause 4 – 5;<br><br>and Section 7 on TR 101 211 Clause 4 | Recommended<br>All receivers |

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| **7.3** | **Interpretation of other descriptors**[11]**{xe "Descriptors—interpretation"}** | Receiving equipment shall interpret MPEG-2 and DVB descriptors correctly and shall be able to skip over those which are currently 'reserved', or which correspond to functions not implemented by the receiving equipment.<br><br>It is important to note that Australian DTTB transmissions will use the Logical Channel Descriptor (tag value 0 × 83), which in the Australian implementation is a 'public' descriptor - See Item 3.4.<br><br>• logical_channel_descriptor – (located in the NIT with Tag 0 x 83)<br><br>Emerging applications under discussion within DVB forums may result in additional new descriptors being adopted by Australian terrestrial broadcasters. | AS 4599 on<br>EN 300 468 Clause 6; and<br><br>Section 7 on<br>TR 101 211 Clause 5 | Recommended<br>All receivers<br><br>highly recommended |

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11 For interoperability{xe "Interoperability"}, recognition and decoding of the Transport Stream Description Table (PID 0 × 0002) is recommended [Refer AS 4599 Clauses 5.2.11 and 6.1 –Table 12 (Aus)].

### 7.4 Interpretation of time and date and time offset tables{xe "Time offset tables"}

- Note Australian time-zone regions

Australian broadcasters use DVB time-offset tables for reasons such as daylight-savings. Receivers should use this information to display the current local time on the STB front panel and/or in OSD programme guides.

Receiving equipment should correctly interpret the DVB Time and Date Table (TDT) and more importantly, **Time Offset Tables** (TOT) in a transmission. Both tables are transmitted with the same unique PID of $0 \times 0014$ but separately identified by the table_ids of $0 \times 70$ and $0 \times 73$ respectively.

The TOT will contain the time in UTC and date in MJD followed by a local_time_offset_descriptor() loop (tag value 0x58). A secondary loop contains country_code, country_region_id, local_time_offset_polarity and local_time_offset, etc. This 2nd loop allows offsets for each time zone to be given – if needed.

The country_code at the beginning of this 2nd loop will be Australia's 3 character code 'AUS' as given below.

To correctly interpret the 'local_time_offset' descriptor information found in the TOT, the receiver will need to have a user set-up menu entry to make a choice of their region and long-term storage of the following:

| | Transmitted Code | Set-up Display |
|---|---|---|
| country_region_id = | 00 0000 | Not used |
| | 00 0001 | Reserved |
| | 00 0010 | NSW/ACT |
| | 00 0011 | VIC |
| | 00 0100 | QLD |
| | 00 0101 | SA |
| | 00 0110 | WA |
| | 00 0111 | TAS |
| | 00 1000 | NT |
| | 00 1001 | Reserved |
| | --------- | \| |
| | 11 1111 | Reserved |

Receivers should provide a set-up menu where the viewer may choose their region as shown in the above list.

The receiver will typically need in the TDT and TOT to recognise and respond to:

country_code = AUS
'0100 0001 0101 0101 0101 0011'

local_time_offset_polarity = '0' (advanced to UTC, east of Greenwich)

and a range of:

local_time_offset = '0001 0001 0000 0000'
(Summer: Australian Eastern Daylight Saving Time +11 hours UTC)

to '0000 1000 0000 0000'
(Australian Western Standard Time +8 hours UTC)

AS 4599 Section 6 on EN 300 468 Clause 4 – 5 and

Clause 6.2.12

TR 101 211 Clause 5

For further explanation see Appendix H

Recommended for all receivers

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<table>
<tr>
<td>7.5 Content descriptors{xe "Content descriptor"}<br>• Note Australian variation to DVB<br>• Content_nibble_level_1 as shown<br>• Content_nibble_level_2 and user_nibble currently not defined.</td>
<td>Receivers may display as required, a program’s classification/genre type as identified by the content_descriptor (Tag value 0 × 54) found in the EIT.<br><br>Only the content_nibble_level_1 is currently defined and is as follows:<br><br>Content_nibble_level_1 code_ — Description<br>0 × 0 — Undefined content<br>0 × 1 — Movie<br>0 × 2 — News<br>0 × 3 — Entertainment<br>0 × 4 — Sport<br>0 × 5 — Children’s<br>0 × 6 — Music<br>0 × 7 — Arts/Culture<br>0 × 8 — Current Affairs<br>0 × 9 — Education/Information<br>0 × A — Infotainment<br>0 × B — Special<br>0 × C — Comedy<br>0 × D — Drama<br>0 × E — Documentary<br>0 × F — Reserved -not defined</td>
<td>AS 4599 Section .6 on EN 300 468</td>
<td>Recommended for all receivers</td>
</tr>
<tr>
<td>7.6 EITs and present/following (Now/Next)</td>
<td>Provide minimum EPG{xe "EPG—Electronic Program Guide"} display—See Items 3.5 and 10.5.<br><br>Receiving equipment shall continue to operate in the absence of EIT information.</td>
<td>AS 4599 Section 6 on EN 300 468</td>
<td>Recommended for all receivers</td>
</tr>
<tr>
<td>7.7 EIT (optional schedules)</td>
<td>(see Item 10.5)</td>
<td>AS 4599 Section 6 on EN 300 468</td>
<td>Informative</td>
</tr>
<tr>
<td>7.8 Radio Services{xe "Radio Services – identifying"}</td>
<td>Radio Services shall be identified in the SDT by Service_type 0 × 02 in the service_descriptor (tag 0x48) syntax.<br><br>Radio services are expected to use the MPEG-1 Layer II format.</td>
<td>EN 300 468 Clause 6.2.24</td>
<td>All receivers</td>
</tr>
<tr>
<td colspan="4">8 VIDEO DECODE AND DISPLAY<br><br>Display format choices are given in Appendix G<br>Consumer equipment Interconnect choices are given in Item 15</td>
</tr>
<tr>
<td>8.1 MPEG video decoding</td>
<td>SD-only receivers should not attempt to decode HD streams but if accidentally selected by a viewer, a ‘service unavailable’ OSD should be displayed.</td>
<td>See Appendix G</td>
<td>All SD-only receivers</td>
</tr>
</table>

| | | | |
|---|---|---|---|
| **8.1.1** *Decode 'SD' MP@ML{xe "MP@ML"} video formats*[12] | The receiver shall decode all valid MP @ ML 25 Hz and 50 Hz formats. (Note: the receiver may display at other rates).<br><br>Pixels × lines: 720 × 576; 544 × 576; 480 × 576; 352 × 576; and also 704 pixels × 576 line at —<br><br>(a) 25 frame per sec progressive scan ('film mode' -see Item 7.2), or<br><br>(b) 50 field per sec interlaced<br><br>The receiver may decode 352 × 288 MPEG 1 (CIF) format. | EN 300 468 Table 16<br>TR 101 154 Cl.5 Annex A (examples only)<br><br>ISO/IEC 13818-2<br>Refer to Annex H | All receivers |
| **8.1.2** *Decode 'HD' MP@HL{xe "MP@HL"} video formats*[13] | High definition streams will be identified by the MPEG video header and in the EIT component_descriptor (tag 0 × 50) syntax.<br><br>The receiver shall decode all valid MP @ HL 50 Hz formats.<br><br>(a) 1080 active line formats at 25 frame/s progressive scan (film mode) or 50 field/s Interlace: 1920 or 1440 or 1280 × 1080 line (**1080i**);<br><br>(b) Progressive Formats at 50 frame per sec. {xe "Video Formats – 50 frames/sec progressive"} 720 × 576 active line '**576 50p**'[14] 1280 × 720 active line '**720 50p**'<br><br>Note: In Australia, the 1152i active line (1250 total) format is not a broadcast transmission format. However it is the basis for a fixed 31.25 kHz line scan 'CRT-friendly' interconnection standard for HD receivers to HD displays when dealing with 720p or 1080i 50 Hz formats, which would otherwise respectively, have 37.5 kHz or 28.125 kHz line scans.<br><br>See footnote and Appendix G - for details on scan timings and HD output requirements. | EN 300 468 Table 16<br><br>AS 4599<br><br>TR 101 154 Clause 5 Annex A<br><br>For digital and analogue interface formats refer to Clause 3.1, Item 15<br><br>For displays Refer to Appendix G | Only HD capable receivers |

12 The MP@ML decoder should be able to decode lower MPEG levels such as MP@LL. For interoperability{xe "Interoperability"}, 704 pixels × 576 line formats may be used, as this is a common industry standard in widespread use

13 Terrestrial broadcasters may use a range of active-lines-in-pictures formats including 1080 × 50i or 25p, 576 × 50p, 50i or 25p and (576/2) 288 × 25p. At the time of preparing this Standard, some terrestrial broadcasters have advised that they will not use 720 line progressive formats, while at least 2 broadcasters have indicated that the 720 50p HD format is under consideration for future use.

**SCAN FREQUENCIES** (Refer Appendix G):

There is benefit in the interest of lower cost displays that for CRT based 'HD-Input' displays, to consider a single frequency horizontal line scan system at 31.25 kHz. (e.g. 2 × 15.625 kHz), which is also used for '100Hz' SD display. Such a scan frequency is suitable for display of 576 × 50p pictures, SD 576 line pictures scaled up by 2, and for 1080i pictures if the VBI is reconstructed so that the total lines are 1250.

720 50p pictures can also be displayed if vertically 'up-scaled' by 8/5 (720/1152=1.6). N.B. MPEG video transmission carries only active picture. Blanking intervals are reconstructed in the receiver for interconnects and display.

The video output(s) of HD-STB's for the consumer market should minimally support 576p (625line total) and 1152i (1250line total) fixed output scan formats under user selection and should for this purpose provide frame/field conversions to convert any of the transmitted (input) formats to the fixed output format. The preferred way is to letterbox '1080i active' line systems into an '1152i' (1250 lines total) format by extending the vertical blanking period by adding 36 black lines at both the top and bottom, i.e. '36+1080i+36' as this will preserve the original video quality. The display will need to recognise this and switch in a vertical scan increase of 6.7% to correct picture geometry.

The display may determine the video interconnect format by the appropriate horizontal and vertical synchronising signals as indicated in Section 15 and given in Appendix H.

14 720 × 576p @ 50 Hz is also used by PAL Progressive Scan DVD players.

DVB MHP has indicated a graphics format for 576 line displays with square pixels on 16:9 displays – i.e. 1024 × 576.

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|---|---|---|---|---|
| **8.2** | **Reproduction of Progressive Scan Video Formats[15],[16],[17] {xe "Video Formats – 25frames/sec progressive"}** | For reproduction on interlaced displays including standard 625 (total) line displays, 25 frame/s progressive formats (presumably from film sources) will need to be output in 50 field/s interlaced format.<br><br>See footnote 17 on inclusion of vertical video filtering{xe "Video filtering"} to reduce interline twitter in interlaced displays.<br><br>NOTE: This is not to discourage the use of progressive format displays at 50 or 100 Hz or direct pixel addressed displays.<br><br>For interconnect standards, and possible display formats refer to this table, Item 15 and Appendix G. | TR 101 154 Clause 5 and Table 4 | All receivers |
| **8.3** | **Video scaling for display and output{xe "Video scaling"}, up and down** | Refers to translation of transmitted format to display format as these may be different. May also be used for aspect ratio{xe "Aspect ratio"} mode choices. Preferred values typically are 1/2, 3/4 and 2 also 3/2, 4/3, 2/3. Digital processing filters should be multi-tap.<br><br>Scaling may be required for display of interactive material. | Refer to Appendix G | Optional |
| **8.4** | **Display of transmitted video stills** | Part of the DVB MPEG system | TR 101 154 Clause 5.2 | All receivers |
| **8.5** | **Multiview display{xe "Multiview display"}** | In a MP@HL decoder, SIF concurrent decoding recommended for picture-in-picture. | | Recommended in premium receivers, otherwise, optional |
| **8.6** | **Mosaic display** | Displayed from a single transport stream | TR 101 211 Clause 5<br><br>EN 300 468 Clause 6.2.13 | Optional |
| **8.7** | **SD decoder response to a HD Service** | Identify on screen the inability of the unit to display selected service.<br><br>Note: SD Receivers with MP @ ML decoders should not try to display 720 x 576 x 50p MP @ HL streams | | All SD receivers |
| **8.8** | **Aspect ratio** | | | |
| **8.8.1** | *Picture 'shape' setup for a receiver and/or display* | Digital STB receivers with video outputs shall provide, via the setup menu, a choice of display configurations to satisfy the viewer's display unit which may be a standard 4:3 or widescreen 16:9 format.<br><br>16:9 pictures should be capable of being displayed on a 4:3 display. The choices should include 4:3 centre-cut or 4:3 pan and scan, letterbox or, for a widescreen video display, true 16:9.<br><br>When outputting 4:3 pictures from a pan and scan cutout of a widescreen picture, receivers may optionally follow offsets data if included in the MPEG video bitstream (refer to Item 7.8.5).<br><br>Manufacturers may also choose to provide overscan and stretch modes for 4:3 pictures on wide-screen displays.<br><br>It's recommended that a receiver's remote control include some picture shape control (refer to Item 7.8.3). | | All SD receivers<br><br>And SD outputs of HD |

15 Video 25 or 50 frame/s progressive scan formats may be broadcast.

16 The receiver does not need to accept 24 or 23.98 frame/s progressive formats used for Cinema production. In the Australian 25/50 Hz environment such formats will be broadcast when sped up by 4% to 25 frame/s progressive.

17 When HD progressive scan format material is received, and the interconnect or display format is 50 field/sec interlaced, it is recommended to include vertical video filtering{xe "Video filtering"} to reduce interline twitter in the interlaced display.

| | | | |
|---|---|---|---|
| **8.8.2** *Identification of 4:3 and 16:9 pictures*<br>• Optional use of Active-Format-Descriptor (AFD)<br>• Optional use of Wide-Screen-Signalling (WSS) | Broadcasts may have 4:3 or 16:9 pictures as identified by the 4-bit integer aspect_ratio_information '0010' or '0011' respectively found in the MPEG video header information.<br><br>The use of MPEG's extra widescreen 2.21:1 format is not proposed.<br><br>Additional AFD information may be included. Use of AFD indication of picture 'area of interest' by a receiver is optional.<br><br>Also WSS carried via DVB packetised VBI Data (See EN 301 775) may be reinserted on VBI line 23 analogue output or used to activate WSS on a SCART connector. | ISO/IEC 13818-2 Clause 6.3.12<br><br>TR 101 154 Clause 5.1.3 Annex B<br><br>ETS 300 294<br>EN 301 775 | All receivers<br><br>Optional<br><br>Optional |
| **8.8.3** *Changing between 16:9 and 4:3 pictures on displays*<br>• Provide 'wide-screen' – 'standard' (4:3 center cut) format switching on remote control<br>• in 'letterbox' mode to feed a 4:3 display, the incoming video should be blanked to line 25 to avoid accidental display of VBI | Note that Australian broadcasters have indicated that both SD and HD programs will be 16:9 wherever possible. However in many cases only a 4:3 format version of a program is available and the program may be broadcast as 16:9 'pillarbox' with black bars on either side.<br><br>Furthermore, occasionally letterbox material in a 4:3 format may be broadcast. On a 16:9 display, such a picture would have black bars left and right, top and bottom – sometimes known as 'postage-stamp'.<br><br>For these reasons, receiver manufacturers are **highly recommended** to provide the ability to switch between display formats as a user selectable function button on the remote control. This would need to override signalling such as WSS and/or AFD.<br><br>**Letterbox display**<br>To create a 'letterbox' display the incoming 576 active lines (288 line per field), are normally scaled on the video output to 432 lines with 72 lines of black added top and bottom.<br><br>**Avoid visibility of VBI signals in Letterbox display**<br>A common problem with letterbox display is the occasional visibility of VBI signals such as WSS or vertical interval time-code that may be (accidentally) broadcast offset to their regular position. This may be prevented if the incoming video is blanked to line 25 instead of line 23 before scaling.<br><br>Note that the last (bottom) lines of picture may also be affected and can also be similarly blanked. | ISO/IEC 13818-2 Clause 6.3.12 | Highly recommended for all receivers<br><br>Recommended for all receivers |
| **8.8.4** *Display of broadcast 14:9 pictures* | Some broadcasts may use this ratio but on a 16:9 background.<br><br>Manufacturers may choose to provide a 14:9 option for 16:9 video on a 4:3 display. | | Optional |
| **8.8.5** *On 4:3 displays, show full height 4:3 pictures cut from a 16:9 video program stream by use of MPEG-2 pan and scan vectors{xe "Pan and scan"}* | (This applies to set-top-boxes feeding existing 4:3 display TV sets or integrated digital receivers with 4:3 displays).<br><br>Horizontal (Pan) offset may be available in the MPEG video bitstream.<br><br>The (16-bit signed) integer frame_centre_horizontal_offset will be included in the video bitstream semantics. If this element is absent from the bitstream then a zero offset (i.e. centred) is assumed.<br><br>Vertical (scan) offsets (per TR 101 154) will not be used.<br><br>In the case of HD 16:9 program video that is being fed to a SD 4:3 display, the received line structure should be scaled appropriately. | ISO/IEC 13818-2 Clause 6.3.12 | Recommended for all receivers |

| | | | | |
|---|---|---|---|---|
| **8.8.6** | *Frame accuracy{xe "Pan & scan - frame accuracy"} of use of scan offset when cutting 4:3 picture from transmitted 16:9 picture* | Shift of picture should be frame accurate with reception of frame_centre_horizontal_offset information | | All receivers |
| **8.9** | **Picture colorimetry** | | TR 101 154 Clause 5 | |
| **8.9.1** | *Chroma_format* | Chroma decoding to 4:2:0 format<br><br>chroma_format will be 0 × 01 | ISO/IEC 13818-2<br>Clause 6.1.1.8<br>Clause 6.3.5; Table 6-5 | All receivers |
| **8.9.2** | *Colorimetry{xe "Colorimetry"}* | SDTV to Recommendation ITU-R BT.470-6 – 'Conventional Television Systems' –Table 2, B-PAL Chromaticity.<br><br>HD to Rec. ITU-R BT. 709-4. Transmitted pictures will be colour balanced to D6500.<br><br>Manufacturers may choose to alter or provide various display colour temperature options. | ISO/IEC 13818-2<br>Clause 6.3.6; Table 6-7<br><br>ITU-R BT 709-4 | Optional |
| **9** | **AUDIO—DECODE AND REPRODUCTION** | | | |
| **9.1** | **Audio Outputs** | Manufacturers may choose to include digital outputs in addition to analogue interfaces. For further information on preferred analogue and digital outputs, see Items. 15.3.1 and 15.4.1. | | Optional |
| **9.2** | **MPEG audio** | | | |
| **9.2.1** | *Decode Audio stream using MPEG-1 Layer II* | MPEG-1 layer II audio streams may be in single (mono) or dual or joint stereo or stereo modes.<br><br>Multiple services may be present to support other languages. The User should be able to select these. | ISO/IEC 11172-3 | All receivers |
| **9.2.2** | *Decode all MPEG-1 Layer II sampling rates* | Broadcasts may use either 32, 44.1 or 48 kHz sampling rates— all audio frames have the same bit rate. | | All receivers |
| **9.2.3** | *Decode all MPEG-1 Layer II formats if MPEG-2 decoder fitted* | Backward compatible basic stereo information should be able to be decoded. | TR 101 154 Clause 6.1 | If MPEG-2 audio decoder fitted |
| **9.2.4** | *If MPEG-1 decoder fitted, ability to decode MPEG-2 audio formats* | If an MPEG-1 decoder fitted, forward decode compatibility of MPEG-2 (MPEG-2 multichannel sound includes 5.1 and 7.1 channel audio.) | ISO/IEC 13818-3 | Optional |
| **9.3** | **AC-3—Decoding and Output{xe "AC-3 – decoding and output"}** | AC-3 may be included in the DVB TS with the MPEG stream_id set to 0 × BD (private stream_1) –see detail below.<br><br>AC-3 may be used for mono, stereo, stereo with matrix encoded surround sound or discrete 5.1 channel surround sound. Stereo with matrix encoded surround sound may be decoded using decoding technology such as Prologic.<br><br>Receiving equipment with AC-3 decoders should be able to downmix to output requirement (e.g. 5.1 to mono in simple single speaker receivers).<br><br>Receiving equipment with a digital SP/DIF output capable of feeding an external AC-3 decoder are not required to downmix an AC-3 stream on that output.<br><br>Other features of AC-3 follow: | AS 4599 Section 5<br><br>and<br>TR 101 154 Annex C<br><br>also AS 4599 Section 6 Appendix E (Aus) | Receivers with AC-3 decoders |

| | | | | |
|---|---|---|---|---|
| **9.3.1** | *Ability to decode AC-3* | Complete main (CM) services each 1 to 5.1 channels plus associated services.<br><br>The coding and decoding of an AC-3 elementary stream is based upon Recommendation ITU-R BS1196 – Annex 2. Each CM service may have a complete mix or only music effects which could be mixed in the receiver with dialogue (MEandD); Visually Impaired; Hearing Impaired. Additionally, where a second decoder is fitted, the following have over-ride capability: Commentary; voice over and emergency (CandVO).<br><br>Ability to decode ME and D and CandVO services are not required. | TR 101 154 Version 4 Annex C<br><br>ITU-R BS 1196, Annex 2<br><br>DVB implementation differs from ATSC | Receivers with AC-3 decoders |
| **9.3.2** | *AC-3 karaoke mode* | | | Not applicable |
| **9.3.3** | *Dual AC-3 decoders* | Refers to presentation of dual sound channels in a time synchronous manner when required. | TR 101 154 Version 4,Annex C Clause C.5.2, Decoding | Optional for receivers with AC-3 decoders |
| **9.3.4** | *Decodable AC-3 sampling frequency range* | Receiver sampling frequency range.<br><br>Digital audio sampled at a frequency of 32 kHz, 44.1 kHz or 48 kHz, locked to the 27 MHz system clock. The 48 kHz audio sampling clock is defined as:<br><br>48 kHz audio sample rate = (2 ÷1125) × (27 MHz system clock). | ITU-R BS 1196, Annex 2 | Receivers with AC-3 decoders |
| **9.3.5** | *Decodable AC-3 bitrate range{xe "AC-3—bitrate range"}* | The receiver should be able to decode the transmission bit rates as defined below:<br><br>A main audio service, or an associated audio service which is a complete service (containing all necessary program elements) will be encoded at a bit rate less than or equal to 640 kbit/s. A single channel associated service containing a single program element will be encoded at a bit rate less than or equal to 128 kbit/s. A two channel associated service containing only dialogue will be encoded at a bit rate less than or equal to 256 kbit/s. The combined bit rate of a main service and an associated service which are intended to be decoded simultaneously will be less than or equal to 768 kbit/s. | ITU-R BS 1196, Annex 2 | Receivers with AC-3 decoders |
| **9.3.6** | *Recognition of AC-3 in a DVB MPEG transport stream* | AC-3 PES audio is identified by a public DVB descriptor. When an AC-3 stream is present in a DVB transport stream, it may be identified by the presence of the AC-3_descriptor. The DVB AC-3_descriptor is defined in ETS 300 468, Annex E.<br><br>The AC-3_descriptor{xe "AC-3 – descriptor"} has a tag value 0 × 6A<br><br>The AC-3 PES is carried as an MPEG private data stream type, conforming to the structure of a private_stream_1 as described in ISO/IEC 13818-1 Table 2-18 (stream_id) and Table 2-29 (stream_type). Since the AC-3 descriptor is not a DVB private descriptor, but is a public DVB descriptor, the component_tag is not used, nor are the component_tag values of component_type assigned.<br><br>When the component descriptor is referring to a DVB A-3 PES, the value assigned to the stream_content field is 0 × 04 for values of the component_type field between 0 × 00 and 0 × 7F.<br><br>The values of component_type between 0 × 00 and 0 × 7F indicate the particular mode of AC-3 audio in the PES. There may be other AC-3 streams and/or other private data streams such as sub-title data with the same stream_id also present. | AS 4599 Section 5 and TR 101 154 Ver 4 Appendix C also AS 4599 Section . 6 Annex E (Aus)<br><br>ETS 300 468 Annex E, Tables E.2 and E.3<br><br>ITU-R BS 1196 Note: AC-3 implementation in DVB differs from ATSC | Receivers with AC-3 decoders |

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|---|---|---|---|---|
| **9.4** | **Audio identification and control** | User facility via OSD and/or remote control | | |
| **9.4.1** | *Identifying which audio stream present* | Menu option may indicate stream type (e.g. AC-3 5.1), available for selected program. (Refer to Item 8.3.2 for other languages available for selected program). | | Optional |
| **9.4.2** | *User access to other audio streams (including other language)* | Menu option. To give user access if several audio streams are present in either MPEG-1 layer II and/or AC-3. | | All receivers |
| **9.4.3** | *Receiver auto-switch when program audio changes from MPEG-1 layer II to AC-3 or vice versa* | For channel change or if a program stream changes its audio delivery from MPEG-1 layer II to AC-3 or vice-versa, switch should be automatic and muted. | | If AC-3 decoder fitted. |
| **9.4.4** | *Ability to present stereo audio encoded with surround information suitable for external Dolby Pro Logic™{xe "Dolby ProLogic™"} decoding.* | To ensure satisfactory Dolby Pro Logic™{xe "Dolby ProLogic™"} decoding, the audio phase response must be maintained on the stereo output interface for the decoded MPEG-1 layer II or AC-3. | | For MPEG and/or AC-3. Recommended in premium receivers, otherwise, optional |
| **9.4.5** | *System reference level{xe "Audio reference level"}*<br><br>The reference levels for system alignment used at the Transmission Audio Encoder are:<br><br>MPEG-1 (Layer II) –18 dBFs<br><br>AC-3 –20 dBFs[18] | The fixed gain nature of the MPEG-1 system gives a receiver reference level of –18 dBFS, i.e. 18 dB below the digital transmission clipping level.<br><br>The Dolby Digital (AC-3) system operation allows:<br>1. Dialog norm (*dialnorm*) control by the broadcaster;<br>2. Dynamic range control (DRC) parameters by the broadcaster; and<br>3. Selection of two standard output level profiles or operating modes called Line Mode and RF Mode<br>4. Protection limiting against overload in the receiver.<br><br>For each programme, the available dynamic range in both Line and RF modes is determined by the programme content and the DRC profile selected at the encoder. Line Mode for 5.1 channel outputs has the added ability to scale the amount of high-level compression applied.<br><br>In Line mode, with dialnorm set to -31 dB and no mixdown to stereo, the system has unity gain. Some ability to scale the DRC in the decoder may be available in this mode.<br><br>In RF mode, the system has 11 dB gain relative to Line mode, with dynamic range being set by the DRC profile selected at the encoder.<br><br>Item 8.3.6 provides guidance to potentially achieve matching of loudness between digital programme services.<br><br>Items 8.3.7 and 8.3.8 provides guidance when an RF PAL modulated output is provided on a receiver. | AS 4599 AC-3:<br><br>ITU-R Rec. BS 1196, Annex 2;<br><br>MPEG:<br><br>TR 101 154 Clause 6 | Informative |

[18] Subject to change. Relative levels of audio from different systems including PAL with analogue-FM, if fitted, need to be taken into account

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| **9.4.6** *Receiver Average Output level* | Manufacturers of digital TV receivers for the Australian market should be aware that some services may be broadcast in MPEG-1 layer II and/or AC-3 digital audio.<br><br>Receiver manufacturers should also be aware that there may be some level differences when changing between MPEG-1 layer II and AC-3 bitstreams due to these two types of decoders and the available AC-3 operating modes and the presence of metadata. | | Informative |
| **9.4.7** *Modulated RF Output Deviation*<br><br>If a RF modulated output is fitted:<br>it shall be compatible with the PAL-B system; and produce FM Output deviation of ±20 kHz (with 400 Hz input) at the reference alignment level of:<br>–18 dBFs for MPEG-1 Layer II and<br>–20 dBFs for AC-3 | It is recommended for compatibility with attached PAL receivers and analogue transmissions, that STB's have a variable output that can provide the specified FM deviations at slightly less than the maximum volume setting.<br><br>Designers should be aware that the maximum typical deviation that can be accepted in PAL receivers, without excessive distortion is ±70 kHz for any audio frequency.<br><br>For AC-3 encoded audio the default setting in the STB decoder shall be the RF Mode operating mode. | AS 4542.1 | Recommended |
| **9.4.8** *Operating mode and audio dynamic range control{xe "Audio dynamic range control"}* | For products with RF modulators, the default AC-3 operating mode is RF mode. The user may then be able to select the Line Mode and dynamic range options.<br><br>For products without RF modulators, the preferred AC-3 operating mode is Line Mode. However if the receiver has dynamic range options fitted, this will become a user selectable function.<br><br>Manufacturers may choose also to provide a compression facility on the MPEG audio. | | If AC-3 decoder fitted, recommended in premium receivers, otherwise, optional |
| **9.4.9** *Maximum picture-sound timing mis-alignment (Lip Sync)* | As a result of receiver processing alone ±10 ms<br><br>Applies to MPEG audio and AC-3 | | Recommended for MPEG and AC-3. |

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| **10 OPERATING SOFTWARE AND MIDDLEWARE API{XE "API AND OPERATING SOFTWARE"}[19]** | | | |
| **10.1 API[20]**<br>NOTE: See also related Items:<br>Item 6: Service information (SI) processing<br>Item 10: Interactivity{xe "Interactivity"} and on-screen display<br>Item 13: Conditional access{xe "CA—Conditional Access"}<br>Item 17: System software revision{xe "Software revision"} | Basic operating system—at manufacturers' choice.<br><br>API and coding (virtual machine) are to be specified such that applications may be potentially downloaded to receivers.<br><br>A software system design no less complicated than the remainder of the specification document will be necessary. The system level design is the subject of active standards work in DVB and other forums and is being addressed in Australia.<br><br>For operation with MHP, the capability to decode DSM-CC{xe "DSM-CC"} object and data carousels would be considered essential. | ISO/IEC 13818-6 | Informative<br><br>Informative for Data Download and interactivity equipped receivers |
| **10.2 Middleware API** | | | |
| **10.2.1** *DVB MHP* | Australian television broadcasters have adopted the DVB MHP Specification as in DVB/ETSI: TR 101 812.<br><br>DVB/ETSI: TS 102 812 Multimedia Home Platform (MHP) Specification 1.1 including DVB-HTML is under consideration. – see Item 10.1.2.<br><br>Receivers incorporating interactive capabilities according to DVB/ETSI: TR 102 812 Multimedia Home Platform Specification 1.1 are highly recommended to include the DVB-HTML option. | DVB ETSI: TS 101 812<br><br>DVB ETSI: TR 102 812 | Informative<br><br>Informative |
| **11 INTERACTIVITY{XE "INTERACTIVITY"}[21] AND ON-SCREEN DISPLAY** | | | |
| **11.1 Remote Control** | | | |
| **11.1.1** *Conformance of Remote Control design{xe "Remote control design"} - (where supplied)*<br>• Cursor keys<br>• Coloured Buttons (Red, green yellow and blue) | As a minimum, the remote control should provide the requirements for basic navigation in the digital TV environment and where interactivity is provided: cursor, select, menu and information keys and the standardised coloured buttons.<br><br>A separate button to provide Aspect Ratio switching on remote control is recommended - (see Item 7.8.3). | | Recommended |
| **11.1.2** *Capability to operate interactively*<br>• Follow MHP Specification | It is expected that Australian broadcasters will use MHP as in Item 9.1. | DVB/ETSI: TR 101 812 and TR 102 812 | Recommended in premium receivers, otherwise, optional |

19 Refer to Section 17 for operating software revisions by download by broadcaster

20 DVB APIs are under discussion in International forums.

21 System operation providing capabilities for interactivity are currently under discussion in DVB forums including aspects of receiver design such as remote control functionality.

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| **11.2 On-Screen-Displays (OSD)** | | | |
| **11.2.1** *Video planes* | At least video and static OSD; the OSD may also be used to display subtitles/{xe "Subtitles"}closed captions.<br><br>Additional planes with degrees of transparency and colour range are optional although receivers conforming to the MHP standard, will need to follow that specification.<br><br>NOTE: For optional inclusion of interactive applications, additional video planes are required including support of a 'cursor'. | | All receivers<br><br>Optional for interactive receivers |
| **11.3 Teletext closed captions** {xe "Teletext"} {xe "Subtitles"} | Note that receivers are only expected to implement decoding and display of teletext services to support closed captioning on the Australian DVB-T transmissions. Full teletext support is optional.<br><br>There may be multiple teletext{xe "Teletext"} data streams in a transport stream. In the transport stream, each program service may have both a teletext caption stream and a teletext information stream each with their own PIDs.<br><br>Teletext{xe "Teletext"} may be used for the provision of closed captions in one or more languages. These will be able to be identified by the receiver in the usual manner from the PMT (Tag = 0 × 56).<br><br>It is recommended to ignore the teletext private data PCR and PTS when decoding and present to the display when received – see 'decoding' below.<br><br>NOTES:<br>(a) Provision of teletext{xe "Teletext"} decoding for closed captions is required (see Item 10.3.1).<br>(b) The teletext{xe "Teletext"} information —<br>(i) shall be capable of being displayed on the picture as a normal over-write of the picture by text; and<br>(ii) shall be added as standard analogue teletext{xe "Teletext"} data to the VBI of a PAL format output – refer Item 10.3.3 (this option would apply to modular set-top-boxes to feed teletext{xe "Teletext"} capable TVs).<br>(c) Refer to Items 10.3.1 to 10.3.5.<br>(d) Note changes identified in descriptor tables (tag values 0 × 046, 0 × 047 and 0 × 056) in latest EN 300 468. | EN 300 468<br>Clause 6. Table 12<br>EN 300 472<br><br>DVB A056<br><br>ETS 300 706<br><br>Refer to Appendix F and Appendix H | All receivers |
| **11.3.1** *Access to closed captions in a teletext{xe "Teletext—closed captions"} format for hearing impaired* | Australian DTTB transmissions may include closed captions for hearing impaired in a teletext{xe "Teletext" \i} format. This will generally correspond to only a few lines of text per second.<br><br>On Australian analogue PAL broadcasts these subtitles{xe "Subtitles" \i} are on lines 21 and 334 on teletext page 801. This information is carried in the DVB teletext packets per EN 300 472.<br><br>The receiving equipment shall be capable of decoding the teletext caption data when present. The receiving equipment shall be capable of overlaying the teletext subtitles{xe "Subtitles" \i} on the picture, and this feature should be controllable from the receiver's remote control.<br><br>In the case of set-top-boxes capable of connection to SD PAL TVs, the teletext shall be re-inserted on the output PAL VBI as detailed in Item 10.3.3. | EN 300 472<br>EN 300 468<br>TR 101 211 Cl.4.2.6.4<br><br>Refer to Appendix F | All receivers |

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| **11.3.2** *Decoding of teletext information{xe "Decoding of teletext information" \i}* | The OSD shall indicate to the viewer that teletext subtitles are available in a service.<br><br>The PIDs are identified in PMT of the PSI.<br><br>The PMT teletext_descriptor{xe "Teletext_descriptor" \i} tag value is $0 \times 56$.<br><br>The stream_type is $0 \times 06$ (private data).<br><br>Each stream identified by different data_identifier.<br><br>Even though a PMT may reference a teletext data stream associated with a video stream, the teletext stream may have a different PCR to the video. Consequently it is recommended to ignore the teletext private data PCR and PTS when decoding and present to the display when received – see Appendix H and EN 300 472 Annex A, PTS transmission. | EN 300 468 Clause 6.2.32<br>EN 300 472 and revisions | All receivers for teletext subtitles but optional for other teletext |
| **11.3.3** *Teletext re-insertion on VBI{xe "Teletext—re-insertion on VBI" \i} of analogue SD or ED 625 line output- (applies to set-top-boxes)* | Where fitted, teletext shall be reinserted on VBI lines of video output for display on teletext capable PAL TVs connected to the STB. The teletext line will be identified in the teletext packet information as detailed in EN 300 472. | EN 300 472 Clause 1<br>ITU-R BT653-2<br>EBU SPB 492 | All set-top-boxes' Standard Definition outputs |
| **11.3.4** *Use assigned colour and position where displayed on 4:3 and 16:9 pictures* | In teletext assigned colour and position. | | All receivers |
| **11.3.5** *Time accuracy of closed captions (CC)* | The receiver's decoding delay for the teletext output or display of the line 21/334 teletext closed captions should not be more than 2 video frames (80 msec). PTS are not used. | | All receivers |
| **11.4 Bit-mapped subtitles{xe "Subtitles bit-mapped"}** | Subtitles, logos and other graphical elements may be coded and carried in DVB bitstreams.<br><br>This format may also include bitmapped closed captions for the hearing impaired. The receiving equipment shall be capable of decoding bit-mapped captions when present. | EN 300 743<br>EN 300 468 Clause 6, Tables 12 and Clause 6.2.30 | All receivers |
| **11.4.1** *Decoding of bit-mapped information* | The OSD shall indicate to the viewer that subtitles are available in a service and may be displayed. The receiver is able confirm this information from the PMT (Tag = $0 \times 59$). | | All receivers |
| **11.4.2** *Features of display minimum number of colours* | At least 256 colour system is recommended. | | Recommended All receivers |
| **11.4.3** *Closed caption display* | The bit-mapped captions display should be easily activated at the user's choice by a dedicated button on the remote control. | | All receivers |
| **11.4.4** *Time accuracy of display of closed captions* | bit-mapped captions provided ±40 msec with respect to PTS. | | All receivers |

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| **11.5 Electronic program guide (EPG){xe "EPG—Electronic Program Guide"}** | | | |
| **11.5.1** *EPG General* | Receivers shall be able to use information from EIT tables but shall not be adversely affected by the absence of EIT tables in a transmission.<br><br>At the time of publication, Australian DTV broadcasters will transmit their own SI which may include EIT tables for their own services only.<br><br>Receiver manufacturers relying on EIT information will need to make their own decisions on memory and allocation for viewer's convenience in referring to previously captured EPG data. | | All receivers<br><br>Optional |
| **11.5.2** *Use of EPG flush* | EPG Flush function may erase EPGs. | | Informative |
| **11.5.3** *Display of broadcaster supplied EPGs* | Under discussion with broadcasters and dependant on receiver API software.<br>EPGs may be provided by broadcasters as a feature of an interactive service. | | Informative |
| **11.5.4** *Use of now/next (present/following)* | Required for basic navigation in digital and for parental guidance operation in consumer DTV receivers. Supplied by EIT.<br><br>See Items 3.5 and 6.6 | | All receivers |
| **11.5.5** *Use of extended program information* | Some broadcasters may provide this information. | | Informative |
| **11.5.6** *Running Status Table* | Use in Australia not determined. Receivers should not rely on this table for operation. | EN 300 468 | Not required |
| **12 DATA BROADCASTING{XE "DATA BROADCASTING"} (BROADCAST TELEVISION RELATED)** | Will be dependent on application software (see Item 9.1).<br><br>For detailed information on datacasting specific receivers refer to the relevant part of this Standard. | EN 301 192<br>TR 101 202 | Informative |
| **12.1 Access to data service** | Receivers should be capable of operating with DSM-CC streams. There may be more than one data broadcast stream in a transport stream. See EN 301 192.<br><br>Databroadcasters may include proprietary private streams and may be encrypted requiring a CA system. | ISO/IEC 13818-6 | Recommended in premium receivers, otherwise, optional |
| **12.2 Data interface** | Where data interface is fitted, options for interface is given in Item 15. | | Optional |

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| **13 PARENTAL GUIDANCE** | | | |
| • Use Code provided by Broadcaster in EIT<br>• Display Code in EPG (Now and Next)<br>• Provide 'Lock-out' with PIN access | The Australian Parental Guidance classification codes for television programs when transmitted, are intended to be displayed, and form a part of the parental service locking mechanism in a digital receiver.<br><br>Unlike the DVB European usage, the Australian code is based on program content without age assignment. The transport stream EIT will generally include the DVB parental_rating_descriptor{xe "Parental_rating_descriptor"} (Tag = 0 × 55) and associated information but the receiver should use the 'look-up' table given in Appendix E for the on-screen EPG display and the lock-out set-up screen.<br><br>The receiver should check the parental_rating_descriptor as indicated in the EITnow/next, when accessing a program, and if the parental guidance lock-out is activated, blank the program if the parental guidance rating is exceeded. | EN 300 468<br><br>Modified as detailed in Appendix E | Recommended for all receivers |
| **14 CONDITIONAL ACCESS (CA) {XE "CA—CONDITIONAL ACCESS"}[22]** | | | |
| NOTE: Options include the following:<br>(a) Provide for fitting CA system later<br>(b) Include a CA system<br>(c) No CA system | Manufacturers have two choices for Option (a):<br>(i) Fit a 'PCMCIA{xe "PCMCIA" \i}/PC-Card' socket using DVB common interface (CI). Then CA Service providers can provide customers with an appropriate PC-Card as required.<br>(ii) Fit a 'smartcard' slot and provision to download CA software to be 'embedded' in the receiver software. CA service providers can provide customers with an appropriate smartcard and arrange software download later. This option requires great care in software download of CA system. | ETR 289; DVB A011 | Option (a) i) Recommended for all receivers |
| **14.1 SimulCrypt{xe "SimulCrypt" \i} compliance of receivers with a CA system or where provision to add a CA later is provided** | Where the ability to fit a CA system to a receiver after purchase is provided, compliance with DVB (ETSI ETR 289) common scrambling algorithm is essential, i.e. if the receiver has a CA system fitted or is capable of being fitted (e.g. via a common interface) with a CA system, then it shall be capable of successfully decoding a DVB SimulCrypt compliant transmission. | AS 4599<br>ETR 289<br><br>TS 101 197 Part 1 and 2 | All receivers complying with Clause 13 (a) (i) or (ii) |
| **15 COPYRIGHT PROTECTION{XE "COPYRIGHT PROTECTION"} ON OUTPUTS[23]** | | | |
| **15.1 Activation** | Activated by MPEG copyright bit flag and/or descriptor. | ISO/IEC 13818-1 | Informative |
| **15.2 Digital outputs** | IEEE 1394 CP and DVI/HDCP under international discussion. | IEC 62315 | Informative |
| **15.3 High definition analogue outputs** | Under international discussion. | | Informative |
| **15.4 Standard definition analogue outputs** | Under international discussion. | | Informative |

22 Range of use and type of Conditional Access{xe "CA—Conditional Access"} system subject to outcome of Government, Broadcasters and Industry discussions. Manufacturers will need advice if Option (c) is preferred.

23 Use and type of copyright protection system(s) subject to Broadcaster and Industry discussions.

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| **16 INTERFACES AND CONNECTORS {XE "INTERFACES AND CONNECTORS"}** | ETSI TS 102 201 V1.1.1 (1999-03) *Digital video Broadcasting; Interfaces for DVB Integrated Receiver Decoder (DVB-IRD)*. Sections of this document that are applicable to Australian requirements are under consideration. | | |
| **16.1 RF input/output** | | | |
| **16.1.1** *RF input* | IEC 60169-2 (VHF/UHF) female, 75 Ω.<br>An RF loop-through output (Male) may also be fitted. | IEC 60169-2 | All receivers |
| **16.1.2** *RF modulated PAL composite output* | Where fitted, complies with AS 4542.1<br><br>RF Output should be tuned by software or hardware in a range between 470-862 MHz in PAL B (7MHz channel spacing VHF/UHF and 5.5 MHz sound). | Clause 3.1.2<br><br>AS 4542.1 | Recommended for SD STBs |
| **16.2 Base-band analogue video connectors{xe "Connectors - Base-band analog video"}** | Where fitted, options are the following: | | |
| **16.2.1** *Component Analogue outputs for HD and SD using Y, Pb, Pr or RGB+HV {xe "Video Interconnect, Analog HD"}* | <u>For High Definition Receivers</u><br>**Y** (with bi-level sync, tri-level optional), **Pr**, **Pb** provided on Cinch/RCA-phono/BNC, or **RGB+HV** provided on VGA<br>D-Sub 15pin/5x Cinch/RCA phono<br><br>Note: It's recommended that HD receivers provide HD analogue outputs that are switchable (preferably mechanical), between 'native' HD formats or CRT-friendly (31.25 kHz) formats.<br><br>HD receivers are also recommended to have separate SD output(s) or outputs that are switchable to SD. (For example this is useful for consumers that initially wish to connect to an SD display but may wish to upgrade to an HD display later.)<br><br><u>For Standard Definition Receivers</u><br>Y, Pr and Pb provided on Cinch/RCA-phono or BNC<br><br>Analogue voltage levels for SD and HD:<br><br>Y Blanking to peak level = +700 mV<br>Pb, Pr maximum peak level = ±350 mV<br>Sync on Y = –300 mV (bi-level), ±300 mV (tri-level)<br><br>RGB+HV per VESA VGA standards for monitor displays<br>or<br>EIA/CEA-861-B/ITU-R BT1358 for CRT TV displays | An explanation of Y, Pb, Pr is given in the Glossary in Appendix I<br><br>Refer to Appendix G for details of sync wave-forms<br><br>See Appendix G<br><br>See Appendix G | Recommended on HD receivers<br><br>Recommended |
| **16.2.2** *PAL composite (CVBS)* | Complies with 625/50 line PAL ITU-R Report 624-4.<br>Connector -IEC 48B Section 316 (Yellow Cinch/RCA-phono)<br><br>Note: High Definition receivers when receiving a HD service may also provide downconverted video to its SD PAL output.<br><br>See AS 4542.2, *Consumer television interfaces* Part 2: *Analogue baseband*. | AS 4542.2 | Recommended for all receivers |
| **16.2.3** *S-video (Y/C) {xe "S-Video"}* | Note: High Definition receivers when receiving a HD service may also provide downconverted video to its SD S-Video output. See AS 4542.2 ,*Consumer television interfaces*, Part 2: *Analogue baseband* | AS 4542.2 | Recommended for all receivers for SD output |

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| **16.2.4** *SCART Video and Audio{xe "SCART"}* | If a SCART connector is fitted and marked 'TV', SD video outputs shall be provided on this connector with **RGB**, CVBS (PAL) and optional S-video.<br><br>Stereo left and right Audio shall also be provided. Wide-screen signalling is optional.<br><br>Selection between **RGB**, CVBS and S-Video (Y/C) may be via a user set-up menu.<br><br>See AS 4542.2,*Consumer television interfaces*, Part 2: *Analogue baseband*. (also known as Peritelevision or Euroconnector).<br><br>NOTE: If manufacturers choose to provide non-Euro-standard SCART connections with Y, Pb, Pr instead of G, B, R on pins 11, .7, 15 respectively, these should be prominently marked to avoid consumer confusion with non compatible equipment and consequent loss of picture quality. | AS 4542.2<br><br>ETSI TS 102 201 Section 4.9 – Table 1<br><br>EN 50049-1 | Optional for SD output |
| **16.3 Base-band audio connectors** | | | |
| **16.3.1** *Analogue audio* | See AS 4542.2. Dependant on receiver type – may be Cinch/RCA-phono or minature headphone jack on portables. | AS 4542.2 | All Receivers |
| **16.4 Digital{xe "Connectors - Digital"} program interfaces** | | | |
| **16.4.1** *Audio SP/DIF and/or Toslink:{ XE "Audio outputs - digital" }*<br>• PCM/AC-3 data bit-stream output<br>- Optical or electrical | S/PDIF digital audio output – electrical or optical (TOSLINK).<br><br>This digital interface may carry PCM stereo audio and/or AC3 coded audio and/or MPEG1-L2 audio streams to an external decoder multichannel sound system. | IEC 61937<br>IEC 60958 | Recommended for receivers with AC-3 decoders, otherwise optional |
| **16.4.2** *Uncompressed Digital Video outputs{xe "Video Interconnect, Uncompressed Digital"}* | For SD and HD formats using DVI {xe "DVI interconnect"}and uncompressed digital video interfaces and appropriate synchronising signals. | IEC 62315 | Optional |
| **16.4.3** *Digital program stream* | Transport or program stream. For example; to and from digital recorder or from satellite receiver<br>Use of IEEE-1394A or 1394B is proposed but a copy protection system may be required. | IEEE 1394{xe "IEEE 1394" \i} A/B | Recommended in premium receivers, otherwise, optional |
| **16.5 Common interface (CI){xe "Common interface (CI)"} connector** [24] | PCMCIA {xe "PCMCIA" \i}(PC-Card) socket(s) may be fitted. The PC-Card may be used for CA or other applications.<br><br>Pin assignments in accordance with EN 50221.<br><br>Support for modules of type 2, type 3 is optional.<br><br>Ease of viewer access is recommended as PC-Cards used in this connector may include a 'smartcard' holder. | EN 50221<br>CENELEC R206-001:1998<br>TS 101 699 | Recommended for receivers with interactive or data output capabilities |
| **16.5.1** *Additional CI slot* | PCMCIA{xe "PCMCIA" \i} (PC-Card) socket . | EN 50221 | Recommended in premium receivers, otherwise, optional |

24 Copy management and protection of CI transport stream interface currently under discussion in DVB forums.

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| **16.6 Smartcard slot(s){xe "Smartcard slot(s)"}** | For interactive applications including T-commerce{xe "CA—Conditional Access"} . | ISO 7816 (Series) | Optional |
| **16.6.1** *Additional smartcard slot* | Card interface Specifications are not yet finalised . | ISO 7816 | Optional |
| **16.7 Data connectors{xe "Data connectors"}** | Where fitted, options are the following: | AS 4542.3 | |
| **16.7.1** *Serial port For use with a PC or to connect to an external modem* | 9 pin D (RS-232) Female (DCE configuration) capable of connection to a PC or other external device.<br><br>Additionally or alternatively a Male (DTE) connection may be provided for connection to an external modem.<br><br>Otherwise the female (DCE) port could also be used to connect a modem but would require a 'NULL Modem' adapter or interconnect cable. If this option is intended to be available then the need for the adapter should be clearly indicated in the operating literature accompanying the unit. | AS 4542.3 | Optional |
| **16.7.2** *Parallel data port* | 25-pin D female IEEE 1284 possibly to be used by dedicated printer or other external devices. Such a facility is now considered superseded by USB. | AS 4542.3 | Optional |
| **16.7.3** *IEEE 1394A or 1394B* | This may provide interconnection between various components in an in-home digital network and carry two-way transport stream, program stream or data.<br><br>In the case of transport stream or program stream, the requirements of copyright protection could be applicable (also known as – FireWire{xe "FireWire" \i} or i.Link™).{xe "i.Link" \i} | AS 4542.3 ;<br>IEC 61883-1;<br>IEC 61883-4 1998-02;<br>IEEE 1394{xe "IEEE 1394"} A/B | Recommended in premium receivers, otherwise, optional |
| **16.7.4** *USB Port{xe "USB port" \i}* | May be future preferred home network interconnection for a cable, xDSL or cord-less phone type modem or peripherals items such as a keyboard, printer, external hard-disk etc.<br><br>If a USB port is fitted and the receiver includes interactive capabilities, the receiver should have installed or the ability to install, printer driver software. As a minimum, a generic ASCII text driver may be fitted which could be used for print-out of on-screen text derived from data in an interactive application such as DigitalTeletext. | USB | Optional |
| **16.7.5** *LAN Connection* | The receiver may as an additional or alternative feature be fitted with a physical or wireless network connection complying with IEEE 802 formats including IEEE 802.11b (wireless) or similar such as 'Bluetooth'. | IEEE 802 | Optional |

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| **17 RETURN CHANNEL{XE "RETURN CHANNEL"} PATH** | Some features of the 'return channel' are proposed be confirmed in an Australian 'Feature Set' for interactivity based on MHP.<br><br>The return channel may be implemented by a variety of methods at the manufacturers choice, which will typically provide a data path back to an IP address. | MHP<br><br>HAVi | Recommended |
| **17.1 Type of operation: Internal or External** | The access to a return channel may be via a data interface such as described in Section 15 above. In such cases the access may be via a wired or wireless connection to a cable or xDSL modem, or an inbuilt or external dial-up modem intended for connection to the PSTN, ISDN, GSM style or other. DVB-RCT (ETSI EN 301 958) is under consideration. | | Optional |
| **17.2 External Modem{xe "Modem"}** | If a port for an external modem is provided, the configuration may be either as a USB port or a standard serial data communications port on a D9 connector as detailed in 15.71 above and use standard 'Hayes AT' commands. | | Recommended |
| **17.3 Internal Modem{xe "Modem-internal"}** | Where fitted, a V92 (fast connect) is recommended. | ACA TS001 ACA TS002 | Optional |
| **17.4 Internal modem port connector** | RJ 11. | | Optional |
| **18 SYSTEM SOFTWARE REVISION{XE "SYSTEM SOFTWARE REVISION"}** | | | |
| **18.1 Ability to upgrade** | Ability to upgrade the operating software of a receiver is recommended. This may be used to correct operational 'bugs' and/or add new or improved features. DVB/ETSI have published a standard for digital receiver software upgrades, available from ETSI (TS 102 006).<br><br>Provision for revision of software is recommended as specified in TS 102 006 or using a method determined by the manufacturer. | TS 102 006 V1.2.1 | Recommended |
| **18.2 Receiver embedded identification{xe "Receiver embedded identification"}** | To identify model, software release etc. (e.g. for software upgrades, loading APIs). Use of an Organisational Unique Identifier (OUI) is recommended. | TS 102 006 V1.2.1 | Recommended |
| **18.3 Via DTTB transmission {xe "Data Download, for operating system"}** | Some broadcasters have indicated a willingness to provide the broadcast option for use throughout Australia.<br><br>Manufacturers and suppliers will need to negotiate with the broadcasters. Typical requirements would include that the download for the particular brand of receiver would not interfere with any other receivers. | TS 102 006 V1.2.1 | Recommended |
| **18.4 Other methods** | For example, Via PC to USB or RS-232 Serial port, IEEE 1284 parallel port, IEEE 1394{xe "IEEE 1394"}, CI slot or modem may be used. | | Alternative Recommend-ation |

| 19 MEMORY AND PROCESSOR REQUIREMENTS{XE "MEMORY REQUIREMENTS"} [25] | | | |
|---|---|---|---|
| **19.1 Ability to expand** | For upgraded future applications | | Optional |
| **19.2 Minimum Memory requirement** | Will depend on operating system interactivity and APIs. | | Informative |
| **19.2.1** *Video Memory* | Typically: 2 MByte for an SD video MPEG decoder<br><br>8 MByte for an HD video decoder. | | Informative |
| **19.2.2** *Non-volatile and Volatile for operation and applications* | Suggested minimum for MHP applications:<br><br>Profile 1 (enhanced): 8 + 16 MByte<br>Profile 1 and 2 (interactive): 16 + 32 MByte<br>Profile 1, 2 and 3 (Internet): 16 + 32 Mbyte. | | Informative for MHP equipped receivers |
| **19.2.3** *Other Storage* | {xe "PVR"}For TV-Anytime/Personal Video Recorder type applications, hard-disk drives may be fitted. In such cases encryption may be required so that recorded program material cannot be in a readable format if the drive is removed to another unit such as a PC. This requirement would be as an anti-piracy measure. | TV-Anytime<br><br>MHP | Informative |
| **19.3 Processor** | These figures are indicative only as performance may be determined by processor architecture.<br><br>Suggested minimum for MHP applications:<br>Profile 1 (enhanced): 100 MIP's<br>Profile 1 and 2 (interactive): 150 MIP's<br>Profile 1, 2 and 3 (Internet): 200 MIP's | | Informative for MHP equipped receivers |

25 Receiving equipment memory requirements{xe "Memory requirements"} include consideration for API operating system and upgrades; decoding of program material including MP @ HL pictures; audio (including advanced features for AC-3) and caption buffer sizes for synchronous presentation; decoding and display of OSDs and captions; Storage of 5 station minimum EPGs based on now/next schedules in EITs; 'housekeeping' items such as storage of tuning tables; Program interactive applications etc.

DRAFT

APPENDIX A

# DTTB RECEIVER RF SPECIFICATION

(Normative)

## A1 GENERAL

This receiver specification is used to define a notional receiver for emission and channel planning purposes.

## A2 RECEIVER TUNING RANGE

DTTB transmissions in Australia are based upon a 7 MHz channel spectrum plan for VHF Band III (174 – 230 MHz: channels 6 to 12), UHF Band IV (520 – 582 MHz: channels 27 to 35) and UHF Band V (582 – 820 MHz: channels 36 to 69). The transmissions are nominally centred in the channel with the exact location determined by the DTTB offset requirements. Refer to Appendix D, Table D1, for the channel frequencies.

## A3 CHANNEL OFFSETS

Where applied, the digital channel offsets{xe "Digital channel offsets" \i} referenced to the nominal 7 MHz channel centre frequency will be +125 kHz or –125 kHz. Refer to Table D1 for Australian DTV channel plan.

## A4 DVB-T MODES

The receiver shall be capable of correctly demodulating all COFDM non-hierarchical and hierarchical modes with both 2 K-carrier and 8 K-carrier operation specified in AS 4599 (as in EN 300 744).

The modes shall be detected automatically upon change. This is signalled by the TPS carrier information.

## A5 RECEIVER RF INPUT CONNECTOR and RETURN LOSS

At the RF input socket shall be an IEC female in accordance with IEC 60169.2, preferably with a return loss of better than 10 dB for the VHF or UHF channel being received.

## A6 RECEIVER NOISE FIGURE{xe "Receiver noise figure" \i}

(Measured at receiver RF 75 ohm input socket)

| | |
|---|---|
| VHF Band III | 6 dB max |
| UHF Band IV | 7 dB max |
| UHF Band V | 8 dB max |

The receiver NF should not exceed the above figures on any channel within the Bands indicated.

NOTE: Such Receiver NF performance is required in combination with the following C/N Threshold performance. Note also that, to obtain overall adequate performance, the lack of NF performance cannot necessarily be balanced or improved by a better C/N threshold performance than indicated below to obtain overall adequate performance.

## A7 CARRIER TO NOISE THRESHOLD PERFORMANCE

The receiver should have a minimum C/N threshold performance given in Table A1 for non-hierarchical modes with 2 K carrier or 8 K carriers operation. A receiver implementation margin loss for service planning purposes is included in the table and for example is assumed to be 3.5 dB for 64QAM with a FEC of 2/3. This margin loss is expected to decrease with time as technology improves.

**TABLE A1**

**C/N Threshold minimum performance for QEF reception**

| Modulation | Code rate | Gaussian | Ricean | Rayleigh |
|---|---|---|---|---|
| QPSK | 1/2 | 6.4 | 6.9 | 8.7 |
| QPSK | 2/3 | 8.2 | 9.0 | 11.7 |
| QPSK | 3/4 | 9.2 | 10.1 | 14.0 |
| QPSK | 5/6 | 10.2 | 11.3 | 16.5 |
| QPSK | 7/8 | 11.0 | 12.0 | 19.7 |
| 16QAM | 1/2 | 12.1 | 13.0 | 14.6 |
| 16QAM | 2/3 | 14.4 | 14.9 | 17.6 |
| 16QAM | 3/4 | 15.9 | 16.4 | 20.2 |
| 16QAM | 5/6 | 16.9 | 17.8 | 22.9 |
| 16QAM | 7/8 | 17.3 | 18.4 | 26.8 |
| 64QAM | 1/2 | 17.8 | 18.1 | 19.4 |
| 64QAM | 2/3 | 20.0 | 20.6 | 22.9 |
| 64QAM | 3/4 | 21.5 | 22.2 | 25.5 |
| 64QAM | 5/6 | 22.9 | 23.7 | 30.0 |
| 64QAM | 7/8 | 23.8 | 24.8 | 34.1 |

Note: Quasi Error Free (QEF) reception corresponds to a BER = $10^{-11}$ at the input to the MPEG-2 demultiplexer. This nominally corresponds to a BER = $2 \times 10^{-4}$ after Viterbi decoding.

## A8 MULTIPATH PERFORMANCE

The C/N threshold shall not increase by more than 10 dB above the C/N threshold performance defined in section B7, when the echo profile given in Table A2 is applied to a received signal with an operating mode of 64QAM, 2/3 FEC and a guard interval of 1/32.

**TABLE A2**

**Echo profile**

| Delay (μSec) | Relative attenuation (dB) |
|---|---|
| 0 | 2.8 |
| 0.05 | 0 |
| 0.4 | 3.8 |
| 1.45 | 0.1 |
| 2.3 | 2.6 |
| 2.8 | 1.3 |

## A9 SINGLE FREQUENCY NETWORK (SFN) PERFORMANCE

Single frequency networks are likely to produce both pre-echoes and post-echoes. To ensure the maximum potential for successful reception in an SFN environment the receiver shall have the same pre-echo and post-echo performance.

To ensure that guard intervals are fully utilised, the BER shall be better than $2 \times 10^{-4}$ after Viterbi decoding when the channel contains two static paths with a relative delay equal to the guard interval length, independent of the relative amplitudes and phases of the two paths and with no noise added.

## A10 SIGNAL LEVEL RANGE (at RECEIVER INPUT)

The minimum range the receiver is able to operate over shall be as follows:

(3 dBμV + NF + C/N) to 85 dBμV (−22 dBm)

where

NF = Noise figure of receiver; and

C/N = C/N threshold in a Gaussian environment.

Giving, for C/N thresholds of 20 dB (e.g. 64QAM, FEC 2/3)—

**VHF Band III** **29 dBμV to 85 dBμV**

**UHF Band IV** **30 dBμV to 85 dBμV**

**UHF Band V** **31 dBμV to 85 dBμV**

Giving, for C/N thresholds of approximately 6.5 dB (eg QPSK, FEC 1/2)—

**VHF Band III** **15.5 dBμV to 85 dBμV**

**UHF Band IV** **16.5 dBμV to 85 dBμV**

**UHF Band V** **17.5 dBμV to 85 dBμV**

## A11 RECEIVER SELECTIVITY

The transmission environment in Australia will have—

(a) 7 MHz channels with DVB-T services interleaved with PAL-B (with A2 sound carriers) services and other DVB-T services;

(b) DVB-T and/or PAL-B services on adjacent channels transmitted from one or more individual towers;

(c) DVB-T services with, typically, 3dB to 10dB less effective radiated power than the equivalent coverage PAL services in the same Band;

(d) Maximum levels of—

(i) up to eight (8)[26] PAL-B channels with an allowance up to 90 dBµV (–17 dBm) each; and

(ii) up to eight (8) DVB-T channels with an allowance up to 85 dBµV (–22 dBm) each.

The selectivity requirement are—

The nominal mode for the wanted service in the receiver selectivity specification is to be taken to be 64QAM with a FEC of 2/3.

To cater for the above conditions so as to provide QEF (quasi-error-free) output from the wanted DVB-T channel, the receiver selectivity shall be sufficient that:

When an upper or lower adjacent channel analogue service is up to—

1 37 dB on lower and 38 dB on the upper, greater than the DVB-T wanted channel with a level up to 50 dBµV;

2 tapering down to 10 dB higher than the DVB-T wanted channel with a level up to 85 dBµV.

When an upper or lower adjacent channel digital service is up to:

1 30 dB with higher than the DVB-T wanted channel with a level up to 50 dBµV;

2 tapering down to 10 dB higher than the DVB-T wanted channel with level up to 85 dBµV.

When an analogue service on another channel, including an image channel is up to:

1 46 dB with higher than the DVB-T wanted channel with a level up to 50 dBµV;

2 tapering down to 20 dB higher than the DVB-T wanted channel with a level up to 85 dBµV.

When a digital service on another channel, including an image channel is up to:

1 30 dB higher than the DVB-T wanted channel with a level up to 50 dBµV;

2 tapering down to 20 dB higher than the DVB-T wanted channel with a level up to 85 dBµV.

## A12 PROTECTION RATIOS

The receiver selectivity requirements have been derived from the protection ratios used for planning and are shown in Figure A1 and Table A3. The protection ratios has been extracted from recommendation ITU-R BT.1368 the *Planning Criteria for Digital Terrestrial Television Services in the VHF/UHF Bands*. (This document is now at revision 2 and will be further revised as more data becomes available)

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26 In areas of overlapping coverage. Typically six (6) channels would be encountered.

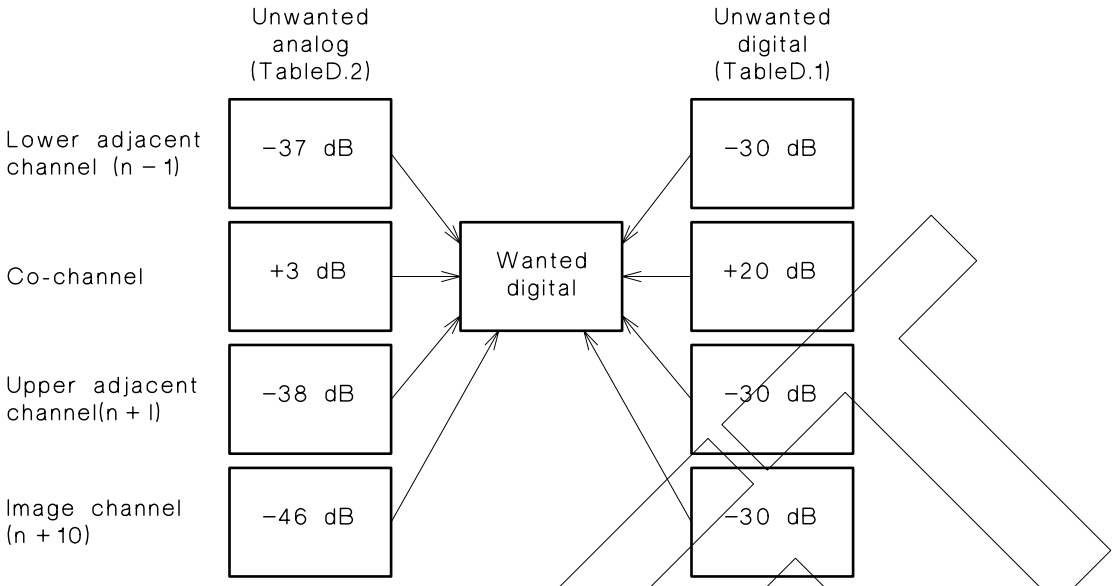


FIGURE A1 DIGITAL PLANNING PROTECTION RATIO

**TABLE A3**

**Protection Ratios (dB) For 7 MHz DVB-T Interfered with by7 MHz DVB-T**

| Parameter | Δf | Tropospheric | Continuous | Note or ITU table |
|---|---|---|---|---|
| Lower Image (n – Y) | | | –30 | Note 1 and 4 |
| Lower LO (n – X) | | | –30 | Note 2 and 3 |
| Lower Adjacent (n – 1) | –7 | | –30 | Note 1 |
| Co-channel (n) | 0 | | +20 | Table 6 |
| Upper Adjacent (n + 1) | +7 | | –30 | Note 1 |
| Upper LO (n + X) | | | –30 | Note 2 and 3 |
| Upper Image (n + Y) | | | –30 | Note 1 and 4 |

NOTE: The frequency difference (Δf) is the centre frequency of the wanted DVB-T signal minus the centre frequency of the unwanted DVB-T signal in megahertz (MHz).

The typical Australian situation is a dominant incoming signal with lower level delayed signals and thermal noise. This will normally be the case with directional antennas at roof level. In the case of a Single Frequency Network (SFN), the delay signals may also come from other transmitter sites.

Of the three types of propagation channels used of Gaussian, Ricean and Rayleigh; for fixed antenna reception, the Ricean channel figures have been adopted for planning.

Indoor reception is also common hence performance with Rayleigh complexity is important in the Australian market.

NOTES: (To Table A3):

1 For adjacent and image channel interference a protection ratio of –30 dB is assumed to be appropriate. This assumption is based on only one measurement, further studies are required

2 For overlapping channels, in the absence of measurement information the protection ratio should be extrapolated from the co-channel ratio Figure as follows.

3 PR = 20 + 10*$Log_{10}$ (Overlap (MHz)/7 (MHz))

4 PR= –30 dB should be used when the above formula gives PR < –30 dB.

5 Where X is the number of channels between the wanted channel and the channel affected by local oscillator (LO) interference. In the case of current Australian analogue planning X = 5.

6 Where Y is the number of channels between the wanted channel and the channel affected by image interference. In the case of current Australian analogue planning Y = 10.

Refer to 'Digital Terrestrial Television Broadcasting Planning Handbook including Technical and General Assumptions' Australian Broadcasting Authority. (Australian Broadcasting Authority website: http://www.aba.gov.au/)

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# APPENDIX B

# RANGE OF RECEIVERS AND RECEIVER BLOCK DIAGRAM

(Informative)

## TABLE B1

**Example Range Of Receiving Equipment{xe "Receivers - Examples of Range"}**

| | **Modular equipment units (STB)** | **Integrated receiver with display** |
|---|---|---|
| **Low cost with basic limited facilities** | Typically:<br>Low cost, may operate with existing 4:3 PAL TV; single tuner.<br>Outputs may include SD (S-Video{xe "S-Video"}, PAL baseband and RF); Mono or stereo audio output; CI card slot | Small TVs, portable TVs; single tuner; may have 16:9 display; single or dual speakers; CI card slot |
| | Range ↑ ↓ | Range ↑ ↓ |
| **Premium with full facilities** | Outputs may be HD RGB+HV, to feed hi-quality 16:9 display, and/or SD S-Video{xe "S-Video"}/Scart/PAL; Data and IEEE 1394{xe "IEEE 1394" \i} ports; CI card(s) and SmartCard slot(s);<br>May have modem, internal hard-disk storage, DVD, for example. | Hi-quality 16:9 display; May have several display modes for HD, progressive, line doubling for SD input; PIP; Digital and PAL tuner;<br>Full surround audio<br>Data and IEEE 1394{xe "IEEE 1394" \i} ports; CI card(s) and SmartCard slot(s); Modem{xe "Modem" \i} |

NOTES:

1 Modular equipment may be Set-top box style Integrated-Receiver-Decoders or plug-in PC card tuner-decoders.

2 PIP: Picture-in-Picture, STB: Set-Top-Box, (see Glossary in Appendix I.).

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Figure B1 gives an example of the components of the architecture of a typical digital terrestrial television receiver set-top-box.

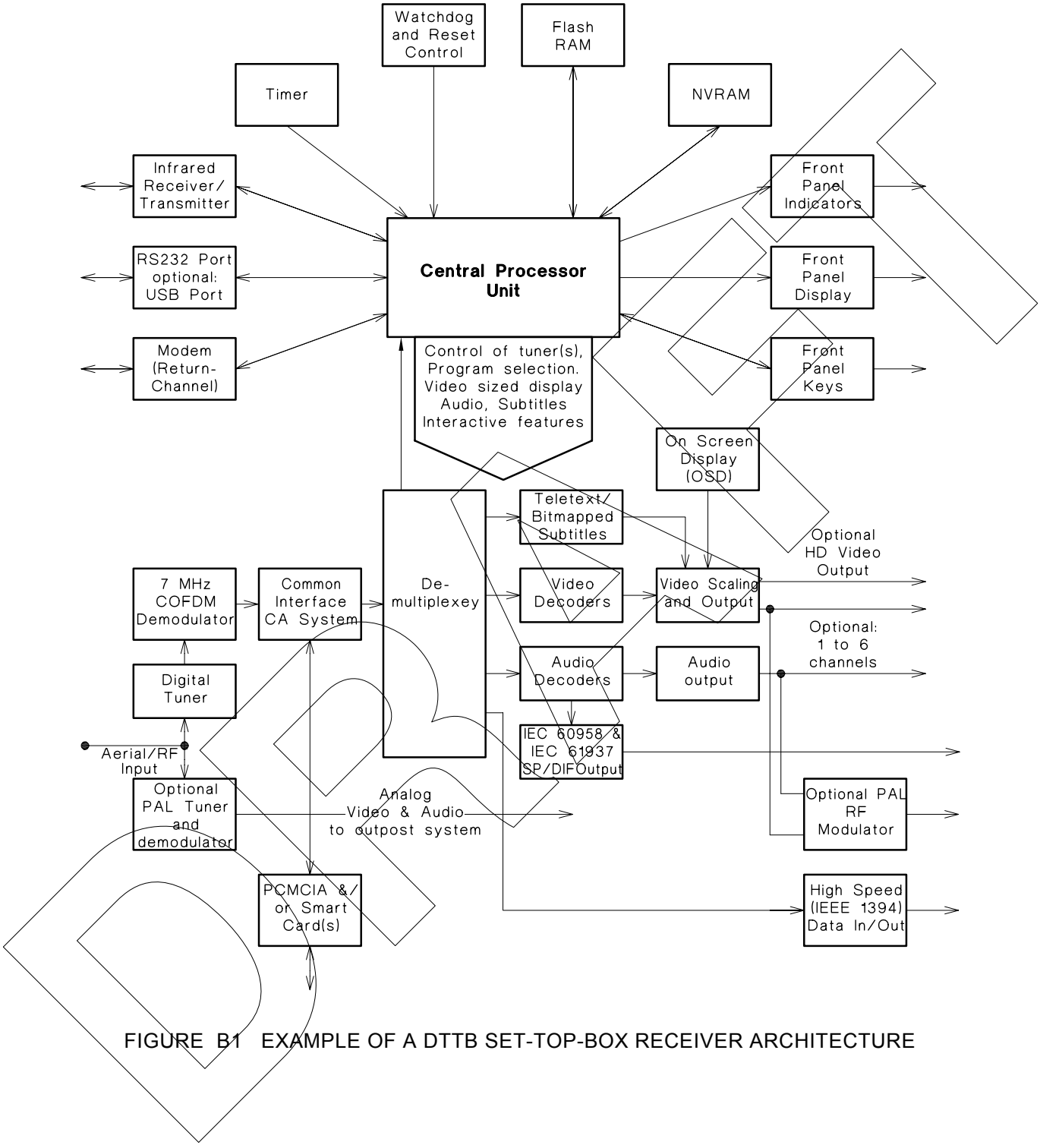


FIGURE B1 EXAMPLE OF A DTTB SET-TOP-BOX RECEIVER ARCHITECTURE

# APPENDIX C

# RECEPTION QUALITY OSD METER

(Informative)

Satisfactory reception of a digital terrestrial television emission is dependent upon total signal quality{xe "Signal quality meter" \i}. Satisfactory reception cannot be guaranteed on signal strength alone.

A tuning meter should not be activated by signal strength or AGC level alone. There are other effects such as multipath (ghosting) which even with a strong signal strength may result in error levels that renders the signal undecodable.

Figure C1 shows a suggested on-screen display (OSD) of decoding margin for use on DTTB receivers and decoding equipment to be used by either a technician or viewer.

NOTE: The display should be the result of both the received signal level and bit error rate prior to error correction, for the display to be meaningful in the DVB-T COFDM environment.

As an alternative, a manufacturer may choose to display the received signal level and bit error rate, prior to error correction, as side-by-side bar graphs. In any case however, a numerical scale is considered essential to quantify the reception quality as this will aid any reference back to the manufacturer or the broadcaster in cases of user inquiry.

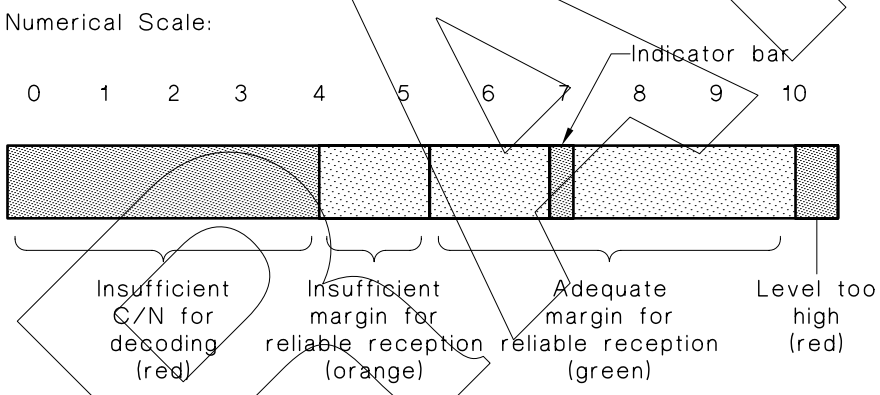


FIGURE C1 SUGGESTED ON-SCREEN DISPLAY OF DECODING MARGIN

This type of indicator will allow the following:

(a) Proper installation of fixed antennas.

(b) Alignment of portable or ‘rabbit ears’ antenna.

(c) Correct distribution system outlet levels.

APPENDIX D

# BROADCAST AND NON-BROADCAST BAND 7 MHz CHANNEL PLAN

(Normative)

## TABLE D1

**Australian Digital Television Broadcast Bands**
**Channel Numbers And Centre Frequencies (in MHz)**
**{xe "Frequency, channel centre"} (Where applicable, add or subtract 125 kHz offsets)**

| Digital channel | Nominal centre frequency MHz |
|---|---|
| | **BAND III** |
| 6 | 177.500 |
| 7 | 184.500 |
| 8 | 191.500 |
| 9 | 198.500 |
| 9A | 205.500 |
| 10 | 212.500 |
| 11 | 219.500 |
| 12 | 226.500 |
| | **BAND IV** |
| 27[5] | +++ 522.500 +++ |
| 28 | 529.500 |
| 29 | 536.500 |
| 30 | 543.500 |
| 31 | 550.500 |
| 32 | 557.500 |
| 33 | 564.500 |
| 34 | 571.500 |
| 35 | 578.500 |
| | **BAND V** |
| 36 | 585.500 |
| 37 | 592.500 |
| 38 | 599.500 |
| 39 | 606.500 |
| 40 | 613.500 |
| 41 | 620.500 |
| 42 | 627.500 |
| 43 | 634.500 |
| 44 | 641.500 |
| 45 | 648.500 |
| 46 | 655.500 |
| 47 | 662.500 |
| 48 | 669.500 |
| 49 | 676.500 |
| 50 | 683.500 |
| 51 | 690.500 |
| 52 | 697.500 |
| 53 | 704.500 |
| 54 | 711.500 |
| 55 | 718.500 |
| 56 | 725.500 |
| 57 | 732.500 |
| 58 | 739.500 |
| 59 | 746.500 |
| 60 | 753.500 |
| 61 | 760.500 |
| 62 | 767.500 |
| 63 | 774.500 |
| 64 | 781.500 |
| 65 | 788.500 |
| 66 | 795.500 |
| 67 | 802.500 |
| 68[6] | 809.500 |
| 69[6] | 816.500 |

## TABLE D2

### Overview of Australian Television Broadcast Bands– Television Channel Numbers And Frequency Limits (in MHz)

| | VHF, MHz | | UHF, MHz | | UHF, MHz |
|---|---|---|---|---|---|
| | **BAND I**[1] | | **BAND IV** | | **BAND V** |
| 0 | 45–52 | 27[5] | 520–526 | 48 | 666–673 |
| 1 | 56–63 | 28 | 526–533 | 49 | 673–680 |
| 2 | 63–70 | 29 | 533–540 | 50 | 680–687 |
| | | 30 | 540–547 | 51 | 687–694 |
| | | 31 | 547–554 | 52 | 694–701 |
| | **BAND II**[1] | 32 | 554–561 | 53 | 701–708 |
| 3 | 85–92 | 33 | 561–568 | 54 | 708–715 |
| 4 | 94–101 | 34 | 568–575 | 55 | 715–722 |
| 5 | 101–108 | 35 | 575–582 | 56 | 722–729 |
| | | | **BAND V** | 57 | 729–736 |
| | | 36 | 582–589 | 58 | 736–743 |
| | **BAND III** | 37 | 589–596 | 59 | 743–750 |
| 5A[2] | 137–144 | 38 | 596–603 | 60 | 750–757 |
| 6 | 174–181 | 39 | 603–610 | 61 | 757–764 |
| 7 | 181–188 | 40 | 610–617 | 62 | 764–771 |
| 8 | 188–195 | 41 | 617–624 | 63 | 771–778 |
| 9 | 195–202 | 42 | 624–631 | 64 | 778–785 |
| 9A[3] | 202–209 | 43 | 631–638 | 65 | 785–792 |
| 10[4] | 208–215 (old) | 44 | 638–645 | 66 | 792–799 |
| 10 | 209–216 (new) | 45 | 645–652 | 67 | 799–806 |
| 11[4] | 215–222 (old) | 46 | 652–659 | 68[6] | 806–813 |
| 11 | 216–223 (new) | 47 | 659–666 | 69[6] | 813–820 |
| 12[3] | 223–230 | | | | |

NOTES to Tables D1 and D2:

1 Television Bands I (Channels 0, 1 and 2) and Band II (Channels 3, 4 and 5) are not being considered for the introduction or ongoing transmission of digital television services.

2 VHF Channel 5A is currently within the broadcasting services bands (BSB) and has been recommended for clearance by the ABA and ACA to allow for the introduction of low earth orbiting (LEO) satellites. Channel 5A is not being considered for the introduction or ongoing transmission of digital television services.

3 Clearance of radio communication services from 202–208 MHz and from 222–230 MHz has allowed a revised channel arrangement to be implemented. The current channel arrangement has two new channels (channels 9A and 12). To accommodate channel 9A, channels 10 and 11 were shifted up in frequency by 1 MHz.

4 The majority of existing services on channels 10 and 11 were assigned using the superseded channel arrangement. Services on channels 10 and 11 may be required to shift in frequency to align with the current channel arrangement. Any such requirement will be considered on a case-by-case basis. New services on channels 10 and 11 will be assigned according to the current channel arrangement i.e. channel 10 (209–216 MHz) and channel 11 (216–223 MHz).

5 UHF television Channel 27 has a bandwidth of 6 MHz and, therefore, is not currently suitable for digital television services. The ABA and ACA are considering ways of making use of channel 27 as a 7 MHz channel. As a 6 MHz channel, channel 27 could possibly be suitable for use by non-broadcasting services, e.g. datacasting services.

6 The ABA and ACA are considering spectrum that may be re-allocated for non-broadcasting purposes due to the increased spectral efficiency with digital television. In particular the use of part, or the entire frequency band 806–820 MHz is under consideration. Where practicable the ABA will endeavour to avoid the use of channels 68 and 69.

7 These tables are reproduced from the ABA Digital Terrestrial Television Planning Handbook, Appendix E and AS 4542.

## TABLE D3

### Australian Television Non-Broadcast Bands Channel Numbers And Frequency Limits (in MHz)

| VHF—lower special channels | | UHF—special channels | | Band IV (non-broadcast) | |
|---|---|---|---|---|---|
| S2 | 111–118 | Cable distribution system pilot and control signals: 300–302 | | 20 | 470–477 |
| S3 | 118–125 | | | 21 | 477–484 |
| S4 | 125–132 | | | 22 | 484–491 |
| S5 | 132–139 | | | 23 | 491–498 |
| S6 | 139–146 | S21 | 302–309 | 24 | 498–505 |
| S7 | 146–153 | S22 | 309–316 | 25 | 505–512 |
| S8 | 153–160 | S23 | 316–323 | 26 | 512–519 |
| S9 | 160–167 | S24 | 323–330 | 27 | 519–526 |
| S10 | 167–174 | S25 | 330–337 | | |
| | | S26 | 337–344 | | |
| | | S27 | 344–351 | Band V (non-broadcast) | |
| VHF—upper special channels | | S28 | 351–358 | | |
| | | S29 | 358–365 | 70 | 820–827 |
| S11 | 230–237 | S30 | 365–372 | 71 | 827–834 |
| S12 | 237–244 | S31 | 372–379 | 72 | 834–841 |
| S13 | 244–251 | S32 | 379–386 | 73 | 841–848 |
| S14 | 251–258 | S33 | 386–393 | 74 | 848–855 |
| S15 | 258–265 | S34 | 393–400 | 75 | 855–862 |
| S16 | 265–272 | S35 | 400–407 | | |
| S17 | 272–279 | S36 | 407–414 | | |
| S18 | 279–286 | S37 | 414–421 | | |
| S19 | 286–293 | S38 | 421–428 | | |
| S20 | 293–300 | S39 | 428–435 | | |
| | | S40 | 435–442 | | |
| | | S41 | 442–449 | | |
| | | S42 | 449–456 | | |
| | | S43 | 456–463 | | |
| | | S44 | 463–470 | | |

APPENDIX E

# AUSTRALIAN PARENTAL GUIDANCE CODES{xe "Parental guidance codes" \i}

(Normative)

## E1 General

Recommended on-screen-display{xe "On-screen-display"} for parental guidance codes transmitted within DVB-SI EIT information using the DVB parental_rating_descriptor.{xe "Parental_rating_descriptor"}

**TABLE E1**

**Australian Parental Guidance Codes**

| | | | **Receiver menu set-up and Suggested OSD wording for setting blocking (Restriction of access)** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Block All** | **Block G and above (optional)** | **Block PG and above** | **Block M and above** | **Block MA and above** | **Block AV and above** | **Block R and above** | **No Block** |
| **Transmitted rating hex code** | **Australian parental guide code** | **On-screen display** | **Resultant receiver action to received hex code ✓ is show program —X is block until PIN entered** | | | | | | | |
| 0 × 00 | Not Classified | - | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 0 × 01 | | - | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **0 × 02** | **P Pre school** | **P** | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 0 × 03 | | P | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **0 × 04** | **C Children's** | **C** | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 0 × 05 | | C | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **0 × 06** | **G General** | **G** | X | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 0×07 | | G | X | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **0 × 08** | **PG Parental Guidance Recommended** | **PG** | X | X | X | ✓ | ✓ | ✓ | ✓ | ✓ |
| 0 × 09 | | PG | X | X | X | ✓ | ✓ | ✓ | ✓ | ✓ |
| **0 × 0A** | **M Mature Audience 15+** | **M** | X | X | X | X | ✓ | ✓ | ✓ | ✓ |
| 0 × 0B | | M | X | X | X | X | ✓ | ✓ | ✓ | ✓ |
| **0 × 0C** | **MA Mature Adult Audience 15+** | **MA** | X | X | X | X | X | ✓ | ✓ | ✓ |
| 0 × 0D | | MA | X | X | X | X | X | ✓ | ✓ | ✓ |
| **0 × 0E** | **AV Adult Audience, Strong violence 15+** | **AV** | X | X | X | X | X | X | ✓ | ✓ |
| 0 × 0F | R Restricted 18+ | R | X | X | X | X | X | X | X | ✓ |

NOTES: (To Table E1):

1 The parental guidance set-up in a receiver allows the user to set a maximum parental guidance rating level so that the receiver will only show programs below that level while a PIN number controls access to higher level programs.

2 The OSD column in the above table should be used in the parental guidance fields of the receiver's displayed electronic program guide.

3 In the case of $0 \times 00$ and $0 \times 01$, a dash should be displayed.

4 The rows shown in **Bold** characters show the codes that are expected to be in transmissions but receivers should react to all codes.

5 The inclusion of a 'Block G and above' function as shown the above table in the receiver's OSD is optional.

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# APPENDIX F

# TELETEXT FORMAT FOR CLOSED CAPTION TRANSMISSIONS

(Normative)

The following details the specifications that are being used in Australia for carrying Closed Captions in a Teletext Data stream on a 625/50 analogue video signal. These specifications are in addition to those detailed in the ITU-R System B Teletext Standards. Therefore where Teletext based Closed Captions are used for DTTB transmissions in Australia these specifications should be used in addition to those detailed in the ITU-R document and also those in ETSI EN 300 472 (Digital Video Broadcasting (DVB) Specification for conveying ITU-R System B Teletext in DVB bitstreams.)

In addition to normal pre-produced Closed Captions, Teletext is also used in Australia for so called 'Live Captions'. Such captions may be displayed with additional words being displayed near existing words or as a complete new row replacing a previous row which would then 'scroll upwards', or in some similar manner. To ensure optimum display of such Live Captions on a DTTB receiver the details listed below, Item (h) should be noted.

| | | |
|---|---|---|
| (a) | TV Data Lines | Lines 21 and 334 are exclusively used for teletext closed captions |
| (b) | Data Line 'Dummy Headers' | During transmission of Closed Captions lines 21 and 334 should always contain Teletext information. This should consist of so called 'dummy header rows' between transmissions of actual teletext rows containing closed caption data. The 'null page address' of such dummy header rows may be either FF 3F 7F or FE 3F 7F.<br>Refer to CTVA OP42 '*Distribution, Transmission, and Monitoring of Closed Captions on Line 21/334*' |
| (c) | Magazine and Page Address | Magazine 8 shall be used and reserved for Closed Caption transmissions.<br>Page 801 should be used for the English version of a Closed Caption service. |
| (d) | Double Transmission of Caption Data | Closed Caption data may be transmitted twice to reduce the possibility of reception errors.<br>On the first transmission control bit C8 should be set to 1 whilst on the second transmission it should be set to 0. |
| (e) | Magazine Parallel Transmission | Control Bit C11 shall be set to 0 (Parallel mode transmission) for both the Closed Caption and any other Teletext service that may be carried on the same (analogue) video signal. This is necessary to ensure compatibility between the two (or more) Teletext transmissions. |
| (f) | Sub-title Indicator Bit | Control Bit C6 shall be set to 1. |
| (g) | Interrupted Sequence Bit | Control Bit C9 shall be set to 1. |
| (h) | Live Closed Captions | For Live Closed Captions it shall not be necessary for the erase page bit C4 to be set to 1 between the transmissions of caption data. |
| (i) | Character Height | Australian Closed Captions may use the 'double height' Teletext character set for visibility reasons. |

APPENDIX G

# 50 Hz HD and SD PICTURE TIMINGS PARTICULARLY RELATED TO SCAN RATES FOR CRT BASED DISPLAYS{xe "CRT Scan Rates for HD"}

(Normative and Informative)

## G1 Introduction—Receivers and Displays

This Appendix deals with advice to manufacturers of Set-Top-Boxes (STB), Digital Terrestrial Television (DTT) receivers and display equipment. Recommended picture timings and scan-rates are given for 50 Hz based High-Definition (HD) picture formats at 1080i, 720p and 576p, as broadcast on Australian DTT.

Because STBs with HD decoding will be connected to a range of display types, including scanning displays (CRTs), and fixed pixel format displays that use digital 'scaling' technologies, manufacturers are recommended to adopt specifications given in this Appendix to maintain optimum picture quality and avoid consumer equipment compatibility problems.

Both analogue and digital interconnect interfaces are detailed in the recommended scan timings for display of 50 Hz based HD and SD formats.

Of special note is a recommended scanning set for 1080i50, 720p50 and 576p50 HD broadcasts, based on more economic CRT-based HD-capable displays using 100 Hz CRT television architecture with fixed 31.25 kHz scan, as detailed in Paragraph H3 and Tables G2 and G3. These CRT-friendly HD display formats are derived from the ITU-R BT.1358 standard, specifically intended for Consumer Electronic (CE) manufacturers who wish to provide a simple cost effective HD CRT display solution that avoids the variations in horizontal scan frequencies encountered in studio and professional equipment.

HD capable STBs are recommended to have analogue and/or digital HD output interconnect options as detailed in Item 15 of Clause 3.1. The formats of those outputs for all video modes are detailed in this Appendix.

The HD video output formats should be able to be switched between 'native' or CRT-friendly formats, (a user-accessible hardware switch is recommended). HD capable STBs are also recommended to have separate SD analogue outputs. Because it is unlikely in a single tuner receiver, for a user to have separate SD and HD displays connected to a STB, it is a manufacturer's choice whether their STB has circuitry so that both the HD and SD outputs operate continuously, or the hardware switching provides either SD or HD output operation.

## G2 Professional and Studio 'Native' Video Formats

There are several different 50 Hz video formats for HD, which if displayed as professional broadcast studio formats would require a CRT based display to be able to switch to four different scan frequencies, as shown in Table G1. The use of these formats is only recommended in professional equipment and as added capability in CE equipment intended for non CRT-based displays.

**TABLE G1**

**Native Horizontal Scan Rates for CRT Based Professional Displays**

| Active lines | Total lines including VBI | Format | Frame rate, per second | Horizontal scan frequency | Pixel frequency |
|---|---|---|---|---|---|
| 576i | 625 | SD 576 50i | 25 (50i) | **15.625 kHz** | 13.50 MS/s |
| 576p | 625 | HD 576 50p | 50 p | **31.250 kHz** | 27.00 MS/s |
| 720p | 750 | HD 720 50p | 50 p | **37.500 kHz** | 74.25 MS/s |
| 1080i | 1125 | HD 1080 50i/25pSf | 25 (50i) | **28.125 kHz** | 74.25 MS/s |

## G3 Consumer Equipment Formats for CRT-based Displays

For consumer CRT based '50 Hz HD Input' products, a potentially cost-effective solution is shown in Table G2 and recommended for the display of both SD and HD pictures using the existing '100 Hz' TV architecture based on a fixed 31.250 kHz scan frequency and a 32 µs scan line period.

The picture quality of the three possible 50Hz HD modes is maintained and no rescaling of 1080i50 video is needed although a simple scaling in the STB of the 720p50 mode is required. Displays will need to have a nominal vertical zoom mode for correct geometry of 1080i50, which is easily recognised when the synchronising signal formats detailed in Table G4 are used.

This 'HD CRT' mode is intended as a low cost solution to be implemented in both STBs and displays through CRT based '100 Hz' televisions (possibly fitted with an analogue tuner). Also, integrated digital television receivers (iDTVs), with 100Hz displays may incorporate these scanning formats, which would have the additional benefit that HD A/V inputs could be provided for other advanced consumer products such as 576p50 DVD players. These 50 Hz HD interconnect formats essentially become a common format for uncompressed video of (576p) 625 total lines progressive scan or (1152i) 1250 total lines interlaced. Some CRT television manufacturers have indicated their 'HD Input' CRT televisions will support 'HD Native' modes (Table G9) while European CRT television manufacturers will support 'HD CRT' modes as shown in Table G2.

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## TABLE G2

**Possible Consumer HD CRT Display Modes and Interconnect Format for 50 Hz SD and HD Using a Single 31.250 kHz Horizontal Scan Frequency**

| Received format | Read-out at | Displayed active lines | Total lines including VBI | Vertical scan rate | Horizontal scan frequency |
|---|---|---|---|---|---|
| SD 576 50i | SD Progressive (preferred) | 576p | 625 | 50 Hz | 31.250 kHz |
| | SD @ 100 Hz | 576 | 625 | 100 Hz | |
| | SD @ 75 Hz | 768 | 833 | 75 Hz | |
| | SD Line doubled | 1152 | 1250 | 50 Hz | |
| HD 576 50p[27] | Native | 576p | 625 | 50 Hz | 31.250 kHz |
| HD 720 50p | 8/5 vertical upscale 720p line to 1152i line | 1152i | 1250 | 50 Hz | 31.250 kHz |
| | or, (not preferred) | | | | |
| | 4/5 vertical downscale 720 line to 576 line | 576p | 625 | | |
| HD 1080 50i Or HD 1080 25pSf | 1080i (1250) (‘1080i letterboxed in 1152i’ - 1250 line total) through faster MPEG memory line readout, longer vertical interval | 1080i | 1250 | 50 Hz | 31.250 kHz |

The ‘1080i letterboxed in 1152i’ 1250 line total solution shown in Table G2 results in no potential loss in picture quality and explained in detail through out this Appendix.

Table G3 shows a more complete list of timings for various SD and HD formats as found in broadcast studios. It should be noted that studio implementation of 1080 × 50i also includes an exceptionally long horizontal blanking interval.

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[27] 720 × 576p @ 50 Hz is also used by PAL Progressive Scan DVD players.

## TABLE G3

## DIGITAL TV TIMING PARAMETERS—50 Hz DISPLAY FORMATS{xe "HD 576p"}

| System parameters | 'HD Native Mode' Formats as used in Broadcast Studios | | | | 'HD CRT' modes for CRT Displays (31.250 kHz) | | |
|---|---|---|---|---|---|---|---|
| | SD **625 line** 720 × 576 × 50i | HD **625 line** 720 × 576 × 50p | HD **750 line** 1280 × 720 × 50p | HD **1125 line** 1440 or 1920 × 1080 × 25p/50i | HD **625 line** 720 × 576 × 50p | HD **1250 line** 1280 × 1152 × 50i | HD **1250 line** 1920 × 1080 × 50i |
| Format Description | Standard Definition 576i | High Def 576p | High Def 720p | High Def 1080i | High Def 576p | High Def 1152i | High Def 1080i (1250) |
| Transmitted as MPEG in DVB-T | Yes | Yes | Yes | Yes | Yes | No | No |
| Possible use for interface or display | SD Display Format | Display format: STB to Matrix or CRT display interconnect via Y, Pb, Pr or RGB+HV interface | | | Display format: STB to CRT only display interconnect via Y, Pb, Pr or RGB+HV interface | | |
| Y Sync on Y, Pb, Pr - see Note 1 | **bi-level** | **bi-level** | tri-level | tri-level | **bi-level** | **bi-level** | **bi-level** |
| Picture (Frame) Rate Frame/sec | 25 | 50 | 50 | 25 | 50 | 25 | 25 |
| Display (Field) Rate/sec | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| Interlace or Progressive, Segmented frame transmit (interlace display) | i | P | P | i (pSf) | P | i | i |
| Lines in Active Picture | 576 | 576 | 720 | 1080 | 576 | 1152 | 1080 |
| Total lines per frame | 625 | 625 | 750 | 1125 | 625 | 1250 | 1250 |
| Total vertical interval – lines | 29.5 + 29.5 | 49 | 30 | 22.5 + 22.5 | 49 | 49+49 | 85+85 |
| Active Picture pixels per line | 720 | 720 | 1280 | 1920 | 720 | 1280 | 1920 |
| Total pixels per line | 864 | 864 | 1,980 | 2,640 | 864 | 1,536 | 2,304 |
| Sample Clock Freq MHz | 13.5 | 27 | 74.25 | 74.25 | 27 | 48 | 72 |
| Bits per clock sample- Y+0.5(Cr+Cb) | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Un-compressed Mbit/sec | 270 | 540 | 1,485 | 1,485 | 540 | 960 | 1,440 |
| Horizontal. Blanking width Pixels | 144 | 144 | 700 | 720 | 144 | 256 | 384 |
| Horizontal. Blanking % of total line | 16.7% | 16.7% | 35.4% | 27.3% | 16.7% | 16.7% | 16.7% |
| Horizontal. Line period µs | 64 | 32.00 | 26.67 | 35.56 | 32.00 | 32.00 | 32.00 |
| Horizontal. Active line period µs -Note 2 | 53.33 | 26.67 | 17.24 | 25.86 | 26.67 | 26.67 | 26.67 |
| Horizontal. Blanking period µs | 10.67 | 5.33 | 9.43 | 9.70 | **5.33** | **5.33** | **5.33** |
| Horizontal-Scan: % Variance to 31250 Hz | 50% | 100% | 120% | 90% | 100% | 100% | 100% |
| Horizontal Scan Frequency Hz | 15,625 | 31,250 | 37,500 | 28,125 | **31,250** | **31,250** | **31,250** |

NOTES:

1 For 'HD CRT' modes @ 31.25kHz, 'bi-level' sync is recommended on interconnect interfaces. Analogue component Y, Pb, Pr with 'bi-level' sync (-300 mV) on Y complies with ITU-R BT.1358 standard while Y, Pb, Pr with 'tri-level' sync (+/- 300 mV p-p) on Y complies with EIA 770.3 standard.

2 Standard 625 line PAL is nominally 702 pixels or 52 µs. 53.33 µs is for 720 pixels active picture. Similarly for 576 x 50p the active picture is assumed to be 720 pixels wide giving an active picture time of 26.67 µs.

### G3.1 720p Picture conversion to 1152i @ 31.250kHz for CRT Displays

1280 × 720p@50 Hz is up-converted (8/5 vertical upscale) and interlaced by the STB to 1280 × 1152i@50 Hz using the nominal '100 Hz' CRT timings of 31.250 kHz line frequency with no perceptible loss of video quality.

An alternative of 5/4 down-converted 720p to 576p could be used but it is less recommended as this results in loss of vertical video resolution.

### G3.2 1080i displayed in 1250 line total @ 31.250kHz for CRT Displays{xe "HD 1080i in 1250"}

1080i is 'letterboxed' (i.e. 36 top + 1080i + 36 bottom) by the STB in 1152i active/1250 total lines raster. This is known as the 1080i(1250) display format. Note that the 1080i active lines are NOT scaled to 1152 active lines but letterboxed.

Because the compressed MPEG signal does not include the horizontal and vertical blanking period signals, these have to be reconstructed in the receiver MPEG decoder memory readout and this allows for different timings, blanking intervals and VBI lines, while avoiding processing or scaling the active video.

The readout of the MPEG line store memory is faster than in 'native mode – i.e at 31.25kHz (32µs per line) instead of 28.125kHz (35.56µs per line). This results in extra time being available for more VBI lines including the extra 36 + 36 active black lines that are added to the vertical flyback or vertical over-scan. The line frequency, now at 31.250 kHz, is the horizontal scan frequency standard for PAL '100 Hz' CRT applications.

Reducing the number of clock pulses (also by the STB) from 2640 to 2304 reduces the horizontal flyback and blanking period from 9.70 µs to 5.33 µs. A horizontal flyback time between 5.33 µs and 6.00 µs is considered ideal for CRT television applications. In effect the excess time that was present in the 'native' 1080i horizontal blanking interval has been 'collected' and added to the vertical interval.

The display device is then required to increase the CRT scan height (+6.7% vertical over-scan) to correct picture geometry. Automatic vertical over-scan for 1080i(1250) video can be achieved by measuring the V-sync length on Y, Pb, Pr or sync polarity on RGB+HV as detailed in section H3.4.

### G3.3 1152i and 1080i(1250) 31.250kHz display formats—IMPORTANT DESIGN NOTES

Video timings for 1152i and 1080i(1250) are derived from the 576p (ITU-R BT.1358) standard. The most important deviations from the 576p (and SMPTE295M) standard are as follows:

(a) These formats have an even number of total lines per frame (625x2=1250) that do not provide a naturally interlaced scanning raster. Therefore the frame must be split in two unequal fields of 624.5 and 625.5 lines (refer Figure G2) and a DC coupled vertical raster deflection circuit is required.

(b) Y, Pb, Pr vertical sync occurs in the first half of Line 1 and in the second half of Line 625 (refer Figure G2).

(c) Y, Pb, Pr vertical sync is 13.67µs (refer Figure G1 and Table G6).

(d) Y, Pb, Pr sync is a bi-level sync (refer Figure G1 and Table G6).

(e) 1080i (1250) RGB+HV horizontal and vertical syncs are opposite polarity (refer Table G4).

### G3.4 How does a 31.250kHz HD CRT display distinguish between 576p(625), 1152i(1250) and 1080i(1250) video?

HD-STB's that output 576p/1152i/1080i(1250) video also provide a simple method for fixed 31.250kHz HD CRT displays to distinguish between full screen 576p/1152i video and letterboxed 1080i(1250) video that enables the display to automatically zoom (+6.7% vertical over-scan) the 1080i(1250) video and remove the letterbox bars. The following details a simple method for identifying 1080i(1250) video via Y, Pb, Pr and RGB+HV interfaces.

**G3.4.1** *Analogue Y, Pb, Pr interface*

As per Figure G1 and Table G6, Y, Pb, Pr vertical sync lengths on 'Y' are as follows:

(a) 576p vertical sync on 'Y' = 5 lines long.

(b) 1152i vertical sync on 'Y' = 5 lines long.

(c) 1080i(1250) vertical sync on 'Y' = 1/2 line long.

The display can identify the HD video type by measuring the v-sync length on 'Y' using an RC filter circuit that can be used to trigger the 6.7% vertical zoom circuit for 1080i(1250) video.

**G3.4.2** *Analogue RGB + HV/DVI interface*

Normally, RGB + HV horizontal and vertical sync are always the same polarity. By using opposite horizontal and vertical sync polarity for 1080i(1250) video, the display can identify 1080i(1250) and trigger the 6.7% vertical zoom circuit.

**TABLE G4**

**Zoom Truth Table for Y, Pb, Pr V-sync on 'Y' and RGB+HV sync polarity**

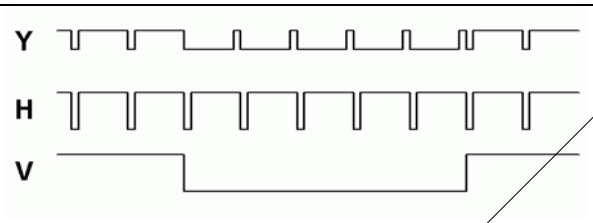
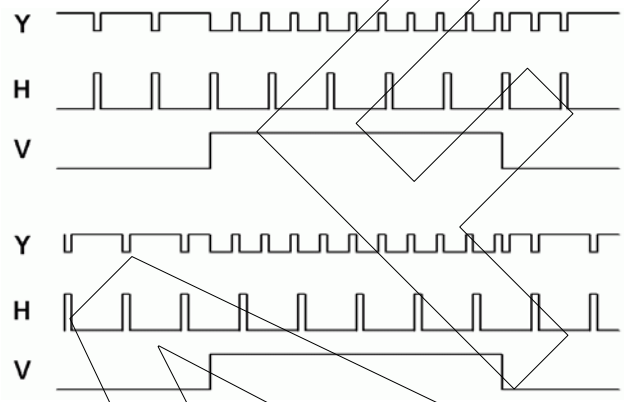
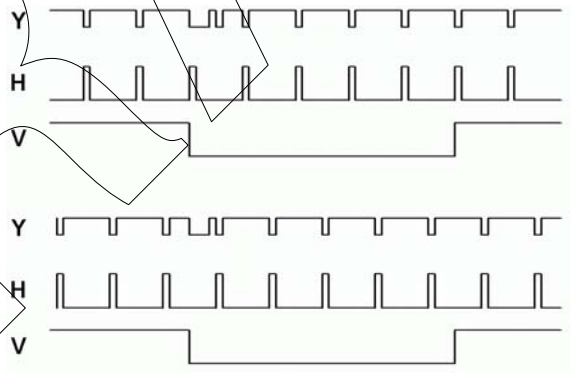
| | Y, Pb, Pr (bi-level sync on 'Y') | RGB+HV | 6.7% Vertical Zoom |
|---|---|---|---|
| 576p (625) | V Sync: 5 lines, 160µs | H and V Sync: Same Polarity | No |
| 1152i (1250) (up-scaled 720p) | V Sync: 5 lines, 160µs | H and V Sync: Same Polarity | No |
| 1080i (1250) (1080i letterboxed in 1152i) | V Sync: 1/2 line, 13.67µs | H and V Sync: *Opposite Polarity* | Yes |

## G4 Synchronising Waveform and Timing Details for 'Native' and CRT-based HD Formats

Table G5 gives a notional view of how a display can distinguish between the various 31.25 kHz based HD formats through the examination of the sync waveforms. This detail is further expanded in Figures G1 and G2 and Table G6.

## TABLE G5

### Notional view of sync waveforms: 576p, 1152i and 1080i(1250)

| | Y, Pb, Pr (bi-level sync on 'Y')/RGB+HV |
|---|---|
| **576p (625 total)** ITU-R BT.1358 |  NOTES:<br>1 Y, Pb, Pr: 5 lines of vertical sync; 160 µs<br>2 RGB+HV: HandV sync same polarity |
| **1152i (1250 total)** (for up-scaled 720p) |  NOTES:<br>1 Y, Pb, Pr: 5 lines of vertical sync; 160µs<br>2 RGB+HV: HandV sync same polarity |
| **1080i (1250 total)** (for 1080i letterboxed in 1152i) |  NOTES:<br>1 Y, Pb, Pr: 1/2 line of vertical sync; 13.67 µs<br>2 RGB+HV: HandV sync opposite polarity |

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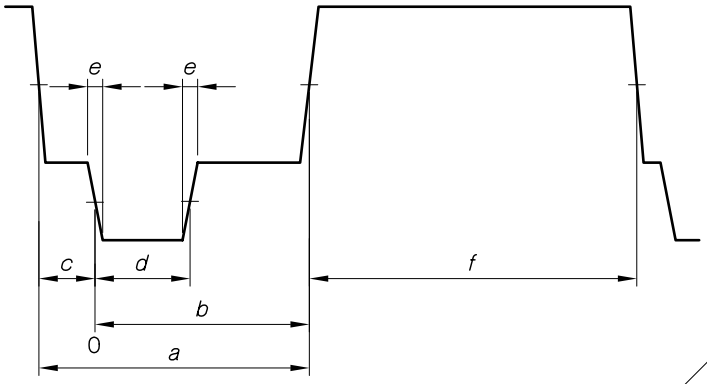
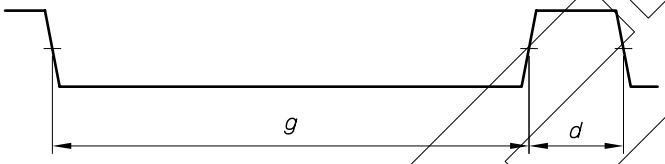
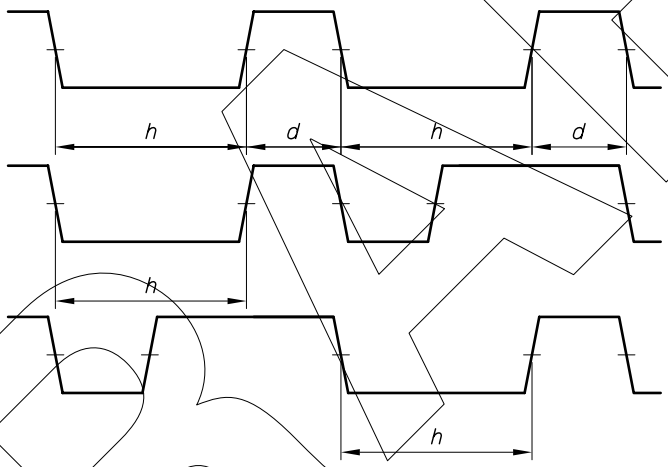



(a) One line 576p 1080i(1250) and 1152i




(b) Vertical sync 576p




(c) Vertical sync 1152i and 1080i(1250)

FIGURE G1 LINE TIMINGS AND CLOCKS FOR 31.25 KHZ HD FORMATS

## TABLE G6

### line timings and clocks for 31.25 kHz HD formats

| | **720 × 576p** | | **1280 × 1152i (for up-scaled 720p)** | | **1920 × 1080i (1250) (for 1080i letterboxed in 1152)** | |
|---|---|---|---|---|---|---|
| Line frequency (kHz) | **31.250** | | **31.250** | | **31.250** | |
| Sample clock frequency (MHz) | 27 | | 48 | | 72 | |
| | (clocks) | (µs) | (clocks) | (µs) | (clocks) | (µs) |
| Total # pixels | 864 | 32.00 | 1536 | 32.00 | 2304 | 32.00 |
| A | 144 | 5.33 | 256 | 5.33 | 384 | 5.33 |
| B | 132 | 4.89 | 235 | 4.90 | 352 | 4.89 |
| C | 12 | 0.44 | 21 | 0.44 | 32 | 0.44 |
| D | 63 | 2.33 | 112 | 2.33 | 168 | 2.33 |
| E | 2 | 0.074 | 4 | 0.083 | 4 | 0.055 |
| F | 720 | 26.67 | 1280 | 26.67 | 1920 | 26.67 |
| G | 801 | 29.67 | | | | |
| H | | | 656 | 13.67 | 984 | 13.67 |

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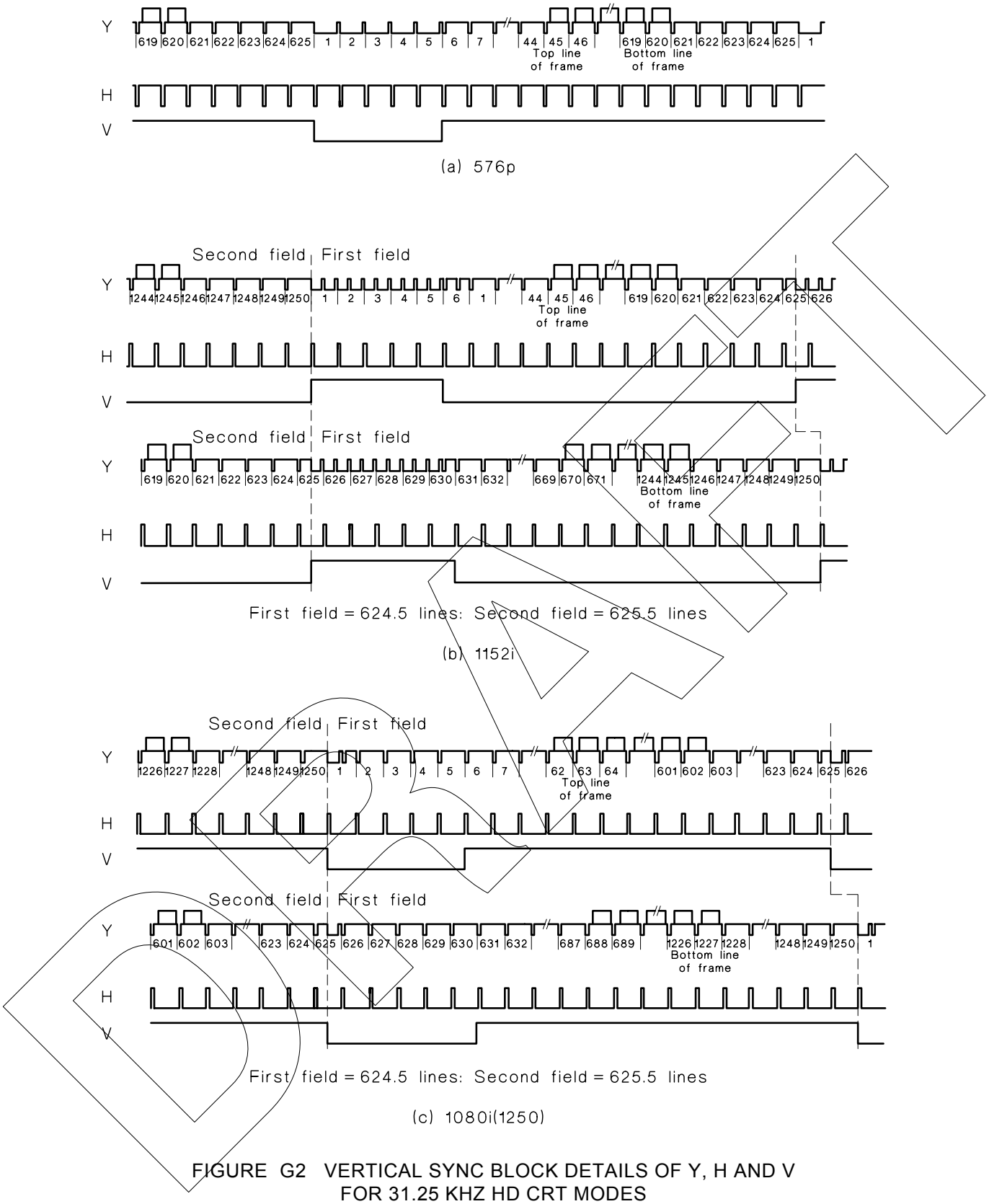


FIGURE G2 VERTICAL SYNC BLOCK DETAILS OF Y, H AND V FOR 31.25 KHZ HD CRT MODES

## TABLE G7

## HD CRT Timing Parameters for 31.250 kHz CRT display devices

| | **720 × 576 @ 50p** (same as 'native') | **1280 × 1152 @ 50i** (up-scaled 720p) | **1920 × 1080(1250) @ 50i** (1080i letterboxed in 1152) |
|---|---|---|---|
| Max. active pixels | 720 | 1280 | 1920 |
| Min. blanking pixels | 144 | 256 | 384 |
| Total pixels | 864 | 1536 | 2304 |
| Pixel frequency | 27.00 MS/s | 48.00 MS/s | 72.00 MS/s |
| Line frequency | **31250 Hz** | **31250 Hz** | **31250 Hz** |
| Max. active line time | 26.67 µs | 26.67 µs | 26.67 µs |
| Min. hor. Flyback time | 5.33 µs | 5.33 µs | 5.33 µs |
| Total line time | **32.00 µs** | **32.00 µs** | **32.00 µs** |
| Min. active pixels | 702 | 1248 | 1872 |
| Min. active line time | 26.00 µs | 26.00 µs | 26.00 µs |
| Max. hor. blanking time | 6.00 µs | 6.00 µs | 6.00 µs |
| Min. visible pixels | 661.5 | 1176 | 1764 (See Note 1) |
| Min. visible line time | 24.50 µs | 24.50 µs | 24.50 µs |
| Max. blanking + overscan | 7.50 µs | 7.50 µs | 7.50 µs |
| Scanning raster | Progressive | Interlaced | Interlaced |
| Active lines | 576 × 1 | 576 × 2 | 540 × 2 |
| Blanking lines | 49 × 1 | 49 × 2 | 85 × 2 (See note 2) |
| Total lines | 625 × 1 | 625 × 2 | 625 × 2 |
| Line frequency | 31250 Hz | 31250 Hz | 31250 Hz |
| Field frequency | 50 Hz (p) | 50 Hz (i) | 50 Hz (i) |
| Frame frequency | 50 Hz | 25 Hz | 25 Hz |
| Active field time | 18.43 ms × 1 | 18.43 ms x 2 | 17.28 ms x 2 |
| Vertical flyback time | 1.57 ms × 1 | 1.57 ms × 2 | 2.72 ms x 2 |
| Total filed time | 20.00 ms × 1 | 20.00 ms × 2 | 20.00 ms × 2 |
| Min. visible lines | 543 × 1 | 543 × 2 | 509 × 2 |
| Min. visible field time | 17.38 ms × 1 | 17.38 ms × 2 | 16.29 ms × 2 |
| Max. blanking + overscan | 2.62 ms × 1 | 2.62 ms × 2 | 3.71 ms × 2 |

NOTES:

1 Maximum Overscan: Of the 1920 active pixels, a minimum of 1872 must be active, of which 1764 will be visible. 48 pixels may be sacrificed to mask the inevitable edge artefacts of digital video processing, (eg. FIR filters, scalers, motion compensation, etc.). Therefore, the maximum overscan is 156 pixels.

2 1080i active lines with 36 lines of black added top and bottom i.e.; 36+1080i+36 = 1152 lines.

## TABLE G8

## HD Output Interface Specifications including 31.25 kHz Formats

| **Waveform Timings{xe "Interface, Waveform Timings"}** | | **576 × 50p (625)** | **1152 × 50i (1250)** | **1080 × 50i (1250)** | **720 × 50p (750)** (native) | **1080 × 50i (1125)** (native) |
|---|---|---|---|---|---|---|
| Total lines including vertical blanking | | 625 | 1250 | 1250 | 750 | 1125 |
| Sample clock frequency | MHz | 27.000 | 48.000 | 72.000 | 74.250 | 74.250 |
| Nominal line period | µs | **32.00** | **32.00** | **32.00** | 26.67 | 35.56 |
| Active line | µs | 26.67 | 26.67 | 26.67 | 17.24 | 25.86 |
| Horizontal blanking (Max for 31.25 kHz formats) | µs | 6 0 | 6.0 | 6.0 | 9.43 | 9.70 |
| Sync pulse width -Standard and tri-level –see Note 1 | µs | 2.35 | 2.33 | 2.33 | 0.54+0.54 | 0.6+0.6 |
| Sync pulse risetime | µs | 0.1 | 0.08 | 0.06 | 0.05 | 0.05 |
| Front porch width (EAV to 0H sync ref) | µs | 0.75[.44] | 1.96 | 1.98 | 5.93 | 7.12 |
| Blanking risetime | µs | 0.15±0.05 | 0.05 | 0.05 | 0.06 | 0.05 |
| Frame period | ms | 20 | 40 | 40 | 20 | 40 |
| Vertical planking period | Lines (H) | 49H + 6 µs | 22 + 23 | 85 + 85 | 30 | 22 + 23 |
| Vert sync serration (broad pulse) width | µs | 29.67 | 13.67 | 13.67 | 0.54 + 0.54 | 11.85 |
| Blanked lines- pre vert sync | Lines | 5 | See Note (b) | See Note (b) | 5 | 2+2½ |
| Vertical block | Lines | 5 | 5 | 5 | 5 | 5 |
| Blanked lines- post vert sync | Lines | 39 | See Note (b) | See Note (b) | 20 | 15 |
| **Analogue bandwidths{xe "Interface, Analog Bandwidths"}** | | | | | | |
| Luminance Y or R, G and B | –1dB | 10 MHz | 30 MHz | 30 MHz | 30 MHz | 30 MHz |
| Pb and Pr | –1dB | 5 MHz | 15 MHz | 15 MHz | 15 MHz | 15 MHz |
| **Analogue output levels{xe "Interface, Output Levels"}** | | | | | | |
| Luminance Y or R, G and B (peak level) | mV | +700 | +700 | +700 | +700 | +700 |
| Blanking level | mV | 0 | 0 | 0 | 0 | 0 |
| Sync pulse amplitude - see Note 1 | mV | –300 | –300 | -300 | ±300 | ±300 |
| Pb and Pr maximum - see Note 4 | mV | +350 | +350 | +350 | +350 | +350 |
| Pb and Pr reference | mV | 0 | 0 | 0 | 0 | 0 |
| Pb and Pr minimum | mV | –350 | -350 | -350 | –350 | –350 |
| **Digital Output Levels - see Note 3** | | | | | | |
| Luminance Y and R, G, B (peak level) | 10b/8b | 940/235 | 940/235 | 940/235 | 940/235 | 940/235 |
| Blanking level | 10b/8b | 64/16 | 64/16 | 64/16 | 64/16 | 64/16 |
| Sync pulse amplitude | 10b/8b | — | — | — | — | — |
| Cb and Cr maximum - see Note (d) | 10b/8b | 960/240 | 960/240 | 960/240 | 960/240 | 960/240 |
| Cb and Cr reference | 10b/8b | 512/128 | 512/128 | 512/128 | 512/128 | 512/128 |
| Cb and Cr minimum | 10b/8b | 64/16 | 64/16 | 64/16 | 64/16 | 64/16 |

NOTES: (To Table G8):

1 For 'native' 1080i and 720p formats - 'Tri-level' sync timings and values are as specified for analogue interfaces in standards: SMPTE274M (1125 line 50i System 6) and SMPTE296M–2001 (720p - 50p System 3).

2 For number of lines pre and post vertical block blanking for the 1080i (1250) and 1152i (1250) formats See Figure G1 and Table G6.

3 For DVI outputs refer to IEC 62315: DTV profiles for uncompressed digital video interfaces.

4 Cb, Cr are digital representations and Pb, Pb analogue representations, proportional to the B-Y and R-Y signals respectively.
Levels Pb = 0.564(B-Y) and Pr = 0.713(R-Y) for 576i(625line SD) and 576p50 HD
but, Pb = 0.539(B-Y) and Pr = 0.635(R-Y) for 1080i and 720p HD
(Note there is a slight value difference for SMPTE and ITU-R based standards – see Glossary Y, Pb, Pb.

## G5{xe "Interface, Digital HD"} Summary of Native and CRT-Friendly Formats

Table G9 summarizes the recommendations for the received video formats and how they should be delivered from a STB to a display device that maintains optimum picture performance.

Table G10 summarizes the recommendations for format timings and hardware requirements for HD-STB's and HD display devices and reference standards from which the formats are derived.

**TABLE G9**

**RECOMMENDED HD-STB VIDEO OUTPUTS**

| SD or HD received format | 'HD native' mode on HD outputs | 'HD CRT' mode on HD outputs |
|---|---|---|
| SD: 576i @ 50Hz 15.625 kHz | 576p @ 50 Hz/31.25 kHz (bi-level sync on 'Y') | 576p @ 50 Hz/31.25 kHz (bi-level sync on 'Y') |
| HD: 576p @ 50 Hz 31.25 kHz | 576p @ 50 Hz/31.25 kHz (bi-level sync on 'Y') | 576p @ 50 Hz/31.25 kHz (bi-level sync on 'Y') |
| HD: 720p @ 50 Hz 37.50 kHz | 720p @ 50 Hz/37.50 kHz (tri-level sync on 'Y') | 1152i @ 50 Hz/31.25 kHz '720p up-scale to 1152i' (bi-level sync on 'Y') |
| HD: 1080i @ 50 Hz 28.125 kHz | 1080i @ 50 Hz/28.125 kHz (tri-level sync on 'Y') | 1080i(1250) @ 50 Hz/31.25 kHz '1080i letterboxed (not scaled) in 1152i' (bi-level sync on 'Y') |
| **Intended display device** | Matrix displays with a digital scaler; i.e. Plasma/LCD displays LCD/DLP projectors etc … | Fixed 31.250 KHz scan 16.9 CRT televisions with 576p/1152i/1080i(1250) HD inputs |
| | CRT projectors - or - 16:9 CRT televisions with 576p/720p/1080i HD input | |

## TABLE G10

### Recommended 50 Hz HD-STB Video Outputs and 50 Hz HD Display Video Inputs Hardware requirements

| Item description | Formats and connectors | Reference Standards | Applicability |
|---|---|---|---|
| **HD-STB**<br>Video Output Formats and Timings | HD-STBs shall provide output video signals in the following formats:<br>- HD Native modes<br>and<br>- HD CRT modes<br>and<br>- SD video<br>*Note:*<br>The HD video output sockets should be switchable between HD Native and HD CRT video modes by the use of a user accessible hardware switch. | Table G9 of this Appendix<br>ITU-R BT.1358 (576p)<br>SMPTE 296M-2001 (Systems 3 and 6) (720p)<br>SMPTE274M (1080i) | All HD-STB's |
| **HD-STB**<br>High Definition<br>Video output connectors | RGB+HV<br>Y, Pb, Pr | Refer Clause 3.1, Item 15.2.1 | ALL HD-STB's |
| **HD-STB**<br>Standard Definition<br>Video output connectors | CVBS (PAL)<br>Y/C (S-Video)<br>Y, Pb, Pr<br>or<br>SCART with RGB+CVBS and Y/C<br>(SCART video selection via user set-up menu) | Refer T Clause 3.1, Item 15.2 | ALL HD-STB's |
| **50 Hz HD Input Display Devices**<br>Video Input formats Timings | 50 Hz HD Input display devices shall accept and display correctly:<br>- HD Native mode video format timings<br>or<br>- HD CRT mode video format timings<br>NOTES:<br>Matrix display devices with a 'digital scaler' such as LCD/DLP projectors, plasma etc., require HD Native mode video for optimum picture performance.<br>The HD CRT mode is specifically intended for CRT television display devices using 31.25 kHz deflection.<br>European CRT TV manufacturers have indicated their preference for 50Hz HD CRT modes @ 31.250kHz as detailed in Table G9 using Y, Pb, Pr with bi-level sync on 'Y' or RGB+HV connectivity.<br>Other CRT TV manufactures have indicated their preference for HD Native mode formats as detailed in Table G9 using Y, Pb, Pr or RGB+HV connectivity. | Table G9 of this Appendix<br>ITU-R BT.1358 (576p)<br>SMPTE 296M-2001 (Systems 3 and 6) (720p)<br>SMPTE274M (1080i) | ALL 50 Hz HD Input display devices |

NOTES:

1 HD Native modes:
576p @31.250 kHz, 720p @37.5 kHz and 1080i @28.125 kHz

2 HD CRT modes:
576p @31.250 kHz, 1152i @31.250 kHz (up-converted 720p) and 1080i(1250) @31.250 kHz

# APPENDIX H

# RECEIVER FUNCTIONAL DESIGN ISSUES OF SPECIAL NOTE FOR AUSTRALIAN DTT

(Informative)

This Appendix is intended as an assistance to manufacturers and software designers of digital terrestrial television receiving equipment for operation in the Australian broadcast environment. The additional information given in the following design issues has been brought to special note through the experience gained in the early year's of on-air transmissions.

## H1 Use of Logical Channel Numbers (LCNs)

Receiver manufacturers are strongly recommended to use the broadcaster provided Logical Channel Numbers for the various services broadcast. Australian use of LCNs is similar to the use in the UK and Europe.

The logical channel descriptor is found in the second descriptor loop of the NIT with a tag value of $0 \times 83$

The syntax of the Logical Channel Descriptor is:

| Syntax | No. of bits | Mnemonic |
|---|---|---|
| logical_channel_descriptor{ | | |
| descriptor_tag | 8 | uimsbf |
| descriptor_length | 8 | uimsbf |
| for (i=0; i<N; i++){ | | |
| service_id | 16 | uimsbf |
| visible_service_flag | 1 | bslbf |
| reserved | 5 | bslbf |
| logical_channel_number | 10 | uimsbf |
| } | | |
| } | | |

Where:

**descriptor_tag**: This shall be assigned to be $[0 \times 83]$ .

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

**visible_service_flag:** This 1-bit field when set to '1' indicates that the receiver shall make the service visible and selectable (subject to the service type being suitable etc.) via the receiver's service list. If set to '0' the receiver is not expected to offer the service to the user in normal service list or navigation modes however the service shall remain accessible by direct entry of the logical channel number on a remote control. Note that this feature was added as an amendment to the European standard and is backward compatible with versions that used 6 reserve bits.

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

**logical_channel_number:** This is a 10-bit field which indicates the broadcaster preference for ordering services. A 10-bit binary number is displayed as its equivalent in decimal notation. For example, 00 0001 0100 is displayed as LCN 20. Valid numbers are 1 to 999. A service with an LCN of '0' should be ignored.

### H1.1 Methods of LCN display in a Receiver's OSD

There are two methods of program list display in common use in Australian DVB-T receivers:

All numbers in numerical sequence – i.e. 1, 2, 3 …9, 10, 11,…99, 100 … 200 … etc

Numbers grouped by broadcaster – i.e.

TEN – 1, 10, 11, 12, …

ABC – 2, 20, 21, 22, … 200 …

SBS – 3, 30, 31, 32, … 300 … etc.

### H1.2 Australian use of LCNs and variations with European use

Unlike recommendations to European broadcasters, Australian broadcasters do use non-contiguous LCNs and 3 digit LCNs.

Australian broadcasters have adopted an 'Operational Practice' (CTVA OP41), for unique use of LCNs in given transmission areas. However if a receiver is located in overlap areas of parent transmitter and translators, the same broadcaster's signal might be received twice on different frequencies but with the same SI.

European standards for LCNs also specify—

*'Services with the same* original_network_id/service_id *shall have the same* logical_channel_number. *Within the scope of one network, logical channel numbers shall be allocated uniquely. When defining regional variants of a service the same* logical_channel_number *can be used (e.g. in neighbouring networks). This facilitates defining a consistent and compact national/regional/local channel numbering scheme as well as indicating to the receiver that services with the same* logical_channel_number *are similar (regional variants)'.*

Australian use of original_network_ids and network_ids has some differences to the use by European broadcasters as within a large island continent each Australian broadcasting network has been assigned its own original_network_id. Broadcasters have assigned the ids as detailed in the CTVA Operational Practice (OP40) so that:

'A service can be uniquely referenced through the path - original_network_id/transport_stream_id/service_id'.

A second receiver situation for LCN overlap might arise with an overlap of parent transmitters or translators from two different transmission areas. Broadcasts from public network broadcasters ABC and SBS could be a common source for this problem as the transmissions from the same broadcaster would have the same original_network_id, but each main transmitter has its own unique transport_stream_id and service_id.

**For example:**

Receivers located in the overlap region of the ABC's transmissions from Sydney and from the city of Wollongong to the south, might receive the Sydney transmission with:

original_network_id = 0 x 1010 and service_id = 0 x 0221 (for the service named 'ABC TV Sydney').

This stream has the network_id = 0 x 3211 and the transport_stream_id = 0 x 0221.

Whereas the transmission from Wollongong would have:

original_network_id = 0 x 1010 and service_id = 0 x 02A1 (for the service named 'ABC TV NSW').

This stream has the network_id = 0 x 3252 and the transport_stream_id = 0 x 0223.

Note for both streams the original_network_id is unchanged. Notwithstanding this, both services can by uniquely identified by the path:
original_network_id/transport_stream_id/service_id.

A receiver with LCN software may choose to ignore the original_network_id and deal with these situations as suggested in Paragraph K2.

Further information is given on LCNs in Clause 3.1, Item 3.4.2.

Reference may also be made to the broadcasters' Operational Practice on LCNs – OP41 and on Australian broadcaster's assignment of original_network_ids and network_ids in OP40. These are available from CTVA – www.ctva.com.au/ ..

### H2 Dynamic Response to PAT, PMT NIT and SDT updates

Other comments regarding Clause 3.1, Item 3.4.6

It is highly recommended that on each transmission of these tables, the decoder compares the tables version number with that currently stored. If the version number has changed, the table information should be read and the new information stored.

Many receivers which lack this fundamental DVB SI feature cause trouble on changing services such as services offering multichannel or multiview (other camera angles, etc., which might change from program event to program event)—many decoders appear to ignore these dynamic PMT changes which are fundamental to the syntax of the MPEG ISO/IEC 13818 and DVB/ETSI EN 300 468 Standards.

Decoders should also implement the service_replacement descriptor.

### H3 Overlap of translator and main transmitter programs

There is a problem where receivers may operate in an overlap region of main transmitters or translators where the same broadcaster's DTT signal may be receivable on different frequencies. The program LCNs may be the same and a viewer needs to determine which signal is the better or their preferred.

Many Australia DTT translators receive their input from direct off-air reception of the parent transmitter. Even though these translators may operate with other translators in an SFN, their operating frequency is different to the parent transmitter. There is no SI change at these translators, so it's not possible to change the LCNs of a program service, (although the frequencies of the parent transmitter and translators are carried in the original NIT).

Receivers, in their initial set-up frequency scan, usually start at the lowest frequencies and proceed up. Many parent transmitters (in the capital cities for example), are in VHF band III, while all translators are at UHF in band IV and V. If a receiver first detects a parent at VHF then a weaker translator at UHF, the LCNs of the parent might be overwritten, which is undesirable.

**Recommendation:**

During the scanning process, when a receiver finds another transmission with services that have identical LCNs to those on a previously found transmission, the receiver should not overwrite or discard either until it has identified to the user, preferably, which transmission has the stronger signal and give the user a choice of discarding or altering the LCNs of the less preferred transmission.

### H4 Setting Time Regions

{ XE "Set-up of Time Regions" }{ XE "Time Regions" }To avoid incorrect on-screen time displays, receivers manufacturers are recommended to use the DTT broadcast's SI 'Time Offset Table' (TOT) in conjunction with a user-menu preset choice of time zone.

### H4.1 Australian States have different time zones

During the Australian winter months, the country is divided into 3 time zones, which increase to 5 and sometimes 6, different zones during various periods in the summer months. For the purposes of interpreting and correctly displaying program time information from the EIT, receiver manufacturers need to have a 'localisation' in the user-setup-menu, where the user can identify the region of the country they are in. This allows the receiver to calculate the local time from the transmitted 'Time Offset Table' (TOT), which carries UTC and a number of time offsets linked to the 'country region ids'.

The preferred on-screen choices for Australia are the abbreviated names of the States (eg. NSW, VIC etc. as given in Clause 3.1, Item 6.4. Each State name corresponds to a country_region_id which the receiver will find in the TOT with an accompanying offset. Broadcasters automatically update these offsets in the broadcast TOT when daylight savings time comes into and out of effect so that the viewers always see correct local time even if the changeover date is changed for some reason (This happened in NSW in 2000 prior to the Sydney-2000 Olympic Games).

### H4.2 Broadcast TOT

Time offsets found in Australian DVB-T broadcasts will have different values over the year but will always be in advance of UTC - Typical current values are +11, +10.5, +10, +9.5, +8 (hours), but these could be added to, if for example, a State Government votes to change. This is of no consequence to a receiver which follows DVB semantics rules as the process is one of simple conversion of the broadcast Modified Julian Date and addition/subtraction according to the broadcast time offset value.

Australian DVB-T broadcasters actually transmit two tables: the DVB 'Time and Date Tables' (TDT) and 'Time Offset Tables' (TOT) as specified in DVB-ETSI EN 300 468.

The Time and Date Table (TDT), has a single purpose in life - to transmit the current time and date in UTC and MJD - and as such is of less use.

The Time Offset Table (TOT) is the more important. It also carries the current time and date in UTC and MJD - plus the local time offsets. The local time offsets may be used in a DTT receiver to:

display of the current local time on the IRD or TV screen;

display of the programme guide in local time;

timer programming of the video recorder in local time.

(see ETSI TR 101 211 V1.5.1 (2003-01) Section . 4.2.5.1 Local time offset descriptor) The Time Offset Table (TOT) carries the country code and offsets identified in a 'local_time_offset_descriptor' (0 x 58).

### H5 Vertical interval signals visible in letterbox mode

Australian government regulation requires free-to-air broadcasters to 'simulcast' their main SD program on both the analogue PAL and DTT services. While the broadcasters are working towards maximising the number of wide-screen 16:9 programs for digital viewers, the broadcasters need to continue to provide standard (4:3) aspect ratio pictures for the majority of viewers who currently, are still watching analogue PAL transmissions. To assist in controlling their networks, some broadcasters are using vertical interval data signals such as line-23 WSS (ETSI ETS 300 294).

Various viewer complaints received indicate that with some digital receivers, these and other vertical interval signals are unfortunately appearing in the on-screen video of some DTT services. These type of video disturbances become more visible if the viewer is using any picture manipulation modes of the digital receiver or display unit and becomes particularly noticeable in widescreen digital pictures that are displayed in letterbox mode on standard 4:3 displays.

Receivers are recommended to blank incoming video information down to line 25 as detailed in this Clause 3.1, Item 7.8.3.

### H6 Identification of 50Hz High Definition video programs streams

{ XE "HD recognition by SD receivers" }Because Australia at present, is the only country with 50 Hz DVB-T broadcasts that regularly include HD video formats, the determination of type of video format is a necessary function for digital receivers. The need for this function is not yet encountered in other 50 Hz-based countries with only MP@ ML encoding.

Australian DTT broadcast transport streams will mainly carry 576 × 50i SD video, but for significant periods will also contain HD in 3 possible MP@ HL video formats: 1080 × 50i, 720 × 50p or 576 × 50p. (1080 may also be broadcast in 'film mode' 25p).

While there a number of SD-only receivers that have entered the Australian market, some SD-only receivers appear to be designs that have been tested to operate in an SD-only environment (as currently encountered in other 50 Hz countries, for example).

If a user accidentally selects a high definition program these receivers seem to be unable to recognise that they are not capable of decoding HD formats. For example, if the HD service is in HD 576 × 50p format, because the pixel format is similar to SD, some SD receivers try to decode it but the result is generally a staccato presentation of pictures like a rapid slide show. This confuses the viewer who cannot determine if there is a problem with their receiver or with the broadcast.

It's assumed software design of these SD-only receivers take 'shortcuts' and lack the important process to identify the video format. If a viewer mistakenly tries to select a HD service the screen should, preferably, display an on-screen message saying 'service not available' or High Definition service' or even simply go blank.

### H6.1 Where the HD Video format is identified

It is unreliable for a receiver to retrieve information about HD/SD formats from the component_descriptor() of the EIT. While the various 25 and 50 Hz frame formats are identified as examples in ETSI DVB TR 101 154 Annex A, the ETSI/DVB EN 300 468 component descriptor as used in the EIT, currently does not include the full gamut of possible values for 25 Hz and 50 Hz HD formats.

The most reliable method to distinguish an HD service is by the 'profile_and_level_indication' in a video_stream_descriptor(), which may appear in two places – the PMT and the program stream header.

(a) The PMT Transport stream map section [TS_program_stream_map_section()], in its stream_type loop should indicate video by a stream_type 0x02, followed by the elementary_PID, and perhaps, also followed by the video_stream_descriptor().

(b) 'profile_and_level_indication' in the video_stream_descriptor() also must appear in the Program Stream sequence_header()/ sequence_extension()

To take information from the HD service PMT may also be less reliable because in a broadcaster's chain of equipment, the PMT is usually inserted by an SI generator associated with the multiplexer (MUX). Therefore some data in the PMT may not always be present or accurate.

To achieve rapid channel change (zapping), the PMT video_stream_descriptor() may provide the information more quickly. Nevertheless, the broadcaster's equipment with the best guarantee of accuracy is the original MPEG encoder which will insert the necessary information in the Program Stream sequence_header().

### H6.2 Recommendation:

Receivers should **not** retrieve information about HD/SD formats from the component_descriptor() of the EIT. The PMT video_stream_descriptor() details of profile and level may be accessed more quickly but the most reliable way to determine a video stream's format parameters is to examine the MPEG-2 PSI header information per ISO/IEC 13818 part 2.

All receivers should read a video program stream's sequence_header()/sequence_extension() to retrieve the profile_and_level_indication, etc. and to distinguish between 25 and 50 Hz progressive and interlace HD and SD formats.

For other details, refer to Clause 3.1, Item 7.

### H7 Closed Captions on High Definition Programs

{xe "Teletext on HD programs"}If a HD capable receiver has an internal teletext decoder, it's recommended that a suitable scaling function be provided to adapt the font to the HD display format.

This will enable Closed Captions to be displayed on High Definition programs by access to teletext captions on page 801, if the broadcaster provides an appropriate link in the HD stream's PMT.

If available, this data will be indicated in the PMT and delivered in the transport stream as private data as described in the ETSI DVB standard EN 300 472 and in Clause 3.1, Item 10.3.

**Important Note:**

At the broadcast station there may be only one teletext private data stream containing closed captions for simulcast SD and HD versions of a program.

This may mean that the SD program PMT and the simulcast HD program PMT may reference the same teletext PID.

Additionally the broadcaster's MPEG encoders are unlikely to encode the teletext with the same PCR as either video streams.

This should not create a problem with different PCRs, as recent discussions in the DVB forums have identified that while the ETSI standard retains reference to PTS, such data may be displayed as received without reference to the PTS and this is the preferred arrangement for Australian receiver operation.

The consequence is that receivers designed for Australian DTT are recommended to decode the teletext even if the teletext packet PCR is different to the video PCR. This may occur with both SD and HD video services.

Further information on Australian implementation of teletext for closed captions is given in Appendix F.

# APPENDIX I

# ABBREVIATIONS AND GLOSSARY

(Informative)

**'5.1' CHANNEL SOUND**

A five point one channel sound system actually has 6 channels of surround sound. The first 5 channels are centre speaker, and then left, right, rear left and rear right. The extra point one refers to the reduced bandwidth Low frequency effects (LFE) sounds that are often reproduced using a 'sub-woofer' loudspeaker. Very low frequency sound below about 100 Hz does not have to be directionalized because human hearing has no directional sensing of these sounds.

Advanced home 5.1 channel 'surround sound' systems can source the six channels either from information derived from incoming stereo (two channel) using systems such as Dolby® Surround ProLogic™ (I/II) or, for better performance, from separate 5.1 channel information carried in advanced digital audio systems such as Dolby AC-3 (5.1 version) or MPEG-2/AAC (5.1 and 7.1 channel versions).

**AC-3**

A proprietary digital sound system developed (and patented) by Dolby Laboratories Inc. (Dolby®). It can carry multiple channels, stereo with ProLogic and 5.1 discrete channel. Also known as Dolby Digital®, variants of the system are used in movie theatres and DVD and in the US ATSC and Australian DVB-T digital broadcast systems. Decode systems may include a second decoder for special requirements.

**CONDITIONAL ACCESS (CA)**

Conditional access{xe "CA—Conditional Access"} refers to methods that scramble or encrypt the program or private data so that it may be received only by 'authorized' receivers. While a number of different 'private' schemes using 'smartcards' have been used by Pay-TV operators working primarily via satellite, the arrangements for terrestrial services are different because free-to-air services should be receivable without CA authorization. In Europe, a Common Scrambling Algorithm was designed to minimize the likelihood of piracy attack over a long period of time. By using the Common Scrambling Algorithm system in conjunction with the standard MPEG data transport and selection mechanisms it is possible to incorporate in a DVB transmission the means to carry multiple messages which all enable control of the same scrambled broadcast but are generated by a number of different CA systems. This 'Simulcrypt'{xe "SimulCrypt"} technique allows both the delivery of one program to a number of different decoder populations that contain different CA systems, and also for the transition between different CA systems in any decoder population, for example to recover from piracy.

The 'Multicrypt' option is also available, facilitated by the Common Interface (DVB-CI) specification proposed for standardization by CENELEC (European Committee for Electrotechnical Standardization). The CA module may operate in conjunction with a smartcard or with a PCMCIA{xe "PCMCIA" \i} card as popularly used with lap-top PCs.

**CARRIER-TO-NOISE RATIO (C/N OR CNR)**

A measurement of the received carrier power relative to the power of background noise at the receiver input.

**CENELEC**

European Committee for Electrotechnical Standardization.

**COLOUR LOOK-UP TABLE (CLUT)**

For DTV on-screen-displays{xe "On-screen-display"}, the CLUT is a look-up table of colour values for translating an object's pseudo-colours into screen display colours. It is a way of simplifying the amount of data required to display an object but has the limitation that only 4, 16 or 256 colour values are allowed somewhat like early PC EGA graphics systems. Not all decoders may support a CLUT with 256 entries. A palette of four colours would be enough for graphics that are basically monochrome, like subtitles{xe "Subtitles"}, while a palette of 16 colours allows for cartoon-like coloured objects.

**COFDM**

A method of coded OFDM used by DVB for digital terrestrial television broadcasting (see OFDM).

**DATA CAROUSEL**

The scenario of the user-to-network download protocol which embodies the cyclic transmission of data by a DSM-CC{xe "DSM-CC"} download server as defined in ISO/IEC 13818-6 Section 7.

**DIFFERENTIAL LATENCY**

Also known as synchronization latency. The time that data is presented to a decoding device relative to the time its associated video is presented to the same decoding device.

**DIGITAL VIDEO BROADCAST (DVB)**

The digital video broadcast is a consortium of over several hundred manufacturers, research institutes, and broadcast organisations principally located in Europe but spread throughout the world. The Project has produced a series of interlinked broadcasting standards for satellite, cable and terrestrial. Through other European groups such as 'ACTS' the work is now going on to interlink computer networking and multimedia.

**DIGITAL VIDEO INTERFACE (DVI)**

Digital Video Interface is a high-speed digital connection standard to connect a PC (or digital TV STB), to a display device. As display technology moves away from the analogue CRT type display to flat-panel and other displays that use digital processing, older analogue interconnect standards, such as VGA, introduce further distortions by additional, unnecessary D/A and A/D conversions. The need for these conversions is removed by the introduction of this DVI standard. DVI is a much simpler standard than IEEE 1394 because it is only a point-to-point link, 1394 is a bus standard with protocols and such. Current maximum data rate of a single DVI link is 165 MHz RGB, transmitted as 3 serial digital streams of 1.65 Gb/s each. The DVI standards was developed by the Digital Display Working Group, which includes companies such as Intel, Compaq, H-P, IBM and NEC. http://www.ddwg.org/

**DVB-T**

The DVB-T terrestrial digital television broadcasting specification is based on a transmission system of COFDM carrying program and data as MPEG packets. It was approved by the Steering Board, in December 1995 and subsequently accepted by ETSI as a European Standard. The work was based on a set of user requirements produced by the Terrestrial Commercial Module of the DVB Project. DVB members contributed to the technical development of DVB-T through the DTTV-SA (Digital Terrestrial Television—Systems Aspects) of the Technical Module. The European Projects SPECTRE, STERNE, HD-DIVINE, HDTVT, dTTb, and several other organizations, developed system hardware and produced results which were fed back to DTTV-SA. http://www.dvb.org/

**DOLBY®**

A US based company specializing in proprietary compression and noise reduction techniques for audio transmission and recording.

**DOLBY SURROUND PRO-LOGIC™**

A method of encoding rear 'surround' and centre information in a 2-channel stereo audio signal. Some receivers have 'Pro-Logic™' enhancement to improve channel separation in the two rear loudspeakers. 'Pro-Logic II™ provides further improvements in the decoding process with greater channel separation and stereo surrounds, giving 5 channels.

**DYNAMIC RANGE**

The ratio between the greatest signal power that may be transmitted over a multichannel analogue transmission system without exceeding distortion or other performance limits, and the least signal power that may be utilized without exceeding noise, error rate or other performance limits.

**ELECTRONIC INDUSTRIES ASSOCIATION (EIA)**

A US voluntary body of manufacturers that, among other activities, prepares and publishes Standards.

**ELECTRONIC PROGRAM GUIDE (EPG){XE "EPG—ELECTRONIC PROGRAM GUIDE"}**

An EPG implies a degree of electronic interactivity and not a static Program Guide. Broadcasters using DVB, transmit program schedule information in Event Information Tables (EIT) tables. These tables may be in several different forms containing - immediate information ($EIT_{now/next}$, also known as $EIT_{pf}$ - present/following) and in limited cases, future program information (known as $EIT_{schedule}$) – related to the transport stream carrying the EIT or other (broadcasters') transport streams. Receivers may decode this data, and perhaps information from other broadcasters, and produce EPGs.

Broadcasters may also generate EPGs in API specific or private data but that would require a particular application program in the receiver-eg. MHP, OpenTV, Liberate etc.. Other suppliers may provide EPGs either through unrelated data streams or, perhaps, over the Internet.

Note that in Australia, the Broadcasting Services Act imposes certain obligations on broadcasters and datacasters in regard to EPGs.

**EUROPEAN TELECOMMUNICATION STANDARDS INSTITUTE (ETSI)**

The major European Standards publishing body. http://www.etsi.org/ Most DVB related standards are available from this site.

**FREE-TO-AIR BROADCASTER (FTA)**

FTA broadcasters offer their programs and related material, where receivable, to be freely accessed by the public. This contrasts with subscription or pay broadcasters that impose a charge on a viewer/listener to access their material. FTA broadcasters may be government, community or commercially (advertising) funded.

**FORWARD ERROR CORRECTION (FEC)**

Methods of improving the ability to recover error-free data from a transmission or storage system usually by adding extra data (about the payload data) before transmission. For example in DVB-T coding, a system of FEC referred to as 'Viterbi' or 'inner' coding can be set to different levels from 7/8 to 1/2 with 1/2 providing the most error protection. Further error protection known as Reed-Solomon adds a further 16 bytes to the 188 Byte MPEG-2 transport stream packet making a new packet size of 204 bytes.

**HAVi**

Home Audio Video interoperability: HAVi is a home networking standard for interoperability between digital audio and video consumer devices. It is an initiative from eight major Consumer Electronics companies - Grundig AG, Hitachi, Ltd., Matsushita Electrical Industrial Co., Ltd. (Panasonic), Royal Philips Electronics, Sharp Corp., Sony Corp., Thomson Multimedia and Toshiba Corp. Parts of the HAVi specifications including 'user interface' have been included into the MHP. www.havi.org

**HEADER**

In data transmission, the header is protocol control information located at the beginning of a protocol data unit.

**HIERARCHICAL MODULATION (HM){XE "HIERARCHICAL MODULATION"}**

One class of the many possible modes of DVB-T COFDM radio-frequency transmission where the transmission effectively becomes split into two parts – known as high and low priority (HP and LP), which results in enhanced receivability for the HP stream while the LP stream can maintain standard receivability characteristics similar to the non-hierarchical transmission. Each part carries its own transport data stream with the data capacity split approximately 1/3 and 2/3 of a non-hierarchical transmission.

HM is best understood by considering the COFDM constellation of possible modulated states in each of the four quadrants. The simplest, and most robust modulation is 4QAM (QPSK) with 16QAM and 64QAM as other less robust possibilities. If a case of QPSK is taken and say, a lower amplitude 16QAM signal (at the same clock rate and same guard interval) added to it, then the constellation would have the appearance of 64QAM but the QPSK and 16QAM would each be carrying their own data (transport stream). Another possibility is QPSK on QPSK, the resultant constellation then appearing as 16QAM.

The HP part of the COFDM transmission, which is carried on the base QPSK modulation, is capable of being more reliably received under difficult reception conditions such as in mobile or portable situations, whereas the low priority stream (if 16QAM), would have comparable receivability to standard 64QAM. The high priority stream's enhanced receivability characteristics may be further strengthened by stronger FEC and/or a shift of the modulation pattern (alpha factor), which in effect increases the amplitude of the QPSK component.

Receivers with a single tuner/COFDM demodulator can only receive one of the streams at a time and can select either the HP stream or the LP stream. In poorer reception conditions where standard non-HM signals are lost, the LP stream will be affected similarly.

With the 16QAM on QPSK case, the demodulated high priority stream typically has a data capacity of between one third and one quarter of the non-hierarchical signal while the low priority is about two thirds to one half. Refer to ETSI EN 300 744 and AS 4599. This implies that in a 7MHz channel, typically 5~7 Mb/s and 14~16 Mb/s may be carried in each transport stream, typically allowing SD in the HP stream and HD or other combinations of SD in the LP stream.

The presence and type of a Hierarchical COFDM transmission may be identified by the COFDM low data rate Transmission Parameter Signalling (TPS). Receiver design should also include software to process Nit $_{other}$ as hierarchical broadcasts should include Nit $_{other}$ in each transport stream with details of the other stream.

**HIERARCHICAL (VIDEO AND/OR AUDIO) CODING**

Not used in DVB implementations. It is a possible feature of MPEG-2 where the video and/or audio information can be coded and scaled spatially or temporally. That is where a base or course layer and a fine detail layer may be sent separately. For example, the Simple, Main, SNR Scalable, Spatially Scalable and High profiles have a hierarchical relationship. Therefore the syntax supported by a 'higher' profile includes all the syntactic elements of 'lower' profiles (e.g., for a given level, a Main profile decoder shall be able to decode a bitstream conforming to Simple profile restrictions). Refer ISO/IEC 13818, Parts 1 to 3.

**HIGH DEFINITION TELEVISION (HDTV)**

High definition television has a resolution of approximately twice that of standard television in both the horizontal (H) and vertical (V) dimensions and a wide screen picture aspect ratio{xe "Aspect ratio"} (H:V) of 16:9. ITU-R defines 'HDTV quality' as the delivery of a television picture which is subjectively identical with the interlaced HDTV studio standard. Note that the number of lines alone does not give an indication of the perceived picture sharpness. Different types of display will affect the result. For example, it is generally agreed that a 720 line 'progressive' format display will have similar degree of sharpness to a 1080 line 'interlace' format display. For MPEG-2 compression, a receiver is required with a 'main profile @ high level' (MP @ HL) decoder, which will decode pixel sample rates greater than 10,368,000 samples per second and less than 62,668,800 samples per second. The maximum is actually determined by maximums of: - samples per line (1920), lines per frame (1152) and frames per second (30).

**HYPER-TEXT-TRANSFER PROTOCOL (HTTP)**

An Internet protocol for transferring text files with layout information.

**IETF**

See Internet Engineering Task Force.

**INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)**

An international voluntary organization based in the US which, among other things, sponsors Standards committees and is accredited by the American National Standards Institute. Various Standards such as IEEE 1394{xe "IEEE 1394"} (also known as FireWire{xe "FireWire" \t "See IEEE 1394"} or i.Link{xe "i.Link" \t "See IEEE 1394"}) have recently been developed for domestic high-speed digital interlinking of TV cameras, recorders and computer equipment. www.ieee.org/

**INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)**

An international Standards body based in Europe.

**INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)**

An international Standards body, commonly known as the International Standards Organization.

**INTERNATIONAL TELECOMMUNICATION UNION-RADIOCOMMUNICATION (ITU-R)**

An international Standards body and a part of the ITU, based in Geneva. It is the recognized Standards publisher for broadcast radio and television transmission standards and Standards on international program exchange.

**INTERNET ENGINEERING TASK FORCE (IETF)**

A body of interested organizations responsible, among other things, for developing Standards used for the Internet.

**LOCAL AREA NETWORK (LAN)**

A non-public data network in which serial transmission is used for direct data communication among data stations located on the user's premises.
Examples are 'ethernet' in various forms as defined by IEEE 802.

**LATENCY**

The time for material to be passed from the input to the output of a system.

**MULTIMEDIA AND HYPERMEDIA INFORMATION CODING EXPERT GROUP (MHEG)**

Multimedia and Hypermedia information coding Expert Group: The Standard known as MHEG-5 is ISO/IEC IS 13522-5 (1996): 'Information technology - Coding of Multimedia and Hypermedia Information - Part 5: Support for Base-Level Interactive Applications'. This standard for interactive television has been adopted by UK terrestrial broadcasters.

**MULTIMEDIA HOME PLATFORM (MHP){XE "MHP"}**

The Multimedia Home Platform (MHP) standard (as an offshoot of DVB), defines a generic interface between interactive digital applications and the terminals (eg STBs, iDTV receivers) on which those applications execute. This interface decouples different provider's applications from the specific hardware and software details of different MHP terminal implementations. It enables digital content providers to address all types of terminals ranging from low-end to high-end set top boxes, integrated digital TV sets and multimedia PCs. The MHP extends the existing, DVB open standards for broadcast and interactive services in all transmission networks including satellite, cable, terrestrial and microwave systems. Elements of the MHP specification include the DVB-J platform with DVB defined APIs and selected parts from existing Java APIs, JavaTV, HAVi (user interface) and DAVIC APIs. (http://www.mhp.org/). *Australian terrestrial broadcasters have adopted this standard for interactive television.*

**MOVING PICTURE EXPERTS GROUP (MPEG)**

A voluntary body ISO/IEC Joint Technical Committee 1, Sub Committee 29/Working Group 11 which has and continues to develop Standards for digital compressed moving pictures and associated audio. MPEG Standards are published in the ISO/IEC 11172 (MPEG-1), and ISO/IEC 13818 (MPEG-2) series of documents. Current work in MPEG includes MPEG-4 which addresses coding and distribution of multimedia objects, and MPEG-7 which defines a multimedia content description interface, for indexing and searching of multimedia information.

**MOSAIC DISPLAY**

An array of small pictures to make a total full-screen picture. Generally provided to give an indication of the content of a number of video programs.

**MPEG-1 AND MPEG-2**

Also refer to entry under 'Moving Pictures Experts Group (MPEG). These are the most common video and audio compression schemes now in use. MPEG-1 was used for lower data rate video on early CDi and VideoCDs. MPEG-2 provides for better quality (at higher data rates) and is used in a variety of professional and consumer applications from SDTV to HDTV on terrestrial, satellite and cable broadcast and DVD. The emerging standard is MPEG-4: ITU Rec H.264; DVB's AVC group have prepared a draft ETSI standards for carriage of MPEG-4 in DVB transport streams.

**MPEG-1 LAYER II AUDIO**

The compressed audio Standards of MPEG-1 were published in the 1993 International Standard ISO/IEC 11172-3. This dealt with mono and two-channel stereo sound coding, at sampling frequencies commonly used for high quality audio (48, 44.1 and 32 kHz). Compared to Layer I, Layer II is able to remove more of the signal redundancy and to apply the psychoacoustic threshold more efficiently.

There is also a Layer III, known as MP3, which is again more complex and is directed towards lower bit rate applications due to the additional redundancy and irrelevancy extraction from enhanced frequency resolution in its filterbank. A 'full Layer II' decoder accepts Layer I and II bitstreams. Likewise an MPEG-2 decoder should be capable of fully compatible decoding an MPEG-1 bitstream. The development of audio standards for MPEG-2 resulted in the 1995 International Standard ISO/IEC 13818-3.

New systems are now attracted to the superior performance of Advanced Audio Coding (AAC), refer to ISO/IEC 13818-7.

**MULTIVIEW DISPLAY{XE "MULTIVIEW DISPLAY"}**

Additional video programs relating to a main program. The additional video may be from other (fixed or switched) point-of-view cameras or simply graphical and text information such as a sporting event statistics. These additional picture sources may be similar or lesser formats to the main program and may be displayed full screen or in advanced receivers in a PIP type window. They may be assigned a Logical Channel Number for selection oan simple 'zapping' STBs and/or selection through an interactive application on receivers appropriately equipped.

**MULTIPLEXER (MUX)**

A physical device which is capable of inserting data into and extracting data from an MPEG-2 transport stream.

**NATIONAL TELEVISION SYSTEMS COMMITTEE (NTSC)**

A US committee formed in the late 1940s and '50s, which defined the analogue colour television broadcast standard used today in North America.

**OPPORTUNISTIC DATA**

Data inserted into the remaining available bandwidth in a given transport stream after all necessary bits have been allocated for video and audio services.

**ON-SCREEN DISPLAY (OSD)**

On screen display of menu for user's setup of receiver's operating parameters. Also refers to display of choices and interaction with a receiver's closed caption or teletext display and/or program interactivity.

**ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM)**

A modulation system which uses a very large number of separate radio frequency carriers each of which carries a small proportion of the total information content to be sent. Also used in Digital Audio Broadcasting (DAB), OFDM has good performance in a very strong multipath (ghosting) environment. DVB based digital television broadcasts use Coded OFDM.

**PACKET IDENTIFIER (PID)**

A unique integer value used to identify elementary streams of a program in a single- or multi-program MPEG-2 stream. Carried on 13 bits within each 4byte packet header.

| | |
|---|---|
| **PHASE ALTERNATE LINE (PAL)** | An analogue encoding system for colour television. Compatible with analogue monochrome systems of the same scanning rates. It has a high frequency subcarrier to carry two colour component signals, similar to the principles used in NTSC but alternates the phase of one of the colour signals so that the receiver may correct colour errors with a delay line. It was developed by AEG Telefunken Laboratories in Hanover, Germany. |
| **PROGRAM CLOCK REFERENCE (PCR)** | A signal transmitted typically 25 times a second to allow synchronisation of a decoder's system clock (usually 27MHz) to the original MPEG encoder 'clock'. Decoders may also use it with 'Presentation Time Stamps' (PTS) included with the video and audio to ensure the correct presentation of picture and sound (lip-sync). |
| **{XE "PCMCIA" \I}PERSONAL COMPUTER MEMORY CARD INTERNATIONAL ASSOCIATION (PCMCIA)** | Also known as PC card. A card/socket with 68 pins commonly found on notebook computers, digital cameras and in digital TVs for expanded facilities. Three types are defined – Type I, Type II and Type III. The thinnest (3.3 mm thick) are Type I, which are primarily used for memory devices like flash ram. Type II cards are the type normally used in digital TV applications and the card may have a 'smartcard' slot inbuilt. Type II are 5mm thick. Common examples are modems and LAN adapters in PCs. Type III cards are 10.5 mm and are used for the devices that require more space such as disk drives and wireless communication devices. |
| **PACKETISED ELEMENTARY STREAM PACKET (PES PACKET)** | The data structure used to carry elementary stream data. A variable length packet beginning with a PES packet header followed by a number of contiguous bytes from one elementary stream. |
| **PES STREAM** | A PES stream consists of PES packets, containing only data from a single elementary stream, and which all have the same stream_id as defined in ISO/IEC 13818-1. It is not use in DVB specified environments. |
| **PICTURE-IN-PICTURE (PIP)** | A feature of some television receivers (usually with more than one tuner) to display video from other programs. Usually displayed as a smaller window. PIP may also become useful for the display of 'multiview' video, from digital program sources with this optional available. |
| **PROGRAM, PROGRAM STREAM (PS)** | A collection of coded audio, coded video and perhaps other data objects such as caption data. Such objects need not have a defined time base; however, those that do, refer to a common time base for presentation synchronization. |
| **PROGRAM-SPECIFIC INFORMATION (PSI)** | In MPEG-2, normative data necessary for the demultiplexing of transport streams and the successful regeneration of programs. |
| **PROTOCOL** | A set of rules and formats which determines the communication behaviour of layer entities in the performance of the layer functions. |
| **QUADRATURE AMPLITUDE MODULATION (QAM)** | A method of modulating digital signals onto a radio-frequency carrier signal involving both amplitude and phase coding. |
| **QUADRATURE PHASE-SHIFT KEYING (QPSK)** | A method of modulating digital signals onto a radio-frequency carrier signal using four phase states to code two digital bits. |

**RETURN CHANNEL{XE "RETURN CHANNEL"}**

A path for return information from the end-user, usually via a telephone modem. Necessary for full interactivity. In cable systems, the signal flows towards the headend, away from the subscriber; equivalent to upstream.

**SCART{XE "SCART"} CONNECTORS**

Large flat multi-pin plug-socket found on STBs, TVs, DVD players and VCRs for modular interconnects. Mandatory for EU countries. Two specifications, dependent on type of equipment. Includes stereo audio interconnect, separate RGB video signals and/or 'S-Video{xe "S-Video"}' and/or Composite PAL, as well as wide-screen signalling. RGB video or 'S-Video' connections are preferred interconnects for digital transmissions to bypass the resolution loss and artefacts caused by composite PAL. This is an analogue connector with no provision for HD.
(Also known as 'peritel' - peripheral television interconnect or Euroconnector).

**SERVICE MULTIPLEX AND TRANSPORT**

In an MPEG system, 'service multiplex and transport' refers to the division of the digital data stream into 'packets' of information and the means of uniquely identifying each packet or packet type. Also the appropriate methods of multiplexing these video data stream packets with audio data stream packets and ancillary data stream packets into a single data stream consisting of a sequence of 188-byte transport packets.

**SET-TOP-BOX (STB)**

A modular unit for decoding video, audio, and data services physically separated from a display device. Also known as a set-top-unit (STU) or an integrated receiver decoder (IRD), mainly in regard to satellite services.

'Zapping' boxes refer to receivers without an operatable interactive middleware such as MHP, MHEG or OpenTV.

**STANDARD DEFINITION TELEVISION (SDTV)**

This term is used to signify a digital television system in which the quality is approximately equivalent to that of broadcast or cable NTSC and PAL as seen in the customer's TV receiver.

The term Conventional Definition Television (CDTV) has been used to signify the analogue PAL or NTSC television system as defined in Recommendation ITU-R BT 470.

**SURROUND SOUND**

Refers to listening environments where loudspeakers are positioned around the listener(s). Besides the front loudspeakers, other loudspeaker(s) are positioned to the rear and sometimes to the sides. The intention is to recreate the ambience and directionality of the original scene being reproduced. Sound systems employing surround sound can recreate such effects by processing the program stereo channels; or better stereo with phase encoded material such as Dolby ProLogic™{xe "Dolby ProLogic™"}; or best, from a discrete multichannel system of at least six channels including a low frequency sub-woofer channel.

**SERVICE INFORMATION (SI) {XE "SI—SERVICE INFORMATION"}**

In an MPEG data stream, Service information (SI) is included within a DVB MPEG-2 transport stream to assist the user in selection of services and/or events within the digital multiplex, and so that the receiver can automatically configure itself for the selected service. Information carried within SI allows for identification of services or events for the user and may also provide information on services carried by different multiplexes and even other networks. SI data complements the PSI tables by providing other data to aid automatic tuning of decoders, and information intended for display to the user. In general, SI augments and extends the relevant Program specific information (PSI) specified in ISO/IEC 13818-1 (MPEG-2 Systems), the Program association table (PAT) and Program map table (PMT).

**S-VIDEO{XE "S-VIDEO"} CONNECTOR**

A domestic analogue baseband video interconnection on a small 4 pin plug where the video is separate luminance (Y), and chrominance (C – RF colour subcarrier), so as to avoid the resolution loss and artefacts caused by PAL or NTSC decoding. (Also known as S-VHS or Y/C.)

**TRANSMISSION PARAMETER SIGNALLING (TPS)**

The TPS carriers are used for the purpose of signalling parameters related to the transmission scheme, i.e. to channel coding and modulation. The TPS is transmitted in parallel on 17 TPS carriers for the 2K mode and on 68 carriers for the 8K mode. Every TPS carrier in the same symbol conveys the same differentially encoded information bit.

**TRANSPORT STREAM (TS)**

In DVB/MPEG-2, a Transport Stream is a time-division multiplex of one or several program streams into a single stream of ‘packetized’ data. Each packet contains data from one source of material. This material may be video, audio or other information such as teletext{xe "Teletext"}, bit-mapped subtitles{xe "Subtitles"}, or other supporting material in an internet IP-type format. Other material may be from streams in a private data format.

Each packet is 188 bytes but FEC information may be added on the end that increases the size to 204 bytes. A packet has a 4 byte header containing a packet-ID (PID), and a 184 byte payload that may include video, audio, or information on the format of the contents (PSI) and/or adaptation fields or empty stuffing bytes to keep the data rate constant.

**VERTICAL BLANKING INTERVAL (VBI)**

Present in conventional, uncompressed TV signals, this unseen space at the top of a TV picture is now used to carry ancillary data, such as teletext{xe "Teletext"} including closed captions. Historically it was provided for CRT picture displays to allow time for the deflection circuit to return the scanning beam from the bottom of the screen to the top in preparation for the next picture scan.

**WIDE SCREEN SIGNALLING (WSS)**

A wide screen signalling system using line 23 in 625 line systems originally used for the analogue PAL-Plus system. The wide screen signalling information contains information on the aspect ratio range of the transmitted signal and its position, on the position of the subtitles and on the camera/film mode. Furthermore signalling for EDTV and for surround sound is included. The details of the standard are found in ETS 300 294.

**Y, PB, PR FOR ANALOGUE AND Y, CB, CR FOR DIGITAL**

These are designations for types of component video. Various Standards organisations such as SMPTE and ITU-R use the 'Y, Pb, Pr' notation as the 3channel parallel analogue component baseband representation of a colour television signal, but if this is digitised, then the digital representation is notated as 'Y, Cr, Cb'.

Equipment interconnect designations Y, Pb, Pr are analogue signals used for equipment interconnection by three (3) separate parallel leads. The Y lead also carries a composite of the horizontal and vertical scan synchronisation signals.

Y, Cb, Cr are digital signals and are usually present internally in equipment in digital processing, but when used for external interconnects, the three signals are streamed over a single lead in sequence, such as the 270 Mbps Serial Digital Interface used in professional equipment, (see ITU-R BT.656-- Interfaces for digital component video signals in…625-line television systems operating at the 4:2:2 level of ITU-R BT.601), and for HD as shown in ANSI/SMPTE 295M-1997 1920x1080 50 Hz Scanning and Interfaces.

Colour television requires three signals, which are initially captured, and ultimately displayed, as shades of Red Green and Blue (RGB). While RGB is found in interconnects such as Scart, VGA etc., for intermediate processes such as storage on tape, editing, switching and transmission systems using MPEG, it is more convenient to mathematically matrix the RGB signals into Luminance (Y) and two 'colour-difference' (R-Y and B-Y) signals. These have been chosen to match the physiology of the human eye to help mask noise or distortion effects introduced in these processes.

While the Y signal is regarded as always positive, the B-Y and R-Y signals can range from positive to negative in value. For example, a yellow picture made from equal Red and Green is bright (so Y is large), but there is no Blue colour, so B-Y will be negative.

In analogue interconnects where the Y signal is 0Volt (black) to 700mV (white), to limit the excursion of B-Y and R-Y to ±350 mV peak, the signals are reduced (scaled) to the new values represented by Pb and Pr (P for parallel) where:
Pb = 0.564(B-Y) and

Pr = 0.713(R-Y) for 576i(625line SD) and 576p50 HD

But,

Pb = 0.539(B-Y) and Pr = 0.635(R-Y) for 1080i and 720p HD
(Note there's a slight value difference for SMPTE and ITU-R based standards).

These components are coded as Cb and Cr for digital systems.

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Symbols such as RGB, Y, Pb, Pr are generally understood be a 'shorthand' that represent voltage levels which are found in the ITU and SMPTE standards as $E_{Y}$', $E_{Pb}$', $E_{Pr}$' etc., where the ' represents that the signals are, in fact, pre-corrected signals. That is, the video voltage levels are non-linearly related to reproduced picture brightness levels. This non-linear relationship of a display device's video input voltage versus output picture brightness is known as 'gamma'. The current values are based on a Cathode-Ray-Tube's grid-cathode input voltage and the beam current. The earlier designed NTSC system nominated a gamma value of 2.2 and later, PAL, a gamma of 2.8 – partly necessitated by a receiver design change from driving the picture tube's grids to driving the cathodes.

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## PREPARATION OF AUSTRALIAN STANDARDS

Australian Standards are prepared by a consensus process involving representatives nominated by organizations drawn from all major interests associated with the subject. Australian Standards may be derived from existing industry Standards, from established international Standards and practices or may be developed within a Standards Australia technical committee.

During the development process, Australian Standards are made available in draft form at all sales offices and through affiliated overseas bodies in order that all interests concerned with the application of a proposed Standard are given the opportunity to submit views on the requirements to be included.

The following interests are represented on the committee responsible for this draft Australian Standard:

Australian Broadcasting Authority
Australian Broadcasting Corporation
Australian Caption Centre
Australian Chamber of Commerce and Industry
Australian Consumers Association
Australian Electrical and Electronic Manufacturers Association
Australian Information Industry Association
Australian Subscription Television and Radio Association
Cable and Wireless Optus
Community Broadcasting Association of Australia
Consumer Electronics Suppliers Association, Australia
Digital Convergence Australia
Electronic Services Industry Association Inc, Australia
Commercial Television Australia CTVA,
Federation of Australian Radio Broadcasters
Institute of Engineers, Australia
Ministry of Economic Development, New Zealand
Broadcast Australia, (Formerly ntl, Australia)
Special Broadcasting Service, Australia
Television NZ
Telstra Corporation, Australia

Additional interests participating in preparation of Standard:

Broadcast Australia
Foxtel
JJB Associates
Matsushita Electric Co (Aust) Pty Ltd
Modern Antenna Systems
Network TEN
Nine Network Australia
Philips Consumer Electronics
Seven Network
Sony (Australia)

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**Standards Australia**

Standards Australia is an independent company, limited by guarantee, which prepares and publishes most of the voluntary technical and commercial standards used in Australia. These standards are developed through an open process of consultation and consensus, in which all interested parties are invited to participate. Through a Memorandum of Understanding with the Commonwealth government, Standards Australia is recognized as Australia's peak national standards body.

**Australian Standards**

Australian Standards are prepared by committees of experts from industry, governments, consumers and other relevant sectors. The requirements or recommendations contained in published Standards are a consensus of the views of representative interests and also take account of comments received from other sources. They reflect the latest scientific and industry experience. Australian Standards are kept under continuous review after publication and are updated regularly to take account of changing technology.

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Standards Australia is responsible for ensuring that the Australian viewpoint is considered in the formulation of international Standards and that the latest international experience is incorporated in national Standards. This role is vital in assisting local industry to compete in international markets. Standards Australia represents Australia at both ISO (The International Organization for Standardization) and the International Electrotechnical Commission (IEC).

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