IEC 62944

INTERNATIONAL STANDARD

Audio, video and multimedia systems and equipment – Digital television accessibility – Functional specifications

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Audio, video and multimedia systems and equipment – Digital television accessibility – Functional specifications

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AUDIO, VIDEO AND MULTIMEDIA SYSTEMS AND EQUIPMENT – DIGITAL TELEVISION ACCESSIBILITY – FUNCTIONAL SPECIFICATIONS

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International Standard IEC 62944 has been prepared by technical area 16: Active assisted living (AAL), accessibility and user interfaces, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

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

CDV	Report on voting
100/2640/CDV	100/2795/RVC

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

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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AUDIO, VIDEO AND MULTIMEDIA SYSTEMS AND EQUIPMENT – DIGITAL TELEVISION ACCESSIBILITY – FUNCTIONAL SPECIFICATIONS

1 Scope

This document specifies a set of principles and considerations for digital television products in support of older people and persons with disabilities in addition to mainstream users. The effect of following the principles and considerations as set out in this document is to ensure that the widest range of users can access, understand and use digital television products. These principles and considerations cover four main user profiles such as individuals with hearing impairments, individuals with sight impairments, individuals with mobility impairments and individuals with cognitive impairments.

This document applies to consumer solutions whose primary function is to receive digital television, such as integrated digital televisions, set top boxes, digital television recorders and equivalent products and devices (see Annex D). All these solutions are referred to as digital television solutions throughout this document. The standard does not cover solutions that support digital television as a secondary function (for instance gaming consoles or computers with digital receiver cards). However, much of the content also provides for future solutions and/or implementations.This document does not cover delivery, unpacking, secure installation on a stand or wall mounting or first time connection of the power and signals.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62731:2013, *Text-to-speech for television – General requirements*

ISO 7001:2007, *Graphical symbols – Public information symbols*

ISO 24500:2010, *Ergonomics – Accessible design –Auditory signals for consumer products*

ISO 24501:2010, *Ergonomics – Accessible design – Sound pressure levels of auditory signals for consumer products*

ISO 24503:2011, *Ergonomics – Accessible design – Tactile dots and bars on consumer products*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
access service
additional or alternative content associated with a television programme, intended to make the programme accessible to specific users

EXAMPLE   Audio/video description for blind and partially sighted people, captioning/subtitling for deaf and hard of hearing people and/or for delivery to different language audiences, signed programmes for sign language users, etc.

3.1.2
high definition
HD
video resolution, typically in the range of 720 to 1 080 vertical lines

3.1.3
standard definition
SD
video resolution, typically in the range of 480 to 576 vertical lines

3.1.4
electronic program guide
EPG
on screen application that provides users with scheduling information for current and upcoming programming

3.1.5
safe area
area of the television picture that can be seen on the great majority of television screens

Note 1 to entry: See ST 2046-1:2009, RP 218-2002, and FCC 79.101 (12).

3.1.6
text-to-speech
TTS
solution that converts textual content to the audible content speech, often implemented with a speech synthesizer system

3.1.7
audio description
AD
verbal depiction of key visual elements in media and live productions

Note 1 to entry: See 6.2.2.

3.1.8
high visibility interface
user interface that allows the user to change the presentation rules in order to improve visibility

3.1.9
wand remote control
remote control that moves an on screen pointer by aiming it at the screen

3.1.10
companion device
device connected to a digital television solution with the intention to provide a connected experience and interactivity across both

Note 1 to entry: Such devices include a smartphone, tablet or laptop.

Note 2 to entry: Also known as "second screen (device)" or "secondary device".

3.1.11
smartphone
mobile phone with additional advanced features commonly found on computers, with Internet access in addition to the voice channel and with the ability to install applications to extend and customise its properties and abilities

3.1.12
companion screen app
companion screen application
application running on a companion device, interacting with a digital television solution and providing access to the same or additional content and/or programme guides

3.1.13
Internet protocol
IP
principle communications protocol that essentially establishes the Internet

3.1.14
Internet protocol television
IPTV
digital television product that receives programming over the Internet or from a source that uses IP to deliver video

3.1.15
application programming interface
API
specification for software to use and interact with a system or platform

3.2   Abbreviated terms

AD   Audio Description

API   Application Programming Interface

ASR   Automatic Speech Recognition

EPG   Electronic Program Guide

FCC   Federal Communications Commission

HbbTV   Hybrid Broadcast Broadband TeleVision

HD   High Definition

IP   Internet Protocol

IPTV   Internet Protocol Television

NFC   Near Field Communication

SD   Standard Definition

SPL   Sound Pressure Level

TTS   Text-To-Speech

UI   User Interface

USB   Universal Serial Bus

WPS   Wi-Fi Protected Setup

xHCI   eXtensible Host Controller Interface

4 General

4.1 Overview

This document covers solutions that provide access to linear broadcast as well as those that offer on-demand/catch-up broadcast over Internet protocol. It also covers hybrid devices, sometimes referred to as connected TV solutions.

Note that content related aspects of digital television are not solely a property of the digital television solution used by people to consume linear or on-demand content. This document does not cover authoring requirements for content producers. It does set out functionality needed in digital television solutions to enable accessible content to be delivered to the end user.

4.2 Objective

The intent of this document is to assist designers of digital television equipment in such a way that they are able to develop solutions that are accessible to users with a wide range of abilities.

4.3 Summary

This subclause provides overall guidance for the use of this document. Annex E provides additional background information on accessibility of digital television equipment.

Clauses 5 to 8 present accessibility guidelines grouped by ability. These are:

- Accessibility related to auditory perception,
- Accessibility related to visual perception,
- Accessibility related to mobility,
- Accessibility related to cognitive abilities.

Annex F provides additional information about user profiles related to these abilities.

Annex A to Annex D, Annex G and Annex I summarize the guidelines presented in Clauses 5 to 8. However, the information in these annexes is grouped by implementation area, combining the guidelines from the various ability types. These summaries should be of particular use to those responsible for specific subsections of digital television equipment. These areas are:

- Annex A – (informative) Remote controls and buttons;
- Annex B – (informative) On screen display;
- Annex C – (informative) Content;
- Annex D – (informative) External devices;
- Annex G – (informative) Guidance on use of colours;
- Annex I – (informative) Future access .

Annex E – (informative) background describes design solutions and functionalities so that they can be accessed, understood and used by the widest range of users.

Annex F – (informative) user profile outline gives a brief overview of the main user groups that are affected by accessibility barriers in Digital Television products.

Annex H – (informative) includes a table that illustrates how different abilities, characteristics and preferences as well as environmental factors and context of use impact usage.

Annex J – (informative) includes a list of some items covered by video accessibility requirements in the US.

4.4 Principles

Designers of accessible digital television equipment should follow the principles listed below.

- Consider accessibility features early in the design cycle.
- Make accessibility features configurable and readily enabled or disabled.
- Support multiple modes of operation in order to enhance accessibility related to multiple abilities.
- Deliver functional equivalency such that users can experience all content and perform all tasks where feasible.
- Make user interfaces easy to use and to comprehend with attention to clarity, consistency, efficiency, resilience, and responsiveness.
- Evaluate accessibility features before development ends, including the testing of extreme use cases.

See Clause E.4 for more information.

4.5 Considerations

When designing accessible digital television equipment, the following points should be considered.

- Digital television users have a wide range of abilities. The level of specific abilities varies and any given user might have a combination of limitations.
- User abilities are not static. Personal abilities often change due to illness, injury, aging, or viewing and/or listening conditions.
- Television content is viewed on a variety of device types in various settings.
- Televisions can be used regularly by a group of people, such as a family, so the accessibility needs of users of the equipment may change from moment to moment.
- Services can provide a varying level of accessibility features. A variety of access services might be offered.
- A variety of external devices designed to enhance accessibility are available in the marketplace.
- There are many global regions and jurisdictions. Each might have unique social norms, product expectations, and specific regulatory requirements.

See Clause E.3 for more information.

5 Accessibility related to auditory perception

5.1 Overview

Access services, such as closed captioning, spoken subtitles and subtitles, as well as sign language are described as well as the user interface recommendations that primarily assist users having difficulty hearing sound.

5.2 Essential functions

5.2.1 List of functions

Digital television receivers should:

a) where a traditional, button based remote control is provided, have dedicated "subtitles" and "closed captions" on/off buttons on the remote control. The solution can consist of the substitution of a remote control button by menu-operation;

b) allow end users to change the on/off setting for each access service while viewing or playing content;

c) inform the user of the availability of access services for the programme they are currently viewing and for other content in any content guide(s)/browser(s), where possible;

d) inform the user when they are changing to a content source for which an enabled access service is available;

e) maintain the choice of enabled/disabled access services across channel changes/content changes, source devices and across power on/standby cycles;

f) allow end users to select a default on/off setting for each access service supported;

g) support the same control mechanisms for the access service on/off state independent of content origin or type. For instance, dedicated access services buttons on the remote control should work for all types of content supported by the receiver (and, for example, not just for linear broadcast content).

NOTE   While this document deals with the receiver features in support of access services, broadcasters and other content providers have a key role to play in this area too. Unless they provide the access services content, any receiver functions in support of these are void. There are at present significant differences in the availability of access services in different countries and regions.

5.2.2   Closed captioning

For many deaf and hard of hearing users, content might only be relevant if it is available with closed captioning that the receiver is capable of obtaining and rendering. Users of sign language could prefer to filter content with preference for those content assets that include in-vision signing (see also 5.2.4).

Captions provide a real-time on-screen transcript of the dialogue as well as some sound effects. Subtitles are the transcription of spoken words, while captions include spoken words plus symbols to indicate any meaningful sound whose perception is important to understand the content of the audiovisual program.

5.2.3   Subtitles

NOTE 1   Subtitles are called "closed captioning" in some regions.

Subtitles are a text representation of the dialogue or commentary in audio-visual content. They are usually rendered at the bottom of the picture. Subtitles can be provided in the same language as the audio content (supporting deaf and hard of hearing viewers and older people, and those for whom the audio language is not their native one or who have any other difficulty in following the spoken output) or, in another language, effectively providing a textual translation of the audio content.

NOTE 2   For DVB-based receivers, subtitle functionality is specified in ETSI EN 300 743.

5.2.4   (Open) Sign language

Many deaf and some severely hard of hearing people use sign language as their first language, especially where the hearing loss was acquired at birth or shortly thereafter. Sign language is a visual medium and many sign languages are distinct languages, not just gesture versions of the local spoken language. For these users, sign language may be provided in the form of an in-vision sign language interpreter. As this form of delivering the sign language within the main video stream is non-elective (usually referred to as open signing), there is no further support required from the receiver for rendering open signing.

Some on-demand systems will allow users to select an alternative content asset which has open signing in the video track as opposed to the default asset for the same content.

Where available, digital television solutions should ensure that at least one method exists to allow viewers to find and select such content. Examples of such methods are: searching and/or filtering the electronic programme guide by references to signed content; allowing users to reorder and/or filter channels in lists and/or programme guides so they can make channels with substantial signed content more prominently visible; use of a HbbTV application that redirects to signed content and/or programme versions. This is not an exhaustive list. Such functionality might need metadata handling to display an appropriate text message and/or symbol in content guides/browsers.

5.3   Additional functions

Special attention should be given to the visual feedback provided by menus. Many digital television products include some form of menu based user interface elements. As with all parts of the user interface, clarity is essential. Users need to know where they are, how to navigate and control the menu and which current settings are active. Users need to be able to identify and understand the menus. If users do not know how menus work, where they are or what to do, they will be confused, frustrated and often unable to use the product satisfactorily. Many functions of a digital television product are not accessible to users unless they are able to understand and use menus.

Lack of consistency (including inconsistent terminology) between the user interface and other components frequently confuse users. For example, confusion is likely if an on-screen hint instructs the user to press the return button to go back, yet the remote control the button carries only the '↵' symbol. Similarly, if it is not clear to users where in the menu they currently are or which current settings have been activated, this leads to confusion and frustration.

Most receivers provide menu based navigation for at least some operations. Menus may indicate the current position or selection in a menu clearly and unambiguously on screen and this may also be indicated in audible format. Where submenus or additional menu pages exist, this may be indicated visually, with a clear indication of where exactly in the hierarchy the current position is located. Receivers should provide visual feedback when pressing a remote control button.

6   Accessibility related to visual perception

6.1   Overview

This clause refers to audio feedback. While many users can benefit from this feature, for blind and partially sighted users, this feature can be essential to access and use the equipment.

6.2   Essential functions

6.2.1   List of functions

In order to provide minimal usability, the following functions, if included in the equipment, should be made accessible[1]:

- Configuration–CC Control: Function that allows the user to enable or disable the display of closed captioning. (Or Subtitle Control);

- Configuration–CC Options: Function that allows the user to modify the display of closed caption data (e.g., configuration of the font size, font colour, background colour, opacity, etc.). (Or Subtitle Options);

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[1]   From the US Federal Communications Commission (FCC), FCC 13-138, Appendix B.

- Configuration–Audio Description Control or Video Description: Function that allows the user to enable or disable the output of audio description (i.e., allows the user to change from the main audio to the secondary audio stream that contains audio description and from the secondary audio stream back to the main audio).

NOTE   In some countries and regions, the broadcaster controls the display settings for closed captions (subtitles). In this case, it might be impractical or impossible for the user to override these settings.

6.2.2   Audio description

Audio description is also known as "video description" and "described video". The service, if present, provides additional audible narrative, interleaved with the dialogue, which describes the significant aspects of the visual content of audio-visual media that cannot be understood from the main soundtrack alone. Audio description is the verbal depiction of key visual elements in media and live productions. The presentation of any description of media involves the interspersion of these depictions with the program's original audio. This is not verbalization of the dialogue but only the description of unspoken action and a description of the environment, which is not in the dialogue. Audio description should be enabled or disabled by a mechanism reasonably comparable to a button, key or icon.

6.2.3   Spoken subtitles

NOTE 1   Spoken subtitles are sometimes also called "audio subtitles", not to be confused with either regular subtitles/captions or audio description.

In some countries foreign language programmes are translated by means of subtitles (for instance, an English movie broadcast in a Swedish language region could be broadcast with the original English audio, but with Swedish subtitles). To allow users who cannot read the subtitles (such as blind people) access to the programme, a supplementary audio service that voices/intonates the Swedish subtitles (in Swedish) can be provided. Spoken subtitles are not only related to auditory but also visual perception.

NOTE 2   For DVB-based receivers, spoken subtitles are delivered using the DVB supplementary audio services provisions described in ETSI TS 101 154.

6.3   Additional functions

The following additional functions may be accessible to blind and partially sighted users, as appropriate and possible:

- enable assistive speech and/or tone-based features without sight；
- initial setup (see 9.1)；
- wherever possible, complement an icon or symbol with a textual representation；
- use symbols or icons that are widely used and understood.

6.4   Solutions for users with little or no visual perception

6.4.1   Physical buttons and keys

6.4.1.1   Overview

This subclause covers traditional, button based remote controls. It does not cover alternative remote controls such as for example wands, and also does not cover on-screen keyboards or companion devices which are discussed in Annex D. Remote controls often need to be designed to both allow access to, and operation of, many and sometimes complex functions while at the same time be easy to use and meeting aesthetic and branding requirements. In research, it is shown that all users like and favour simpler designs and layouts, as well as those that use familiar and consistent layouts. Predictably, bigger buttons are preferred over smaller ones whereas word based captions are not necessarily favoured over symbols.

6.4.1.2   Shapes and spacing

In order to be considered accessible, remote controls should:

- have clear, legible, and durable button labels consistent with the on-screen interface and any documentation or help function;
- ensure adequate grouping and spacing for buttons of different categories such as numeric, channel and volume control, navigation, colour buttons;
- have keys with a good amount of travel and tactile feedback, which are not too sensitive so that they are not accidentally activated.

Touch panels are exempt.

6.4.1.3   Nibs

In order to be considered accessible, remote controls should, if a numeric pad is present on the remote control, include a raised marker (nib) on the number 5 key of the numeric pad, as described in ISO 24503:2011. Power buttons may also have a nib.

NOTE   This raised marker is a legal requirement in some regions.

6.4.1.4   Layout, power controls

In order to be considered accessible, remote controls should position the power on/standby button away from other buttons. Some recommendations are given in ISO 24503:2011. It is recommended to distinguish the size or shape of the power button from other buttons.

6.4.1.5   Layout, navigation controls

Remote controls often include a set of navigation buttons, which may also include confirmation buttons such as "OK" or "select". In some cases these buttons may be grouped with other related functions, including "home", "guide", etc.

Usability is greatly increased if such buttons and groups are organised logically and can be differentiated easily by touch alone. Space, shape, texture, size and sensitivity are all factors that can improve/impair the usability of buttons and button groups.

It is recommended that:

a) up/down and similar functions (channel up/down, volume up/down) are vertically arranged, with the "up" function above the "down" function,

b) backward/forward and similar functions are horizontally arranged with the "backward" function to the left of the "forward" function,

c) where possible, button shape and/or texture should be consistent with function: arrow buttons can be shaped to reflect left/right/up/down directions,

d) paired operations (such as up/down and backward/forward functions) may be implemented using rocker switches to improve usability,

e) buttons should be as much as possible well-spaced and separated (the closer buttons are together, the easier it is to confuse and/or accidentally activate them).

6.4.1.6   Layout of a numerical keypad

It is recommended that the numeric keys, where present, should be grouped with digits 1 to 9 in a 3 × 3 matrix, beginning with 1 in the top left hand corner to 9 in the bottom right hand corner and with the zero centred under 8 button, as shown in Figure 1.
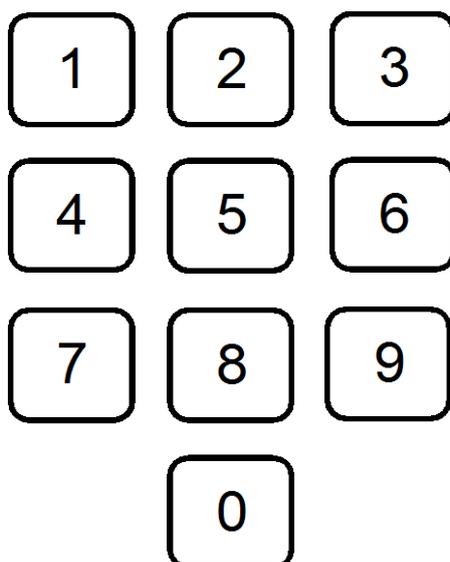
IEC

NOTE   There is another layout of the numerical keypad, for historical reasons. The case of Japan is described in Annex A.

Figure 1 – Recommended layout of numeric keys

6.4.2   Assistive speech

6.4.2.1   Speech interface

For some users, notably many blind people and persons with severe vision loss, a talking user interface can make the digital television solution significantly more accessible. For some people, such talking features are indispensable to be able to use the product altogether.

When rendered through a speech based interface, menus with large numbers of items or other deep nested structures become particularly slow to navigate. Other aspects, otherwise used to aid navigation, such as colour coding and other aspects of presentation might not be represented well through spoken output and implementers are encouraged to design talking features with particular attention to the principle of equivalency as set out in 4.4.

The provision of talking features is covered in detail in IEC 62731:2013.

Receivers should provide both visual and audible feedback when pressing a remote control button. This function should be integrated in the receiver rather than the remote control, to ensure that the feedback indicates correct reception and processing by the receiver. Receivers should use different tones or sequences to differentiate certain actions. Talking features improve significantly the quality of audible confirmation and feedback on remote control key presses.

6.4.2.2   On screen display

When designing the graphical interface, menus, dialogues and other visual components of the user interface, adhering to good design principles can make the user interface more accessible and attractive to all users. A well designed graphical interface benefits both general users as well as disabled and older users.

When designing the user interface, implementers should:

a) use plain language and match the terminology used elsewhere (such as on remote control captions, in documentation, etc.),

b) keep all user interface elements essential for full understanding within the safe area of display,

c) limit the use of font variations,

d) display all elements with very good contrast,

e) avoid, if possible, neighbouring combinations of green and red. This combination may be used when this is recognizable by adding textual representation/marks,

f) use Arabic numerals only, unless the solution is intended for primary use in regions with different numeral systems,

g) render the user interface on a plain, opaque background or offer an optional user setting to this effect,

h) apply at least 1,5 line spacing,

i) avoid the use of columns and, where they are necessary, use sufficient column spacing,

j) provide ample white space between symbols or other graphics and text.

While navigating through the various screens of the digital television solution, the user should be able to:

k) recognize the current location within the structure/hierarchy at all times,

l) go "back" whenever traversing through a list or hierarchy of screens/options,

m) unambiguously confirm selections or actions by visual and audible means.

6.4.2.3   Service and content guides

Amongst the most essential functions on current digital television solutions is the capability to search (and select) content. For users who require the use of access services when using this content, it is essential that this process of finding and selecting content can be done on the basis of the availability of said access services.

For example, for many deaf and hard of hearing users, content might only be relevant if it is available with subtitles that the receiver is capable of obtaining and rendering. Users of sign language might prefer to filter content with preference for those content assets that include in-vision signing (see also 5.2.4). Blind users might wish to only browse content available with audio description (or alternatively to order content preferentially, or mark it correspondingly, based on the availability of audio description).

NOTE 1   This recommendation to filter content on the basis of its accessibility is similar in many ways (including aspects of implementation such as metadata handling and selection of audio and video streams amongst available alternatives) to filtering contents for non-disabled users on the basis of other properties (such as genre, favourites, language settings, etc.).

NOTE 2   Sufficient and accurate metadata is preferable to provide filtering options for specific user content preferences. In the case where such metadata is unavailable, it is recommended to notify the user.

6.4.3   Tone-based feedback

This document refers in several places to the need for audio feedback. The preferred method of giving audible feedback is through talking features whereby the receiver provides aural prompts and announcements similar to speech, usually through a text-to-speech based interface. This is therefore the recommended way to support the concerned user group.

Where talking features are not provided, a tone-based audible feedback mechanism should be provided instead if the solution is to support blind and partially sighted people. Such audible feedback is used as an alternative to visual feedback/clues for people who are unable to use the visual interface. ISO 24500 specifies auditory signals as feedback from operations.

Examples of when such feedback should occur are: when pressing remote control buttons; while navigating a menu or as confirmation of a change in state or setting of the receiver. Because such tone based feedback can be provided in response to a range of different

actions, receivers should use a range of clearly distinguishable audio patterns to signal different types of feedback. The patterns should be chosen so as to easily avoid confusion.

Examples of patterns are: short beep, then long beep; three short beeps in quick succession; ascending/descending tonal patterns.

Where relevant, patterns should logically relate to the action/information they signal and to one another. For example, if a toggle switch uses a sequence of three ascending tones to signal the on state, it should signal the off state by the reverse pattern.

A majority of people hear lower frequencies (within the audible frequency spectrum) better than higher frequencies. As people age, hearing acuity diminishes and is characterized by significant attenuation of higher frequencies compared to lower frequencies. Age-related hearing loss is substantially more pronounced at the higher frequencies.

Fox example, with regard to audible frequencies, a frequency around 500 Hz is more likely to be heard. To design the frequency and volume of alarm tone, receivers should consider domestic noise. To create a discernible gap between tones, reasonable interval rates should be kept.

Digital television solutions should:

a) incorporate audio feedback according to recommendations contained in ISO 24500:2010,

b) determine the sound pressure levels of audio feedback in domestic noise referring to ISO 24501:2010.

NOTE   ISO 7731 can be used for guidance for hearing-impaired people. It is estimated that 14 % of the population suffers from hearing impairments and this percentage is likely to increase in the future. Most common impairments involve loss of sensitivity to frequencies above 1 kHz. Production of tone signals with frequencies below 250 Hz is technically difficult when using low-cost techniques. Therefore, tone signals are preferably in the frequency range of 250 Hz to 1 kHz.

6.4.4   Speech recognition

Receivers may also allow for textual input via automatic speech recognition (ASR) which could render text accessible to some users who are otherwise unable to perceive it. However, this should not be the sole mechanism of text entry, as it is inaccessible to many people with language difficulties, speech impediments and some cognitively disabled people.

When using ASR for text input, receivers may:

a) allow for letter by letter (or number) entry per speech,

b) in addition to visual cues, provide speech synthesis feedback to confirm entries.

6.5   Solutions for users with low visual perception

6.5.1   Overview

Many types of visual impairments, including some commonly found amongst older people, can be mitigated by a high contrast visual interface and large fonts specifically presented clearly against the background. Similarly, context of use factors such as bright ambient lighting can be mitigated with high contrast user interfaces. Ultimately, all users benefit from interfaces with good contrast and careful selection of fonts, colours and backgrounds.

6.5.2   Large fonts, icons, and buttons

There are significant differences in terms of clarity and legibility between different fonts. The selection of the correct font and rendering in an appropriate minimum size improves accessibility for all users, but particularly for persons with vision loss, dyslexic users and some people with cognitive disabilities.

Digital television solutions should

a) provide font with high legibility properties,

b) avoid distortion of font (for example, do not change the aspect ratio),

> NOTE 1 For DVB subtitles, the font is selected by the content creator and subtitles are rendered as bitmaps in accordance with the signalling received.

> NOTE 2 Similarly, where embedded media players and interactive applications and services are included in the digital television solution, control of the font might not be possible.

c) use a typeface designed for digital television displays that is easily discernible among typeface shapes,

d) display text with anti-aliasing and appropriate kerning,

e) use a uniform font style/type across all pages of graphical interfaces when applicable,

f) minimise changes in font type, face, variation, size and colour,

g) avoid rotated fonts.

In order to further improve the accessibility, digital television solutions may:

h) allow users to select from a variety of font types,

i) provide options for increasing/decreasing font size.

Note that an appropriate font style and size is not just relevant to on-screen text. An accessible font style and size should be considered for the remote control and product documentation.

In addition to fonts, icons and symbols can be effective means for clear communication within the user interface. Use of icons and symbols are effective if easily understood by the end user. Otherwise icons and symbols can unnecessarily cause confusion and complicate the graphical interface. Therefore, the choice of icons and symbols should be derived from ubiquitous icon and symbol sets and be easily recognized. The careful choice of icons and symbols contribute to overall accessibility solution.Icons should be easily recognized and less specific to culture or language, not needing translation, and providing consistent user experience.

As with other visual components of a graphical interface, not all users are able to recognize (see) or understand icons or symbols. Therefore, they should not be the sole means to convey essential information.

Digital television solutions should:

• for the sake of simplicity, provide well-known icons without textual captions and if feasible provide a corresponding textual caption for lesser known icons and symbols,

• provide symbols or icons that are demonstrably ubiquitous and easily recognized.

6.5.3 Screen magnifier

> NOTE This function is often referred to as "zoom".

Many people with vision loss and numerous older users benefit from an on-screen magnifier that is used to selectively magnify a portion of the screen. Receivers therefore may include a screen magnifier function. A dedicated and easy to find button on the remote control and/or other means of activating the magnifier improves the usability of this function.

Digital television solutions supporting external connectivity with companion screens or other secondary devices may also be used to offer either an alternative large print interface or for using the secondary screen as the magnifier viewing area. In this case, a solution on a secondary device is beneficial for people with significant vision loss. Care should be taken to ensure connecting the secondary device is as accessible as possible (see also Annex D).

6.5.4   Arrows

Most receivers provide menu based navigation for at least some operations. Menus may use arrows as defined by ISO 7001. Arrows are often used for navigation.

6.5.5   High contrast

High visibility user interfaces should provide a good tonal contrast between foreground and background information or for any element that needs to stand out.

Because there is much variation with colour perception, contrast and related ambient conditions, the ability to adjust the colour and contrast significantly improves accessibility for people with vision loss and/or dyslexia.

Many digital televisions provide browsers and navigation interfaces, frequently using complex backgrounds and/or transparent overlays to enhance attractiveness of the interface. However, with such complex backgrounds, the rendering of textual information creates significant impediments for people with vision loss, dyslexia, the elderly, and other individuals.

6.5.6   Background images

If textual information and other relevant elements are rendered in conjunction with images or other complex backgrounds, a risk exists that the foreground text (or portions) or other elements become indiscernible against the background. For example, white text over a light part of a background picture may be indiscernible. The ability to remove the background or use of techniques such as alpha blending and/or semi-transparent layering can significantly improve contrast and visibility.

6.6   Solutions for those with limited colour vision perception

When designing the user interface, solutions for individuals with colour blindness should be considered.

a) It is recommended not to use red for any button other than the 4 colour keys and the power button. Where the power button is also red, it is recommended that it is made easily distinguishable from the red colour key button by a combination of size, shape, position, grouping and tactile properties.

> NOTE 1   The red button can be used if it does not lead to a mis-operation. In some countries the implementation of a red button is bound to contracts and UI guidelines. In some cases, the red button needs to be used for the "recording start button".

> NOTE 2   Red characters might be needed for "Caution", "Warning" or other special messages. Some regions mandate that the user be able to change closed caption content to a list of colours that includes red.

b) Avoid, if possible, neighbouring combinations of green and red. This combination should be permissible if textual representations/symbols are used to identify the buttons.

c) It is also recommended to display items with sufficient contrast to be clearly visible against their background.

7   Accessibility related to mobility

7.1   Overview

Usability of remote controls affects all users. However, special attention should be given to ensure that remote controls can be operated by users with limited mobility and/or dexterity.

In addition to the remote control, other means (such as companion devices and other controllers) may be considered for accessing, understanding and using the digital television solution. Furthermore, by meeting the guidelines in Annex D, more specialised and/or

personalised ways of operating digital television solutions can be made available to the widest range of users.

Some people have reduced dexterity or strength in their hands and/or might only be able to operate a remote control with one hand. This can be due to permanent conditions such as rheumatoid ailments, temporary situations such as illness or injury or due to aging. In some cases, users might simply be holding something in the opposite hand.

7.2   Functions

7.2.1   General

Limited mobility can make it difficult for people to grip and operate the remote control with precision. Functions that involve pressing two buttons at the same time are difficult and often confusing and might be impossible to operate for some persons.

Many, if not most, people (not just those with impaired sight) operate the remote control by feel. Making it easy to identify which buttons are being operated by using spacing, size, shape and tactile feedback improves usability significantly.

7.2.2   Single hand operation

In order to be considered accessible, remote controls should be operable by a single hand.

7.2.3   Single button operation

In order to be considered accessible, remote controls should minimise the necessity for two buttons to be pressed simultaneously for normal operations. Simultaneous key presses are sometimes required in special cases (such as initial setup, special setup, remote control key code change, child lock setting) in order to prevent mis-operation. Simultaneous key presses are also used in order to initialize the remote control itself.

7.2.4   Resting the remote control on a surface

Remote controls should be able to be operated without being held in the user's hand. The enclosure should not be made of slippery material in order to make it easier for the user to grasp, to place it on a table or armrest, or to affix it to a chair or table.

7.2.5   Angle of use

Most users wish to hold a remote control in a comfortable position, which is not always directly aimed at the receiver. Other users might also have to hold the remote control at an angle because of a disability or other condition.

The remote control should be operable properly from a wide range of angles horizontally and vertically and this range of angles should be clearly indicated in the relevant documentation.

8   Accessibility related to cognitive abilities

8.1   Overview

Some users with cognitive or other disabilities might only be able to operate the television set using basic controls. For some categories of users, remote controls are too complex or might have to be removed for safety or other reasons. For these users, a control panel on the front or other easily accessible part of the receiver that allows them to turn the set on and off, change channel and adjust volume provides some level of access to television that would otherwise not be available to them.

8.2 Language

Most receivers provide menu based navigation for at least some operations. Menus should use plain language and harmonize terminology everywhere practically possible (such as on remote control captions, in documentation, etc.).

NOTE   Due to space constraints it is not always possible to use the exact same terms everywhere.

8.3 Icons

The considered use of icons and symbols can in itself contribute to the overall accessibility of the solution. They can be recognised easily, are often less culture and language specific so as not to need translation and can bring consistency to the user experience.

Furthermore, digital television solutions should use symbols or icons that are demonstrably widely used and understood.

8.4 Labels

Have clear, legible, and durable button labels consistent with the on-screen interface and any documentation or help function. Touch panels are exempt.

8.5 Buttons

In addition, remote controls may:

- have buttons with a good amount of travel or stroke and tactile feedback, which are not too sensitive so that they aren't accidentally activated,
- position the power on/standby button away from other buttons.

8.6 Use of red

In addition, remote controls should not use red for any button other than the 4 colour keys and the power button. Where the power button is also red, it is recommended that it is made easily distinguishable from the red colour key button by a combination of size, shape, position, grouping and tactile properties.

NOTE   The red button could be used if it does not lead to a mis-operation. Furthermore, the implementation of a red button is bound to some contract/UI guidelines in some cases, and it is conventional to use a red colour for the "recording start" button.

8.7 Simplicity

Lack of consistency including inconsistent language between the user interface and other components frequently confuses the users. Receivers should provide consistency between the on-screen menu and the remote control buttons.

9 Accessibility related all (other) perception

9.1 Setup

9.1.1 Overview

The initial setup of a receiver can be challenging for all users, and even more so for people with disabilities, the elderly, and cognitively limited persons.

In line with the principles expressed in 4.4, the initial setup and installation should be made as accessible as possible. Nevertheless, there are overriding health and safety considerations. For that reason, this document does not cover the delivery, unpacking, secure installation on a stand or wall mounting or first time connection of the power and signals. These are activities

where users might need to obtain assistance or other support, including for reasons of health and safety.

The following key principles should be applied in designing the initial setup process.

a) It is recommended that following the first power on cycle, the initial setup process starts automatically.

b) Prompts and other instructions (including printed guidance and/or on-screen help dialogues) should use plain language that can be understood by all users. Jargon and technical terminology might not be known or understood by all users.

c) For receivers with talking features, the initial setup should be fully supported by the talking interface.

d) With regard to tuning for linear broadcast, the receiver should install the full range of available services and keep the user informed of progress through both visual and audible feedback, as appropriate (see also 6.4.3 on audio feedback).

e) If no linear broadcast source (antenna, cable, satellite) is connected and/or no channels are found, the user should be instructed in simple and clear language on how to connect the source and restart the tuning process.

f) For receivers that need Internet protocol (IP) setup, the DHCP based configuration should be the default setting, so that most users will be able to establish an IP connection without having to enter any IP related settings.

g) Where equipment supports IEEE 802.11 wireless network connections, the receiver should support Wi-Fi protected setup (WPS) to make the setup easy for the user.

h) Receivers that support externally connected USB human interface input devices should be connectable for use with external input devices from the beginning of the setup process.

NOTE Receivers that support Internet Protocol often support both IPv4 (IETF RFC 791) and IPv6 (IETF RFC 2460).

9.1.2 Entering account and authorisation information

A user might be required to enter credentials and/or authentication details to allow the digital television solution to connect to, and obtain content from, various service providers.

This can create significant problems for blind and partially sighted users and for those with physical disabilities that mean text entry using the default interface and/or remote control is difficult. Some users with cognitive disabilities might also be affected, especially if the process uses jargon or is otherwise complicated.

The digital television should also allow every configured account to be tested if this is not automatically done after the user has entered details. If the test fails because the details entered are incorrect, the user should be offered the choice of retrying immediately, trying again later (this might necessitate providing guidance on how to do this) or proceeding with the rest of the setup process. Note that feedback on the result should adhere to the multimodality principle set out in 4.4.

EXAMPLE: The user has just entered a username and password to access a service. Upon confirmation of the input, the system tries to authenticate using these details. If authentication fails, the user is informed of this together with any authentication result message received back from the service. If the authentication response indicates incorrect credentials, the user is invited to try entering the credentials again or skip this step. If authentication was successful, the system proceeds as appropriate, indicating success to the user.

NOTE The dialogue for entry of account and authorisation information might be part of a third party application hosted by the receiver. It is preferable that the host environment for such applications supports as many of the receiver's accessibility features as possible and that any documentation for application developers describes how to enable and use such features where applicable.

9.1.3 Suggested sequence for initial setup

The suggested sequence for the initial setup is as follows:

- initial power on;

- welcome message;

- talking features settings;

- accessibility preferences (i.e. high contrast colour scheme, audio description/subtitles on/off);

- linear tuning;

- IP setup (by default via DHCP, WPS);

- companion device pairing;

- service account setup.

In many linear broadcast environments, there is a recurring need to retune the receiver at various intervals throughout the product's lifetime. As such, particular attention should be given to ensuring that this process (including appropriately notifying the user when the need to retune is signalled in the broadcast) is made as accessible as possible.

It is recommended that retuning is automated to the degree allowed by the local broadcasting system. The use cases are:

a) when a new service starts on a previously unused frequency band,

b) when an existing service stops broadcasting, and

c) when a service changes frequency bands, due to spectrum reallocation.

9.2   Content search

Amongst the most essential functions on current digital television solutions is the ability to search (and select) content. For users who require the use of access services when using this content, it is essential that this process of finding and selecting content can be done on the basis of the availability of said access services.

Modern digital television solutions often provide access to a range of content from different providers and may offer facilities to play content at the user's time of choosing, either by providing recording facilities, by supporting access to on-demand content (streamed, downloaded) or both of these.

However, the means by which users can find, navigate and control this content can be fragmented and sometimes confusing, presenting different interaction paradigms and presentational styles for different types of content or even content provider. Furthermore, it is common for (certain) features in support of accessibility not to be consistently available across all content guides, delivery and play-out technologies.

Some of these differences are as the result of the fact that the navigation and control interface might be provided by an external content provider or other third party instead of being part of the design of the digital television solution. Implementers might seek to collaborate with content providers from the early stages of design and implementation in order to minimise these differences and to maximise the ability of the non-native interface to take advantage of any accessibility features built into the digital television solution. In particular, implementers should consider how embedded media players and other non-native applications can make use of the accessibility features of the solution (for example to take advantage of a magnifier, high visibility settings or an embedded or externally connected TTS interface).

Within the limitations as set out above, it is recommended that digital television solutions should, wherever possible:

a) offer a consistent presentation of content, irrespective of its origin or source,

b) use the same terminology for searching, filtering and marking as "favourite" across different types and provenance of content,

c) allow users to search and filter content on the basis of access service preferences.

NOTE   For DVB systems the necessary signalling properties in support of subtitles and audio description are covered in the DVB-SI specification ETSI EN 300 468.

Annex A
(informative)

Remote controls and buttons

To design physical controls that are considered accessible implementers should:

a) where a traditional, button based remote control is provided, have dedicated audio description on/off and subtitles on/off buttons on the remote control. It is recommended to allow substitution of a remote control button by menu-operation (see 5.2.1);

b) have clear, legible, and durable button labels consistent with the on-screen interface and any documentation or help function (see 6.4.1.2);

c) ensure adequate grouping and spacing for buttons of different categories such as numeric, channel and volume control, navigation, colour buttons (see 6.4.1.2);

d) have keys with a good amount of travel and tactile feedback, which are not too sensitive so that they aren't accidentally activated (see 6.4.1.2);

NOTE 1   Touch panels are excepted.

e) if a numeric pad is present on the remote control, include a raised marker (nib) on the number 5 key of the numeric pad (see 6.4.1.3);

NOTE 2   This raised marker is a legal requirement in some regions.

f) Position the power on/standby button away from other buttons (see 6.4.1.4);

g) Power buttons might also have a nib. Some recommendations are given in ISO 24503:2011. It is recommended to distinguish the size or shape of the power button from other buttons.

In addition, it is recommended that for remote controls:

h) up/down and similar functions (channel up/down, volume up/down) are vertically arranged, with the "up" function above the "down" function;

i) backward/forward and similar functions are horizontally arranged with the "backward" function to the left of the "forward" function;

j) where possible, button shape and/or texture should be consistent with function: arrow buttons can be shaped to reflect left/right/up/down directions;

k) paired operations (such as up/down and backward/forward functions) may be implemented using rocker switches to improve usability;

l) buttons should be, as much as possible, well-spaced and separated; the closer buttons are together, the easier it is to confuse and/or accidentally activate them;

m) it is recommended that the numeric keys, where present, should be grouped with digits 1 to 9 in a 3 × 3 matrix, from 1 in the top left hand corner to 9 in the bottom right hand corner and with the zero centred under the 8 button (see 6.4.1.6).

In order to be considered accessible, remote controls should:

n) be operable with a single hand;

o) allow up to two buttons to be pressed simultaneously. Simultaneous key presses are used in special cases (such as initial setup, special setup, remote control key code change, child lock setting) in order to prevent mis-operation. Simultaneous key presses are also used in order to initialize the remote control itself;

p) be able to be operated without being held in the user's hand;

q) the remote control should not be made of a slippery material in order to help users to hold it and makes it easier, where necessary, to place it on a table or armrest, or to fix it to a chair or table;

r) most users wish to hold a remote control in a comfortable position, which is not always directly aimed at the receiver. Other users might also have to hold the remote control at an angle because of a disability or other condition;

s) properly operate from a wide range of angles horizontally and vertically. The ranges should be indicated clearly in any documentation;

t) not use red for any button other than the 4 colour keys and the power button. Where the power button is also red, it is recommended that it is made easily distinguishable from the red colour key button by a combination of size, shape, position, grouping and tactile properties.

NOTE 3   The red button could be used if it does not lead to a mis-operation. Furthermore, the implementation of a red button is bound to some contract/UI guidelines in some cases, and it is conventional to use the red button for "recording start".

In some countries, the layout of the numerical keypad might be different. Subclause 6.4.1.6 describes a layout of a numerical keypad. But in some countries, the remote control has more than 10 numeric keys to select the channel directly.
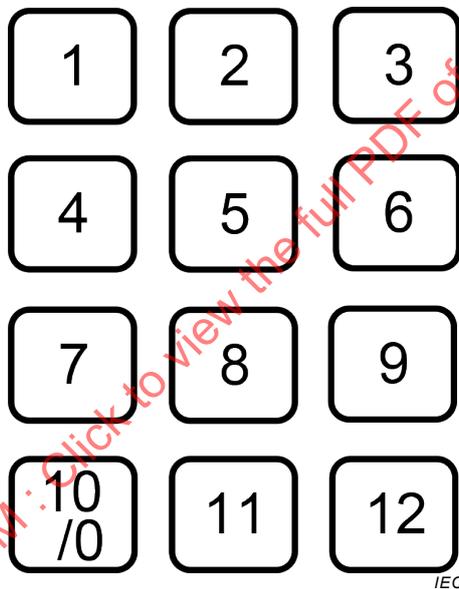
Figure A.1 shows layout with 12 direct keys.

Figure A.1 – Layout of numeric keys in Japan

Annex B
(informative)

On screen display

This annex summarizes all of the recommendations related to the on screen display into a single list.

When designing the user interface, implementers should:

a) use plain language and match the terminology used elsewhere (such as on remote control captions, in documentation, etc.);
b) keep all user interface elements essential for full understanding within the display's safe area;
c) limit the use of font variations;
d) display all elements with very good contrast;
e) avoid, if possible, combinations of green and red. This combination should be allowed when this is recognizable by adding literary captions / marks.

In addition, implementers should:

f) use Arabic numerals only, unless the solution is intended for primary use in regions with different numeral systems;
g) render the user interface on a plain, opaque background or offer an optional user setting to this effect;
h) apply at least 1,5 line spacing;
i) avoid the use of columns and, where they are necessary, use sufficient column spacing;
j) provide good amounts of white space between symbols or other graphics and text.

While navigating through the various screens of the digital television solution, the user should be able to:

k) know at all times where in the structure/hierarchy of screens they are at that moment;
l) be able to go "back" whenever they are traversing through a list or hierarchy of screens/options;
m) have their choice or actions clearly and unambiguously confirmed by visual and audible means.

In addition, receivers should provide consistency between the on-screen menu and the remote control buttons (see also 8.7).

Most receivers provide menu based navigation for at least some operations. Menus may indicate the current position/selection in a menu clearly and unambiguously on screen and may also be indicated in audible format.

Where submenus or additional menu pages exist, this may be indicated visually with clear indication of where exactly in the hierarchy the current position is located.

Annex C
(informative)

Content

C.1 General

All recommendations related to content are summarized in a single list, including references to the text, as appropriate.

For many users, in particular those with sensory disabilities and, to a lesser extent, some people with cognitive disabilities, accessibility of the content is as important as interface accessibility. The main means by which the digital television solution contributes to this is by supporting the appropriate delivery mechanisms for access service(s) relevant to its operating environment.

NOTE Content accessibility is not solely under control of the digital television receiver. Content providers are responsible for creating, signalling and transmitting access services content using the appropriate delivery mechanisms supported by the receiver.

This annex describes access services technologies currently available in mainstream products and services.

C.2 Closed captioning

Captions provide a real-time on-screen transcript of the dialogue as well as any sound effects. Subtitles are the transcription of spoken words, while captions include spoken words plus any meaningful sound whose perception is important to understand the content of the audiovisual program.

C.3 Spoken subtitles

NOTE 1 Spoken subtitles are sometimes also called "audio subtitles", not to be confused with either regular subtitles/captions or audio description.

In some countries foreign language programmes are being translated by means of subtitles (for instance, an English movie broadcast in a Swedish language region might be broadcast with the original English audio, but with Swedish subtitles). To allow users who cannot read the subtitles (such as blind people) access to the programme, a supplementary audio service that intonates the Swedish subtitles (in Swedish) can be provided.

NOTE 2 For DVB-based receivers, spoken subtitles are delivered using the DVB supplementary audio services provisions described in ETSI TS 101 154.

C.4 Subtitles

NOTE 1 Subtitles are called "closed captioning" in some regions.

Subtitles are a text representation of the dialog or commentary in audio-visual content. They are usually rendered at the bottom of the picture. Subtitles can be provided in the same language as the audio content (supporting deaf and hard of hearing viewers and older people, and those for whom the audio language is not their native language or who have any other difficulty in following the spoken output) or in a different language, effectively providing a textual translation of the audio content.

NOTE 2 For DVB-based receivers, subtitle functionality is specified in ETSI EN 300 743.

C.5   (Open) Sign language

Sign language is a visual medium and many sign languages are languages in their own right, not just gesture versions of the local spoken language. For these users, sign language may be provided in the form of an in-vision sign language interpreter. As this form of delivering the sign language within the main video stream is non-elective (usually referred to as open signing), there is no further support necessary from the receiver for rendering open signing.

Currently, sign language interpretation of a television programme is almost always delivered as part of the main video content (which is called "open signing"). Systems and delivery mechanisms that would allow sign language to be offered as an elective service (i.e. which can be turned on an off, like for example subtitles or audio description) are not generally available at present. For linear broadcast environments, the signing will simply be part of the currently viewed broadcast picture.

Some on-demand systems will allow users to select an alternative content asset which has open signing in the video track as opposed to the default asset for the same content.

Where available, digital television solutions should ensure that a suitable method exists to allow viewers to find and select such content. Examples of such methods are: searching and/or filtering the electronic programme guide by references to signed content; allowing users to reorder and/or filter channels in lists and/or programme guides so they can make channels with substantial signed content more prominently visible; use of a HbbTV application that redirects to signed content and/or programme versions. This is not an exhaustive list. Such functionality might involve metadata handling to display an appropriate text message and/or symbol in content guides/browsers.

Annex D
(informative)

External devices

D.1   Overview

In general, three types of external devices of interest exist. These are:

* companion screens,

* audio devices, and

* human interface devices.

The issues and some possible solutions are listed in Clauses D.2 through D.4.

D.2   Pairing with external devices

Many digital television solutions allow connections to companion screens such as smartphones and tablets as well as other devices that can increase the overall accessibility of the system. To use such devices, the user must be able to successfully pair the devices, which might necessitate input of an authorisation code.

For instance, a blind person might want to use a talking interface on a companion device to operate a digital television solution. This requires a person to read a pairing code from the screen of the digital television solution and enter this code in a dialogue on the secondary device. If the code is only visually displayed on the screen, the blind user would be unable to access it.

To address the barriers in the above example, possible solutions include:

a) the digital television solution could implement talking features (see 6.4.2.1) so that the need to enter the code is announced to the end user and the code itself is spoken;

b) when entering the code in the secondary device, the device could pronounce the digits as entered and announce success or failure of the pairing process (and, in the latter case, a clear error message and guidance to the user on how to try again);

c) for devices that do not support talking features, suitably designed audio feedback could indicate to the user the requirement to enter a code as well as the code itself;

    NOTE Systems that do not implement talking features as described in 6.4.2.1 could still provide spoken output for pairing digits. This could be implemented by recorded prompts for each of the digits 0 to 9 for example.

d) solutions could also implement implicit authentication based on automated discovery and exchange of certificates or any other suitable credentials on the companion device. This would remove the need to enter any codes or otherwise manually perform a pairing process;

e) solutions could also implement implicit authentication by virtue of the companion device being connected to the same local network. For IPv4 devices, this could mean accepting connections from other devices on the same local subnet. For IPv6 devices, this could be based on neighbour discovery methods. Security is an important consideration and could be implemented with a simplified interaction akin to the methodology of Wi-Fi protected setup;

f) solutions could also implement authentication by means of, for example, near field communication (NFC) pairing, as one example of an alternative pairing method with accessibility benefits. For instance, once the pairing process has been instantiated the user could be required to tap or slide the companion device on/across the receiver or a remote control. It should be noted that people with visual impairments and some users

with physical or cognitive impairments might face difficulty with such a process, especially if requiring a high level of motor skill precision.

Time-outs associated with the pairing process can cause barriers. To remove these barriers, the time-out interval could be configurable and/or disabled altogether.

As a general rule, pairing processes often provide significant hurdles to many disabled users. Ideally, limitations related to sight, physical mobility and cognitive abilities are all considered when designing these processes.

D.3   External audio/headphone connections

Many digital television solutions provide external audio connections and/or the ability to connect headphones to the receiver. Some of these connections may be used by hearing aid wearers for direct connection to the audio source. Analogue audio out connections may be used to drive an inductive loop amplifier, whereas Bluetooth and other wireless solutions can also be used to connect to some hearing aids.

For external audio and/or headphone support features, it is important for users to be able to select which, if any, audio based access service they wish to enable over the connection, independently from what is rendered over the primary output. Having separate tone control (and separate volume control, in particular for analogue audio out connections) over each individual audio connection is also beneficial for people with hearing loss.

For example, in a mixed household, the primary output might be set to have the audio description or spoken subtitle service switched off, while a person listening simultaneously via a headphone or over an inductive loop amplifier connected to an audio out socket might have the audio description or spoken subtitle service switched on.

It is helpful for all headphone or audio sockets, as well as all other external connectors to be clearly marked and labelled.

D.4   Support for USB human interface input/output devices

In order to maximise interoperability with externally connected input and output devices, digital television solutions can:

a) support external input and output devices compliant with open host controller interface OR implement the extensible host controller interface (xHCI) for such devices;

b) automatically recognise any human interface input or output device connected via USB and, where necessary and available, install a correct driver for the device;

   NOTE   This provision might be difficult to be implemented, especially for future devices.

c) where external speakers are connected to the USB interface, allow these to be used either as a replacement for the primary output speakers or concurrently with the primary output;

d) allow users to select which, if any, audio based access service they wish to enable over any USB connected speakers.

The intention is that external keyboards, speakers and/or microphones can be connected to the digital television solution. This would include specialised input devices that appear to the host as a standard keyboard. It is helpful for all USB connectors, as well as any other external connectors, to be clearly marked and labelled.

Annex E
(informative)

Background

E.1 Widest range of users

Users of digital television products are incredibly diverse as manifested through their different individual abilities, characteristics and preferences. In addition to that user diversity, the way in which they consume digital television has also rapidly changed and content is consumed in almost any place and at almost any time on a variety of devices and solutions. Content can be from linear and non-linear sources and comes from a variety of providers.

In designing solutions, it is not feasible to try and accommodate each individual permutation of user abilities, characteristics and preferences, even less so if considered in conjunction with all the possible contexts of use and types of content. Instead, one should design solutions so that they make as little assumptions as possible about user abilities or context of use. It is possible to design solutions so that they can be accessed, understood and used by the widest range of users by following the principles set out in this document and including the functionality described herein.

Digital television, which includes both broadcast and on-demand services, is of great importance to all consumers. It is therefore important to strive to enable the widest range of users to access, understand and use television.

In many regions, access services such as subtitling, audio description, signing, etc. are available for a proportion of content. Provided these are supported by the receiver, they make television accessible to viewers who would otherwise not, or only in a limited way, be able to use it.

Designing a product in accordance with this document means, all users benefit, not just a subsection of people with disabilities. This is a key feature of designing for the widest range of users.

When interacting with a digital television solution, the user typically uses a combination of visual, audible, physical and cognitive capabilities to both access and control the solution as well as to consume its content. If these user abilities are not matched by compatible features in the user interface or content, then the user might experience barriers in using the solution and consuming its content. There is, thus, an interaction and a dependency between the user's abilities, characteristics and preferences on the one hand and the modalities offered by the solution's user interface and content on the other.

E.2 Context of use

However, it is essential to understand that user abilities, characteristics and preferences are not always static, but often change depending on the environment in which a solution is used and on context of use. The main factors that define whether a user can access, understand and use a digital television solution are the following.

- The abilities and characteristics of the user (in particular their sensory, physical and cognitive faculties) and any disabilities (either permanent or temporary) such as visual impairment, impaired hearing, reduced mobility or dexterity, contrary to what is often assumed, this does not just affect specific groups like blind, partially sighted, hard of hearing,etc., individuals. Every person can experience a disabling condition, either temporary or permanent. It can be brought about as the result of illness or injury, the aging process or, as set out below, the context of use. Annex F discusses the main user groups affected.

- The environment and context of use of the solution can also impact on how well a solution is accessed, understood and used. These environments comprise viewing content on a tablet outdoors where there is lots of glare and using a reduced touch screen based interface versus indoors in dimmed lighting and on a large screen using a traditional remote control; consuming content in a busy or noisy environment or just having the television on in the background while undertaking other activities; providing or consuming content where not all media is appropriate such as having television screens with the sound off in reception or other communal areas.

Annex H gives examples of how different abilities, characteristics and preferences as well as environmental factors and context of use have an impact on usage and might stimulate design considerations. Careful and creative design of solutions can address a great deal of the barriers and problems that users can otherwise experience and will lead to products that work better for all users, not only older people or those with disabilities.

It follows, then, that television related products and services are likely to have implications for a significant number of potential users. Perhaps the most recognised are people with hearing or sight loss, or where the context or environment affects hearing or sight. However, as will be apparent from the description above and as illustrated by Annex F and Annex H, there are many other groups of affected consumers.

E.3   Accessibility considerations

In order to achieve the best levels of accessibility at the lowest cost and with the highest level of coherence and integration within a given digital television solution, accessibility requirements and features ought to be considered and addressed from the earliest stages of design and implementation. This should include reviewing the appropriate mechanisms in support of access services delivery for the broadcast technologies for which the solution in question is being developed.

Leaving consideration of accessibility to a later stage almost always creates significant barriers and higher costs. Processing capabilities, memory and storage, bit-rate and bandwidth needs, spatial and layout requirements, support for given content discovery, getting and decoding technologies all might be impacted by the need to support a given accessibility requirement.

It is essential to understand that user abilities, characteristics and preferences are not always static, but often change depending on the environment in which a solution is used and on context of use. The main factors that define whether a user can access, understand and use a digital television solution are: the abilities and characteristics of the user (in particular their sensory, physical and cognitive faculties) and any disabilities (either permanent or temporary) such as visual impairment, impaired hearing, reduced mobility or dexterity may concern anyone. Contrary to what is often assumed, this does not just affect specific groups like blind, partially sighted, hard of hearing,etc., individuals. Indeed, anybody can experience a disabling condition, either temporary or permanent. It can be brought about as the result of illness or injury, aging or, as set out below, the context of use.

E.4   Accessibility principles

E.4.1   General

In developing digital television solutions for accessibility, implementers should proceed on the basis of certain overarching principles in order to achieve the highest rate of success. It is assumed, however, that not all digital television solutions intend to support every possible combination of end user needs and preferences. As such, implementers may decide to offer only a subset of the features discussed in this document. They may base those decisions on specific regulatory requirements in markets for which solutions are intended.

By addressing accessibility the widest range of users should be able to use the solution. In seeking to reduce the usage gap, the purpose of the design should be to ensure that the widest range of users can access, understand and use the digital television solution. Furthermore, if a product or service is easy to access, understand and use, every user benefits.

E.4.2   Functional equivalency

Provide functional equivalency using the various modes of operation.

The features and practices in support of accessibility as discussed in this document seek to achieve, to the largest extent possible, functional equivalency of the user experience for the person using them. This means that, when making use of one or more of these accessibility provisions, the user should be able to enjoy the same content as much as possible and be able to accomplish the same tasks, or as similar as possible, as someone using the default interface and controls.

Depending on the users' abilities and preferences, some objective differences might remain. For example, using a talking interface creates a more serialised interaction compared to using a graphical interface. Another example is where someone is following the dialogue by means of subtitles instead of the spoken audio. In these instances, the use of alternative means to interact and/or consume content means that the experience is not entirely equal, but is as equivalent as possible as defined by the user's specific abilities and preferences.

E.4.3   User interface accessibility

Make the user interface easy to use and comprehend.

Many older and disabled people require specific features in the user interface of a digital television solution in order to be able to use it. This document covers the user interface, remote controls (in the broadest sense) and delegated command and control interfaces through external connectivity provision, including companion devices. Providing a user interface that the widest range of users can access, understand and use is of great importance in determining how effective, usable and attractive the product can be.

There are a number of ways that the design of user interfaces (including traditional remote controls and other external controls) and user interactions can either help or hinder the user in navigating, selecting, controlling and understanding the product.

This document includes a series of features in support of accessibility that implementers might wish to include in their digital television solution. Each section sets out the recommended and desirable functionality if such a feature is to be effective in supporting the target user group for which it is intended.

This document, then, seeks to result in user interfaces that are clear, consistent, efficient and responsive to user needs and context of use, as well as forgiving of the differences in abilities, characteristics and preferences that different users exhibit.

As another general principle, digital television solutions should use plain language and avoid jargon in the user interface, in any documentation, both in print and on-screen and in any applications and accessories. This also includes labelling on the receiver and/or remote controls.

E.4.4   Content accessibility

Support accessibility features provided by external services, such as closed captioning.

Even with an accessible user interface, digital television solutions should support a relevant complement of access services (such as subtitling or audio description) which are essential for many consumers if they are to be able to access the content itself.

For many users, in particular those with sensory disabilities and, to a lesser extent, some people with cognitive disabilities, accessibility of the content is as important as interface accessibility. The main means by which the digital television solution contributes to this is by supporting the appropriate delivery mechanisms for the access service(s) relevant to its operating environment.

NOTE   Content accessibility is not solely under control of the digital television receiver. Content providers are responsible for creating, signalling and transmitting access services content using the appropriate delivery mechanisms supported by the receiver.

Access services provide additional or alternative content for television programmes for the purpose of making these accessible to users who experience content accessibility barriers.

This standard describes access services technologies currently available in mainstream products and services. Digital television solutions should support all these access services in the markets and for the content technologies (i.e. DVB, IPTV) for which they are intended. Annex I lists potential future access services.

E.4.5   Accessibility through external solutions

Support external accessibility solutions with open interfaces. Digital television solutions do not operate in a standalone manner, but provide command and control via companion screens and other secondary devices and/or deliver additional content (including access services) via such connections.

E.4.6   Evaluating accessibility and usability

Evaluate designs and implementations with extreme use cases, such as no video or no audio, potentially by users with limited abilities.

It is always important to ensure that a design meets the user requirements and needs. When aiming for the widest range of users, this is even more important.

There are many different methods to help define and understand user needs and evaluate designs against these needs. Amongst these are:

- using personas and human factors data,
- prototype evaluation in user experience labs,
- focus groups and user observation,
- involving actual users in design and testing activities.

Using "extreme" use cases is generally considered a useful way to test a product's ability to meet the needs of the widest range of users. For instance: can the solution be accessed, understood and used without audio or video? Is it possible to operate the product solely through a companion device?

Existing design guidance often advocates, where practical, the inclusion of disabled users and/or older people and require user tests involving such participants. There can be no doubt that such involvement and a programme of user testing across the widest range of abilities and preferences is often useful, but there are downsides to consider too, such as the time, cost and other resource requirements this adds and the anecdotal nature of collecting data from a relatively small group of people.

Some sources highlight the positive impact of a user-centred focus in design and engineering, arguing that it provides competitive advantages in terms of increased market sizes, improved customer satisfaction and better market retention.

E.4.7 Multi-modality

Satisfy a wide range of users by using multi-modality.

Supporting a range of users with differing profiles of abilities and preferences involves not relying on a single modality (text and graphics, sound, haptic features) as this would mean that a user who is unable to use that mode of communication, or only with severe limitations, could be hindered or stopped altogether from accomplishing a task and/or using content.

For example, where the user interface only provides audible feedback, this would be inaccessible for deaf and some hard of hearing people. Conversely, if the user interface only uses visual feedback mechanisms then blind people and many with sight loss are excluded.

The solution is therefore to create a user interface that does not rely on a single modality, but instead provides interaction through an appropriate mix of modalities. Digital television is fundamentally an audio-visual medium. As such, people with sensory disabilities are generally affected mostly by access barriers (although other groups are not to be overlooked). Generally, it is of great importance to combine visual and audible user interface output methods.

NOTE   The profile of abilities and preferences for older people very frequently includes sensory impairments such as sight loss and hearing loss, both of which are corollaries of the aging process.

The most common use case is thus ensuring that, as far as output is concerned, the digital television solution consistently provides both audible and visual information and feedback, while for input it should allow for the use of alternative input methods (traditional remote control, companion device, USB human interface input device, etc.) rather than being limited to a single method (usually a remote control).

Particular consideration should be given to the inclusion of talking features, for instance by a text-to-speech function, as referenced in 6.4.2.1, and described in IEC 62731:2013. This is because of the highly visual and content rich nature of digital television, which creates significant barriers for blind people and other user groups.

Annex F
(informative)

Brief user profile outline

F.1　Preliminary remarks

This annex gives a very brief summary overview of some of the main user groups that are affected by accessibility barriers in digital television products. It is not intended to be a full and detailed exposition of every relevant detail or to cover all possible use cases. It is meant as a short outline of some of the main characteristics of the groups discussed.

It should be noted that people are individuals and have an almost immeasurable diversity in their abilities and preferences. Care should be taken not to unduly stylise people nor to inappropriately label them.

The terms "disability", "disabled people", "people with disabilities", "impairment" and "older people" can be used in different ways, with somewhat different meaning and intent depending on context, political perspective and other viewpoints. This document does not aim to define these terms other than in their common language meaning as understood by a native speaker.

F.2　Key demographic groups

F.2.1　Blind and partially sighted people

In spite of widespread misconceptions, blind and partially sighted people do use television, just like any other people. Indeed, in many countries people with sight loss or blindness are heavy television consumers. Most people with sight loss have some perception of at least light and darkness and many of course are able to enjoy sound. Digital television can offer all these individuals rich enjoyment and a great source of information. However, in terms of accessibility, blind people and those with significant sight loss are arguably the most disenfranchised users of digital television solutions.

As many people with sight loss cannot follow the visual action directly, audio description is a key service for these individuals. They also require non-visual means of using the digital television solution, which include non-visual output of feedback and state information. A spoken interface can be of great value. As programme guides are key to being able to fully use modern digital television products, particular care should be given to ensuring these are properly made accessible too.

For partially sighted people, high visibility/contrast, fonts with high legibility and magnifiers are often important. In order to be fully inclusive, allowing users to choose from a variety of options for size, colour, contrast, etc., is beneficial.

For all users with sight loss it is helpful to have controls laid out and designed so that they are easy to identify, learn and remember.

Some smartphones, tablets and other devices use operating systems that have extensive support for blind and partially sighted people. This makes scenarios for supporting this user group through externally connected devices highly relevant. This could even include being able to use screen reader software for accessing a delegated user interface on a companion screen where the digital television solution supports this.

Talking solutions and/or spoken input help many blind users as well as some with substantial sight loss.

F.2.2 People with colour blindness

Colour blindness is a condition that affects approximately 8 % of men but only around 0,5 % of women. While there are different causes for colour blindness, in the majority of cases, it is a genetic condition (other common causes are diseases such as diabetes or medication).

Typically, colour blindness manifests itself as an inability (whole or partial) to see red, green or blue light. In some rare cases people cannot see any colour at all. The most prevalent form of colour blindness is red/green colour blindness, meaning that all colours that have a red or green component are mixed up (for instance confusing blue and purple as they cannot see the red component in the purple). However, colour blindness can happen for the whole colour spectrum and even black can be confused for dark green or dark blue in some cases.

As with other conditions, colour blindness can vary from mild over moderate to severe. Typically, most people with a moderate form of red/green colour blindness can only identify accurately 5 or so coloured pencils from a standard box of 24 pencil crayons.

F.2.3 Deaf and hard of hearing people

Possibly the largest single disability of the population are deaf and hard of hearing people. Yet, despite the prevalence of hearing loss, it is also an often overlooked group. Apart from stigma associated with hearing loss in many cultures, this might also be related to the fact that under the broad category of hearing loss come a wide range of subgroups with sometimes quite different profiles of abilities and preferences. The most common cause of hearing loss is the aging process.

Hearing loss is often misunderstood to be about volume, whereas it is mainly an issue relating to tone/frequency response. Commonly, hearing loss is categorised from mild over moderate and severe to profound. People who have developed hearing loss at least a few years after birth usually have acquired spoken language, whereas in many regions those born deaf or with severe hearing loss from birth or shortly thereafter might use sign language as their first language. A significant number of these people do not, or only to a very basic degree, understand spoken and written language. Sign languages in many parts of the world are languages in their own right, with their own vocabulary, grammar and semantics which do not necessarily correspond directly to those of the local spoken language. Apart from being unable to use sound, these individuals often face barriers in using text, especially when it is complex or uses jargon.

Many people with moderate to severe hearing loss use hearing aids or cochlear implants, although uptake can differ significantly between countries and regions. It is estimated that at present there are about 50 million hearing aid users worldwide. Providing a direct connection between the hearing aid and the audio source is often helpful to improve understanding. This reduces interference from background noise (see also below) and generally provides a better user experience, with improved concentration and understanding. Connection between hearing aids and audio-visual equipment is achieved in different ways: inductive coupling with a loop system ('hearing loop'), connection via FM or Bluetooth or through proprietary specialised accessories.

A common corollary of (even mild) hearing loss is that people experience difficulty in discerning speech from background. Even minor hearing loss leads to a noticeable reduction in audibility or intelligibility of the dialogue, well before the hearing loss would be clinically identified by traditional audiometric measures. As much modern audio-visual content uses background sound and effects extensively, this can be a significant barrier.

People with moderate hearing loss often use listening devices, hearing aids (sometimes through 'hearing loop' systems, see IEC 60118-4). For those with severe to profound hearing loss, much or all audio might be unusable. These viewers typically rely on subtitles and/or sign language. Subtitles are essential for many people with hearing loss, while sign language interpretation opens up content for those for whom sign language is their first language.