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Recommendation

ITU-T H.872 (10/2024)

SERIES H: Audiovisual and multimedia systems

E-health multimedia systems, services and applications – Safe listening

Safe listening for video gameplay and esports

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Recommendation ITU-T H.872

Safe listening for video gameplay and esports

Summary

Recommendation ITU-T H.872 is aimed at reducing the risk of hearing loss among video game players. It is aligned with the principles of sound levels, exposure measurement and communication outlined in Recommendation ITU-T H.870.

History *

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T H.872	2024-10-29	16	11.1002/1000/16190

Keywords

Esports, safe listening, sound-induced hearing loss, video gameplay, video gaming.

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Introduction

Globally, over one billion people are at risk of hearing loss due to unsafe listening in recreational settings. To address this, the World Health Organization (WHO) launched the *Make Listening Safe* initiative aimed to promote safe listening and reduce hearing loss.

Amongst the outputs of this initiative was the WHO/ITU H.870 standard for safe listening devices and systems. This standard aims to promote safe listening and minimize the risk of hearing loss among users of personal audio devices/systems. However, video gameplay devices, including those used in competitive video gameplay (esports) are not covered by this standard. Esports and video gameplay are rapidly becoming one of the largest entertainment industries worldwide reaching over 3 billion people, with approximately 1.7 billion game players participating in video gameplay via a personal computer (PC) or a video game console (that are most likely played with sound on or with headphones).

From a public health perspective, video gameplay and esports may expose game players to risky health behaviours including prolonged exposure to loud sounds. It is the responsibility of public health and standardization agencies, governments and industry to ensure that health risks associated with esports and video gameplay are minimized including the promotion of safer listening practices. For these reasons, WHO and ITU have developed a universal standard for safe listening in video gameplay and esports. This standard includes the standardization of sound levels, sound exposure measurement, information provision, and warnings.

Recommendation ITU-T H.872

Safe listening for video gameplay and esports

1 Scope

This Recommendation provides comprehensive safe listening guidelines for devices, video game titles (software) and audio peripherals used for the purposes of video gameplay, either in home entertainment or esports contexts. Devices include video game consoles, handheld or mobile devices and personal computers (PCs), headphones and headsets.

The guidelines herein are designed to ensure auditory health and prevent hearing damage for all types of video game players, across a wide spectrum of video gameplay scenarios and equipment.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.100.1] Recommendation ITU-T G.100.1 (2015), *The use of the decibel and of relative levels in speech band telecommunications*.

[ITU-T H.870] Recommendation ITU-T H.870 (V2) (03/2022), *Guidelines for safe listening devices/systems*.

[EN 50332-1] CENELEC EN 50332-1:2013, *Sound system equipment: Headphones and earphones associated with personal music players. Maximum sound pressure level measurement methodology. General method for "one package equipment"*.

[EN 50332-2] CENELEC EN 50332-2:2013, *Sound system equipment: Headphones and earphones associated with personal music players. Maximum sound pressure level measurement methodology. Matching of sets with headphones if either or both are offered separately, or are offered as one package equipment but with standardised connectors between the two allowing to combine components of different manufacturers or different design*.

[EN 50332-3] CENELEC EN 50332-3:2017, *Sound system equipment: Headphones and earphones associated with personal music players – Maximum sound pressure level measurement methodology – Part 3: Measurement method for sound dose management*.

[IEC 61252] IEC 61252:1993+AMD1:2000+AMD2:2017, *Electroacoustics – Specifications for personal sound exposure meters*.
https://webstore.iec.ch/en/publication/60417

[IEC 61672-1] IEC 61672-1:2013, *Electroacoustics – Sound level meters – Part 1: Specifications*.

[IEC 62368-1] IEC 62368-1:2018, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*.

[ISO 226] ISO 226:2003, *Acoustics – Normal equal-loudness-level contours*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 acoustic reflex threshold [ITU-T H.870]: The sound pressure level (SPL) at which a sound stimulus triggers stapedius muscle reflex (SMR).

3.1.2 acoustic trauma [ITU-T H.870]: A single exposure to sound resulting in immediate injury to the auditory system.

3.1.3 calculated sound dose [IEC 62368-1]: One-week rolling estimate of sound exposure expressed in percent of the maximum regarded as safe.

NOTE – See B.4 of [EN 50332-3] for additional information.

3.1.4 damage-risk criteria [ITU-T H.870]: An archaic term referring to the risk of noise induced hearing loss (NIHL) presented by various levels of noise exposure. In [ITU-T H.870] this term is replaced with several preferred contemporary terms: "dose-response relationship", "risk", or "exposure limit".

3.1.5 dBA [ITU-T H.870]: Decibels of sound pressure level measured using the A-weighting network [IEC 61672] and [IEC 60268-1], see also Figure II.2 of [ITU-T H.870]; a frequency weighting intended to measure low-intensity noise (around 40 phon loudness level) but which has also become commonly used for measuring occupational and environmental noise exposures.

NOTE – The latter use is based on studies of noise-exposed workplace populations in the 1950s and 1960s. That work recommended the use of A-weighting given both its availability in sound level meters and its ability to predict the dose-response relationship over the noise spectra studied [b-Burns-1973] and [b-Burns-Robinson]. Subsequent to that work, the analyses of noise exposed populations upon which the weekly sound allowance in this document are based used A-weighting in measuring noise exposure [b-Neitzel] and [b-Fligor].

3.1.6 dBFS [ITU-T H.870]: dB full scale is the signal level of a digital signal relative to its overload or maximum level. Different conventions exist. It is common to assign a digital representation of a full-scale sinusoidal the value of 0 dBFS RMS. The peak level can then reach +3.01 dBFS. In other cases, the RMS level of a digital full-scale square wave is assigned 0 dBFS RMS. The maximum peak level is then also 0 dBFS. For the latter cases, dBFS is equivalent to dBov. (dBov: dB relative to digital overload is the signal level of a digital signal relative to its overload or maximum level. See [ITU-T G.100.1].)

3.1.7 dBHL [ITU-T H.870]: Decibels of hearing level at a certain frequency; a level used to measure an audiometric hearing threshold relative to the level defined as normal.

NOTE – It is the ear's sensitivity in a human with normal hearing, at different frequencies, that is the reference. Figure 1 of [ISO 226] shows standardized equal-loudness contours at different sound levels and a mapping of phon (loudness) against dB SPL (level). The two scales meet at 1 kHz. dB SPL is by definition referenced at the threshold of hearing at 1 kHz, i.e., 0 phon (and 0 dB SPL).

3.1.8 diffuse-field frequency response of head and torso simulator (sound pick-up) [b-ITU-T P.58]: Difference, in decibels, between the third octave spectrum level of the acoustic pressure at the eardrum reference point and the third octave spectrum level of the acoustic pressure at the head and torso simulator (HATS) reference point in a diffuse sound field with the HATS absent.

3.1.9 diffuse sound field [ITU-T H.870]: A field where at any position in the medium, sound is incident from all directions with equal intensities and random phase. The reverberant sound does not vary with receiver position. (Adapted from [b-Vér].)

3.1.10 (sound) dose [ITU-T H.870]: The total quantity of sound energy received by the human ear during a specified period. In the context of this [ITU-T H.870], it is the same as sound exposure (see clause 3.1.14 of [ITU-T H.870]). The unit of (sound) dose is Pa^2h.

3.1.11 dosimetry [ITU-T H.870]: The calculation and assessment of the dose received by the human ear.

3.1.12 eardrum reference point [b-ITU-T P.10]: A point located at the end of the ear canal, corresponding to the eardrum position.

3.1.13 equal energy principle [ITU-T H.870]: The premise that the total effect of sound is proportional to the total amount of sound energy received by the ear, irrespective of the distribution of that energy in time. According to this principle, equal amounts of sound energy are expected to cause equal amounts of sound induced permanent threshold shift regardless of the distribution of the energy across time. This principle allows the question of hearing damage risk posed by a sound exposure to be related to a sound dose.

3.1.14 equivalent continuous A-weighted sound pressure level [ITU-T H.870]: A continuous sound pressure level (SPL) in dBA which is considered to pose the same risk as a time-varying SPL, calculated using a 3-dB exchange rate between level and time. Mathematically, it is represented as:

$$L_{Aeq,T} = 10\lg\left\{\left[\frac{1}{T}\int_{t_1}^{t_2} {p_A}^2(\mathrm{t})\mathrm{d}t\right]/p_0^2\right\}\ dBA$$

where:

$L_{\mathrm{Aeq},T}$ is the equivalent continuous A-weighted sound pressure level re 20 μPa, determined over a time integration interval $T = t_2 - t_1$

$p_{\mathrm{A}}(t)$ is the instantaneous A-weighted sound pressure of the sound signal

p_0 is the reference sound pressure of 20 μPa.

3.1.15 equivalent continuous average sound level normalized [ITU-T H.870]: A continuous SPL in dBA which is considered to pose the same risk as a certain time-varying SPL pattern measured using a 3-dB exchange rate and normalized to an *n*-hour exposure period. For example, the value for n could be 8, in which case this may also be referred to as an L_{A8hn} or L_{EX8h}", or $n = 40$, L_{EX40h}.

3.1.16 excess risk [ITU-T H.870]: The risk of sound induced hearing loss (SIHL) associated with a specific amount of exposure.

3.1.17 exchange rate [ITU-T H.870]: The change in average noise level (in dB) that corresponds to a doubling or halving of allowable exposure time.

3.1.18 free sound field [ISO 3745]: A field in a homogeneous, isotropic medium free of boundaries.

3.1.19 free-field frequency response of head and torso simulator (sound pick-up) [b-ITU-T P.58]: Difference, in decibels, between the third octave spectrum level of the acoustic pressure at the eardrum reference point and the third octave spectrum level of the acoustic pressure at the head and torso simulator (HATS) reference point in a free sound field with the HATS absent (test point).

3.1.20 frequency response [ITU-T H.870]: In this context, frequency response is short for "sensitivity vs. frequency response", sometimes referred to as the "tone curve" of an audio device, such as a headphone, loudspeaker, microphone, amplifier, etc.

3.1.21 head and torso simulator (HATS) [b-ITU-T P.10]: Manikin extending downward from the top of the head to the waist, designed to simulate the sound pick-up characteristics and the acoustic diffraction produced by a median human adult and to reproduce the acoustic field generated by the human mouth.

3.1.22 hearing threshold level [ITU-T H.870]: Sound pressure level (SPL) at specific audiometric test frequencies, measured in dBHL.

3.1.23 instructed person [IEC 62368-1]: Instructed person is a term applied to persons who have been instructed and trained by a skilled person, or who are supervised by a skilled person, to identify energy sources that may cause pain (see Table 1) and to take precautions to avoid unintentional

contact with or exposure to those energy sources. Under normal operating conditions, abnormal operating conditions or single fault conditions, instructed persons should not be exposed to parts comprising energy sources capable of causing injury.

3.1.24 listening device [ITU-T H.870]: A wearable device used to deliver sound to the ear. Consists of a transducer and fitting to accommodate in the ear, on the ear or over the ear listening. Examples are headphones and earphones. Headphones and earphones may include amplifiers and other electronics, such as for wireless or digital connection, signal processing, noise cancellation, or even media storage for subsequent playback. As such, headphones and earphones with such functionality could be classed as personal audio systems.

NOTE – The principle of classifying energy sources and proscribing safeguards against those sources is enshrined in [IEC 62368-1], on which much of this Recommendation is based.

3.1.25 loudness K-weighted full scale (LKFS) [b-ITU-R BS.1770-5]: This designation signifies: Loudness, K-weighted, relative to nominal full scale. The LKFS unit is equivalent to a decibel in that an increase in the level of a signal by 1 dB will cause the loudness reading to increase by 1 LKFS.

3.1.26 loudness unit full scale (LUFS) [EBU R 128-2023]: LUFS' is equivalent to 'LKFS' (which is used in [b-ITU-R BS.1770-5]). The EBU uses 'LUFS' which is compliant with international naming conventions.

3.1.27 hearing loss [b-WHO 2021]: A person is said to have hearing loss if their hearing capacity is reduced and they are not able to hear as well as someone with normal hearing. "Normal" hearing typically refers to hearing thresholds of 20 dB or better in both ears.

3.1.28 material hearing impairment [b-NIOSH]: An average of the hearing threshold levels for both ears that exceeds 25 dBHL at 1000, 2000, 3000 and 4000 Hz.

3.1.29 microphone-in-real-ear [ISO 11904-1]: Refers to measurements carried out using miniature or probe microphones inserted in the ears of human subjects.

3.1.30 momentary exposure level [IEC 62368-1]: Metric for estimating 1s sound exposure level from the HD 483-1 S2 test signal applied to both channels, based on [EN 50332-1], clause 4.2.

NOTE 1 – MEL is measured in dB.

NOTE 2 – See B.3 of [EN 50332-3] for additional information.

3.1.31 ordinary person [IEC 62368-1]: Ordinary person is the term applied to all persons other than instructed persons and skilled persons. Ordinary persons include not only users of the equipment, but also all persons who may have access to the equipment or who may be in the vicinity of the equipment. Under normal operating conditions or abnormal operating conditions, ordinary persons should not be exposed to parts comprising energy sources capable of causing pain or injury. Under a single fault condition, ordinary persons should not be exposed to parts comprising energy sources capable of causing injury.

3.1.32 personal music/media player [IEC 62368-1]: A personal music player is a portable equipment intended for use by an ordinary person, that:

– Is designed to allow the user to listen to audio or audio-visual content/material; and

– Uses a listening device, such as headphones or earphones that can be worn in or on or around the ears; and

– Has a player that can be body worn (of a size suitable to be carried in a clothing pocket) and is intended for the user to walk around while in continuous use (for example, on a street, in a subway, at an airport, etc.).

NOTE – Examples are portable CD players, MP3 audio players, mobile phones with MP3 type features, PDAs or similar equipment.

3.1.33 personal audio device [ITU-T H.870]: A portable device designed to be worn on the body or fit in the clothing pocket to listen to various forms of media. It can be connected to a listening device. An example of a personal audio device is a personal media player (PMP).

3.1.34 personal audio system (PAS) [ITU-T H.870]: A system of a personal audio device and a listening device. Examples are a personal media player (PMP) connected to headphones, and headphones capable of playing locally stored content independently of an external PAD.

3.1.35 skilled person [IEC 62368-1]: Skilled person is a term applied to persons who have training or experience in the equipment technology, particularly in knowing the various energies and energy magnitudes used in the equipment. Skilled persons are expected to use their training and experience to recognize energy sources capable of causing pain or injury and to take action for protection from injury from those energies. Skilled persons should also be protected against unintentional contact or exposure to energy sources capable of causing injury.

3.1.36 sound allowance [ITU-T H.870]: A dose estimate of sound exposure over a certain rolling period of time (e.g., daily or weekly), commonly expressed as a percentage of the maximum regarded as safe. A weekly sound allowance is equivalent to 100% calculated sound dose (CSD).

$$E = \int_{t1}^{t2} (p_A(t))^2 dt$$

3.1.37 sound-induced [ITU-T H.870]: Refers to a state or a quality resulting from exposure to sound. The sound may be (part of) music or "noise", which implies the sound is not desirable.

3.1.38 sound-induced permanent threshold shift [ITU-T H.870]: Synonymous with permanent sound induced hearing loss (SIHL).

3.1.39 sound-induced temporary threshold shift [ITU-T H.870]: Sound induced hearing loss (SIHL) that results from exposure to sound but recovers after a sufficient time spent in low sound conditions.

3.1.40 sound-induced tinnitus [ITU-T H.870]: Perception of phantom sound in the ears or head that are either temporary or permanent, following excessive sound exposure.

3.1.41 sound pressure level [b-ITU-R V.574]: The logarithm, generally expressed in decibels (dB SPL), of the ratio of sound pressure and a reference pressure p_0, often 20 μPa. Note that a factor of 20 is used when the ratio is between two sound pressures, rather than between two sound intensities.

$$SPL = 20log10\left(\frac{p}{p_0}\right)$$

3.1.42 stapedius muscle reflex [ITU-T H.870]: The process in which the stapedius and tensor tympani muscles of the ossicles contract when the ear is exposed to high intensity sound. This is also called auditory reflex.

3.1.43 transducer [ITU-T H.870]: An electronic device that converts energy from one form to another.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms.

3.2.1 audio peripheral: An external device that either captures or outputs sound and connects to a computer system for the purpose of enabling or contributing to video game audio. In the context of video gameplay, audio peripherals typically include (but are not limited to) earphones, headphones and headsets.

3.2.2 close fitting audio devices: Such as headphones, earphones, ear buds, in ear monitors (IEMs); wireless and wired, which often feature both sound producing components (e.g., drivers, speakers, etc) as well as sound capturing components (e.g., microphones).

3.2.3 dynamic range compression: Refers to a signal processing technique that will reduce the ratio between the highest and lowest amplitudes of an audio signal, thus altering the dynamic of a sound signal.

3.2.4 esports: Competitive and organized computer and video gameplay, in which two or more parties (individuals or teams) face each other under regulated and balanced conditions.

3.2.5 esports live event: An esports live event (ELE) can be defined as an event around competitive video gameplay(s), involving video game tournaments and related content. These events are conducted in a live format, sometimes in designated venues, where esports enthusiasts gather to witness the gameplay, competition and associated entertainment. The primary focus of ELEs is the hosting of video game tournaments, where players or teams compete against each other, and during gameplay ELEs may feature sound reinforcement audio systems, multimedia displays (such as large screens) and stages to showcase the gameplay, commentary and highlights to the audience.

3.2.6 free-field audio devices: Such as speakers, soundbars and sound systems.

3.2.7 game player: A person that plays video games on video gameplay devices.

3.2.8 handheld or portable console: A portable gameplay system designed for on-the-go video gameplay.

3.2.9 headphone safety mode: A hearing protection feature used within a video gameplay device or software that activates when a game player switches from free-field loudspeaker to headphone or headset audio peripheral.

3.2.10 home game console: A game console designed to be stationary.

3.2.11 in-ear monitor: A device with earbud-like fitted earpieces used to provide audio to a listener while eliminating external noise.

3.2.12 input accessories: Various hardware accessories like keyboards, joysticks, steering wheels, gamepads and motion-sensing devices that enhance gameplay for specific genres and may include onboard microphone systems.

3.2.13 location-based entertainment (LBE): A type of entertainment that occurs in a physical location beyond the confines of one's home.

3.2.14 loudness unit: The unit of measurement used in the process of quantifying a digital recording's perceived loudness by analysing the average level over time.

3.2.15 mobile devices: Smartphones and tablets with capabilities to run and play video games, often available through app stores.

3.2.16 passive gameplay: Refers to a section of a video game where the game player is not actively participating but still observing game play. This type of gameplay is most commonly found in multiplayer games where a game player has been eliminated from the game temporarily.

3.2.17 passive gameplay audio: Refers to the video game soundtrack that is produced during passive gameplay moments of a video gameplay session. Passive gameplay audio includes sound effects, music, voice chat or dialogue that occur during moments of a video game where the game player is not actively involved or participating in the game play.

3.2.18 personal computer (PC): Computer (including laptops) with capabilities to run and play video games.

3.2.19 safe listening gameplay device: A video gameplay device designed to include features and functionalities that prioritize the well-being of the user's auditory health during gameplay. The primary objective of a safe listening gameplay device is to promote responsible and healthy video gameplay practices by safeguarding users from excessive sound levels that could lead to hearing impairment, tinnitus and/or discomfort.

3.2.20 smart listening mode: A video game software user interface option, typically found in sound or audio settings menus. When enabled, it activates available safe listening features within a specific video game software title.

3.2.21 sound category volume controls: Settings in a video game that allow the player to adjust the volume levels of various key audio components to the game player's preferences, such as background music, sound effects, dialogue, voice chat and other in-game audio categories.

3.2.22 speaker: A device for converting electrical energy into acoustical signal energy that is radiated into a room or open air. It includes transducers that are in-built into the video gameplay device or are external to these, e.g., loudspeakers, sound bars, or sound reinforcement speakers.

3.2.23 video game: An electronic game that involves interaction with a user interface or input device (such as a joystick, controller, keyboard, or motion sensing device) to generate visual and/or audio feedback for a player. Video games encompass a wide variety of genres and formats, ranging from simple arcade games to complex, immersive simulations. They can be played on various platforms, including personal computers, video game consoles, handheld devices, and mobile phones.

3.2.24 video game audience participant: Someone who observes the video game play of others but is not playing the game. Video game audience participants can include (but are not limited to) people viewing video game events being streamed via an online broadcasting service (live or pre-recorded) or people viewing live esports events at venues.

3.2.25 video game console: A purposed game playing system designed to connect to televisions or monitors, providing a platform to run video games.

3.2.26 video gameplay device (VGD): A device designed for executing the software instructions that constitute a video game. It comprises a combination of hardware, firmware and an operating system that facilitates the playing, processing, rendering and production of immersive video and audio gameplay content. A VGD can be designed to be stationary, such as a video game console or arcade game device, or portable. In the context of this safe listening standard, examples of VGDs include video game consoles, handheld or mobile devices, and personal computers (PCs).

3.2.27 video gameplay peripheral: An additional video game hardware connected to a VGD that provides some sort of additional functionality relevant to a particular video game being executed. Whilst peripherals can provide a range of functions, those most relevant to this standard are peripheral devices capable of reproducing or capturing audio.

3.2.28 video gameplay software: Video gameplay software, in the context of digital entertainment, refers to computer programs and applications specifically crafted to facilitate interactive engagement with video gameplay content.

3.2.29 video gameplay software title: Name or title given to a specific video game software program or application used to distinguish one video game from another.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AR Augmented Reality

CSD Calculated Sound Dosage

DRP Eardrum Reference Point

ELE Esports Live Event

LU Loudness Unit

LUFS Loudness Unit relative to Full Scale

PAS Personal Audio Systems

PC Personal Computer

SIHL Sound-Induced Hearing Loss

VGD Video Gameplay Device

VR Virtual Reality

5 Conventions

In this Recommendation:

– The word "shall" is used to express mandatory requirements for conformance to this Specification. When used to express a mandatory constraint on the values of syntax elements or the values of variables derived from these syntax elements, it is the responsibility of the encoder to ensure that the constraint is fulfilled.

– The word "may" is used to refer to behaviour that is allowed, but not necessarily required.

– The word "should" is used to refer to behaviour of an implementation that is encouraged to be followed under anticipated ordinary circumstances, but is not a mandatory requirement for conformance to this Specification.

6 Background

6.1 Safe listening introduction

Temporary and permanent hearing threshold shifts from exposure to sound and noise is an increasing public health problem, particularly in children and adolescents. In fact, sound-induced hearing loss (SIHL) is the leading cause of preventable hearing loss in the world. From the early 1990s to 2000, it was estimated that the number of young people with SIHL has increased from 6.7% to 18.8% [b-Smith 2000]. Some of this can be attributed to the fact that in this day and age, young people are utilizing their leisure time with activities that expose them to high levels of music using personal audio systems (PAS) or attending communal events such as concerts, bars, clubs, etc.

Hearing loss can occur as a consequence of listening to high levels of sound over prolonged periods of time. In addition to the above-mentioned sources of leisure sound, the unsafe use of video gameplay devices (VGDs) poses a threat to the hearing of millions [b-Dillard 2024].

Hearing loss caused by sound exposure is permanent, but it can largely be prevented through safe listening practices. It may be considered that prevention of hearing loss through safe listening practices is the responsibility of the individual. However, the onus of raising awareness and creating an environment for safe listening lies with the community, manufacturers of devices, governments and other stakeholders.

Appropriate technology can help to reduce the risk of unsafe listening. A personal audio device/system in compliance with safe listening standards, which serve to minimize the users' risk of acquiring hearing loss (as a consequence of its use), can be termed as a safe listening device/system.

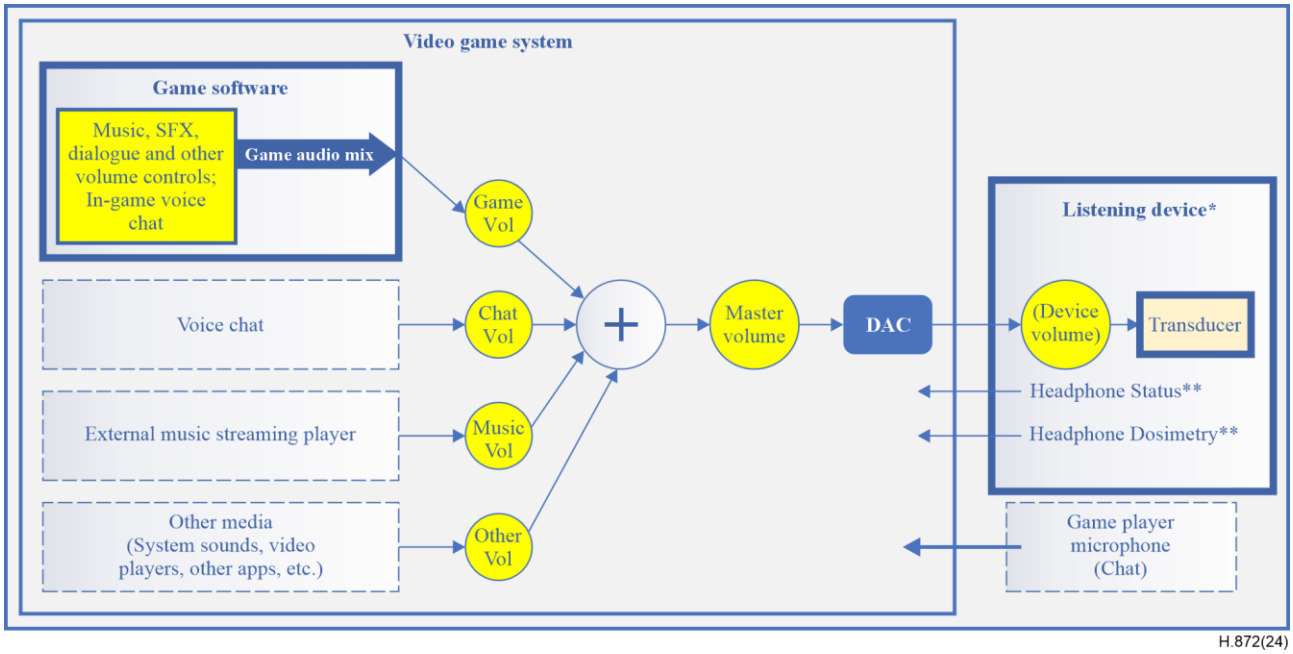
The term safe listening refers to listening behaviour that does not put peoples' hearing at risk. A person's risk of losing his/her hearing depends on how loud, for how long and how often the person is exposed to loud sounds. Such exposure may be through personal audio devices or in entertainment venues as well as in the surrounding environment, such as in traffic, in the workplace or at home.

The term sound allowance refers to the acceptable level of sound energy an individual can receive without putting his/her hearing at risk. The term "weekly sound allowance" is equivalent in meaning to "100% calculated sound dose (CSD)" (see clause 3.1.3). It is recommended to use the term 'sound allowance' for health communication purposes, rather than 'dose'. It should be also noted that the sound allowance determined as described by this Recommendation ignores sound exposure from

sources other than personal audio devices. Depending on what those exposures are, a risk of hearing loss may still exist for an individual.

6.2 Video gameplay device

Figure 6-1 illustrates the general architecture of a VGD, following the definition in clause 3.2.



NOTE 1 – Items in dashed boxes may or may not be present or active during game play. Voice chat may be provided as part of the game itself, or via an external app such as Discord.
NOTE 2 – Game provided music may be supplanted by the player via an external music player, such as Spotify
NOTE 3 – Location of Master Volume, DAC or other controls may depend on user configuration. For example, DAC and/or Volume control may be located in the Listening device (such as USB headphones, or analogue headsets with hardware volume controls).
NOTE 4 – Headset Status may or may not be available. In some cases, the make/model headset may be known which can help map digital audio level to SPL. Status may include also dosimetry, but generally the listening hardware is unknown.

Figure 6-1 – Architecture of a video gameplay device (VGD)

A VGD is intended for use by an individual or individuals and

– is designed to enable the user to engage with video gameplay content;
– utilizes a display screen for visual presentation;
– incorporates video gameplay peripherals such as controllers, keyboards or motion-sensitive devices for interactive input;
– features an audio component for delivering sound effects and immersive audio experiences;
– can be carried or placed in close proximity to the user during operation (for example, played within proximity to television/computer screen, held in hands, placed on a surface); and
– provides adjustable settings for visual and auditory output.

Examples of VGDs include video game consoles, personal computers (PCs), handheld gameplay devices and mobile devices with gameplay capabilities; wearable gameplay accessories with integrated displays and interaction mechanisms; devices equipped with virtual reality (VR) or augmented reality (AR) functionalities.

The provisions outlined do not apply to:

– hearing aids, hearing aid equipment and other specialized devices for assistive listening;

– location-entertainment such as arcade games.

NOTE – The listed exemptions are subject to reassessment as technology progresses.

While the current scope emphasizes gameplay and visual content, considerations for virtual reality and immersive experiences are for future study.

6.3 Video gameplay software (titles)

Video gameplay software, in the context of digital entertainment, refers to computer programs and applications specifically crafted to facilitate interactive engagement with video gameplay content. This software is intricately designed to enhance user experiences through interactive elements and is typically designed to include both visual and audio content to create a sense of immersion. Key features of video gameplay software include:

– Interactive engagement: Gameplay software enables users to actively participate in video gameplay experiences by providing a platform for user input and interaction. This can involve controlling characters, making decisions, and influencing the virtual environment;

– Visual presentation: Utilizing display screens for visual presentation, gameplay software delivers graphics and dynamic visuals that contribute to the immersive nature of video games;

– User input devices: Gameplay software is compatible with various video gameplay peripherals, including controllers, keyboards, microphones, and motion-sensitive devices. These peripherals serve as interfaces, allowing users to control and navigate the virtual world created by the software;

– Audio component: To enrich the gameplay experience, gameplay software incorporates audio components that deliver sound effects, music, and other auditory cues. This audio component (also referred to as the soundtrack) is typically designed to be reproduced by speakers or close-fitting audio devices or transducers such as headphones, earphones or in-ear monitors;

– Adjustable settings: Providing users with adjustable settings for visual and auditory output, gameplay software allows individuals to customize their gameplay experience based on personal preferences. This adaptability enhances accessibility and accommodates diverse user preferences.

Examples of platforms hosting video gameplay software include video game consoles, PCs, handheld video gameplay devices and mobile devices with gameplay capabilities. Additionally, video gameplay software can extend to wearable gameplay accessories featuring integrated displays and interaction mechanisms, as well as devices equipped with virtual reality (VR) or augmented reality (AR) functionalities.

The provisions outlined do not apply to:

– Gameplay software specifically developed for the purpose of auditory diagnosis or rehabilitation;

– Gameplay software designed with no soundtrack at all.

7 Damage risk criteria

7.1 Operational modes for video gameplay devices (VGD)

The following considerations are taken from clause 7.1 of [ITU-T H.870], for the convenience of the reader. In case of any discrepancy, the provisions in [ITU-T H.870] prevail.

It is required that VGD paired with a personal audio accessory (such as a headphone) shall include a system that tracks the user's exposure time, and estimates sound level and usage of a reference exposure (sound allowance). This includes all media playback through the device or system (i.e., stored locally or streamed) during times when the user is using ear/headphones.

This system shall determine the exposure of the user based on the following mode:

– Mode 1: (WHO) standard level for adults: this will apply 1.6 Pa^2h per 7 days as the reference exposure.

NOTE 1 – The value is adapted from [IEC 62368-1] and is based on the values mentioned in [b-2009/490/EC], which stipulated that sound is safe when below 80 dB(A) for a maximum of 40 hours per week. Therefore, the value of 100% calculated sound dose (CSD) corresponds to 80 dB(A) for 40 hours.

The VGD should offer a more conservative mode to users that prefer or benefit from a more conservative level as outlined in Mode 2:

– Mode 2: (WHO) standard level for users that prefer or may benefit from lower sound levels (e.g., for children): this will apply 0.51 Pa^2h per 7 days as the reference exposure.

The device or system should allow the users to select their reference exposure as one of the above-mentioned two modes.

NOTE 2 – Reference exposures are derived from 80 dBA (Mode 1) and 75 dBA (Mode 2) sound pressure level (SPL) for 40 hours per week (which in turn is derived from 8 hours per day, 5 days/week).

NOTE 3 – An alternative to expressing exposure in terms of percentage used, is to express the *time left* until reaching a certain exposure (e.g., remaining playback time at the current playback level until reaching 100%).

It is recommended that mode choice be given when using the player for the first time (or when the device is reset to factory settings). It is recommended that the user be able to change the mode choice at any later time, e.g., via a device configuration menu.

Examples of weekly listening time duration based on sound allowance for the modes above can be found in Table 1 and Table 2.

Table 1 – Example of weekly listening time for Mode 1

dB(A) SPL	Weekly (1.6 Pa^2h)
107	4.5 min
104	9.5 min
101	19 min
98	37.5 min
95	75 min
92	2.5 h
89	5 h
86	10 h
83	20 h
80	40 h

Table 2 – Example of weekly listening time for Mode 2

dB(A) SPL	Weekly (0.51 Pa^2h)
107	1.5 min
104	3 min
101	6 min
98	12 min
95	24 min
92	48 min
89	1 h 36 min
86	3 h 15 min
83	6 h 24 min
80	12 h 30 min
77	25 h
75	40 h

7.2 Uncertainty in dose estimate

The following considerations are taken from clause 7.2 of [ITU-T H.870], for the convenience of the reader. In case of any discrepancy, the provisions in [ITU-T H.870] prevail.

In estimating sound dose there is some uncertainty. Some sources for uncertainties are:

– sound source;
– variation in headphone characteristics of a single model, due to production tolerances;
– variation due to unknown headphone type;
– manufacturing tolerance;
– errors due to incorrect manual selection of headphone type;
– variations pertaining to the artificial ear during characterization;
– imperfect relation between artificial ears and real ears;
– imperfect relation between a standardized diffuse-field correction and a variety of human head-related transfer functions;
– variations pertaining to the human ears;
– uncertainties in characterization of player characteristics, especially due to non-linear processing in the alternative implementation shown in Figure II.5 of [ITU-T H.870];
– errors in calculations;
– exposure from other sources;
– variation in headphone characteristics between models, for instance sensitivity and impedance.

Since some of these uncertainties are typically several dB, and an error of 3 dB constitutes a 100% dose error, uncertainties of dose estimation can be expected to be greater than a hundred percent. It is therefore suggested to refrain from signalling "safe" and "green" to the user based on dose readings below a certain limit.

The dose estimation is however relevant in accounting for general trends:

– higher signal level means higher risk;

– longer exposure means higher risk;

– the spectral content of the audio is accounted for.

Further details on this subject remain for future study.

See Appendix II in [ITU-T H.870] for a discussion on implementation of dose estimation functionality.

For dose measurement methods, refer to clause 8 of [ITU-T H.870].

8 Safe listening features for video gameplay devices

VGDs include, but are not limited to, video game consoles, personal computers (PCs), handheld gameplay devices, mobile devices, virtual reality, augmented reality devices, and includes the operating systems which may be installed upon these devices for it to operate.

Among the various components integral to the video game experience, VGDs stand out as a pivotal factor that can directly influence the resulting sound pressure level experienced by game players. This influence becomes particularly pronounced in scenarios where the entire video gameplay setup is sourced from a single vendor or manufacturer, where all operating equipment values will be known, and calculated sound dosage can be more accurately recorded.

The following clause outlines features required in order for a VGD to become compliant with this standard.

8.1 Dosimetry

A VGD connected to headphones or earphones shall track the level and duration of the user's exposure to sound as a percentage used of a reference exposure, also known as a user's "sound allowance".

The user should have the option to choose one of two modes that determine the total sound dose they can safely consume:

– Mode 1 for adults: 80 dB (A-weighted) for 40 hours per week;

– Mode 2 for children: 75 dB (A-weighted) for 40 hours per week.

Where feasible, the calculation should be made across multiple devices used by the same individual, for example, personal audio systems, VGDs and others. It is ideal to provide a single estimate for the individual.

NOTE – Where feasible, a VGD may also be able to calculate sound dosage for both closefitting audio peripheral devices (headphones, earphones, in-ear monitors etc.) and free field audio devices (loudspeakers, surround sound arrays etc.), including location-based entertainment. The detail of such is for future study. Consideration needs to be made where a single VGD is used by multiple users, dosimetry should be calculated on an individual user basis. This specific information (whether the dosimetry is user specific or not) should be provided to the users.

See Appendix II of [ITU-T H.870] for information on implementation of dosimetry.

8.2 Dosimetry user interface

A VGD shall provide dosimetry information to the user in a clear, easily accessible and user-friendly user interface.

User interface features shall include, at the minimum:

– Rolling 7-day recorded information on sound allowance use;

– A suitable indication of whether activity is "Safe/OK" or "Unsafe/Not OK". Where possible, this calculation should be calculated across multiple devices used by the same individual. Where such harmonization isn't possible, users must be informed that listening over multiple

devices can reduce the accuracy of the estimate presented and that the user should exercise caution and keep volumes low;

– Information on how to listen safely;

– Information on safe listening features available in the VGD.

Examples are shown in Appendix II, in particular Figures II.1 to II.4.

8.2.1 Messages

The VGD shall provide messages about general sound allowance use, such as time spent, sound allowance consumption and/or prediction of when the sound allowance will be exceeded. These can be delivered at appropriate times that do not break video gameplay immersion. Messages could be provided:

a) upon the initial boot of the VGD prior to a game title being loaded;

b) upon the end of a video gameplay session at the exit screen;

c) using real-time notifications by using in-game notification systems.

Should in-game notification systems be the selected method of safe listening notifications for the video gameplay device, provisions need to be made to ensure safe listening notifications should still occur even if the user enables "do not disturb" or similar modes.

When the VGD dosimetry system establishes the game player has exceeded 100% of their weekly allowance, the user shall be provided with a cue for action.

8.2.1.1 Cue for action message

The VGD shall give relevant warnings and cues for actions when the user exceeds 100% of the weekly allowance, without interrupting the game session or breaking the immersive experience.

– The user shall receive, first a "warning" expressed through text and visual notification informing that the weekly sound allowance has been exceeded and that from this point on, further listening at the same volume will pose a risk to their hearing.

– The warning shall be followed by a "cue for action" in which the user is offered the choice to either accept the risk of continued listening or protect their hearing. The "cue for action" should be linked to active options on the device such as:

  • automatic safe volume option, by which the device automatically changes the volume to achieve a safer listening level;

  • direct access to volume settings;

  • set-up of default volume limits;

  • remind later option;

  • ignore and continue option.

– If the user fails to take any action, the volume shall automatically be reduced as described in clause 8.3.1 (a sound level at the eardrum reference point (DRP), with diffuse-field correction, no greater than 80 or 75 dBA (according to the mode selected)).

NOTE – See Appendix II for examples of this type of message.

8.3 Volume control system

A VGD **shall provide an easily accessible and configurable volume control system** (which is in accordance with the selected operational mode) to mitigate the risk of permanent hearing damage for game players and participants by setting the default volume levels to a safe listening level.

NOTE – In the context of video game audio, "volume control" refers to the mechanism by which players and users can adjust the intensity or loudness of sound output generated by a video game. A volume control system

can work manually, with input from the game player, or can be part of an automatic volume control system, which is controlled by the VGD.

8.3.1 Volume limiting

The VGD shall provide the user with a suitable method for volume limiting when headphones or earphones are detected. This refers to a feature which provides a message relative to a predetermined reference exposure (sound allowance) limit in accordance with clause 8.1.

A volume limiting option message shall be automatically provided when the user reaches 100% of the weekly allowance. The user shall be given a message in accordance with clause 8.2.1.1 which will allow them the option to "continue listening" in case they do not wish the device volume to reduce. When the message is not acknowledged, the default action will be to reduce the volume of the device to achieve a sound level at the eardrum reference point (DRP), with diffuse-field correction, no greater than 80 or 75 dBA (according to the mode selected). If possible, the users should be given the option to customize this level (the level at which they would like their device to limit the volume) according to their preference. It is further recommended that this should be set as the default option and that the user should have the option of turning this feature off if they do not wish to use this setting.

NOTE – If, upon reaching 100% of the user's weekly allowance, the level is automatically reduced to 80 dBA (75 dBA for sensitive listeners), the user's sound exposure will continue to increase beyond 100%. Such an action is therefore not fully protective against further risk to hearing; rather, the intention is to ensure that listening proceeds at no more than a moderate level until the user has acknowledged the warning, without interrupting the game session or breaking the immersive experience.

8.3.2 Password-protected sound output control

The VGD shall have the option where if it has a child/parental account system (also known as parental controls), the maximum sound output can be fixed and locked in the settings, possibly through the use of a password. The intent of this feature is to allow parents (or other adults) to limit the maximum sound output of the child's device, in a way that cannot be changed by the child.

8.4 Headphone safety mode

A VGD shall provide a default headphone safety mode where the audio output of VGD for headphones is also intended for use with a speaker and the audio output level is not stored separately for each type of audio peripheral.

The default headphone safety mode shall be implemented when the VGD is capable of detecting that users are moving from free-field to headphones on the same audio output. In such instances an automatic volume reduction of at least 3 dB occurs.

9 Safe listening features for video gameplay software

Safe listening feature compliance can be achieved by a video game software title, separate to that of the VGD it is designed to run on. Should equivalent features be available on the VGD, they are not required to be included in the video gameplay software and can be omitted.

9.1 Safe listening warnings/messages

Video gameplay software **shall provide a message/warning to game players regarding** auditory risks (e.g., hearing loss, tinnitus) associated with loud sounds and extended exposure, which can occur when taking part in video gameplay activities.

NOTE 1 – The warnings/messages described in this clause are separate and are of a different nature to those outlined in clause 8.2.1, and are of a general health information nature, as opposed to warnings related to dosimetry readings.

NOTE 2 – See Appendix III for examples of warnings/messages.

9.1.1 Initial load screen warnings

The video gameplay software warning shall be displayed upon initial loading of the game, notifying the game player that loud sounds and extended exposure to sound can be a source of unsafe listening. The warning should include:

– a description of safe sound level dosage;

– examples of auditory symptoms to be aware of in case of hearing damage (e.g., ringing in the ears, fullness in the ear, loss of sensitivity to other sounds etc.);

– The message should also indicate that absence of these symptoms does not necessarily indicate an absence of hearing damage.

9.1.2 After a period of continuous gameplay

The game title **shall provide additional notifications/messages** during convenient moments in the game that do not break video gameplay immersion.

NOTE 1 – When accessing audio options, convenient moments may include the end of a round of gameplay, after completing a level, after losing a life, when pausing game, at the end of two-hours of continuous gameplay, upon exit etc.

NOTE 2 – See clause II.2 for a visual example.

9.2 Sound category and master volume controls

The video game software **shall include independent sound category volume controls** allowing the game player to adjust levels of and selectively mute different sounds within the game. This could be, for example, under the game audio menu options.

Sound category volume controls of this nature can provide game players an efficient way to reduce and mute:

1) the overall master volume level within the game, and

2) specific sounds that they feel are not required based on their gameplay style.

Sound category volume channel controls **should** be easily and readily available to the individual, so that adjustments for comfort are quick to perform.

Examples of such controls could be:

– Game dialogue level;

– Sound effects level;

– Music level;

– Voice chat level.

NOTE – In designing the user interface for the sound category volume channel controls, universal design principles should be taken into account, so that adjustments are quick to perform. See [b-ISO/TC 159/SC 4], [b-ISO 9241-210] and [b-ISO 24508] for more information.

9.3 Title dependent safe listening features

The video game **should include default safe listening features within the game** with the intent to reduce the overall sound exposure and risk of hearing damage among game players.

This document acknowledges the diverse range of soundtracks, gameplay styles and listening requirements of video gameplay software titles. As such, developers are encouraged to consider the implementation of safe listening features, some of which are listed below.

9.3.1 Feature 1: Game audio output scaling

A video games' output should be scaled so that a 30-minute integrated window is measured at no higher than −23 loudness unit relative to full scale (LUFS) with a deviation of ± 2 loudness unit (LU). The true peak level should not exceed −1 dBTP (dB true peak).

NOTE 1 – [b-EBU R 128] uses −23 LUFS ± 1 LU and [b-Sony ASWG-R001] uses −24 LKFS ± 2 LU. Both standards use −1 dBTP true peak level, measured with a meter compliant with [b-ITU-R BS.1770] and [b-TECH 3341].

NOTE 2 – Loudness K-weighted full scale (LKFS), originally defined in [b-ITU-R BS.1770], is synonymous with LUFS, with LUFS being compliant with international naming conventions [b-EBU R 128].

NOTE 3 – There is a reference implementation of the algorithm in [ITU-R BS.1770-5] which can be found in [b-ITU-T G.191].

NOTE 4 – Should a video game software title be specifically designed for game play on a handheld or portable device with on board loudspeaker with insufficient dynamic range to appropriately reproduce a soundtrack scaled for −23 LUFS ± 2 LU, an alternative −–18 LUFS ± 2 LU can be used, and the inclusion of a headphone output safety mode with reduction of 5 dB is strongly recommended (see clause 8.4).

9.3.2 Feature 2: Player dynamic range setup

Video gameplay software should include an initial dynamic range test, which can establish what sounds are "loud" to the game player, and what sounds are at lowest levels of audibility based on the gameplayer's own audio system.

This information is to be used to set the initial volume of the game title (avoiding starting the game at an uncomfortably loud volume) and/or calibrate a dynamic range compression mechanism which can be used to limit loud sounds throughout gameplay. The usefulness and implementation of dynamic range compression is for further study.

9.3.3 Feature 3: Tinnitus sounds removal

Tinnitus sounds refer to sound effects that provide a simulation of tinnitus in response to a particular gameplay event, such as when a player is overwhelmed by an enemy during a fight or directly exposed to an explosion or flashbang.

Should such sound effects exist within a particular game, an option should be provided to remove such sounds when first running the game. Once selected, the setting should be maintained unless the player opts to change the setting in the audio menu of the game.

To better assess whether this feature is suitable, the game player could be asked if they have troublesome tinnitus (ringing or buzzing in their ears that is made worse by certain in-game audio sounds).

9.3.4 Feature 4: Passive gameplay audio reduction

The video game software should include automated attenuation of game audio components of a video game during periods of passive, non-interactive gameplay by a minimum of 3 LUs (e.g., audio between rounds of a first-person shooter).

The most common intended application of this definition will be towards sections of game play in between rounds of a multiplayer game, where a game player has been excluded from participating in the game until a new round begins.

9.3.5 Feature 5: Subtitles

Video gameplay software should enable subtitles by default, which can facilitate gameplay at lower volumes.

9.3.6 Feature 6: Equalization presets

The video gameplay should include adjustable equalization presets which apply filters to reduce the mid and high frequency range. Reducing this particular frequency range can reduce harshness, spikes in intensity and ear fatigue.

9.3.7 Feature 7: Smart listening mode preset

In a similar way to how modern game menus manage graphics quality, the video game should combine and enable by default, relevant safe listening features available within that software title under one, easy to enable settings preset.

A smart listening preset should be aimed at reducing the total sound dosage a game player will receive during a gameplay session, whilst minimally affecting the gameplay experience.

9.3.8 Feature 8: Audio Behaviour Telemetry

Game software developers should consider adding audio behaviour telemetry to their games, to help determine player listening behaviours, such as if/when the user changes app/system volume during gameplay, end-user settings for category volume sliders, time spent in gameplay sessions, etc.

9.4 Headphone safety mode

Video game play software titles should provide a default headphone safety mode where the audio output of VGD for headphones is also intended for use with a speaker and the audio output level is not stored separately for each type of audio peripheral.

The default headphone safety mode should be implemented when the video game play software title is capable of detecting that users are moving from free-field to headphones on the same audio output. In such instances an automatic volume reduction of at least 3 dB occurs.

This feature is not required when the VGD on which the video gameplay software title is released provides an equivalent feature.

10 Textual health warnings

See clause 11 in [ITU-T H.870] for a discussion on the importance of health communication to inform and empower the end user of listening devices, such as VGDs, to make the right listening choice through greater awareness and information.

10.1 User guides and other written information

VGDs and video game software shall provide appropriate text-based information to game players in user guides or related electronic resources and websites.

This information should go beyond a minimum set of instructions and aim to change behaviour. It should include:

– a simple statement confirming that loud sounds can be a source of unsafe listening due to potential volume levels and duration of gameplay;

– a list of common auditory symptoms that can occur when unsafe listening has occurred, including tinnitus and loss of hearing sensitivity;

– simple instructions to incorporate safe listening into gameplay, including references to more information as well as any onboard features they can use.

Such information should avoid technical or complex terminology, or references that are not easy to understand for a lay person.

Appendix IV gives some examples of appropriate and insufficient warnings.

10.2 Safe listening feature information

To ensure the effective use of safe listening features, VGDs or video gameplay software titles shall include information pertaining to the purpose and/or rationale of safe listening features available within their systems.

NOTE – See Figures IV.5, IV.6, IV.7 and IV.8 for examples.

11 Guidance on ancillary concerns

In addition to the direct effect of the transducer and the playing device connected to the VGD, there are several points that may need to be taken into account when a VGD is deemed safe. [b-ITU-T P.360] has some information in this regard.

– When a headphone or an earphone is connected, there may be an acute noise (clicks and pops) due to transients (undesirable noise) in the system;

– Certain devices, when connected or "paired" together, give off a "confirmation-sound" to indicate that the devices are successfully paired. In such a case, the sound level of the confirmation sound may need to be in the safe range.

Such sounds cannot be measured by a dosimeter on a VGD.

Effort has been made to accommodate a transition between certain transducers, namely from loudspeaker to earphones/headphones, which may unintentionally cause an increase in volume under certain circumstances. See clauses 8.4 and 9.4.

Appendix I

Status report

(This appendix does not form an integral part of this Recommendation.)

WHO estimates that currently over 1.5 billion people worldwide experience some degree of hearing loss, nearly 30% of which is disabling hearing loss. It is estimated that with the current demographic trends, by 2050, there could be over 2.5 billion people with hearing loss globally. While this upward trend reflects changes in population demographics, it also underlines the need to address the preventable causes of hearing loss [b-WHO 2021].

One of the main avoidable causes of hearing loss is termed as "noise-induced" hearing loss, which refers to hearing loss due to overexposure of ears to sound energy, including recreational sources, such as music listened to over personal audio devices as well as exposure to sound from video gameplay activities. WHO estimates that more than one billion people are at risk of hearing loss due to unsafe listening practices, which makes it an issue of imminent public health concern, especially since even now, unaddressed hearing loss poses an annual global cost of USD 980 billion [b-WHO 2021].

Responding to the request of its Member States in the World Health Assembly resolution WHA70.13, WHO is working with other stakeholders to mitigate the risk of hearing loss due to unsafe listening by raising awareness and promoting safe listening behaviours. Making this change requires that users of video gameplay devices and related gameplay audio accessories should be able to access these devices that include safe listening features.

To this end, WHO completed a background paper, reviewing approaches related to safe listening from video gameplay devices and esports activities, which included a systematic scoping review [b-Dillard 2024], international game player survey and stakeholder interviews. The results are found in the paper which is available at [b-WHO safe listening].

Other related background documents on the "Making Listening Safe" initiative can be found at https://www.who.int/activities/making-listening-safe.

Appendix II

Information on implementing dosimetry

(This appendix does not form an integral part of this Recommendation.)

II.1 Dose estimation functionality for implementation in a video gameplay device

The considerations that are found in Appendix II of [ITU-T H.870] apply with the understanding that references to personal audio systems (PAS) or personal audio devices (PAD) should be read as video gameplay devices (VGD).

II.2 Volume-limiting and messaging considerations

While dose estimation implementation is comparable between this standard and [ITU-T H.870], some additional consideration of the immersive experience of video games should be considered when implementing sound dosage messages and warnings on VGDs, as the immersive experience can be affected by the arrival time of messages.

As per clause 8.2.1, this standard recommends the VGD shall provide messages about general sound allowance use, such as time spent, sound allowance consumption and/or prediction of when sound allowance will be exceeded. Providing these warnings to the game player earlier than 100% CSD will provide the game player the opportunity to change behaviours and/or consider what other listening activities they have participated in that week to gauge whether they may already be at their weekly limit.

As preserving immersion is also important to the gameplay experience, early warnings and access to general sound allowance allows players to be informed about their sound dose without disrupting their gameplay. See Figures II.1 to II.4 for examples of dosimetry safe listening messaging for VGDs.

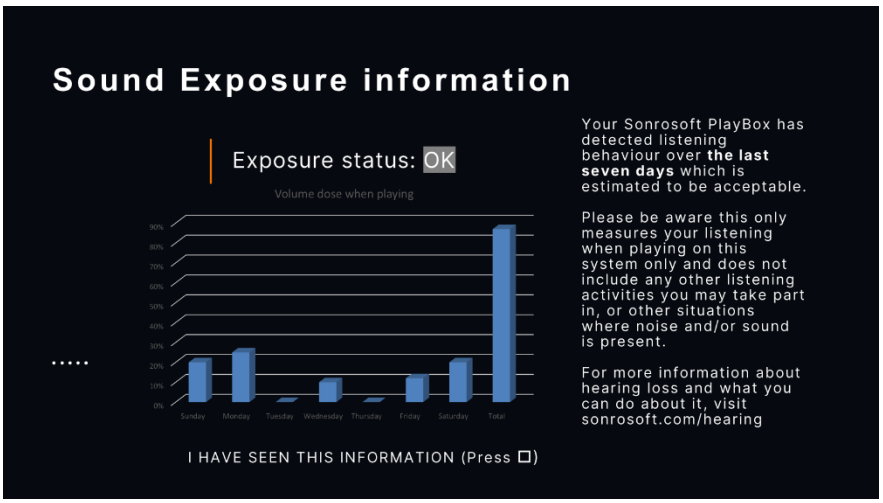


Figure II.1 – Dosimetry information: Safe/OK status when voluntarily accessed from a sound menu

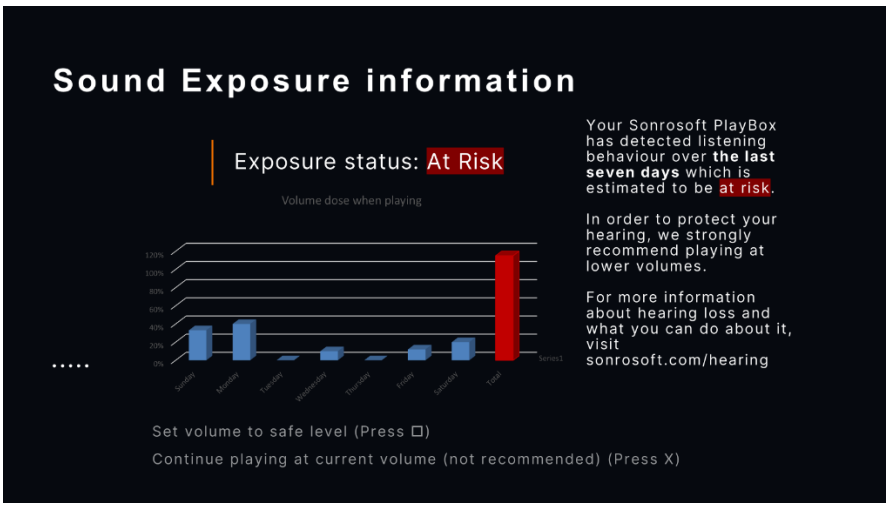


Figure II.2 – Dosimetry information: Unsafe/Not OK status when voluntarily accessed from a sound menu

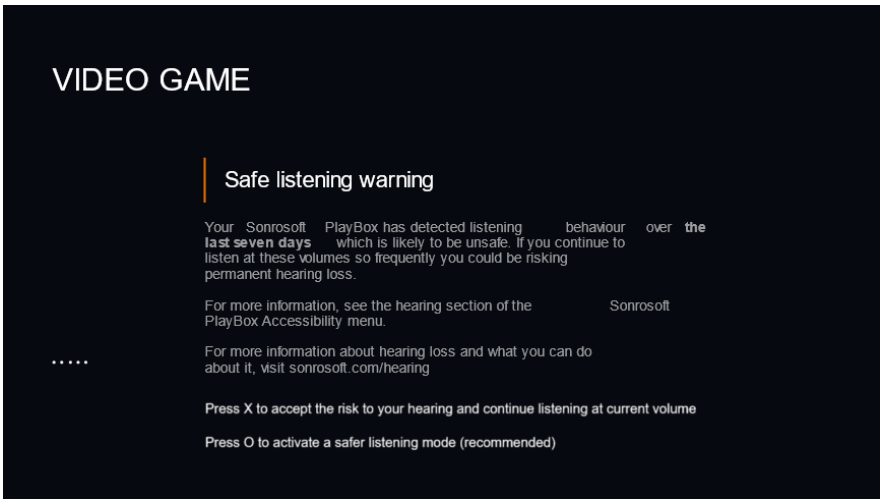


Figure II.3 – Dosimetry information: Warning message shown upon exceeding 100% CSD

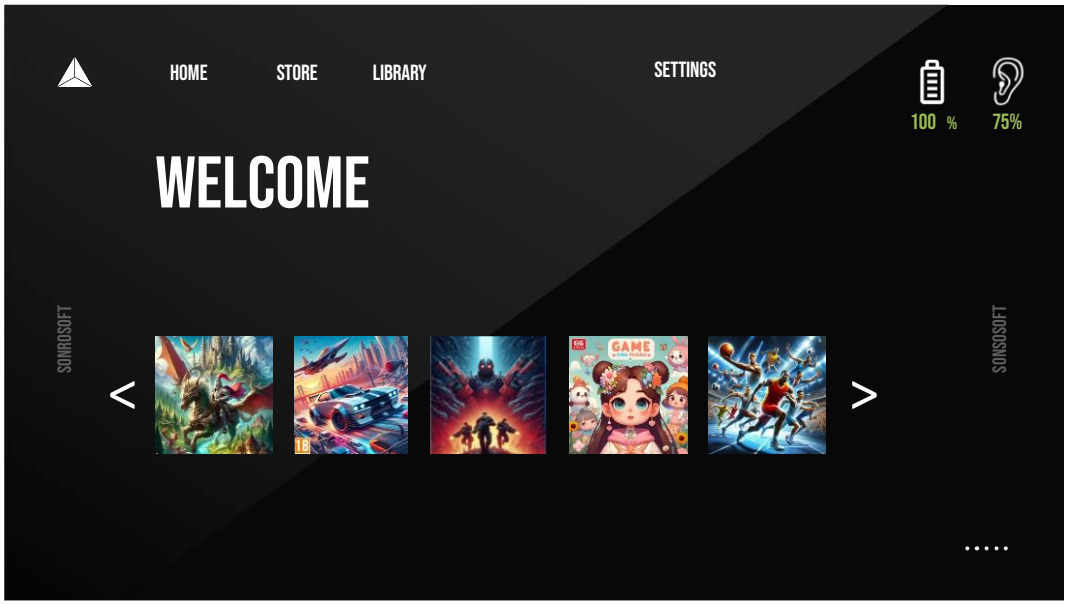


Figure II.4 – Dosimetry information: VGD initial load screen with safe listening icon and dosage indicator in the top right corner

Appendix III

Example of safe listening warnings

(This appendix does not form an integral part of this Recommendation.)

III.1 Safe listening warnings: Example of a safe listening warning upon initial load of a video gameplay software title

Compliant game software titles include a warning, during the first load of the game, as illustrated in Figure III.1. This warning should include the following information:

– A warning to the game player of potential risk to hearing from exposure to loud sounds;

– Examples of potential symptoms to be aware of that indicate unsafe listening.

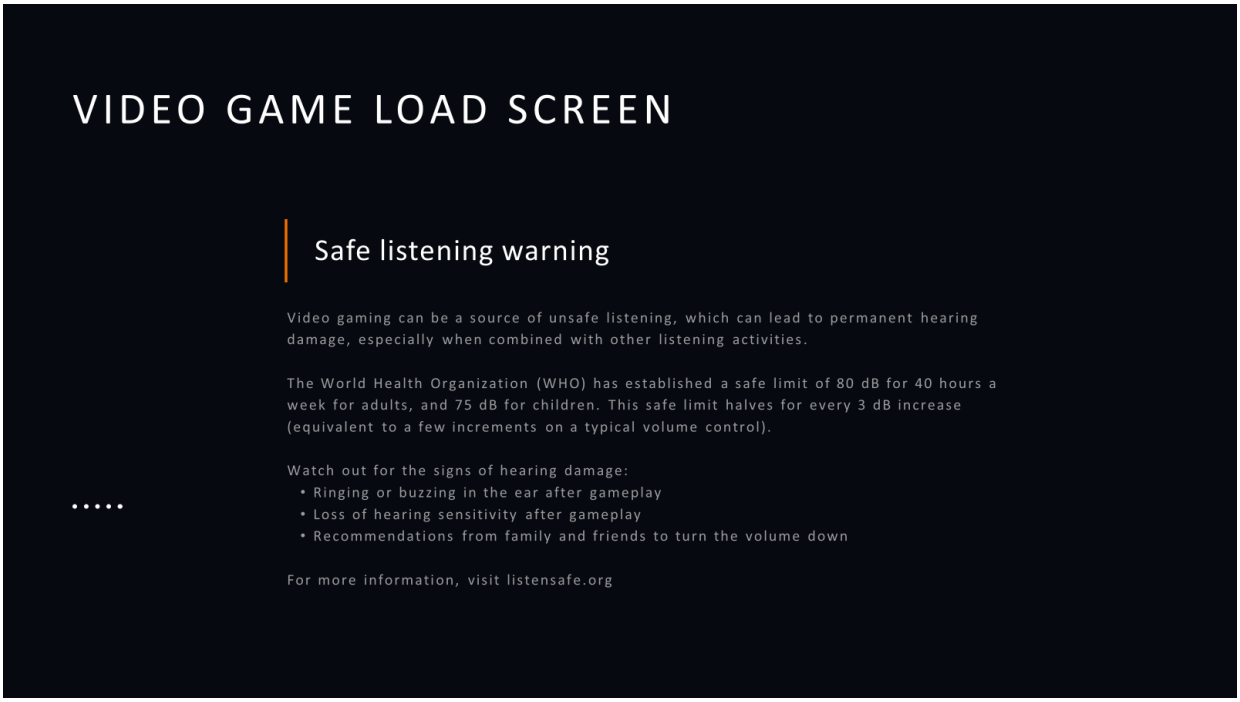


Figure III.1 – Initial load screen warning example

III.2 Safe listening warnings: Example of safe listening warning during gameplay

At a convenient in-game moment (e.g., at the end of a round of gameplay, after completing a level, after losing a life, when pausing game, etc.) a warning message is displayed.

In the example in Figure III.2, the warning is being displayed during pause screen, and notifies the game player of the amount of time they have been exposed to sound in this particular game play session.

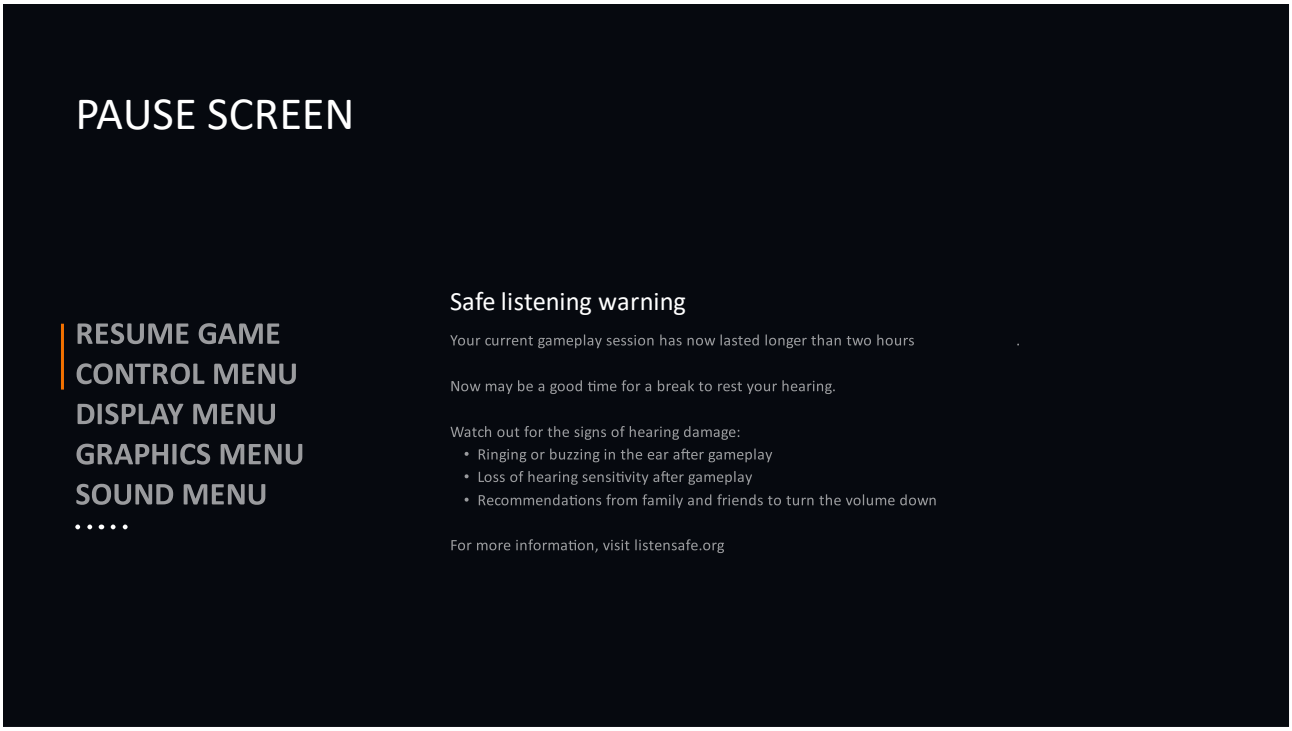


Figure III.2 – An example of Safe listening warning in shown in the pause menu

III.3 Safe listening warnings: Example of safe listening warning upon exit of the game

For warnings placed upon game exit, a final message should be displayed prompting the gamer to check their hearing status with simple messaging. For example, as illustrated in Figure III.3:

– Are your ears ringing?

– Does your hearing seem muffled after your latest gameplay session?

– Has anyone in your household mentioned your video game volume is too loud?

– Did you know: hearing damage can occur without any symptoms?

The warning should display for a reasonable amount of time to allow the game player sufficient time to read the displayed content, and could include a call to action to confirm understanding, e.g. "I have seen this message".

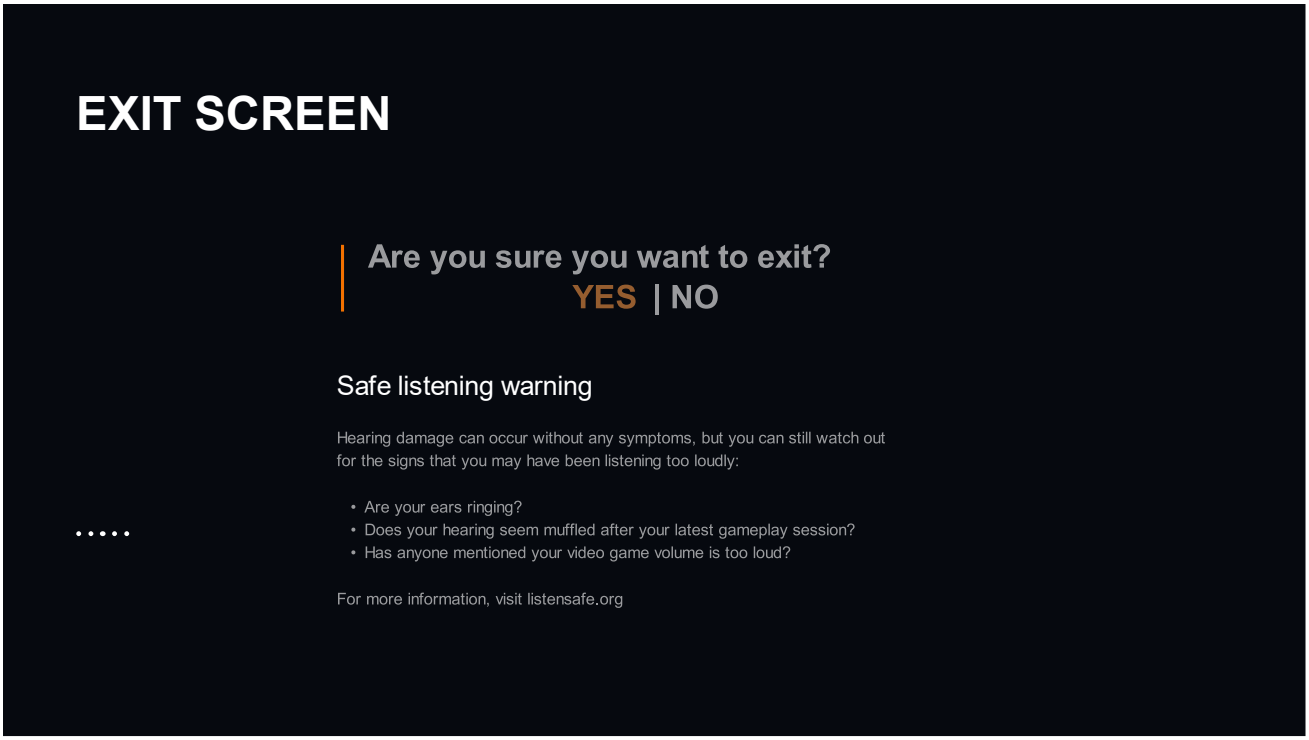


Figure III.3 – Safe listening warning on exit of video game

Appendix IV

Examples of textual information provided to the user

(This appendix does not form an integral part of this Recommendation.)

IV.1 Textual information provided with video gameplay devices

– Provide a simple statement confirming that activities which include exposure to loud sounds can lead to hearing damage;

– Provide a list of common auditory symptoms that can indicate hearing damage, including tinnitus and loss of hearing sensitivity;

– The message should also indicate that absence of these symptoms does not necessarily indicate an absence of hearing damage;

– Provide simple instructions to incorporate safe listening into video gameplay, including references to more information as well as any onboard features they can use;

– Avoid technical or complex terminology, or references that are not easy to understand for a lay person.

Examples are illustrated in Figures IV.1 to IV.4.

Hearing Damage

• To prevent possible hearing damage, do not listen at high volume levels for long periods.

Figure IV.1 – Example of an insufficient text-based warning

Using headphones or earphones

If your computer has both a headphone connector and an audio-out connector, always use the headphone connector for headphones (also called a headset) or earphones.

CAUTION:
Excessive sound pressure from earphones and headphones can cause hearing loss. Adjustment of the equalizer to maximum increases the earphone and headphone output voltage and the sound pressure level. Therefore, to protect your hearing, adjust the equalizer to an appropriate level.

Excessive use of headphones or earphones for a long period of time at high volume can be dangerous if the output of the headphone or earphone connectors do not comply with specifications of EN 50332-2. The headphone output connector of your computer complies with EN 50332-2 Sub clause 7. This specification limits the computer's maximum wide band true RMS output voltage to 150 mV. To help protect against hearing loss, ensure that the headphones or earphones you use also comply with EN 50332-2 (Clause 7 limits) for a wide band characteristic voltage of 75 mV. Using headphones that do not comply with EN 50332-2 can be dangerous due to excessive sound pressure levels.

Figure IV.2 – Example of an overly technical example of a text-based warning

Warning: Protect Your Hearing During Gameplay!
Video gaming and esports activities can provide exciting and immersive experiences, but it's important to be aware that they can also pose risks to your hearing due to high volume levels and extended gameplay. To ensure your auditory well-being, follow these guidelines:

Recognize the common signs of hearing damage:
- Tinnitus: If you experience ringing, buzzing, or hissing sounds in your ears, it could be a sign of auditory damage.
- Loss of Hearing Sensitivity: If you find it harder to hear quiet sounds or conversations, take action to prevent further hearing loss.

Safe Listening Practices:
- Adjust Volume: Keep your gaming device's volume at a comfortable level. If you can't hear external sounds while playing, it's too loud.
- Take Breaks: Give your ears a break by taking 5-10 minute breaks every hour of gameplay. This helps reduce strain on your hearing.
- Use Headphones Wisely: Opt for over-ear headphones that provide better noise isolation at lower volumes.
- Enable Volume Limiting: Check your gaming device's settings to enable this feature.
- Listen to Your Body: If you notice discomfort, pain, or auditory symptoms, take a break and allow your ears to recover.

Get More Information:
- Refer to your device's user manual or visit the manufacturer's website for details on safe listening practices.
- Explore resources from reputable sources like the World Health Organization (WHO) and hearing health organizations.

Remember, responsible gameplay includes looking out for your hearing.
By incorporating safe listening practices into your gameplay routine, you can enjoy a world of video games while safeguarding your hearing for years to come.

Figure IV.3 – Example of a sufficient text-based warning

PlayBox User guide

Warning: protect your hearing while gaming!

Playing video games can be really fun, but loud sounds can hurt your hearing if you play for too long. Follow these tips to keep your ears healthy:
Watch for signs of hearing damage:

- **Ringing or buzzing:** if you hear ringing or buzzing in your ears during or after gameplay, it could mean your hearing is being damaged.
- **Hard to hear:** if you struggle to hear quiet sounds or conversations, take action to protect your hearing.

Safe listening tips:

- **Keep the volume down!** Set your game volume at a comfortable level. If you can't hear external noises, it might be probably too loud.
- **Take breaks:** give your ears a rest by taking 5-10 minute breaks every hour. This helps prevent ear strain.
- **Choose headphones carefully:** use over-ear headphones that block out noise. These can help you play at lower volumes.
- **Use volume limits:** check your device settings to limit the maximum volume.
- **Listen to your body:** if your ears hurt or you notice hearing problems, take a break and let your ears rest.

Get more info:

- **Check the manual:** If using other audio devices such as headphones or earphones, check the manual or the manufacturer's website for safe listening tips.
- **Visit trusted sources:** Find more information from places like the World Health Organization (WHO) and other hearing health organizations.

Remember: playing safely means protecting your ears. By following these tips, you can enjoy gaming without damaging your hearing.

Figure IV.4 – Alternative example of a sufficient text-based warning

IV.2 Safe listening feature information examples for within video gameplay software titles

To ensure the effective use of any safe listening features available within a video game software title, compliant titles shall also include necessary supporting information within the video game itself to inform, guide and encourage the gameplayer of any features that have been included for the purpose of safe listening.

At the point of activation and access (for example an in-game sound or audio menu), software titles shall:

– Provide a short description of the safe listening feature, including rationale and purpose with regards to safe listening;

– Provide guidance to the gameplayer how to use the safe listening feature;

– Information should avoid technical or complex terminology, or references that are not easy to understand for a lay person, or younger audiences.

Examples are illustrated in Figures IV.5 to IV.8.

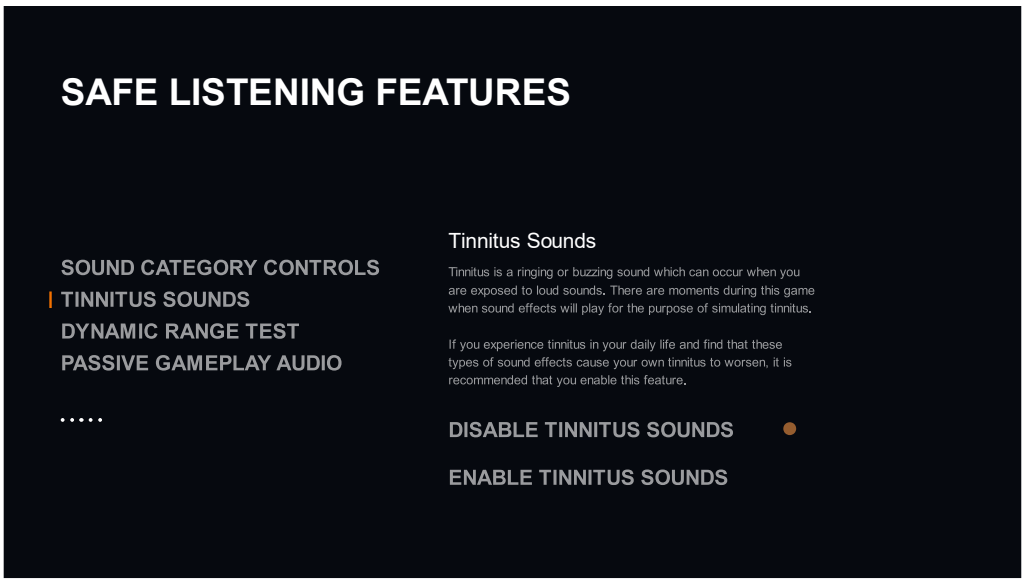


Figure IV.5 – Safe listening feature information: tinnitus sounds

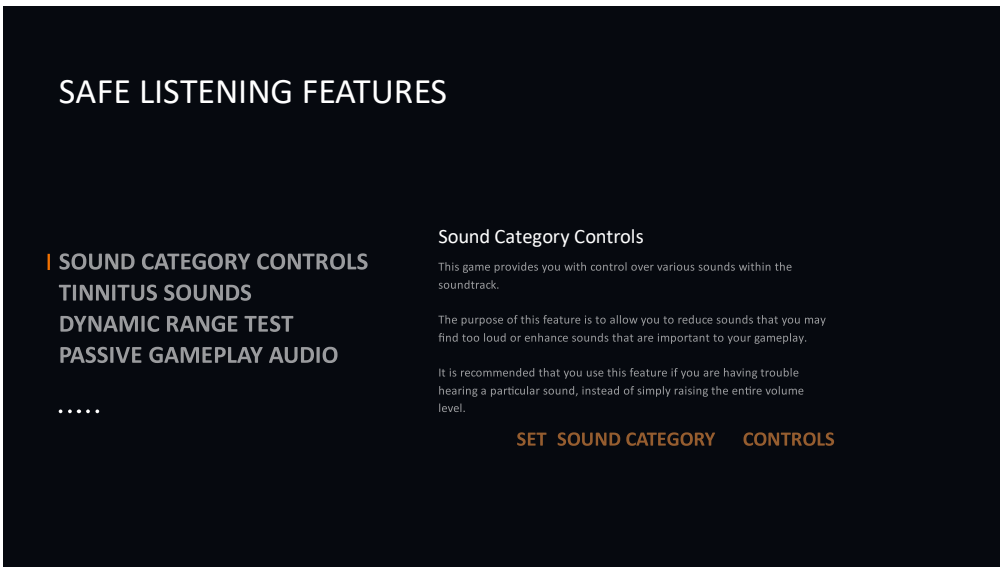


Figure IV.6 – Safe listening feature information: sound category volume controls

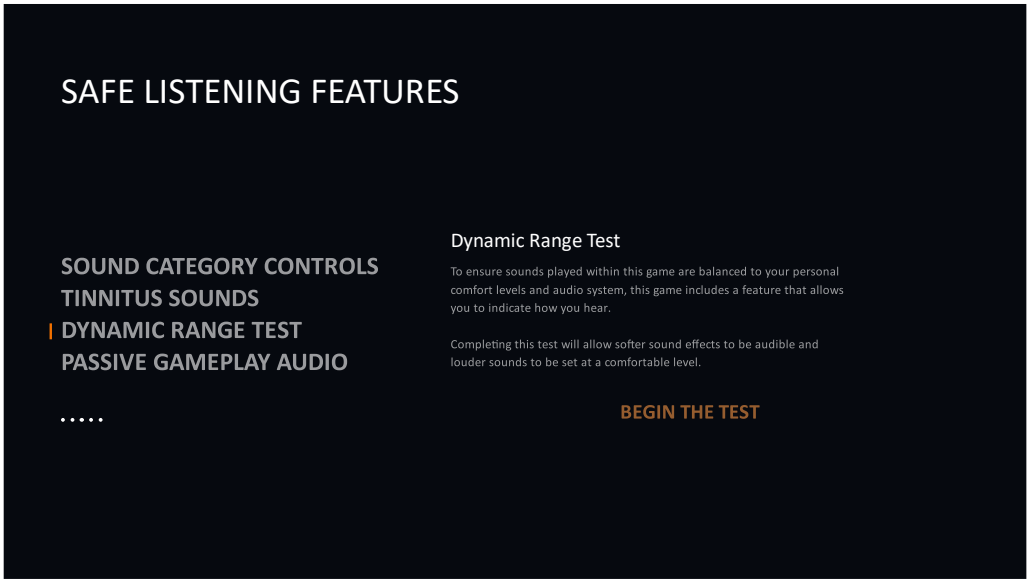


Figure IV.7 – Safe listening feature information: dynamic range test

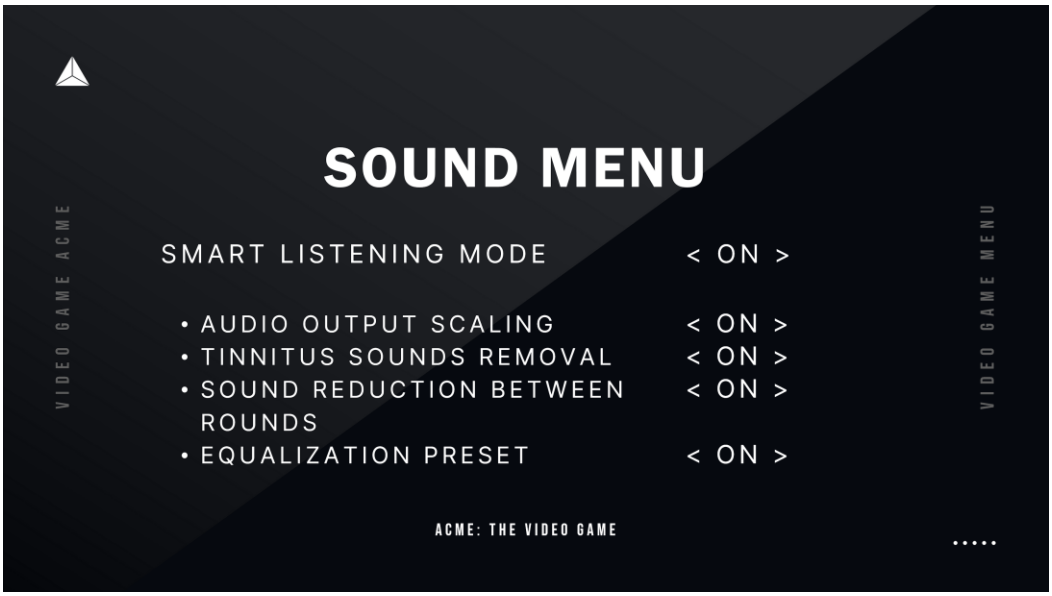


Figure IV.8 – Safe listening feature information: example of smart listening mode

Appendix V

Safe listening for live esports venues and events

(This appendix does not form an integral part of this Recommendation.)

The text below is adapted from the WHO Global standard for safe listening venues and events, [WHO, 2022] and the [b-HSTP-SLD-Venue].

V.1 Live esports event background

A live esports event is organized for the purpose of hosting competitive matches in front of a live audience. It involves:

– the assembly of professional and/or amateur players and teams to compete in a tournament or match;

– the utilization of video game consoles, PCs, or other gameplay devices as the primary platform for gameplay;

– the incorporation of a stage and visual display to present the ongoing gameplay and related content to the live audience;

– the implementation of an audio system that delivers in-game sound effects, commentator commentary, crowd reactions, and event-related announcements; and

– the provision of seating or standing areas for the live audience to watch the matches in person.

Examples of ELEs encompass international esports tournaments, local competitive events and exhibition matches that bring together professional and amateur players for high-stakes competition. ELEs showcase a range of esports genres, including multiplayer online battle arena (MOBA), first-person shooter (FPS), real-time strategy (RTS) and more.

These provisions do not apply to:

– recreational video gameplay sessions or casual gatherings;

– non-competitive video gameplay events conducted in an unstructured way;

– competitive esports events without live in-person component, e.g. streamed online only.

NOTE 1 – This exemption recognizes the distinct nature of esports events and their focus on competitive gameplay. Non-competitive video gameplay events are subject to different considerations.

The future exploration of video gameplay and virtual reality integration within the esports live event setting is anticipated for subsequent study.

NOTE 2 – The recommendations made in this document apply to video gameplay hardware and software (game titles) used during esports. The external sound in the esports venue (other than that heard through the video gameplay hardware and software) is outside the scope of this document. Features of a safe listening entertainment venue are covered in [b-HSTP-SLD-Venue].

V.2 Main features for live esports events

[b-HSTP-SLD-Venue] presents a systematic and comprehensive approach to achieving safe listening practices within live events and venues. It methodically balances the imperative of ensuring auditory safety with the desire to preserve the entertainment value inherent in live performances. This framework serves as the foundation upon which the subsequent recommendations for volume control in esports live event audiences are built.

V.2.1 Sound level limit

An upper limit of 100 dB $L_{\mathrm{Aeq,\,15\,min}}$ shall be imposed for the venue, keeping sound safe and enjoyable for the audience.

V.2.2 Sound level monitoring

Live monitoring of sound levels shall be performed by a designated staff member using calibrated equipment.

V.2.3 Venue acoustics and sound systems

Sound system and venue acoustics shall be optimized ensuring safe listening and improved sound quality.

V.2.4 Personal hearing protection

Hearing protection, such as earplugs, along with appropriate instructions should be available to audience members.

V.2.5 Quiet zones

Esports live events shall include quiet rooms for competitors and audience members. In addition, adequate breaks shall be taken between the competitive rounds when sound levels shall be kept below 80 dBA, in order to provide a break from sound exposure.

V.2.6 Appropriate training and information

Esports players, audience members and venue staff shall be provided information to make them aware of practical steps they can take to ensure safe listening.

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