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Gap analysis: Use cases of safe listening devices

ITU-T



Summary

This Technical Paper reports on new use cases not covered in Recommendation ITU-T H.870 (2022) "Guideline on safe listening devices/systems" and explores how users can be given a consistent hearing safeguarding message in accordance with the spirit of this standard.

Wireless headsets are being used in a variety of configurations with other devices. ITU/WHO safe-listening standard first edition (Recommendation ITU-T H.870 1st edition) has explicitly addressed their use with portable music playing devices such as the smartphone handset.

This Technical Paper considers other use cases and explores how users can be given a consistent hearing safeguarding message in accordance with the spirit of this standard.

Note

This is an informative ITU-T publication. Mandatory provisions, such as those found in ITU-T Recommendations, are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

Keywords

Headsets, personal audio systems, personal music player, safe listening

Change Log

This document contains Version 1 of Technical Paper ITU-T FSTP-SLD-UC "Gap analysis: Use cases of safe listening devices" approved at the ITU-T Study Group 16 meeting held online, 17-28 January 2022.

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Table of Contents

	Page
1 Scope	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere.....	1
3.2 Terms defined in this Technical Paper	1
4 Abbreviations and acronyms	2
5 Background.....	2
5.1 Issue.....	2
5.2 Consideration.....	3
6 Use cases.....	3
Annex A – Use cases	4

Technical Paper ITU-T FSTP-SLD-UC

Gap analysis: Use cases of safe listening devices

1 Scope

This Technical Paper considers new use cases not covered in the first version of [ITU-T H.870] and explores how users can be given a consistent hearing safeguarding message in accordance with the spirit of this standard. This is intended to be a gap analysis for the current version of [ITU-T H.870] against market trends.

2 References

- [ITU-T H.870] Recommendation ITU-T H.870 (2022), *Guidelines for safe listening devices/systems*.
- [IEC 62368-1] IEC 62368-1:2018, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*.
- [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*.
- [Bluetooth] Bluetooth SIG, *Bluetooth Core Specification Version 5.2, Feature Overview*, 9 December 2020.
<https://www.bluetooth.com/wp-content/uploads/2020/01/Bluetooth_5.2_Feature_Overview.pdf>

3 Definitions

3.1 Terms defined elsewhere

This Technical Paper uses the following terms defined elsewhere:

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

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

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

3.1.3 personal audio system (PAS) [ITU-T H.870]: A system of a personal audio device and a listening device.

3.1.4 safe listening device [ITU-T H.870]: A personal audio device/system that meets the requirements and criteria to minimize the users' risk of acquiring hearing loss, (as a consequence of its use) can possibly be termed as a safe listening device. It could include music players (MP3 players, smartphones and personal music players), together with a transducer that converts the electric signal into audio (e.g., earphones and headphones).

3.2 Terms defined in this Technical Paper

This Technical Paper defines the following terms:

3.2.1 headsets: A general term used to include headphones, headsets, earpieces, ear buds and true wireless stereo (TWS). Handsets is a single term used for smartphone handsets or mobiles.

3.2.2 true wireless stereo: A technology which allows one to pair two audio devices via Bluetooth, enabling the transmission of the left channel and the right channel separately.

4 Abbreviations and acronyms

This Technical Paper uses the following abbreviations and acronyms:

CSD	Calculated Sound Dose
PAD	Personal Audio Device
PAS	Personal Audio System
PMP	Personal Music Player
TWS	True Wireless Stereo

5 Background

5.1 Issue

Current technology developments and some recent product entries to the market mean that headsets are no longer simply the "listening devices" defined in [ITU-T H.870] and [IEC 62368-1] standards.

Some headsets are obviously portable music players in themselves, matching the definition in [ITU-T H.870] of a personal audio system (PAS) and in [IEC 62368-1] 10.6.2.1 of "equipment provided as a package (player with its listening device)".

All wireless headsets effectively stream media content from other devices in normal operation, thereby coming under the clause 6.2 description of a personal audio system (PAS) of [ITU-T H.870] where its "source can either be stored or retrieved remotely".

All wireless headsets are able to be connected to a variety of remote sources, of which only some will be within the definition of personal media/music player (PMP [IEC 62368-1]) and personal audio device (PAD [ITU-T H.870]). There is a high risk of a person using multiple sources, in turn being misled by any PAD/PMP with a protection scheme mandated by these standards.

Some playing devices are able to stream to multiple sources, especially through the new Bluetooth 5.2 profiles [Bluetooth]. A single protection scheme within the playing device is unlikely to be able to account for differing connections or listening periods and multiple volumes or enhancement settings in the headset. This again leads to misleading information, with any guidance or protection being based on erroneous data.

Any scheme intending to protect hearing has to avoid both false negatives (failures to inform, warn or protect) and false positives (premature informing, warning or protecting), resulting in loss of trust or frustration. It is of the utmost importance to ensure standards for safe hearing avoid confusion and establish confidence through clear and consistent messaging and intervention.

Any consumer purchasing a PAS/PMP/PAD or wireless headset that claims to comply with these standards needs to be able to trust the product delivers hearing safeguarding in all current and anticipated listening scenarios; they should not be given a false feeling of safety.

An additional consideration is that headphones and portable devices are not the only sources contributing towards user's exposure to sound. A laptop or tablet connected to headphones can be a major calculated sound dose (CSD) contributor; a car audio system is a likely significant contributor as a listening device, given the hours people spend in them seeking entertainment as they drive and the desire to listen louder than road noise.

5.2 Consideration

Those engaged in the development of standards for hearing safeguarding continue to ensure due consideration is given to the range of use cases presented by present and upcoming products; and where necessary, that they adapt the definitions and clauses embodied within the standards to meet the needs of consumers. For example, recent ITU-T H.870 discussions have moved to include wireless headsets capable of playing local or streamed content within the concept of PAS. This arose from both the existing definitions within the standard and consideration of new use cases.

In particular the wireless headphone, being the energy source of sound delivered to the user and typically able to alter the level of delivery, should more clearly be encompassed within definitions of PAS [ITU-T H.870] or PMP-with-listening-device [IEC 62368-1].

6 Use cases

A set of use cases are appended which have been compiled to explore the ways in which hearing safeguarding both is and is not being made available to users:

- One PMP/PAD to many wireless headsets
- Wireless headsets and non PMP/PAD sources
- Wireless headsets streaming from watches
- Wireless headsets with media storage
- Bluetooth DAC
- Sound personalization
- Analogue amplification
- Protection system conflict

The detailed description of each of the above is found in Annex A.

Annex A

Use cases

Use cases – Conflicted hearing safeguarding			One PMP/PAD to many wireless headsets
Date	June 2020	Use case	1
Description:			
<p>A PMP/PAD with the ability to simultaneously stream to multiple listening devices, making PMP/PAD-based hearing protection less effective.</p> <p>This is likely to become more common as Bluetooth 5.2 protocols introduce more advanced communication possibilities such as streaming to multiple devices and audio sharing.</p>			
Issues/gaps:			
<p>Present regulatory standards recommend dose-based assessment of the media content reaching the user's ears, envisage the protection being incorporated within the PMP/PAD, and it being connected to a single listening device with known or assumed characteristics. Streaming to multiple headsets introduces uncertainty:</p> <ol style="list-style-type: none"> 1) The headsets may have differing characteristics such as sensitivity, volume setting or sound enhancement mode; the single protection function, with its warnings and possible control, may over or under-protect each user. 2) The users may be listening to the streamed content at differing but overlapping periods; this again leads to errors in the issuance of warnings etc. 3) Users may be able to defeat PMP/PAD protection through a BT-connected dongle acting as a headset with 'known' low sensitivity. 4) One of the users may be a child <p>Without action, this use case will fall outside of the spirit and intention of both [IEC 62368-1] and [ITU-T H.870].</p>			
Possible options:			
<ol style="list-style-type: none"> 1) Ignore as being a fringe population. 2) Prohibit such use. 3) Parallel PMP/PAD protection channels. 4) Include wireless headsets within 'PMP with headset', or 'headset incorporating a PMP/PAD' so as to require them to incorporate appropriate protection. Existing wording of both standards can be interpreted in this way; minor changes would remove ambiguity. 			

Use cases – Conflicted hearing safeguarding			Wireless headsets and non-PMP/PAD sources
Date	June 2020	Use case	2
Description:			
<p>There are many sources, not currently designated as PMP/PADs (for example tablets, Kindles, laptops, PCs, gaming consoles, in-car audio). These can deliver content to wireless headsets but are not required to incorporate protection for safe listening. This is an increasingly complex area as with the possibilities of portable handsets being directly linked with another portable device (e.g., Microsoft's 'Your Phone') and headsets being connected to either.</p>			
Issues/gaps:			
<p>1) Those using wireless headsets with multiple sources, some PMP/PAD and others not, will suffer from two factors. Any dose-based assessment of their hearing exposure on a PMP/PAD will understate it. Users becoming used to PMP/PAD protection can become reliant on it and risk over-exposure when their same headset is used on sources without protection.</p> <p>2) The regulations target portable players, giving an indication of portability as being body-worn or pocketable whilst moving about freely. However, there is a whole range of relatively portable devices that do not fit in the arbitrary definition of 'pockets', such as tablets and laptops, which are often used during travel or in coffee bars etc.</p> <p>NOTE – The definition of PAS within the standard includes playing devices which are streaming from an external source. Although not explicitly included, a wireless headset does fall within this description.</p>			
Possible options:			
<p>1) Ignore as being a fringe population.</p> <p>2) Extend the definition of portability to include these devices (tablets, laptops etc) and thereby require incorporation of safe hearing protection.</p> <p>3) Ensure all wireless headsets are designated as PAS [ITU-TH.870] or as incorporating a PMP [IEC 62368-1], due to their ability to play streamed content and being portable; this would require them to incorporate safe listening protection.</p>			

Use cases – Conflicted hearing safeguarding				Wireless headsets streaming from watches
Date	June 2020	Use case	3	
Description:				
Some models of watches (from Garmin, Xiaomi, Fitbit, Fenix, Polar, amongst other brands) have the ability to stream content via Bluetooth to wireless headsets.				
Issues/gaps:				
Present regulatory standards recommend dose-based assessment of the media content reaching the user's ears and assume one PMP/PAD being connected to one headset; a single dose-based monitoring combined with available knowledge of headset characteristics provides suitable protection. Such watches are not clearly classified as a PMP/PAD; users are at risk.				
Possible options:				
<ol style="list-style-type: none"> 1) Ignore as being a fringe population. 2) Ensure such devices are clearly covered by the definitions of portable music players etc. 3) Ensure all wireless headsets are designated as PAS [ITU-T H.870] or as incorporating a PMP [IEC 62368-1], due to their ability to play streamed content and being portable; this would require them to incorporate safe listening protection. 				

Use cases – Conflicted hearing safeguarding				Wireless headsets with media storage
Date	June 2020	Use case	4	
Description:				
A number of headset manufacturers (including Aftershocks, JBL, Samsung, Sony, amongst others) produce wireless headsets with the ability to store MP3 or MP4 formatted programme material.				
Issues/gaps:				
Present regulatory standards recommend dose-based assessment of the media content reaching the user's ears, and assume one listening device being connected to one PMP/PAD; single dose-based monitoring combined with available knowledge of listening device characteristics provides suitable protection. Such headsets are not clearly classified as a PMP/PAD or PAS; users are at risk. NOTE 1 – [IEC 62368-1] defines PMP as portable music player; it is designed to allow the user to listen to audio content 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 with while in continuous use (for example, on a street, in a subway, at an airport, etc.). This implies the wireless headset of this use case has an embedded PMP which needs to comply with either option 1 or 2 of the regulation. NOTE 2 – [ITU-T H.870] is more explicit in its description of PAS (a PAD + listening device) as being able to play either from locally stored content or stream from an external source.				
Possible options:				
<ol style="list-style-type: none"> 1) Ignore as being a fringe population. 2) Ensure all such wireless headsets are designated as PAS [ITU-T H.870] or as incorporating a PMP [IEC 62368-1], due to their ability to play streamed content and being portable; this would require them to incorporate safe listening protection. 				

Use cases – Conflicted hearing safeguarding				Bluetooth DAC
Date	June 2020	Use case	5	
Description:				
Products exist in the form of a portable Bluetooth device with integral DAC that drives analogue headsets. There is no limit to the DAC dongle's drive levels and hence even a 62368-sensitivity-constrained headset can produce damaging outputs.				
Issues/gaps:				
1) Present regulatory standards recommend dose-based assessment of the media content reaching the user's ears. They specifically exclude situations where external amplifiers are used.				
Possible options:				
1) Ignore as being a fringe population. 2) Ensure all such devices are designated as PAS [ITU-T H.870] or as PMP [IEC 62368-1], requiring them to incorporate safe listening protection.				

Use cases – Conflicted hearing safeguarding				Sound personalization
Date	June 2020	Use case	6	
Description:				
Apps and in-built mobile handset features are able to use the handset's equalization and other capabilities to manipulate the sound for greater clarity. Many techniques are possible.				
Issues/gaps:				
1) Where protection within the handset is being relied on, this becomes unreliable unless the effects of such enhancements on a user's hearing dose is accounted for. 2) Where the protection method is only referenced to a standard test signal (PSN), media with differing characteristics may be assessed erroneously, even if auto-level adjustments are incorporated into the enhancement implementation. 3) Where headsets permit sound-personalization profiles to be downloaded as semi-permanent configurations for use with other media sources, including when self-playing, unless these are taken into account by the handset's protection, misleading indications and protection will occur.				
Possible options:				
1) Ignore as being a fringe population. 2) Ensure all such functions are clearly to be included within the definitions of maximum user settings within the standards. For example, sound personalization is to be applied without altering the contribution to hearing dose. 3) Ensure all wireless headsets are designated as PAS [ITU-T H.870] or as incorporating a PMP [IEC 62368-1], due to their ability to play streamed content and being portable; this would require them to incorporate safe listening protection.				

Use cases – Conflicted hearing safeguarding				Analogue amplification
Date	June 2020	Use case	7	
Description:				
For portable devices with output connectors, portable booster amplifiers can be inserted to generate significantly high audio levels than permitted under [ITU-T H.870] or [IEC 62368-1]. The regulations specifically absent themselves from this scenario.				
Issues/gaps:				
N/A				
Possible options:				
<ol style="list-style-type: none"> 1) Ignore as being a fringe population. 2) Ensure all such devices are designated as PAS [ITU-T H.870] or as PMP [IEC 62368-1], requiring them to incorporate safe listening protection. 				

Use cases – Conflicted hearing safeguarding				Protection system conflict
Date	June 2020	Use case	8	
Description:				
Where dose-monitoring handsets may be connected to dose-capable headsets.				
Issues/gaps:				
Potential conflicts between two systems attempting the same protection scheme.				
Possible options:				
<ol style="list-style-type: none"> 1) Ignore as being too far off or a fringe problem. 2) Introduce a clause requiring such scenarios need to be resolved through suitable negotiation between devices. 				