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INFORMATION

A Guide to
Assistive Listening Systems

Institute of Sound, Communications
and Visual Engineers Ltd

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A Guide to **Assistive Listening Systems**

Hearing loss affects approximately 12 million people in the UK and is often termed the 'hidden disability' as it may not be immediately obvious although it can be just as debilitating as other forms of more obvious impediment. Furthermore, it is generally not appreciated that a traditional hearing aid has a limited useable range of typically just 2-3m and does not fully restore the user's hearing ability. An assistive listening system (ALS) can help make up for this shortfall by eliminating the acoustic space and its associated noise and reverberation, and bringing the wanted speech or sound directly to the ear or hearing device of the listener.

Traditionally, hearing loops (AFILS) or, to a more limited extent, Infra-red (IR) systems have been used in UK and can be found in a wide variety of buildings and venues ranging from churches and houses of worship, theatres and concert halls to court rooms, railway station platforms, ticket counters and help points. Many shop and supermarket checkout counters, ticket desks and information points also have loops or portable loop systems that enable the hard of hearing to hear the sales assistants and operators directly over the ambient noise and so provide a vital means of communication.

New technologies however are emerging that offer alternative approaches but their use and limitations are not as well understood and results can be variable, particularly as currently there are no standards or codes of practice that cover their use and installation. Furthermore, these systems may not always be installed by those familiar with the needs of hard of hearing (HoH) and deaf aid users.

This guide is therefore intended to provide both background to the needs of the deaf and HoH ALS user and to set out the basic performance criteria that Assistive Listening Systems, regardless of the technology employed, should meet in order to be of benefit and to provide listeners with a highly intelligible speech signal of good audio quality.

It is anticipated that the guide will be of equal use to the user, specifier, installer and evaluator of an ALS.

What is an Assistive Listening System, how does it work and who benefits?

An Assistive Listening System provides (or should provide) the user with clearer and more intelligible sound than their hearing aid or cochlear implant can achieve alone. It does this by either taking an audio signal directly from a sound system or from a dedicated microphone located close to the source of the sound This 'clean' signal is then transmitted directly to the user's hearing device, thus by-passing the reverberation and ambient noise in a room or space. In noisy environments this can improve the signal to noise ratio by as much as 15-20 dB. It effectively places the listener close to the talker or desired sound.

An ALS is therefore beneficial when the listener is either located at some distance from a talker or the source of sound and / or when the background noise level is such as to be clearly audible.

Assistive Listening Systems may either be permanently or temporarily installed or can be portable devices. However, in order for them to be effective, they must deliver the desired audio signal to the listener in such a way as to preserve the fidelity of the speech signal and its timing.

ALS, whilst primarily intended for use by the deaf and hard of hearing, have also been found to help other listeners in environments with poor acoustic conditions or where they are non-native listeners. A good ALS can not only improve speech intelligibility and the clarity of music but also reduce listening fatigue and the cognitive load imposed on a listener.

Requirements for a successful Assistive Listening System

To be of benefit, an ALS must not only be able to deliver a highly intelligible audio signal to the user but do so in a manner that is easy and straightforward for the listener to access. The received speech must have adequate level (be loud enough but not too loud), have all the important speech frequencies present, not be noticeably distorted and be essentially free from noise and reverberation. Also, most importantly, though often not understood, is that any audio and visual information must be in synchronisation so that lip reading is not adversely affected. A mis-synchronisation of as little as 40-50 milliseconds can seriously degrade the ability to lip read - which most people with a hearing loss rely on, either consciously or subconsciously. Unfortunately, some forms of signal transmission and processing can unacceptably delay the ALS audio signal, rendering a system unusable – even for those without significant hearing loss. A disturbing mismatch and delay may also be heard when the ALS speech signal is heard together with that arriving from a sound system loudspeaker. By applying a suitable delay to the ALS signal, the acoustic and audio signals can be aligned.

It is also vital that potential users of an ALS are aware of its presence, its availability and how to access it.

Technical Performance

Technically, the performance of an ALS may be characterised by the following key parameters and be objectively tested to ensure that it is fit for purpose and potentially capable of providing benefit.

- Intelligibility
- Bandwidth and frequency response
- Delivered sound level or equivalent signal level
- Received noise level and signal to noise ratio (SNR)
- Reverberation (D/R ratio)
- Distortion
- Continuity of signal
- Audio latency – end to end delay from source to receiver

These factors are discussed in more detail below and the technical requirements are summarised in Table 2 towards the rear of this guide. Further information can also be found in the ISCVE ALS Code of Practice[1].

Other aspects that need to be considered for successful operation include the siting and control of any associated microphones and the Integration of the ALS with sound reinforcement, PA and emergency communication systems.

Accessibility and signage

From an accessibility point of view, the user must be informed about the existence of the ALS system and how to use it. The following factors need to be taken into account.

- Signage – this needs to indicate the presence and type ALS
- Coverage – the user needs to know which areas of a building or venue are covered and if there are any coverage dead spots or non-coverage areas.
- Are intermediary devices required to listen to the system or can it be used directly with a normal hearing aid?
- Where in the venue can intermediary devices and receivers be obtained? Are they free loan or is there a charge or deposit etc.?
- Can ALS users bring their own devices (BYOD) and is the system known to work satisfactorily with a range of typical smart phones and receivers?
- Who will instruct the user in the use of the ALS and ensure that is operating correctly for them?
- Who should the ALS user go to or contact in case of a problem?
- How does the venue know that the system is working correctly? How do they monitor its performance? What procedures do they have in place if there is a problem?

[1]Code of practice for the design and operation of assistive listening systems ISCVE 2023

- A venue or facility should not have to rely on the user telling them that the system is not working or working correctly.

Internationally recognised Assistive Listening System sign

Most of this necessary information can and should be available on a venue's or facility's website.

[The ISCVE code of practice addresses the above issues together with the need to actively monitor and regularly test an assistive listening system].

Sound Pickup and interconnection of an ALS with sound reinforcement, Audio Visual (AV) and Public Address (PA) systems

Microphones

One of the greatest weaknesses of many assistive listening systems is the way in which the wanted sound is captured – particularly when there isn't a sound reinforcement system. The primary objective of an ALS is to improve the intelligibility of the wanted speech by delivering a high quality audio signal, as free as possible from noise and reverberation, directly to the listeners' ears or hearing device. The positioning of microphones used to pick up the speech is therefore extremely important. Where there isn't a sound system, it will be necessary to provide appropriate microphones and a mixer specifically for the ALS. (Many ALS amplifiers incorporate microphone inputs).

Directional microphones normally give better results than omnidirectional types, as they pick-up less room sound and reverberation. If several microphones are needed, they should be controlled by an automatic mixer assuming that an operator is not available. To optimise intelligibility, the microphone should be as close to the talker as possible, for example by using a headset microphone, lavalier (tie clip) or alternatively a gooseneck microphone for lectern or table use. (An advantage of taking the output from a sound system is that the microphones employed automatically tend to be close to the talkers in order to avoid acoustic feedback).

The maximum microphone to talker distance depends on the room and microphone type but in most cases should usually be less than 2m from the talker. In meeting rooms, table mounted microphones typically need to be within 0.5 to 1.0m of a person speaking. Microphones should be placed in front of or possibly directly above a talker but not behind them, and away from sources of noise such as air conditioning grilles or equipment incorporating motors or fans. In classrooms and meeting rooms, ceiling mounted microphones can be made to work but again the 2m rule should be adhered to unless a highly-directional 'beam steered' microphone is employed.

In theatres and auditoria, the ALS is often fed from the show relay system, which typically uses highly directional 'gun' microphones to pick-up the sound from the stage. However, great care needs to be taken to ensure that the sound does not become too reverberant or 'distorted' as the sound from the ALS needs to be of a higher quality than many show relay systems normally provide.

An exception to the 'shortest distance' rule is where an ambience microphone is used. Such microphones are extremely useful to pick up the general sound in a room or where microphones are not specifically picking up the desired sound or performance, as they enable the ALS listener to be aware of what is happening and also provide confidence that the system is working prior to an event beginning. They can also reduce the sense of isolation that an ALS user may feel when only hearing just the sound of a performance or talker. It is important however, that the ambience microphone is muted when the main audio signal is present.

Integration of the ALS with local AV and sound reinforcement systems

It is important that all audio sources in the room or space are reproduced by the ALS; this includes sound reinforcement systems, AV such as PC audio or any media playback and both the near and far end of video conferencing. In many cases, this may be achieved simply by connecting an auxiliary output (see below) from the main sound-system mixer to one of the inputs on the ALS mixer, however in some cases a separate audio mix may be required.

When obtaining the ALS signal from a sound reinforcement (SR) or PA system, it is essential that any adjustment of the output of the main PA/SR system does not affect the signal being fed to the ALS. A dedicated, controllable output, protected against inadvertent adjustment needs to be provided. It should also be difficult to inadvertently disconnect, switch off, or to fade down the feed to the ALS. This is particularly important where an ALS is used as a supplementary alarm device, where it needs to reproduce messages or signals from a voice alarm or emergency communication system (See ISCVE CoP, BS 5839-8: 2023 and BS 7827: 2019 for further information).

Other factors to consider when designing, specifying or purchasing an ALS

There are many aspects to take into account when designing or purchasing an Assistive Listening System, factors to consider include:

- Who will use the system (general public, informed or regular users e.g. students using lecture room systems)?

- What area(s) does the ALS need to cover?
- Does the speech signal need to be confidential or be restricted to certain areas (for example court rooms or overspill between cinema screens)?
- Will adjacent areas be used simultaneously (This also includes rooms above or below the area under consideration.)
- Who will operate and maintain the system?
- If intermediate receivers or devices are required, who will distribute, maintain and clean them?
- Is the system to cover a large area or be confined to service or sales counters, ticket counters/machines or help points?
- Is the location particularly affected by noise e.g. train station ticket desks and information points?
- How can the system be installed – does the building or structure limit the scope and likely potential effectiveness of one technology over another?

Assistive Listening Systems and Technologies

Careful consideration of the specific requirements and circumstances should be given when choosing the technology to be employed for an ALS installation or use, as no one technology or system can fit all requirements. Furthermore, different age groups and demographics can have different views about the technologies, particularly with regard to the potential stigma they feel may be associated with wearing a hearing aid and with hearing loss and the complexity of system use. Table 3 summarises the applications and potential compatibility of the system technologies.

Hearing Loops

The most widely used ALS in the UK is the Hearing Loop or AFILS (Audio Frequency Induction Loop System). This technology has been around for over 70 years and has advanced considerably since the early systems.

A hearing loop system works by the hearing aid or listening device picking up the audio frequency signal transmitted by the loop when driven by a suitable amplifier. The loop wire (or thin copper tape) may be located around the perimeter of an area to be covered, or the area may be covered using a number of smaller loops.

A major advantage of a hearing Loop is that it can be used directly with any hearing aid that incorporates a Tcoil (telecoil) – which all NHS provided aids have and around 70% of other aids incorporate. This advantage to the user cannot be overstressed as it means that they can seamlessly use their hearing aids without the need to obtain an intermediary device and so it is often the preferred technology. It is important that venue owners and system suppliers understand and appreciate the impact that this can have for the user, although there are situations where the benefits of an indirect system can outweigh this convenience. To access a hearing loop, a hearing aid or cochlear implant is switched to the 'T' or 'MT' setting. Loops can provide not only coverage of large areas but are also particularly useful in providing local coverage at service points, information desks and ticket counters as well as at help points, ticket machines and service intercoms.

Whilst hearing loops currently offer the broadest range of application, they are not without their limitations. Tcoils can pick up electromagnetic interference and noise particularly from some forms of mains power installation, various types of lighting (e.g. theatre lighting systems) and power distribution transformers. Overspill of the loop signal can cause privacy and confidentiality issues though specific measures can be taken to mitigate this. Metal content in building constructions, in lifts and in transportation vehicles can cause both signal loss and imbalance in the frequency response, requiring careful design and specific measures to resolve. Loop installation in some existing buildings can be difficult particularly where access is restricted, or construction precludes cable and loop installation in a straightforward and easy manner. Hearing loops have only a single channel capability and so cannot broadcast stereo or multi-channel information. Whilst not important for many uses, this potential restriction should to be borne in mind when considering more complex applications.

Infra-red

An infra-red (IR) ALS delivers the targeted sound to the listener by means of an infra-red beam of light. The infra-red beam is modulated with the audio signal and picked up by a receiver worn by the listener. This in turn can either connect directly to headphones / earbuds or to the user's hearing aid or cochlear implant via a neck loop. As with Hearing Loops, a high quality pick-up of the wanted sound source is required.

Infra-red systems are generally found in theatres, concert halls and similar auditoria or where speech privacy and confidentiality are required. Regular users often purchase their own IR receiver as most systems use compatible frequencies. In order to obtain a reliable signal the IR receiver needs to effectively have line of sight to the transmitter and so needs to be worn so that it is not obscured. This not only provides good visibility to the IR transmitter but also to other event attendees, which could identify the user as someone with hearing loss. A few compact IR transmitters can readily cover large seating areas and so enable venues of over 2000 seats to be easily covered. This is particularly useful where the seating areas and layout of an arena, for example, may change depending on the use.

IR systems are also found in conference venues where simultaneous language interpretation is required, as the system can handle several audio channels and so

provide multiple languages / translations via the same system. They are also used in classroom 'soundfield' systems, both for the transmission of the audio to the HoH user but also, in some systems, as the means to transmit the wanted speech (e.g. teacher's voice) to the soundfield amplifier. Because there is virtually no overspill, IR soundfield systems are a practical solution where there are several adjacent classrooms. They are also generally easy to retrofit. The bandwidth of IR systems is typically around 10 kHz and they exhibit flat frequency response. To those listeners with little or mild hearing loss, IR systems are often reported to exhibit higher audio quality than hearing loops but to the normal hearing aid user there is unlikely to be any discernible difference, except for the added requirement that a visible receiver and neck loop are required. (See the neck loops section later in this guide.). IR systems are generally not suitable for outdoor or semi-outdoor use, because daylight can affect their transmission.

Audio over Wi-Fi

This is a relatively new technology and has applications beyond ALS. A receiver, smart phone or tablet is required to pick up the Wi-Fi signal and select which audio stream to connect to. As with Hearing Loops and Infra-red ALS, a high quality pick-up of the wanted sound source (speech etc.) is required. Alternately, the audio signal can be provided from a sound system output. Sound is transmitted to a hearing aid either via a neck loop or via a hearing aid compatible Bluetooth signal from the receiver/smart phone. (Note that not all Bluetooth signals are compatible with all hearing devices and often will only connect to products from the same manufacturer). Some experience by the user is required to be able to connect to a Wi-Fi system (an app will also be needed) and clear instructions for use are necessary. Wi-Fi systems can exhibit significant signal latency which, under certain conditions can make them unsuitable for ALS use due to the delay in the arrival of the sound affecting both intelligibility and lip sync. The latency is created both by the IT network and also by the smartphone device and the combined value can vary significantly with network use and traffic. Being a radio-based system; audio over Wi-Fi has the advantage that the area of coverage can be wide, with signal repeaters potentially extending the coverage to multiple areas. Another advantage is that there can be a number of different simultaneous audio channels. Before installation, detailed testing of the network and the potential latency should be carried out under normal network traffic and operational conditions in order to determine if the technology will be suitable for the application and venue or building.

Auracast

Auracast is an emerging technology, but at the time of publication of this guide, its potential availability and real-world performance capability are unknown. It is not envisaged that products will enter the market before 2024 and the international standard determining the operational requirements is currently not expected to be published until 2027.

Auracast is a proprietary audio transmission system using Bluetooth LE that, unlike other Bluetooth systems, enables several separate audio streams to be simultaneously transmitted to multiple compatible listening devices at anticipated distances of up to typically 50m, depending on the local conditions and spectrum usage. It is anticipated that Auracast will eventually find application where traditional ALS are employed and enable either new uses to be leveraged, or by its potentially easier installation enable current applications to be extended or enhanced.

In the long term it should be possible for PA and emergency sound system announcements to be automatically broadcast directly to a listener's Auracast equipped hearing aid. The possibility to receive and select from multiple audio streams is also inbuilt into the technology but how the user will do this has yet to be confirmed. The practical transmission range and use of multiple transmitters to seamlessly cover large spaces or areas has also yet to be determined. The potential latency of Auracast devices when used in real world situations has also to be established. Although a maximum latency of up to 50 ms has initially been set, when combined with the audio latencies of typical hearing aids and the digital processing found in most sound systems, this could result in an end-to-end latency that is at best of only borderline toleration for many ALS applications.

Auracast however, should provide a common standard for communication between hearing aids and audio and speech capture and enhancement devices, thereby enabling Bluetooth based products from different manufacturers to be compatible.

Whereas Auracast could develop to become a universal assistive listening system, it will take several years for a sufficient number of products and devices to both reach the market and be purchased for it to attain a point where it can cover all ALS requirements. As with all other assistive listening systems, a high quality pick-up of the wanted sound source will be required.

Soundfield Systems

Soundfield systems are a special type of assistive listening system, normally associated with, though not necessarily limited to, school classrooms. Their objective is to amplify the level of the natural voice and improve the signal to noise ratio. This is achieved by broadcasting the speech over a number of dedicated loudspeakers within the room, with the aim of providing an even distribution of the sound. The teacher or instructor wears a radio (or infra-red) based microphone to transmit their voice to the amplification system, though this signal is often also simultaneously

transmitted directly to the students via their personal hearing devices or associated receivers. It is important that the sound system provides a high level of speech intelligibility, with values in excess of 0.6 STI (see IEC 60268-16) being required in order to provide effective improvement. Inputs from AV systems and other devices such as laptop computers are also desirable and should be provided where practical.

Soundfield systems are often used in conjunction with either infra-red or proprietary radio systems to transmit the audio signals, both from the talker and to the users' hearing devices. It is often not fully appreciated just how high the level of intelligibility of the loudspeaker system needs to be in order for the system to be effective and that this usually requires the room to exhibit an inherently good acoustic performance.

Neck loops and Personal Listeners

Neck loops

A neck loop is a device that allows a personal listener or ALS receiver to be used with a hearing aid that is fitted with a Tcoil by transmitting the audio signal inductively to the hearing aid in a similar manner to a hearing loop. Neck loops are typically about 230mm in diameter and worn as a necklace by the hearing aid / CI user. The design and construction of neck loops varies considerably. They may be either active or passive devices and may be intended for general use or for use with a specific receiver. In either case, it is important that they can provide both an adequate magnetic signal and frequency response, though in practice their efficacy seems to vary. IEC 60118-4 provides detailed performance requirements and IEC 62489-1 provides the technical measurement requirements.

A neck loop often forms part of an intermediate receiver required to enable a hearing aid to be used with either radio or infra-red based systems. Venues must provide enough receivers to cater for the expected audience, with one receiver per 25 seats often being used as rule of thumb.

Where provided for public use, the venue or facility operator needs to maintain and clean the receivers and keep them fully charged ready for use.

Personal Listeners

Personal listeners are a related form of assistive listening device which, as their name suggests, are used by individuals to improve speech intelligibility and their listening experience. These often take the form of a remote microphone that can be placed close to or worn by a talker. This is then linked to the user's hearing aids, usually wirelessly either by means of an inbuilt receiver or more commonly via a receiver and neck loop. Personal listeners often incorporate speech enhancement and noise reduction processing to improve intelligibility. A detailed description of their use and types is beyond the scope of this guide but some further information can be found in the ISCVE Code of Practice.

Design and test certification

With the range of technologies now available, the best choice of assistive listening system may not always be immediately obvious. It is good practice to draw up a list of system uses and requirements so that an informed choice can be made. Although the user requirements are of primary importance, additional factors such as building construction, access and installation should also be considered together with the management and maintenance of the system once it has been installed. After an ALS has been installed and commissioned a test certificate should be provided by the installer together with 'as installed' drawings, operating instructions, maintenance requirements and equipment handbooks. The ISCVE Code of Practice for Assistive Listening Systems provides detailed testing information together with sample design and test certificates.

Table 1 - Equipment performance standards and information

ALS	Standard	Comment
Hearing loops	IEC 60118-4 and IEC TR 63079	
Neck loops	IEC 60118-4 and IEC 62489-1	
System monitoring	IEC 62489-1, ISCVE CoP	Also fire alarm and emergency sound system standards
Infra-red	IEC 61603-1, IEC 61603-2, IEC 61603-3	
Auracast	IEC 60118-17 (To be published)	
Other forms of ALS, including soundfield systems	ISCVE Code of practice for the Design and Operation of Assistive Listening Systems	
Personal listeners	IEC 63087-1	
Accessibility standards	BS 8300, EN 17210	

Table 2 - Recommended ALS technical performance parameters and criteria

Parameter	Recommended value	Comment
Intelligibility	⩾ 0.70 STI (IEC 60268-16)	Speech Transmission Index (This measure takes account of both signal to noise ratio and direct to reverberant ratio but requires a special test signal, and specialist test equipment / knowledge).
Bandwidth and frequency response	100 Hz to ⩾ 5 kHz	± 3dB from 100Hz to 5 kHz 50Hz – 11 kHz high quality (e.g. music applications)
Equivalent sound level	Long-term average signal level to achieve equivalent of 70 dB SPL at the hearing aid	
Spatial variation in signal level	⩽ +/- 3 dB variation within coverage area of ALS	Typically measure at 1 kHz
Control of signal level (AGC)	AGC to control ALS signal level within 20-30 dB range	ALS should also be provided with a peak limiter to protect listeners (and system) against acoustic shock
Signal to noise ratio	Minimum for short period (e.g. for Help points, Info desks) > 22 dB (A wtd) below max speech level	> 32 dB (A wtd) – acceptable > 45 dB (A wtd) – high quality
Received noise level (rnl) and signal to noise ratio	Maximum received noise level for short period to be at least 15 dB (A wtd) below the long term average speech signal (LTASL) level or 22 dB (A wtd) below nominal max rms speech level	snr > 15 dB (A wtd) minimum requirement for intelligibility (LATSL) rnl < 22 dB (A wtd) – minimum short time rnl < 32 dB (A wtd) – acceptable rnl < 45 dB (A wtd) – high quality
Direct to reverberant ratio	⩾ + 6dB C50 @ 1 kHz	Assumes low ambient noise
Distortion	< 0.5% THD	< 1.0% THD N
Continuity of signal	Signal to be free from dropouts and audible distortion	
Coverage (limit)	Hearing Loop – where the magnetic field strength drops by >3 dB. Radio & infra-red wireless based systems, where the signal begins to drop out and distortion and noise noticeably increase.	How the limit of useful coverage is determined depends on the ALS technology.
Audio latency	< 40 ms	(Max latency end to end < 50ms)
Further information on these parameters and measures can be found in the ISCVE CoP		

Table 3 - Assistive listening systems comparison

APPLICATION	Hearing Loops and T-coils	Infra-red	Wi-Fi	Auracast (Expected)	Limitation
Requires	T-coil enabled device	IR receiver	Smartphone or receiver	Auracast and equipped hearing aid or receiver	'Rec' = receiver
Education					
Schools	✔✔	✔+	✔*+	✔✔	*Latency +Rec
Colleges / Universities	✔✔	✔+	✔*+	✔✔	*Latency +Rec
Entertainment and leisure					
Outdoor arenas and stadiums	✔-	✔	✔+	✔✔	- Coverage limited +Rec
Indoor arenas	✔-	✔+	✔+*	✔✔	- Coverage limited *Latency with video + Rec
Auditoriums, cinemas and theatre	✔✔	✔+	✔*	✔✔	*Latency + Rec
Museums	✔✔-	✔*	✔+	✔✔	- Coverage limited + Rec
Theme parks (outdoor use only)	✔-	✔	✔+	✔✔	- Coverage limited + Rec
Tour groups	✔	✔	✔+	✔✔	
Corporate					
Conference centres and meeting rooms	✔✔	✔✔+	✔*	✔✔	*AV Latency + Rec
Hotels and hospitality	✔✔	✔+	✔*	✔✔	*AV Latency + Rec
Justice					
Courtrooms	✔	✔+	✔**	✔	Privacy
Interview rooms	✔	✔+	✔**	✔	**If encoded
Retail and service areas					
Service counters eg banks, retail stores, malls, airport, bus and train	✔✔	✔	✔	?	
Ticket machines, ATMs, automatic check outs, door entry, lifts/ elevators and intercom systems	✔✔^	✔	✔	?	Metal loss on signal to be considered
Healthcare					
Hospitals, retirement and nursing homes	✔✔	✔+	✔+	✔✔	+Requires receiver
Transport					
Airports, railway stations, bus stations[1]	✔✔-	✔	✔+	✔✔	- Coverage +Rec
On board taxis, buses, trains, coaches	✔✔^	✔	✔+	✔✔	Metal loss +Rec
Cruise ships & passenger ferries	✔^	✔+	✔^ Signal Transmission	✔✔^ Signal Transmission	^ Metal loss and signal transmission +Rec
Home & Domestic					
TV and home theatre	✔✔	✔+	✔+	✔✔	+Requires receiver
Places of worship					
Halls of worship	✔✔	✔+	✔+*	✔✔	+Requires receiver
Meeting rooms	✔✔	✔+	✔+	✔✔	+Requires receiver
Counselling spaces	✔✔	✔+	✔	✔✔	+Requires receiver

[1]Any transient environment, where users of the system are likely to only be within coverage of the ALS for a brief period (such as concourses, waiting areas, service points, intercoms, etc.) should be covered by an ALS that can broadcast directly to hearing aids and should not require the dispensing of dedicated receivers.


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