



Christian Services for the
**BLIND and
HEARING
IMPAIRED**

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HOW TO EQUIP YOUR
CHURCH OR VENUE
FOR PEOPLE WITH

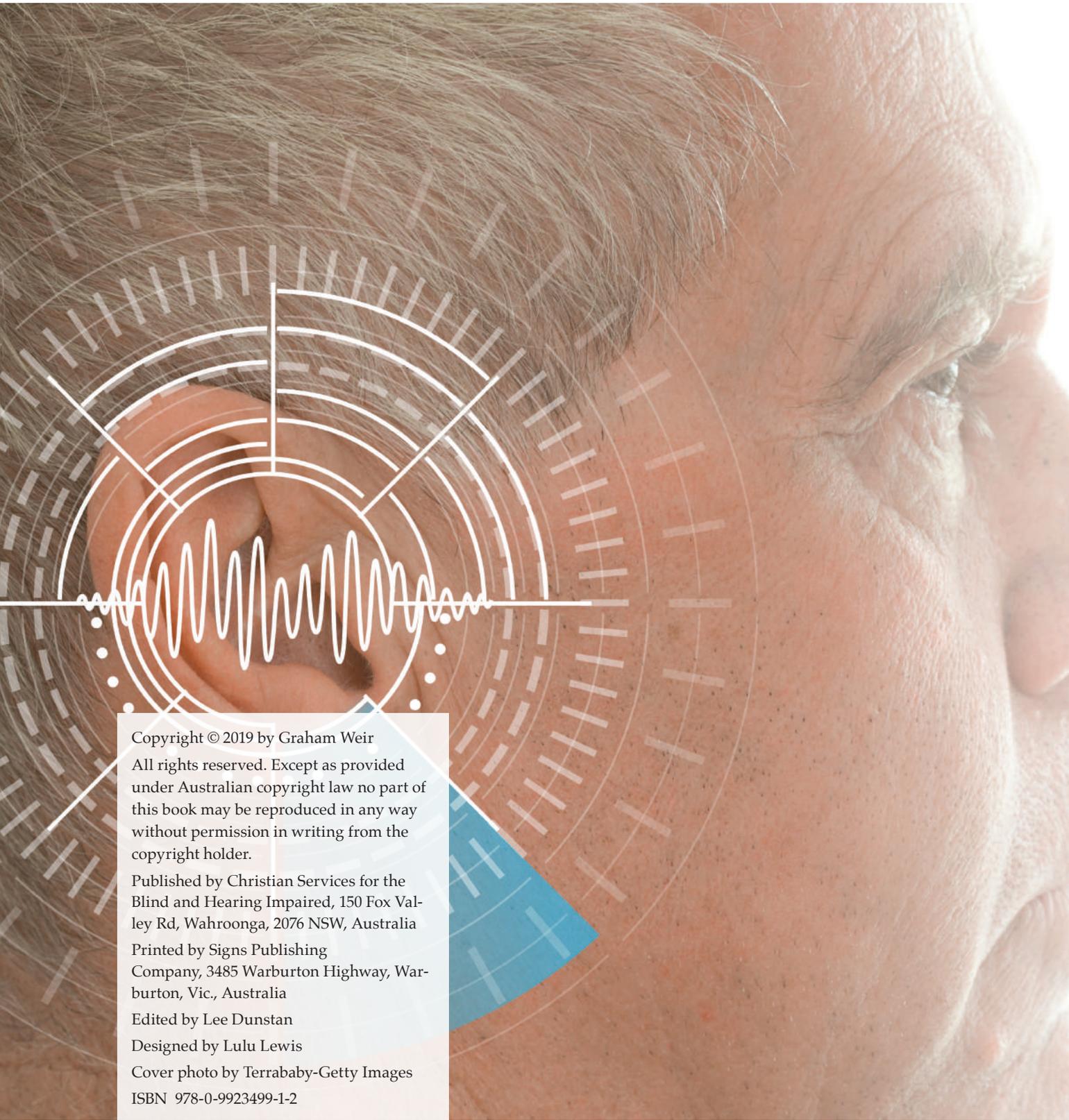
hearing PROBLEMS



GRAHAM WEIR



Seventh-day
Adventist Church™



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A world-wide problem

According to data from the World Health Organization and Australian and US government organisations, some 466 million people globally—14 per cent or three million Australians and 13 per cent or 30 million Americans—live with hearing loss. It is a major challenge as our community ages. It results in problems with communication, leading to social isolation. And to effectively reach people, churches will need to adapt, employing closed captioning and assistive listening technologies.

Hearing impairment affects people of all ages to varying degrees, with as many as 12 children per 10,000 born with moderate or greater hearing loss, while 23 children per 10,000 will require hearing aids by the

age of 17. Inadequate hearing care severely reduces a person's everyday functioning, productivity, communication, social participation and quality of life.

With more than 50 per cent of people over the age of 60 experiencing some form of hearing loss, the expected increase in the proportion of the population in this age bracket over the next 30 years (Figure 1) means that the readiness of churches to cater for people with hearing loss will be a major determinate of their willingness to participate in and enjoy our social and religious activities.

This booklet aims to educate churches in this respect and encourage them to accept their legal and ethical obligations to the hard of hearing.

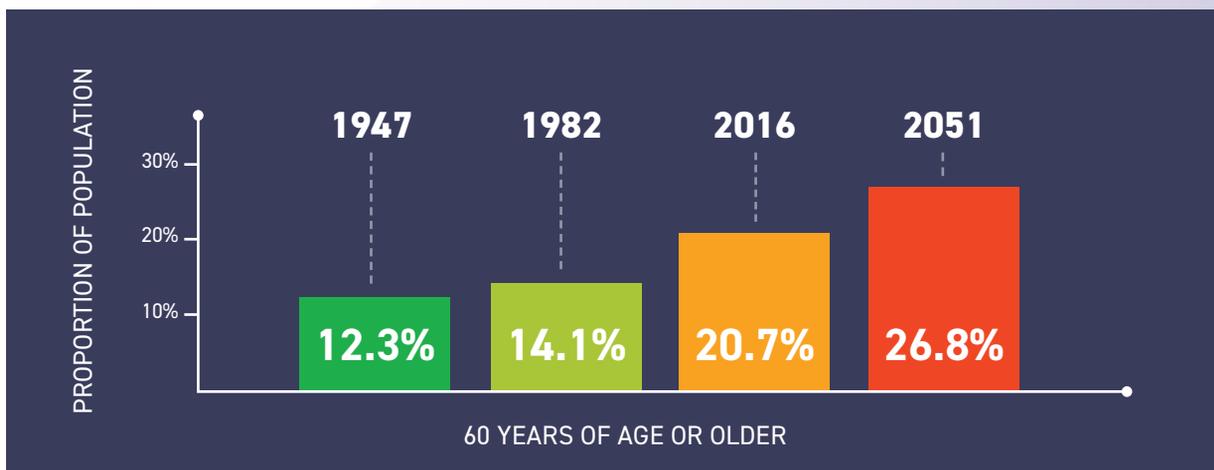


Figure 1. Proportion of Australia's population 60 years of age or over.

(Australian Bureau of Statistics (ABS) cat. No. 3105.65.001, 3101.0, 3222.0, and Price, Waterhouse, Coopers analysis. Percentages rounded to one decimal place.)

WHAT IS “NORMAL” HEARING?

Hearing is measured by an audiometer and recorded as an “audiogram,” which graphically plots a person’s responses to the softest sounds they can hear at each frequency across the spectrum of human hearing. Normal hearing would exhibit responses close to zero across the full range (Figure 2).

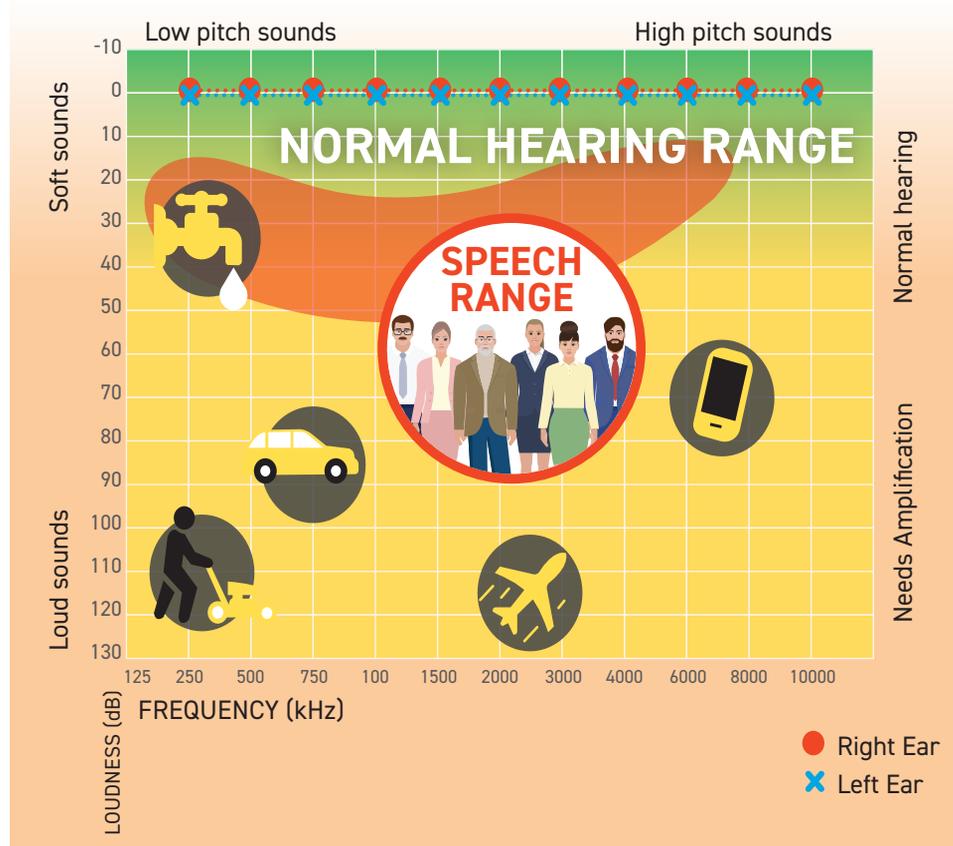


Figure 2. A typical audiogram, illustrating the loudness level of some common sounds. The green shaded area represents the region where most people with normal hearing would hear very soft sounds.

WHAT IS HEARING LOSS?

Hearing loss is most commonly thought of as simply a reduction in loudness levels—something that hearing aids should easily cure. But it is far more complex. While a reduction of loudness levels is a symptom, the most debilitating effect is felt in the loss of clarity of speech sounds, especially in areas filled with people, such as churches, halls and spaces such as malls. The effect of the hearing loss depends upon a variety of factors, such as the location of the damage to the auditory system and the nature of that damage. Degrees of hearing loss, with an example of a typical mild to severe loss, are illustrated in Figure 3.

Note, in this case, the inability to detect soft sounds is worse in the region of many high-pitched speech sounds in the 2000–8000 kHz range. This means that a person with this type of loss would hear the voices of females and children as softer with less clarity than deep male voices. Hearing aids would certainly help in this case, but they could not restore hearing to what was “normal” before the hearing loss occurred. A degree of difficulty would still be experienced in noisy situations such as a church service.

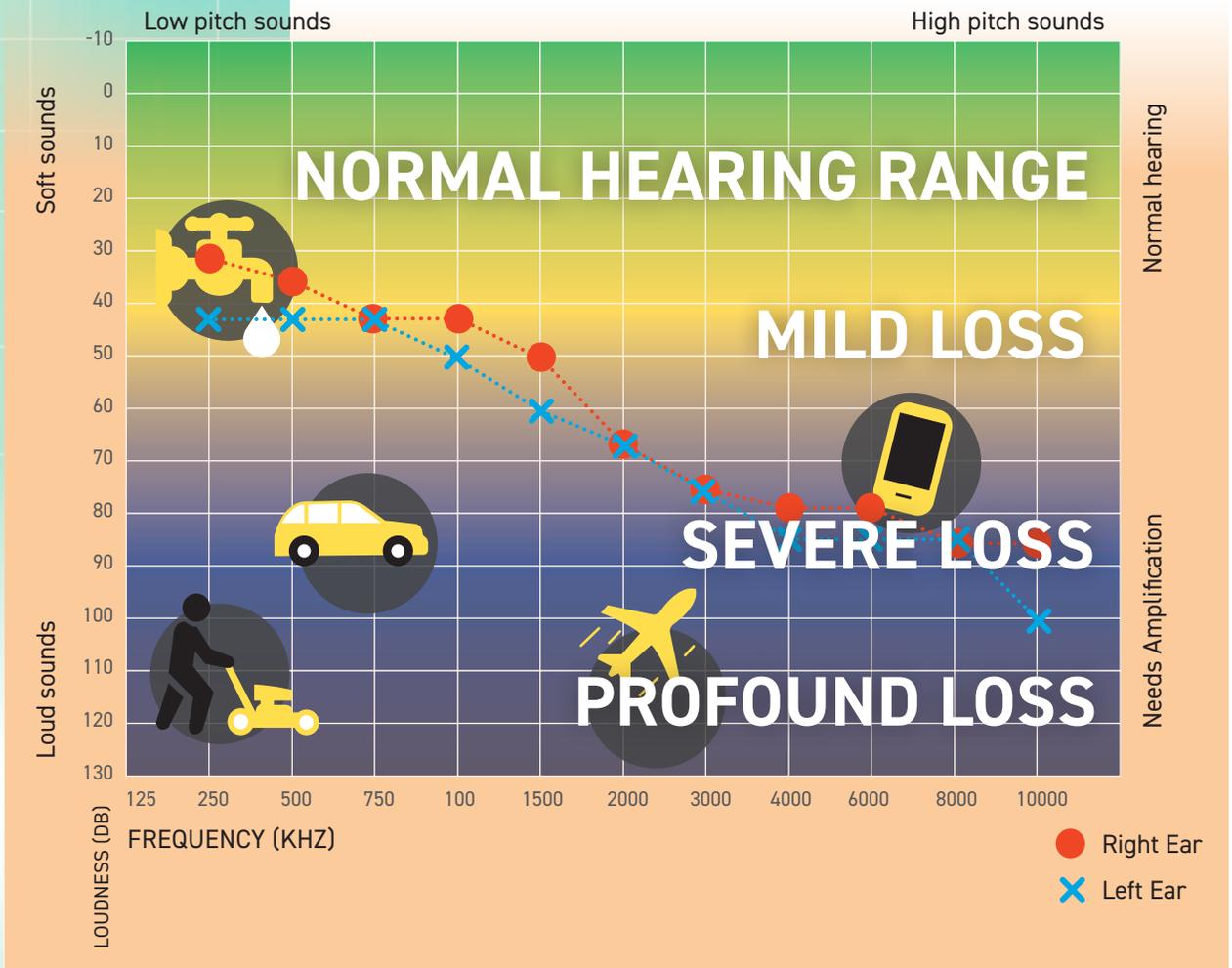


Figure 3. Degrees of hearing loss showing a typical response of a person with a mild to severe loss.

ARE HEARING AIDS ALONE A COMPLETE SOLUTION?

Recent developments in hearing aid technology are amazing, employing Bluetooth direct audio streaming technology. And while this technology certainly provides a dramatic improvement over an unaided condition, it only “aids,” not cures. If the hearing loss is in the mild to moderate range, hearing aids do solve many hearing and communication problems. But people with severe hearing losses are likely to discover that their communication in noisy places is still restricted to a level insufficient for meaningful participation.

Assistive listening systems are therefore essential if churches are to provide optimal participation for members and visitors with hearing loss, not only in formal church presentations, but also in small group Bible study classes, business and board meetings.

**HEARING AIDS
HELP IN QUIET
ENVIRONMENTS, BUT
THEIR PERFORMANCE
IN CHURCHES IS
LIMITED. WHY?**

When hearing is damaged by over-exposure to loud noise over time, or by the effects of disease or ageing, particularly in the case of sensorineural hearing loss or “nerve deafness,” as it is commonly termed, a significant number of microscopic hair-like cells inside the cochlear die (blue area in figure 4).

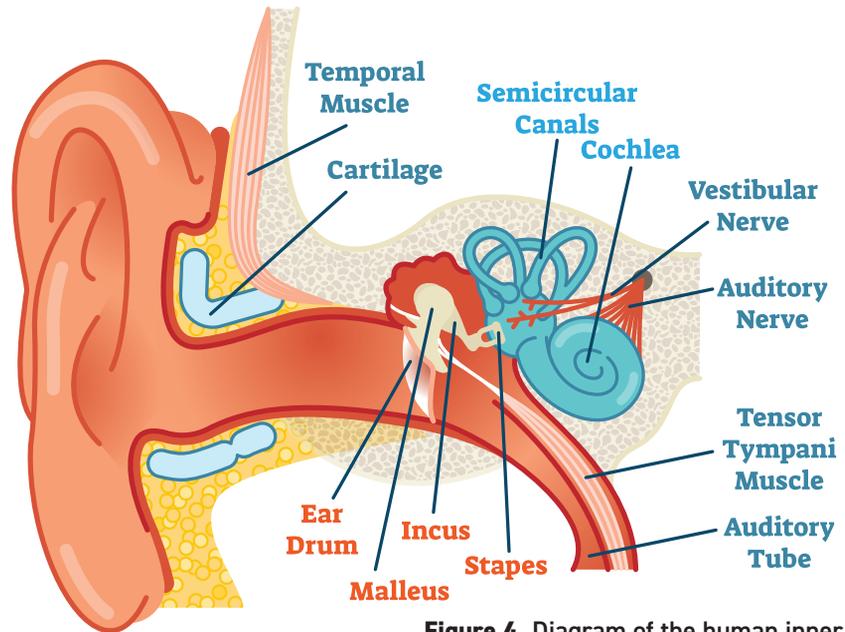


Figure 4. Diagram of the human inner ear.

Since each of those 20,000 to 30,000 hair cells in each ear is designed to respond to minute components of sound pressure and pitch, damage results in a reduced ability to accurately perceive certain frequencies (or pitches) at the same level as someone with undamaged hearing. Hearing aids can only improve the level and quality of sounds available to the remaining cochlea hair cells.

While well-fitted, modern technology hearing aids certainly provide a huge difference in most situations, the most obvious issue for someone with a moderate to severe hearing loss is a frustratingly reduced ability to understand speech within groups with multiple speakers and in large auditoriums with poor acoustics. Since churches are venues where both these conditions exist, they are among the first places someone with a significant hearing loss will avoid.

For people with only mild to moderate hearing damage, a good public address system and/or personal hearing aids may be sufficient for a reasonable level of participation. However, for people with moderate to severe hearing loss, hearing aids or cochlear implants alone are insufficient to restore normal communicative function without additional help from large-area assistive listening systems. This is due to the technical limitations of hearing aid and cochlear implant microphones to detect clear speech signals across a large area filled with competing noises and acoustic reverberation. Unlike the enormously complex human ear, microphones cannot filter out background noise sufficiently to focus on one voice in a crowd. The only way to overcome this technical limitation is to place the microphone as close as possible to the person speaking. All assistive listening systems use this principle to overcome hearing difficulties in large venues, such as theatres and churches.

WHAT DOES THE LAW SAY?

Both Australian and north American anti-discrimination laws recognise the hearing access problems experienced by people with hearing loss in large public venues and make it a legal requirement that assistive listening systems be installed in all new public venues. Although these codes apply primarily to new buildings only, the principle is clearly a worthwhile standard for churches regardless of the age of the building. Australia and the USA are two of the few countries in the world that have detailed legal requirements in regard to assistive listening systems. Australian legislation is summarised below. US legislation is similar, but has some specific differences (see www.listentech.com/support/ada-info/ada-legislation/).

WHAT ARE THE LEGAL REQUIREMENTS FOR ASSISTIVE LISTENING SYSTEMS?

In Australia, where an Audio Frequency Induction (AFIL) **hearing loop** system is provided, legislation requires it to cover at least 80 per cent of the floor area of the room or space that is served by the inbuilt amplification system. Likewise, for assistive listening systems using **audio receivers**, such as Infra-Red (IR) or radio frequency FM transmitter/receiver systems, the system must cover at least 95 per cent of the floor area of the room or space served by the inbuilt system, and a minimum number of receivers must be provided in a ratio depending on the number of people who may be accommodated in the room (see table below for the Australian standard) (BCA Clause D3.7 (b) (ii) and Premises Standards Part D3.7 (2) (b)).4.

Note: BCA only specifies coverage area. It does not specify any performance standard for AFIL systems.

NO. OF OCCUPANTS IN ROOM OR SPACE	NO. OF RECEIVERS REQUIRED
Up to 500	1 receiver for every 25 persons or part thereof, or 2 receivers whichever is greater
More than 500 persons, but not more than 1,000 persons	20 receivers, plus 1 receiver for every 33 persons or part thereof in excess of 500 persons
More than 1,000 persons, but not more than 2,000 persons	35 receivers, plus 1 receiver for every 50 persons or part thereof in excess of 1,000 persons
More than 2,000 persons	55 receivers, plus 1 receiver for every 100 persons or part thereof in excess of 2,000 persons

Receivers to be provided in the following ratios in each room or space served by an assistive listening system (BCA Clause D3.7 (b) (ii) and Premises Standards Part D3.7 (2) (b)).

For more complete Australian information, <https://www.legislation.gov.au/Details/F2010L00668>

It is not only the Building Codes of Australia (BCA) and the Access to Premises Standard that must be met. There are other legal jurisdictions, namely the Australian Disability Discrimination Act (DDA) to consider. Many think that being compliant with the BCA is the end of the matter. However, where the BCA or the Disability Access to Premises Buildings Standards 2010 Amendment 1 is silent*, the DDA needs to be complied with. For example, D3.7 requires receivers be provided but it doesn't indicate what attachments are to be provided. Clearly, not providing attachments means the system isn't functional. Hearing-impaired users with hearing aids or implants fitted with telecoils must have a neck-loop, while those without telecoil-equipped hearing aids or cochlear implants require headphones.

The only practical way to be compliant is for every receiver to have both a neck-loop and a set of headphones. Failure to do so leaves the way open to a potential breach of the DDA and a complaint being lodged with the Australian Human Rights Commission.*

*For a PDF of the complete Australian assistive listening system legal compliance requirements, see <<https://clearasound.com.au/wp-content/uploads/2018/01/ClearaSound-Printacall-Communications-Which-Hearing-Augmentation-Standards-ver-3.pdf>>.

New Zealand law regarding assistive listening systems:

At the time of writing this booklet, no mention could be found of assistive listening systems in New Zealand building access codes or anti-discrimination legislation law. The Australian standards should therefore be a helpful model equally applicable to New Zealand and any other countries considering access standards for people with hearing problems.

Five general types of assistive listening systems are available on the Australian and North American markets. Each of these systems, with their specific advantages and disadvantages for installation in churches, will be discussed in the following section.

What types of assistive listening systems are there?

/ Plug-in headphone systems

The earliest form of assistive listening were individual seats fitted with headphone sockets. A person with a hearing problem could only sit where the headphone sockets were located. Some older churches and cinemas still use this system.

Disadvantages of plug-in headphone systems:

- Restricted seating choices.
- Personal hearing aids need to be removed.
- Ear hygiene is a potential problem.

2. Audio loop systems

Audio loops—also known as audio frequency induction loop systems—are the most common but also oldest assistive listening system available. Many churches have these systems. Audio loops consist of a rack-mounted amplifier connected to a hard-wire installed on or under the floor of a specified area (Figure 5).

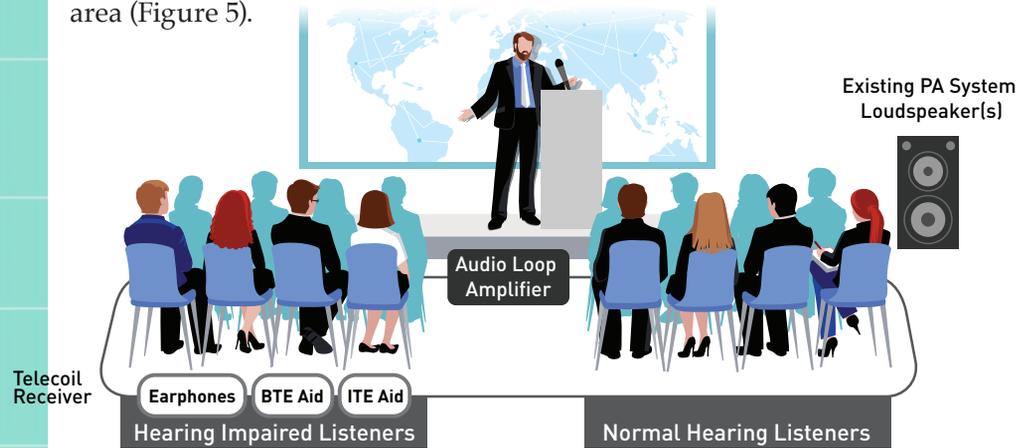


Figure 5. Diagram of an audio loop system layout.

Disadvantages of audio loops:

When audio loops were first promoted in Australia and North America during the late 1970s they were the only serious solution to the problems faced by people with hearing loss in public venues. Consequently, they have been widely promoted as the assistive listening system of choice. However, they present significant disadvantages compared with other available technology at the time of writing.

- Loops interface only with hearing aids or cochlear implants fitted with telecoil technology. Not all hearing aids or implants have telecoils.
- Telecoils are magnetic induction antennae. Their effectiveness depends on their orientation inside the hearing aid relative to the room loop, which if incompatible will affect the strength and quality of the audio.
- Loop systems are complex and expensive. If not installed correctly, they can produce dead spots or weak reception, and cause annoying feedback in the venue PA system.
- They are not easily portable for use in other venues, such as outside evangelistic programs or camps, or for meetings in rented accommodation.

3. Radio frequency RF systems

RF assistive listening systems transmit audio directly from a headset microphone worn by a group leader, or from the main venue PA. People with hearing loss are given a pocket-sized RF receiver, with the choice of either a neck-loop for telecoil-equipped hearing aids, or small, over-the-ear earphones that can be used with or without hearing aids.

The ListenTALK system (Figure 6) can be configured as either listen-only for presentation, or with a talk-back function that enables all users to hear and participate more easily in discussion classes or meetings.



Figure 6. ListenTALK portable RF system.
(Image courtesy of Listen Technologies Corporation)

Advantages of RF systems:

Portable RF systems have several advantages over fixed audio loop installations, namely:

- Compact and portable—works indoors or outdoors. Especially useful for rented venues, evangelistic programs, camps and conferences.
- Simple to set up and use. No hardware installation or extensive cabling.
- No dead spots within the specified radius. (The ListenTALK portable system broadcasts up to 100m even through the walls)
- No dedicated and discriminatory seating needed. Users can sit anywhere.
- Can be used by anyone. Users with telecoil-equipped hearing aids can use a neck-loop; others use headphones.
- Dual function—listen only, or talk-back can easily be enabled for small group discussion (in ListenTALK system only).

Disadvantages of RF systems:

- All radio transmission devices emit a low level of radiation (e.g. mobile phones and wireless microphones.) Although most RF assistive listening products emit radiation at a level much lower than mobile phones, care needs to be taken not to place RF receivers directly on top of pacemakers. They should be placed on the lap or at least in a pocket on the opposite side of the pacemaker.
- The radio transmission frequencies used by all RF systems must be approved in the country of intended use. ListenRF systems and the Phonak Roger systems are approved for use in Australia, New Zealand and USA. Intending users of any RF assistive listening system outside of those countries should check with the retailer or manufacturer that the product's transmission frequencies comply with local radio frequency transmission regulations prior to purchase.

4. Infra-red systems

Infra-red assistive listening systems are similar to RF systems except they operate via a beam of invisible infra-red light instead of radio waves. Audio is conveyed directly from the main venue amplification system via cable to an infra-red emitter, which can be located to the front, side or rear of listeners. Users are given a pocket-sized receiver with the choice of either a neckloop to interface with telecoil-equipped hearing aids or small over-the-ear earphones that can be used without hearing aids. Infra-red systems permit freedom to sit anywhere inside an auditorium. Small churches can utilise portable systems. Large churches seating up to 1000 people or more will need more powerful, fixed emitters mounted on a wall. Most small churches seating less than 100 people could possibly utilise a portable system, as shown in figure 7.



Figure 7. The Listen portable infra-red system kit.
(Image courtesy of Steve Parkins, National Audio Systems)



Audience wearing headphones.

Advantages of infra-red systems:

- ▶ No radiation from transmitters. Infra-red light presents no known harmful effects to humans.
- ▶ No spillage of audio signals outside the room housing the transmitter, ensuring confidentiality.
- ▶ Portable—some systems work well outdoors (but not recommended).
- ▶ Expandable—additional transmitters and receivers can be added as needed.

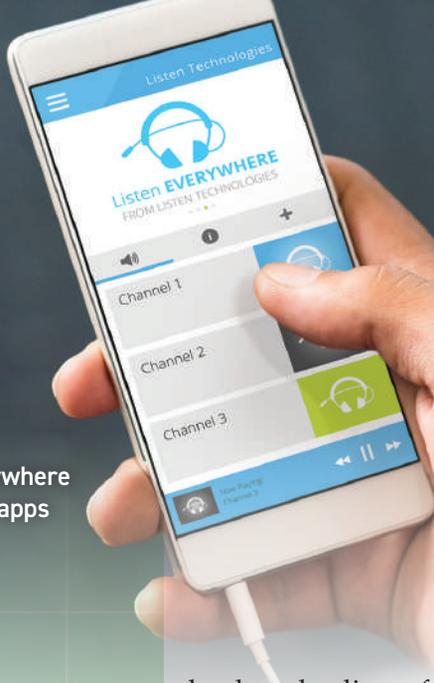
Disadvantages of infra-red systems:

- ▶ Works best indoors.
- ▶ Emitters must have sufficient power to cover required area. Specifications must be negotiated with a supplier prior to ordering.

5. Live-streamed audio via WiFi and mobile phones

Live-streamed audio via WiFi and mobile phones is a new technology already in use in commercial venues. It is particularly useful as an assistive listening system in churches. The in-house WiFi hardware is easily installed and enables the church audio to be heard by anyone with a smartphone, just

Figure 8. Listen everywhere is one of a number of apps available.



by downloading a free app and pressing a button to scan and connect to the in-house WiFi.

Hearing-impaired users can use a neck-loop or direct made-for-iPhone technology (if installed in their hearing aids) or personal earbuds or headphones. The system has several additional features that enable announcements and invitations to upcoming events to be displayed on the phone. (For a fuller description, visit listeneverywhere.com.)

This system is in advance of current Australian building code definitions of an assistive listening system, so isn't listed in that law code. However, it is certainly suitable as an adjunct to such systems and should be acceptable as "fit-for-purpose" under the current Australian Disability Discrimination Act, provided the church has on hand a number of neck-loops and headphones. To accommodate members who don't have smartphones, or aren't familiar with how to use such technology, the church might ask people to donate old smartphones, then install the app and keep them handy as spare receivers.

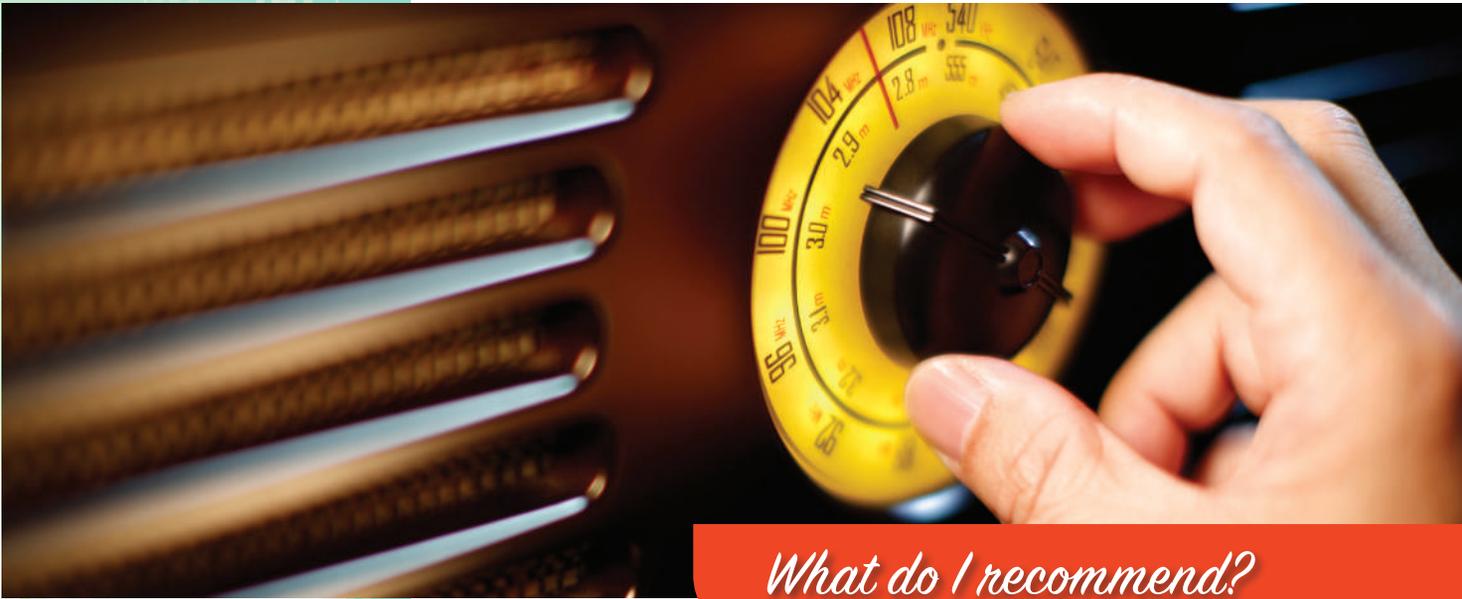
Advantages of live-streamed systems

- By far the cheapest and simplest of all assistive listening systems.
- Can be used anywhere in or outside a building.
- Multiple channels enable simultaneous use as a language interpretation system.
- Supports welcome announcements, video, sliding promotional banners for event adverts, electronic tithe-payment instructions, etc.
- Easy-to-install portable plug-and-play hardware.
- No latency lip sync issues.
- Can be used by anyone with a smartphone, not just those with a hearing problem, keeping the existence of a hearing problem confidential.
- No need for dedicated receivers or personnel to track and maintain them.
- Users with Bluetooth-enabled hearing aids and compatible smartphones can connect directly to their phones without headphones or neck-loops.

Disadvantages of live-streamed audio systems

- Some seniors will be challenged by the phone-based technology.
- Need to have spare headphones and personal neck-loops available for telecoil-enabled hearing aids.
- Highly visible signage and clear instructional cards must be provided to advertise its availability.

(Note: It is law that the system used be “signposted” in a venue, along with the international symbol for hearing impaired. See samples in “Legal requirements for signage” section.)



What do I recommend?

As a practising hearing rehabilitation specialist over many years and an active church member—a listener and presenter—I recommend some systems as more efficient and flexible, and certainly more affordable.

All things considered, I **first recommend** looking ahead to **live-streamed audio via WiFi and mobile phones** as it presents many advantages over older systems. It reduces the number of needed receivers and transmitters, and eliminates the need for complex and expensive installations, such as audio loop systems. It is much more in line with the emerging trend for hearing aids to come equipped with Bluetooth technology, enabling direct audio streaming from phones and TVs to the hearing aids without any need for dedicated receivers. This system’s biggest negative is that some people will be challenged by the phone-based technology. One way to overcome this natural resistance is to run periodic inter-generational technology workshops where younger church members volunteer to teach seniors how to use modern technology—computers, iPads, smart phones—including how to use them to hear better (and even record sermons) in their church and community. It could even be a catalyst for an innovative outreach activity.

My **second** recommendation would be **dedicated RF systems**, which tick most boxes for efficiency, ease of use, reliable coverage, unrestricted seating

without dead spots and ease of system portability.

Third are **infra-red systems**, which tick boxes for efficiency, ease of use and reliability with minimal interference from other sources, but lose points for unpredictable performance outdoors or in the presence of bright sunlight streaming through windows.

Last are the increasingly redundant **audio loops** and plug-in **headphone** systems, which, while still usable by some, are part of a bygone generation.

Finally, compliance with the emerging building code laws for new buildings is essential. While existing buildings may be exempt from building code laws, there is still a **need to comply with the Australian Disability Discrimination Act (DDA)** in regards to access for people with any type of disability, in particular, people with hearing problems. Failure to comply can leave the church open to indefensible complaints that can result in heavy fines.

And whatever system you choose, remember to utilise roving microphones that feed into the assistive listening system, which is essential to ensure the full inclusion of the hearing impaired in interactive group settings.

What is the future?

At the time of writing, many hearing aid manufacturers have introduced direct audio streaming technology into their latest hearing aids and implant technology. This means that audio from compatible devices like smartphones, computers and smart TVs can be streamed directly into hearing aids and some surgically implanted hearing devices, such as cochlear implants and bone-anchored hearing aids without any need for a gateway device like audio loops, neck-loops, personal streamers, FM systems or infra-red systems. In fact, the ubiquitous mobile phone has already become the remote control centre for all the users' hearing aid functions. Some TVs with in-built direct audio streaming compatibility with hearing aids are already on the market. As we see from the advent of live-streamed audio via WiFi and phones, technology is moving fast.

As these new systems emerge in the hearing aid industry, other industries wanting to provide product compatibility with hearing aids and implants will introduce more compatible interface technology into their products. Eventually, all hearing aids, hearing implants and PA systems will be fitted with direct audio streaming technology. When that happens, assistive listening systems as they exist today will become obsolete. But in the meantime, churches need to address their present legal and ethical inclusiveness needs, so that no-one misses out on the presentation of the gospel.



Legal requirements for signage

Many people with hearing problems and their families are unaware of the existence of assistive listening systems in a facility. It is courteous and obligatory to provide information with clear signage about the system you have installed, including instruction cards (see below) on how to use it. It can also be part of your printed church bulletin and on-screen announcements.

Both Australian and United States law specifies signage requirements for assistive listening systems. (See CSFBHI website for downloadable, DDA-compliant printable signage samples). Australian law, for example, states, "Signage including the international symbol for deafness in accordance with AS 1428.1 must be provided within a room containing an assistive listening system identifying: (i) the type of assistive listening; and (ii) the area covered within the room; and (iii) if receivers are being used and where the receivers can be obtained."

Printable signage materials, other useful resources and product-ordering information are available at csfbhi.adventistchurch.com



This church is equipped with a **LIVE-STREAMED AUDIO HEARING AUGMENTATION SYSTEM** for people with hearing difficulties.

Audio can be received by most smartphones using your own earbuds or earphones—alternatively please collect a neck-loop & instruction cards from the sound technician.



How to use the live-streamed audio system

- 1) Search for and install the free "Listen Everywhere" app from your App Store for Apple devices, or Google Play for Android devices.
- 2) Scan for the venue Wifi system, select Channel 1 and press the connect button. (Other channels may be used for language interpretation—consult the venue audio operator for more information)
- 3) Attach your earbuds, or obtain loan headphones, or neck-loop (for hearing aids equipped with telecoil technology) from the venue audio operator.
- 4) If your hearing aids are equipped for direct audio streaming with your phone, it should connect automatically, or you should be able to switch it on manually. (If unsure, consult your hearing aid provider at your convenience)

Please return receiver to sound technician at the end of program, do not leave it unattended on your seat.



about CHRISTIAN SERVICES FOR THE BLIND AND HEARING IMPAIRED

Christian Services for the Blind and Hearing Impaired (CSFBHI), publisher of this booklet, is a charity of the Seventh-day Adventist Church supporting those with a sight or hearing disability. It began operations in 1973, providing audio books for the sight impaired and blind, then later added services for the Deaf and hearing impaired.

This booklet, while relying on Australian data and legal requirements, is easily extrapolated to international situations, where variations will undoubtedly occur. But in the first instance it is about promoting inclusivity and equal access to those with a hearing difficulty, helping to make them part of the church family in a natural way.

Readers familiar with hearing loss will notice this booklet includes nothing about the needs of people who are profoundly deaf and use sign language as one of their modes of communication. This omission is deliberate. The author felt that the needs of the profoundly deaf are already well documented elsewhere, and given the space limitations of this publication, it was his priority to focus entirely on the technological solutions to the needs of those with hearing loss—the largest people group with hearing problems, and who are often overlooked.

For more information about CSFBHI or e-copies of this booklet please visit our website <https://csfbhi.adventistchurch.com/resources-page/>. There you will also find downloadable product ordering information, signage materials and other resources. To order copies of this publication, contact us at:

Tel: +61 2 9847 2296

Email: csfbhi@adventistmedia.org.au

Web: csfbhi.adventistchurch.com

Post: CSFBHI

Locked Bag 1115

WAHROONGA NSW 2076

AUSTRALIA

Recommended Product Providers - Listen Technologies

AUSTRALIA and NEW ZEALAND

National Audio Systems

127 Merridale Drive
Croydon, Vic 3136

Tel: +61 (0)3 8756 2600
+61 (0)413 675 249

Email: listen@nas.solutions

Web: nas.solutions

NORTH AMERICA

Listen Technologies Corporation

14912 Heritage Crest Way
Bluffdale, Utah 84065-4818

Tel: +1 801 233 8992
1800 330 0891

Email: sales@listentech.com

Web: listentech.com

No financial relationships exist between CSFBHI, the author, and any product manufacturers or suppliers. This booklet was written to provide the best information to our churches that would assist them in avoiding the arduous task of sorting through a maze of technical options and supply sources. (A fuller description of listed products can be found at www.listentech.com)



Graham Weir

MA (Counsl.)(Wash. D.C.) Cert Aud.(SoA)
(Syd.) FACAud

Consulting Hearing
Rehabilitation Specialist

Some 465 million people globally, and 50 per cent over the age of 60, experience some form of hearing loss. With this age bracket set to explode over the next 30 years, the readiness of a church to cater for people with hearing loss will be a major determinate of their willingness to participate in and enjoy its social and religious activities. This booklet aims to educate about this community need and encourage churches to accept their legal and ethical obligations to ensure people with hearing loss find optimal communication and participation in church life.

With a profound hearing loss himself since a near-fatal attack of meningitis at the age of eight, Graham Weir has devoted most of his life to the study of hearing loss and its impact on personality and relationships. In 1980, he completed an MA in counselling of the hearing-impaired at Gallaudet University, in Washington DC, USA.

After a career in the field of hearing loss, he most recently worked in private practice, with two hearing aid clinics. He has published in peer-reviewed journals, and on four occasions has visited India with a team of audiologists and health professionals to fit hearing aids to people in isolated areas. Graham's personal experience of learning to live with a profound hearing loss himself, along with the clinical knowledge of hearing technology that his unique experiences have produced, is presented in this booklet. Graham, now semi-retired, with his wife, Dianne, enjoy country living near Perth, Western Australia.

Endorsed by



www.betterhearingaustralia.org.au

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