AURACAST

A revolution in audio accessibility

RNID Supporting people who are deaf, have hearing loss or tinnitus

CONTENTS

INTRODUCTION

There are more than 18 million people in the UK who are deaf, have hearing loss or tinnitus. That is 1 in 3 adults. RNID believes Auracast could make the world more accessible.

Auracast has the potential to make the world more inclusive for all, transforming access to health, employment, transport, culture, and more. This report focuses on people who are deaf or have hearing loss, but there are several other groups who could benefit, including people who are blind or partially sighted, neurodivergent, or non-native speakers.

The Auracast specification defines, technically, how to ensure that devices are interoperable. It does not dictate the user interface.

In this report, we outline what Auracast is and how it will make a difference to people who are deaf or have hearing loss. We also set out a range of in-depth uses of Auracast.

These examples show **what a game-changer Auracast could be for people who are deaf or have hearing loss.** They also highlight potential barriers and share insights into how these can be overcome.

This report is a call to action from RNID, strongly encouraging everyone responsible for implementing any aspect of an Auracast-based system to take an **inclusive design approach**. By considering the needs of all end users, especially those who are often excluded, the resulting systems will work better for everyone.

RNID is ready to support you with freely available, online resources and the opportunity to connect with the communities we support.

We are RNID: the national charity supporting more than 18 million people in the UK who are deaf, have hearing loss or tinnitus.

We campaign to change public attitudes and help people hear better now. We fund groundbreaking biomedical research that will stop hearing loss and silence tinnitus. And we provide practical support and information over the phone, online and in local communities.

EXECUTIVE SUMMARY

Auracast is a new technology which will bring about a revolution in audio accessibility. RNID believes Auracast has the potential to make the world more inclusive for all, transforming access to health, employment, transport, culture, and more.

This report sets out the opportunities, highlighting how Auracast can solve many of the problems that exist today, and makes practical recommendations for everyone who will have a role to play in the rollout. Delivering on the potential of Auracast is not just the responsibility of technology hardware and platform developers, it also requires providers of assistive technology (such as the NHS, audiologists and sensory services) to understand and support the rollout, and for owners and operators of national infrastructure and public venues to get on board.

The problem – hearing speech in noisy environments

Understanding speech in noisy environments is a significant challenge, particularly for more than 18 million people in the UK who are deaf or have hearing loss or tinnitus. While hearing devices help, their effectiveness depends on the individual's hearing loss and environment.

Assistive listening systems (ALS) can transform accessibility by delivering clear audio, but current technologies face barriers like limited availability, poor maintenance, or reliance on additional equipment.

The solution – Auracast

Auracast is a new industry-agreed standard, which allows high-quality audio to be broadcast to next generation Bluetooth audio devices, such as hearing aids, earbuds, and smartphones. Incorporating this technology into both consumer and prescription hearing devices will make life more inclusive for people who are deaf or have hearing loss, including those who have not sought medical help.

Auracast transmitters can include personal devices, such as computers, tablets and smartphones or can be part of ALS installed in public places, such as lecture theatres, gyms, doctors' surgeries or train stations. Several Auracast broadcasts can co-exist in the same space. This creates opportunities for innovation but introduces complexity, because receivers need to know which broadcast to choose. An Auracast assistant can help but smartphone-based solutions risk excluding some people.

The opportunities and the challenges

This report includes a detailed analysis of several use cases, highlighting important considerations which stakeholders should be aware of. We need accessible user interfaces, thoughtful use of encryption, and collaboration between stakeholders.

The rollout of Auracast has already started. We expect public awareness to increase and mass adoption to accelerate when smartphone platforms (iOS and Android) support it at the operating system level, most likely during 2025/26. For people who are deaf or have hearing loss to experience the full benefit of Auracast, we need organisations to keep pace with the latest Bluetooth standards within their infrastructure and products. Specifically, NHS-provided hearing aids must be

Auracast-enabled and national infrastructure, such as public transport, must broadcast announcements using Auracast.

The full rollout of Auracast will take up to 10 years. In the interim, many people will continue to rely on existing ALS technology, especially hearing loops. It is imperative that these systems continue to be installed and maintained until everyone can access Auracast.

Auracast has the potential to transform accessibility for millions of people. RNID is ready to collaborate with stakeholders to make the UK's Auracast rollout inclusive and world-leading.

Sector-specific recommendations

Auracast involves an ecosystem of compatible products and service providers. All stakeholders need to play their part if Auracast is to meet user needs and deliver on its potential of making life more inclusive for people who are deaf or have hearing loss.

See sector-specific recommendations for a summary grouped by sector.

Key recommendations for an inclusive Auracast rollout in the UK

- Hardware manufacturers and platform developers create accessible user interfaces
- The NHS source and provide Auracast-enabled hearing aids and cochlear implants
- National infrastructure pilots Auracast with people while upgrading
- Venues continue to maintain hearing loops throughout the transition period

Sector-specific recommendations are highlighted throughout the report in coloured boxes and collated in the conclusion

Audiologists

National infrastructure

Hardware manufacturers

Sensory services

Mobile/PC platform developers

Venue operators

NHS Supply Chain and procurement

BACKGROUND – WHY WE NEED AURACAST

Communicating using speech is fundamental to life for many people, whether that be in the workplace or among friends and family. Barriers to hearing speech leave many people feeling isolated, excluded, and disconnected. In this section we look at what causes these barriers and how technology can be helpful.

The need for assistive listening systems

Background noise and reverberation make it difficult for everyone to understand speech.

Improving the environment's acoustics can help, but people with hearing loss need more support to hear well enough to fully participate in everyday life.

Prescription hearing devices, such as hearing aids, are very effective at making sounds loud enough so that they can be heard. They can also improve the clarity of speech by using algorithms to reduce background noise and echoes.

But the effectiveness of hearing devices varies. Factors like the user's level of hearing loss, device settings, and environment acoustics all influence accessibility. Environments with multiple people talking at once are especially challenging.

Ultimately, there are many situations where people need more support to hear well. Assistive listening systems (ALS) can overcome the challenges of background noise and reverberation by delivering clear audio directly into the ears.

See Appendix 1 for more information on hearing loss, hearing devices and the need for assistive listening systems.

Venue operators:
Always seek to improve the acoustics to make listening easier, even if assistive listening systems are installed.

Current assistive listening technology

Several ALS technologies are routinely used by people with hearing loss, each with its advantages and disadvantages.

Hearing loops are the most widely available ALS. For those who use them, hearing loops are an essential, easy-to-use means of making listening situations accessible. However, hearing loops in public spaces are often poorly maintained or just not turned on. Also, millions of people who might benefit from them cannot. Either they do not have hearing aids, or their audiologist has not activated the telecoil programme ('T' setting).

See Appendix 2 for more information on current assistive listening technology.

Digital streaming

Digital streaming offers better quality and reliability, and the ability to pick up audio from different sources. However, the lack of interoperability between systems from different manufacturers has been a challenge for users and those supporting them.

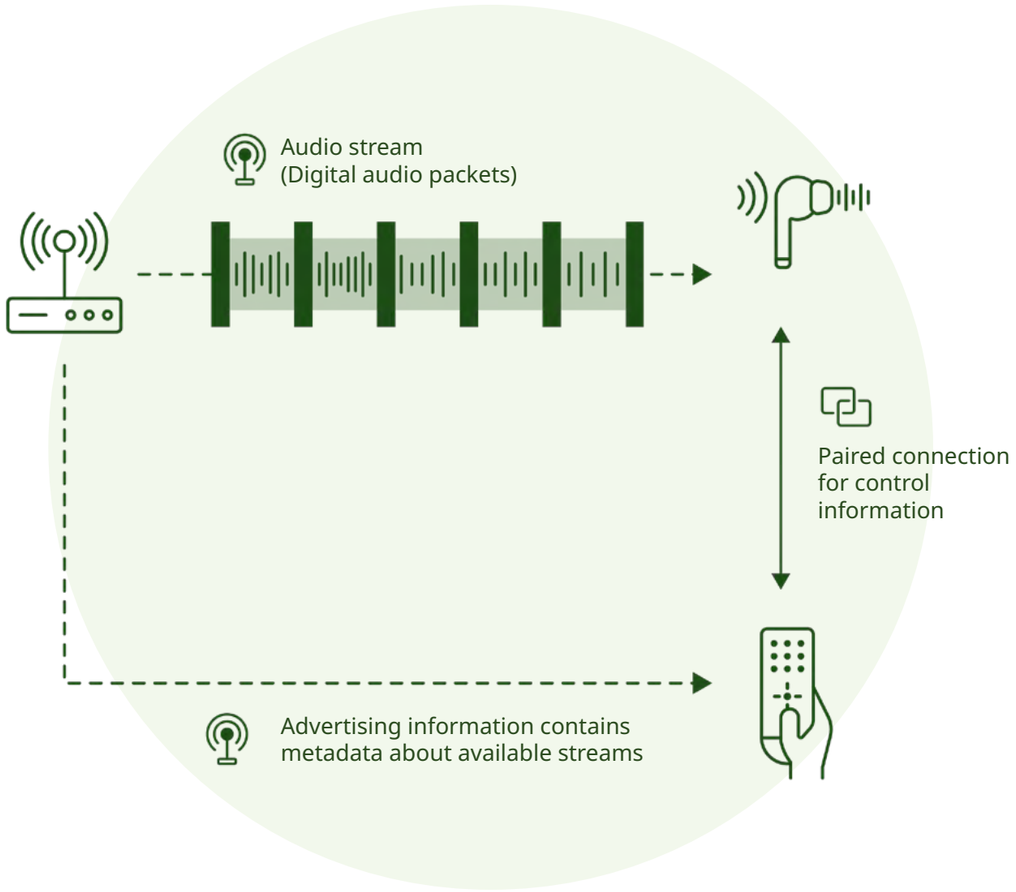
Bluetooth Low Energy Audio (LE Audio) is a new industry-agreed standard that meets the low power and low latency needs of hearing aids. LE Audio introduces a new broadcast audio feature, created with the hearing aid industry, for use in assistive listening systems. It is better known as Auracast and has the potential to revolutionise ALS.

See Appendix 3 for more information about Bluetooth audio standards.

WHAT IS AURACAST?

Bluetooth LE Audio introduces Auracast, a new standard, which has the potential to revolutionise ALS. It enables high-quality, universal audio broadcasting to devices such as hearing aids, earbuds, and smartphones.

To carry the Auracast trademark, a product must support some specific configurations of these broadcast capabilities. This is intended to ensure interoperability between devices.



HOW IT WORKS

Auracast transmitter: Sends one or more audio streams

Any device which captures, processes, or emits sound could be an Auracast transmitter.

An Auracast transmitter could be a device owned by an individual, such as a TV, mobile phone, tablet or computer, or installed in a public space, such as a public address system.

To maintain privacy, the audio stream can be encrypted. A password (also known as a key or 'Broadcast Code') would then be required to decrypt the audio stream. It is important to consider how to share this password in a way that delivers an inclusive user experience.

As well as the audio stream(s), a transmitter must also broadcast information about the audio stream(s). This metadata is called advertising information. It includes things like a friendly name for the broadcast and whether it is encrypted.

Auracast receiver: Picks up a digital stream and turns it back into audio

A receiver could output the audio, so that it can be heard, or used in another way, for example, to provide live captions.

The silicon chip required for an Auracast receiver is tiny, so it can be built into almost any device. The most common Auracast receivers are likely to be earbuds and hearing aids.

To pick up an Auracast audio stream, the receiver can scan for advertising information. If there are several streams available, the receiver needs to pick one. This could be based on prior information, such as preset preferences or 'remembered' streams, or by giving the user a choice.

To make audio stream selection easy, Auracast includes an additional role, called an Auracast assistant.

Auracast assistant: Tells a receiver what to do

Helps the Auracast receiver by passing it the details of the digital stream to receive.

An Auracast assistant could be an app on a phone, a smartwatch or a standalone device. There is huge scope for innovation but also a risk of digital exclusion. **See Auracast is for everyone for further discussion.**

The Auracast assistant pairs with the Auracast receiver it controls, in the same way that previous Bluetooth devices pair with each other. The pairing process allows passwords to be shared securely between the assistant and the receiver.

AURACAST IS FOR EVERYONE

This section outlines the benefits for people who are deaf or have hearing loss, how to make Auracast accessible and a recommendation to work with users who have lived experience. Auracast has been designed to support assistive listening applications.

Auracast streams can be picked up by all types of hearing devices, including hearing aids and cochlear implants as well as consumer hearing devices such as earbuds and headphones.

Benefits for people who are deaf or have hearing loss:

Wider access
Auracast enables new use cases which appeal to everyone, not just people with hearing loss. Because lots of people will be using it every day, awareness among the general population will be high. As a result, for people who are hesitant to adopt new technology, the availability of support through informal channels (family, friends, and colleagues) is likely to be an encouragement.

Reduced stigma
Some people may use Auracast in a way that supports better audio, without even realising it is an assistive listening tool. For others, Auracast might represent an easy and unobtrusive way to try assistive listening – a positive experience could encourage people who are currently reluctant to use hearing aids to seek further support with their hearing.

Lowers cost
By serving a bigger user base, more places will install Auracast transmitters than have current ALS. The much larger volumes of units shipped, and the small size of the hardware, will make it comparatively inexpensive.

Better reliability
Venues can check if the Auracast-based ALS is turned on and working using a wide variety of consumer hardware, reducing the barrier to regular testing. Moreover, with more people accessing Auracast-based ALS, any faults will be picked up more quickly. This will also reduce the burden on people with hearing loss to report faults.

Making Auracast accessible for everyone

There is huge scope for innovation in how Auracast assistances (which allow you to select different audio streams) work, which we think will lead to as-yet unimagined use cases. However, there is also a danger that some users are excluded by inaccessible designs.

The Auracast specification outlines the technical requirements for how Auracast transmitters, receivers, and assistants should work and communicate with each other. However, it does not dictate what the user interface should be. That is left to the companies developing the products.

Different approaches to stream selection

The following approaches to stream selection are inspired by **Bluetooth SIG's How to build an Auracast assistant guide.** They are presented here to give some insight into how people might use Auracast in practice, to identify potential barriers to access, and to suggest some ways in which these barriers might be overcome.

Pick-from-list paradigm
In much the same way as devices scan for WiFi networks, the user can be presented with a list of the available streams and select the one they want. The most obvious way for a user to interact with this list is on a graphical user interface on a touchscreen. There are already examples of this approach running on a smartphone and a smart charging case. A smartwatch would also work well.

The screen-based pick-from-list paradigm already looks like it is becoming the de facto standard method of stream selection.

To make this interface accessible to blind and partially sighted users, standard screen reader approaches could be used.

For people who do not have access to smart devices with screens, a voice-based interface could be implemented directly on the receiver device.

Step-through-list paradigm
Where there are only a few streams available, and they are unencrypted, it may be sufficient to provide users with a ‘next stream’ button, allowing them to step through the available streams. A second, ‘previous stream,’ button could be used to step the other way. This functionality could be provided on a key-fob style remote control, or on the hearing device(s) itself using button presses or gestures.

For encrypted broadcasts, the requirement to enter a password will make the aforementioned stream selection paradigms inconvenient or completely inaccessible.

Rather than manually enter a password for a stream that the user wants to receive, an Auracast assistant can use an out-of-band method to get the broadcast details that must be passed to the Auracast receiver. This can include the broadcast name and the password. If all the required information is provided, then the Auracast assistant does not need to scan for advertising information. The following two out-of-band methods have been proposed.

QR code paradigm
The details a receiver needs to connect to a stream, including the name and password, can be presented as a QR code. A static QR code can be printed for ease of access. In situations where the password should be changed regularly, a dynamic QR code can be displayed on a screen. In either case, the user would scan the QR code on their smartphone.

For users who do not have a smartphone, another option for point-of-sale interactions would be for the user to carry their own QR code which, when scanned, would give the transmitter the details that their receiver has been set up to look for.

NFC paradigm
Stream details, including the password if required, can be passed to an Auracast assistant using the same ‘nearfield communication’ technology as contactless payments.

For users who do not have a smartphone, another option for point-of-sale interactions would be for the user to carry their own QR code which, when scanned, would give the transmitter the details that their receiver has been set up to look for.

Mobile/PC platform developers: Provide open APIs to allow third-party apps to function as an Auracast transmitter, receiver and/or assistant. This will facilitate innovation.

Inclusive design and including users

When designing user interfaces, we recommend adopting an inclusive design approach.
It ensures that a product works for people with diverse needs and appeals to the widest possible audience. By involving individuals who might otherwise be excluded in the design process, businesses can create solutions that deliver a superior experience for everyone, while also gaining a competitive edge in the marketplace.

Making Auracast accessible will require stakeholders responsible for developing products to adopt inclusive design best practice.

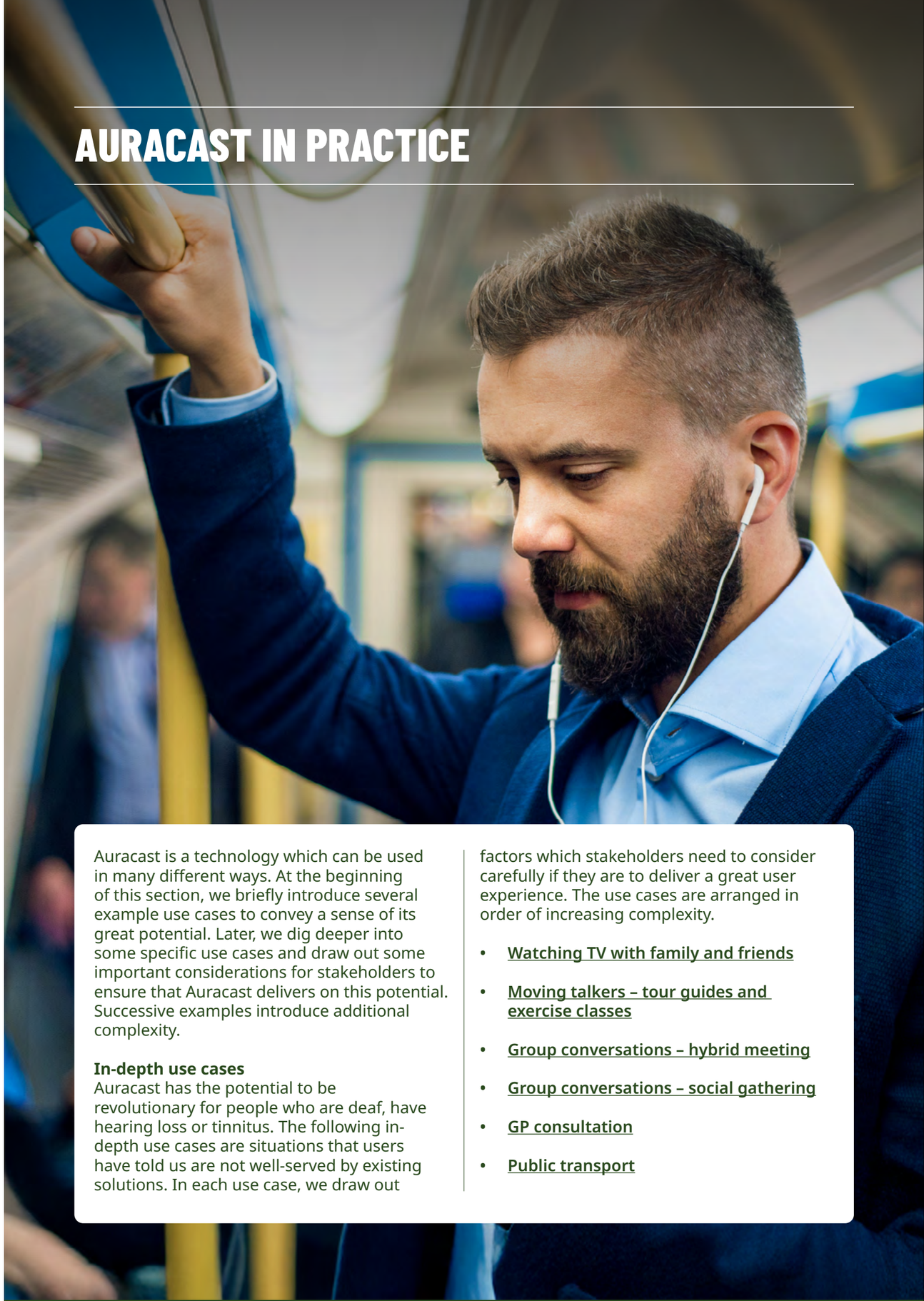
It is also important that the usability of devices is tested under real-world conditions.

Hardware manufacturers: Use an inclusive design approach for user interfaces. This includes any buttons or interactions on the device itself and companion apps. Hearing aid manufacturers, in particular, should consider the needs of people who do not use a smartphone.

Mobile/PC platform developers: Use an inclusive design approach for OS-level user interfaces. Devices need to provide access to the core Auracast functionality whilst considering accessibility requirements.

National infrastructure and Venues: Participate in pilot tests involving end users systems are installed.

AURACAST IN PRACTICE



Auracast is a technology which can be used in many different ways. At the beginning of this section, we briefly introduce several example use cases to convey a sense of its great potential. Later, we dig deeper into some specific use cases and draw out some important considerations for stakeholders to ensure that Auracast delivers on this potential. Successive examples introduce additional complexity.

In-depth use cases
Auracast has the potential to be revolutionary for people who are deaf, have hearing loss or tinnitus. The following in-depth use cases are situations that users have told us are not well-served by existing solutions. In each use case, we draw out factors which stakeholders need to consider carefully if they are to deliver a great user experience. The use cases are arranged in order of increasing complexity.

- Watching TV with family and friends
- Moving talkers – tour guides and exercise classes
- Group conversations – hybrid meeting
- Group conversations – social gathering
- GP consultation
- Public transport

SIMPLE USE CASES

Lecture theatres, conference halls, and places of worship

These venues should be well-served by hearing loops and, for those who can access this technology, the benefits are clear. Installing Auracast alongside a hearing loop will widen access to people who cannot access a loop, either because they do not have hearing aids or their hearing aids don't have an active telecoil. In the long term, everyone will use Auracast, but for now both technologies can, and should, coexist.

Cinemas and theatres

In the auditorium, the standard audio mix is played through the loudspeaker system. Auracast can transmit several additional mixes, such as:

Speech-only or speech enhanced track – to make following the dialogue easier

Audio description track – the action is described to make the performance accessible to blind and partially sighted people

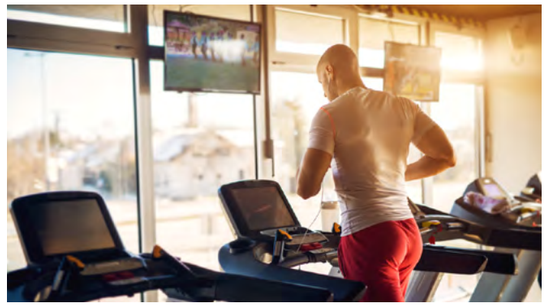
Unlike hearing loops, there is no danger of interference due to spill from other screens (for more information, **see Hearing loops in Appendix 2).**

Museums

Multimedia installations use screens which show video content and wired-in hearing devices to hear the sound. With Auracast the screens can also broadcast their audio so people can listen using their own hearing devices, whether consumer or prescription. This puts less pressure on the wired-in devices. Additional streams could offer the content in other languages.

Silent screens

TVs in public spaces such as gyms, bars, and reception/waiting areas can be a nuisance if their sound is on. Some places have several TVs showing different channels. By keeping the speakers muted but broadcasting their audio using Auracast, people can choose to pick up the sound of whichever screen they choose.



Personal audio sharing

Sometimes you want to be able to share what you're listening to on your phone, tablet, or computer with someone else, without disturbing other people in the room, office, or train carriage. With Auracast you can broadcast the audio so they can pick it up on their own hearing devices.

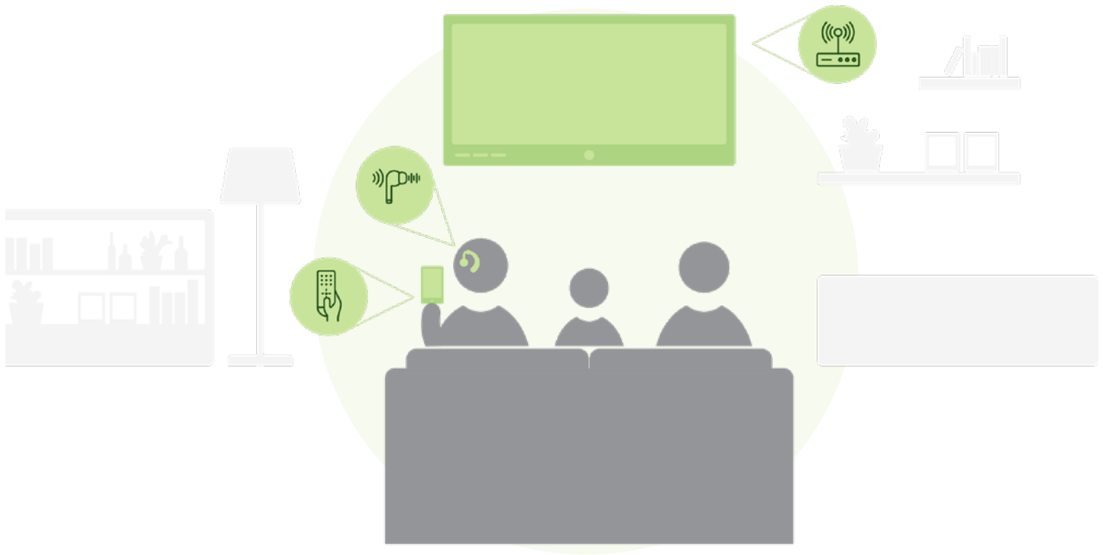
WATCHING TV WITH FRIENDS OR FAMILY

For many people, watching TV is a social activity. It's a way to relax after the day's work is done.

People with hearing loss are often excluded from enjoying this activity because it is not accessible to them. The dialogue is not intelligible or requires excessive listening effort to follow. Subtitles are an essential part of improving access, but many people would also like to hear the audio better.

"You know, it's a family, it's a social event. So, you're watching a programme. You know, something like 'Have I Got News For You' where there are lots of fast quips and I have the words on as always and the words don't keep up with the conversation. So I miss the laugh. It happens every time with every single laugh and if it's something really funny, I have to rewind it so I can hear it and that irritates everbody else."

- Mandy



Setting up the broadcast

With Auracast, a TV will be able to broadcast its sound. To preserve the viewer's privacy, the broadcast should be encrypted.

The TV user interface could make it easy to turn Auracast on and off, to give the stream a friendly name, like 'Living room TV' or 'Barry's bedroom TV' and to set the encryption password.

On-screen guidance could explain what these settings do in plain English.

Connecting to the broadcast

To pick up the TV's audio, an Auracast-enabled hearing aid needs to know the stream name and the password.

An Auracast assistant using the **pick-from-list paradigm** would make selecting the stream simple but entering a password could be a little fiddly.

The TV could display a QR code, which would include the password. This requires interaction with the TV itself, which might be annoying if other people are already watching something.

The inconvenience of password entry or scanning a QR code could be reduced if Auracast assistants or receivers themselves were able to remember the details of previously used streams. The password entry would only be required once.

To minimise the need for user interaction, some users might want their hearing aids to automatically pick up the TV's stream whenever it is turned on.

However, in busy households, this could be quite intrusive. A parent making dinner probably doesn't want the kids' cartoons piped straight into their ears!

We suggest that Auracast receivers maintain a list of previously used streams and passwords to make reconnecting easy.

We suggest that manufacturers explore methods for giving users the ability to individually set remembered streams as 'auto-connect', 'prompt to connect', or 'ignore'.

Since TV is a social activity, many hearing aid users would still like to be able to communicate with other people whilst streaming TV audio. Most hearing aids offer the ability to hear a mix of the telecoil signal and the hearing aid's microphone signal. However, it is often up to the audiologist to set this up.

We suggest that, where possible, users are given an intuitive user interface to adjust the balance between Auracast and microphone signals for themselves.

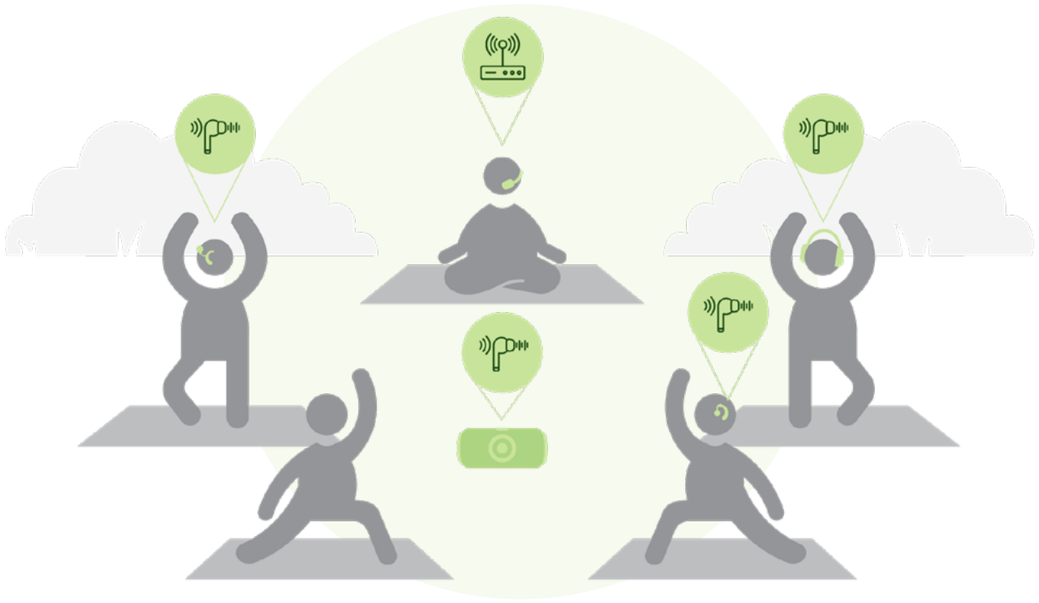
MOVING TALKERS – TOUR GUIDES AND EXERCISE CLASSES

The hardware required for an Auracast transmitter is tiny, which means it can be built into virtually any existing device. Imagine what you could do with a headset microphone that can broadcast its audio.

Tour guides will be audible to everyone. Whether they walk around a museum or a busy town, people at the back of the group will be able to hear by tuning into the Auracast-signal on their headphones, earbuds, hearing aids, or cochlear implants. Museums can provide headphones as they do now, or people can bring their own. Users with hearing loss can pick up the signal and have the clean speech amplified to suit their needs.

So how would this work in practice? Let's consider an exercise class. It could be held in a sports centre, a community centre, the park or on the beach. The principles are the same.

The instructor will wear a headset microphone which broadcasts their speech using Auracast. If it's a big group, the instructor could put battery-powered Auracast-enabled loudspeakers on the ground amongst the participants. These pick up the Auracast stream and play it so the sound level is audible without the instructor having to shout. Anyone who wants to can pick up the same Auracast stream using their hearing devices.



Setting up the broadcast

The instructor doesn't really care if passers-by can hear too (maybe they'll be inspired to join the next class), so they are happy to broadcast the audio without encryption. They also want people to know what they are listening to, so they give the broadcast a sensible name, like "Yoga with Jo".

For something as small as a headset microphone, setting up the broadcast details is likely to require an external interface. There are a few ways this could be approached, for example:

Smartphone app: The app would provide editable fields with embedded help information, guiding the user to choose suitable options.

Web interface: Some Bluetooth chips also support WiFi, so the transmitter could host a webpage where settings are controlled.

Hardware manufacturers: Need to provide clear and easy to use tools to adjust the properties of an Auracast transmitter.

Connecting to the broadcast

For most people attending the class, the simplest way to connect to the stream is likely to be the **pick-from-list paradigm**, using the broadcast assistant in their smartphone, smartwatch, or charging case.

Some people may not have smart devices, and others might prefer not to take them to an exercise class. With some ingenuity, we believe these users can be supported. Some ideas include:

Intelligent, one-touch connection:
Pushing a button on the device initiates a scan for available streams. For each stream found, the broadcast audio is compared to the 'local' sound picked up by the microphone(s) on the receiver device. The stream whose audio best matches the local audio is selected.

Gesture-based scanning:
Touch sensitive devices and inertial measurement units (IMUs) which detect motion could be used to create interactions which allow users to initiate scanning and then select or reject streams. Streams could be announced in sequence, or simply played, and a gesture used to skip to the next stream.

Voice control:
The user directly asks for the stream they want by name. E.g. "Hey hearing aids, connect to Auracast stream 'Yoga with Jo'". Another command could be "Hey hearing aid, what Auracast streams are available?"

Hardware manufacturers: Need to provide ways of accessing Auracast without external hardware. Taking an inclusive design approach may lead to paradigms which are preferred by a wide range of users.

GROUP CONVERSATIONS – HYBRID MEETING

Group conversations are notoriously challenging for people with hearing loss. In the case of hybrid business meetings, the ability to pick up clean speech from in-person participants is vital for people attending remotely but would also benefit people who are deaf or have hearing loss who attend in person.

Simplest possible setup

A typical conference room setup will have at least one microphone array, for example, on the table, mounted in the ceiling, or built into a soundbar. A microphone array combines the signals from two or more individual microphones in such a way that it enhances speech and suppresses background noise and reverberation. Normally, this enhanced signal is only sent to remote participants. Using Auracast, it can also be broadcast to in-person attendees.

Hearing aid companies already make proprietary microphone arrays, sometimes called table mics, to help individuals with hearing loss in this type of scenario. Many people find them exceptionally helpful, however, bringing your own technology to a meeting is not ideal.

Auracast-enabled microphone arrays offer the potential for everyone to benefit from hearing technology, whether or not they use compatible hearing devices.

"If it became quite widespread then you wouldn't have to take your own microphone along and sort of explain to people. I mean, that's not a problem. I'm not embarrassed about it. I just explain to people that it's a listening device, not a recording device. But it would be quite nice if it was a feature of the room. That you just go in and there it is and you know, you get on with it."

- Tom

Hearing everything well

An Auracast-enabled microphone array would already be hugely beneficial, but there are potentially many other things to listen to in a hybrid meeting: speech from remote participants, someone talking from a lectern, and audiovisual content presented onscreen. These can all be played through a single AV system, which could also broadcast its content using Auracast.

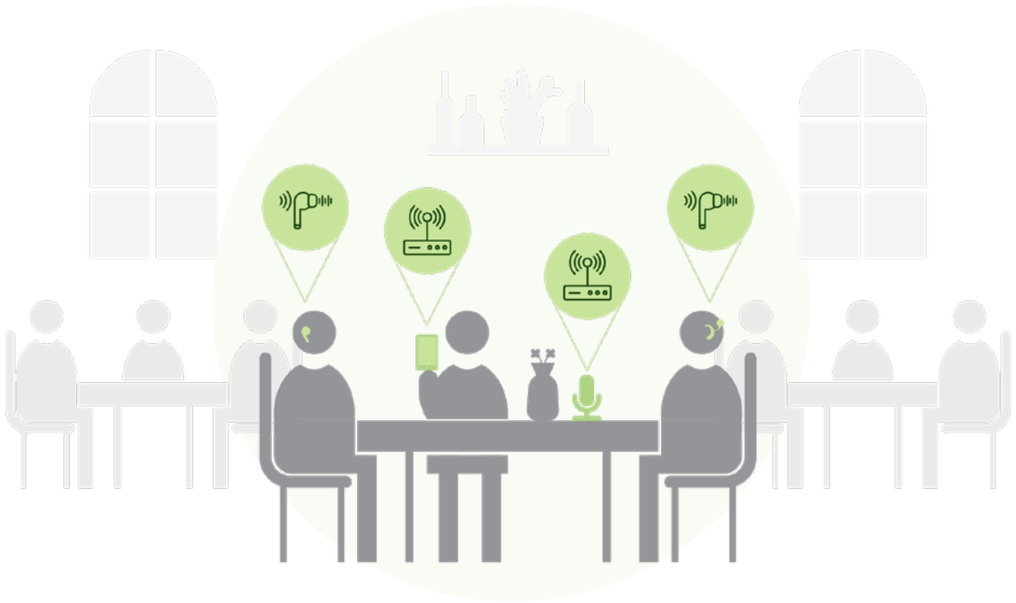
Going further, perhaps one microphone array is not enough to capture everyone clearly. In some cases, using different microphones for each person may provide a cleaner signal. These could be additional arrays installed in the room, or in attendees' own devices (e.g. smartphones, laptops, or hearing devices), with each transmitting its own Auracast stream.

With all these microphones available, it should be possible to pick up a clean signal from all in-person talkers. However, we need intelligent systems which can combine and deliver them to users' ears in a way which meets their needs.

We suspect that a "stream monitor" role may be required, which can decode and analyse the audio from several streams simultaneously and choose the most important streams at any given time, according to the capabilities of the receiver and any user preferences. A broadcast assistant could then tell the receiver which stream(s) to select and their relative level.

GROUP CONVERSATIONS – SOCIAL GATHERING

Family celebrations, dinner parties, trips to the pub, and community events should all be joyful occasions where we connect with other people. But people who are deaf or have hearing loss are often excluded. Conversing with a group of people in a room, surrounded by other people talking, is hard and hearing people can find it difficult too.



Following the conversation requires an increased reliance on lip reading which increases fatigue. Conversation shifting rapidly and people interrupting and talking over each other makes matters even worse. All too often, the conversation becomes too challenging and people withdraw, present but not engaged, leading to a sense of isolation.

Many people choose to avoid these situations altogether.

“Probably the worst places for me are pubs and restaurants, so it’s cut down my social life a lot. I love the summer because I can sit outside.”

- Tracy

The potential Auracast-enabled solutions for social gatherings are technically similar to those discussed in the context of hybrid meetings. However, there are some differences:

Consumer technology:
In a meeting room, you would expect the AV system to use dedicated professional hardware, so meeting participants shouldn’t need to access any admin tools. In a social situation, people are likely to be using consumer technology. This makes it more important that it is easy to set up.

Group dynamics:
In meetings, often only one person talks at once. On the other hand, in large groups, people quickly form several smaller conversations. Being able to infer who the listener wants to listen to is an area of active research. This is likely to need user involvement to develop successful user interfaces.

Responsibility:
In a meeting room, you would expect the AV system to be centrally managed and clear instructions provided to help meeting attendees connect to it. In social situations, no-one has overall responsibility, and most likely, the onus will be on the people who need it to set up an Auracast system. If using individual microphones, connections will be ad hoc, with people joining and leaving during an event. Making the user experience frictionless for everyone will make it much more likely that people embrace the potential of Auracast in this context.

Using assistive technology in social settings, especially when it requires other people to modify their behaviour, can feel awkward. Users need to have confidence that overcoming this awkwardness will be rewarded with an improved experience of the social situation. Two practical ways of giving users this confidence are:

Providing opportunities to practice:
Learning how to use new technology takes time. Things can go wrong until it becomes familiar. An important social situation is not the best time to have a first attempt at using a new technology.

Expectation management:
The level of noise and reverberation in social situations varies greatly. Claiming a product ‘solves’ speech-in-noise challenges risks disappointment. Helping users assess the difficulty of a situation and the likely effectiveness of the product can guide them to use it where it is most likely to work reliably.

GP CONSULTATION

All healthcare providers have a legal obligation to ensure their services are accessible to people with hearing loss. A typical medical appointment has several touch points where unintelligible speech can cause serious barriers. Auracast has the potential to help in each but requires careful consideration.

Waiting area

Sometimes patients are called by a person. Sometimes their name appears on a screen. Neither solution is accessible to everyone.

Ideally a screen would be used in combination with audio being transmitted over Auracast.

It is common for people to access media on mobile devices while waiting for their GP appointment. The Auracast transmitter should make proper use of metadata to indicate when the stream is active (i.e. an announcement is being made). The Auracast receiver should offer the functionality of ducking or pausing the user's personal media when the Auracast stream is active. It would also be desirable for users to be able to consume media from one Auracast stream and automatically switch to another while an announcement is made.

"Being in a waiting room is awkward because people do call things out. [It's a] matter of chance whether you hear it. There is definitely somebody who misheard it and stood up, and I was a bit worried, you know, 'Am I going to hear this?' "

- Tom

Reception desk

Reception desks are required by law to offer hearing assistance. Typically, this is done using a hearing loop. The area covered by the loop is confined to where the hearing device user is located, affording a reasonable level of privacy. The user accesses the loop signal by a simple button press on their hearing device.

In contrast, picking up an encrypted stream requires the user to take a more involved action, even if this is simply scanning a QR code on a smartphone.

While Auracast is an improvement over hearing loops in many situations, this is one case where, provided the hearing loop is correctly set up and maintained, Auracast does not currently offer a better user experience for non-smartphone users. Users could provide their own QR code as a solution.

Hearing aids should continue to include telecoils and reception desks should continue to provide hearing loops until Auracast can offer an equally straightforward user experience.

Consultation

The information being communicated during a medical consultation is critically important. Even if speech can be understood, the listening effort required can reduce a person's ability to process and retain the information. **Deaf-aware communication** can help to reduce this listening effort and legally-defined standards should always be followed as a minimum. Auracast offers opportunities too.

A lapel microphone worn by the clinician would pick up a clean speech signal, even if they move around. This is similar to the headset microphone in the moving talker example, but the broadcast must be encrypted to ensure the consultation is kept private.

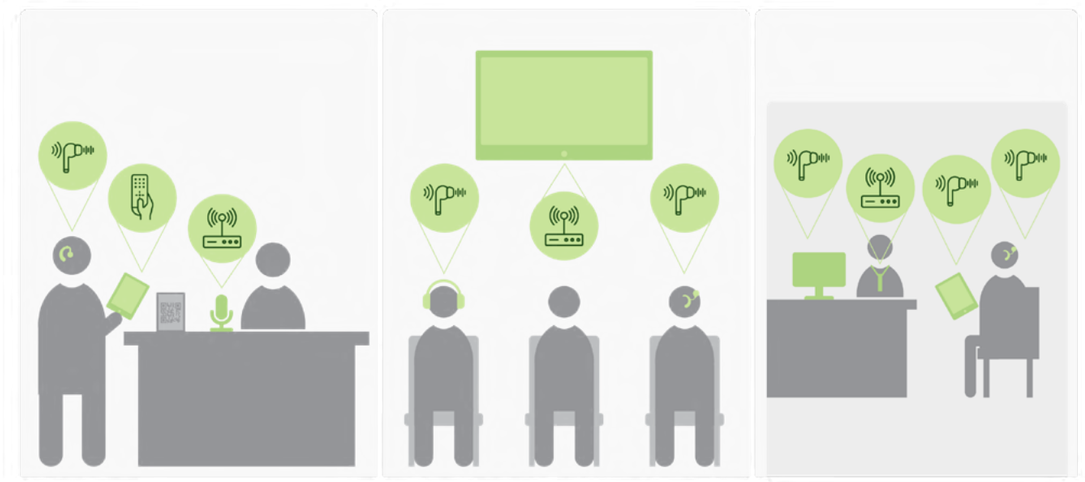
Each appointment requires a new encryption key, otherwise previous patients would be able to eavesdrop on subsequent consultations. Using the **QR code paradigm** is probably the simplest way to share the required broadcast details (name and key).

The general assumption is that the owner of the transmitter would set up the broadcast and share the details. The transmitter would include, or be connected to, a screen, e.g. a mobile device or e-ink display, that can display the QR code. The patient would simply scan the code using a broadcast assistant app on their phone.

As with other situations where an encrypted stream is required, consideration must be given to people who do not use a smartphone.

Once the clinician is wearing a lapel microphone, it would also be possible to use the clean audio stream to provide live transcription. This can be beneficial to many people, not just those with hearing loss. Clinicians should be able to see the generated captions to check they are accurate. This may require two screens.

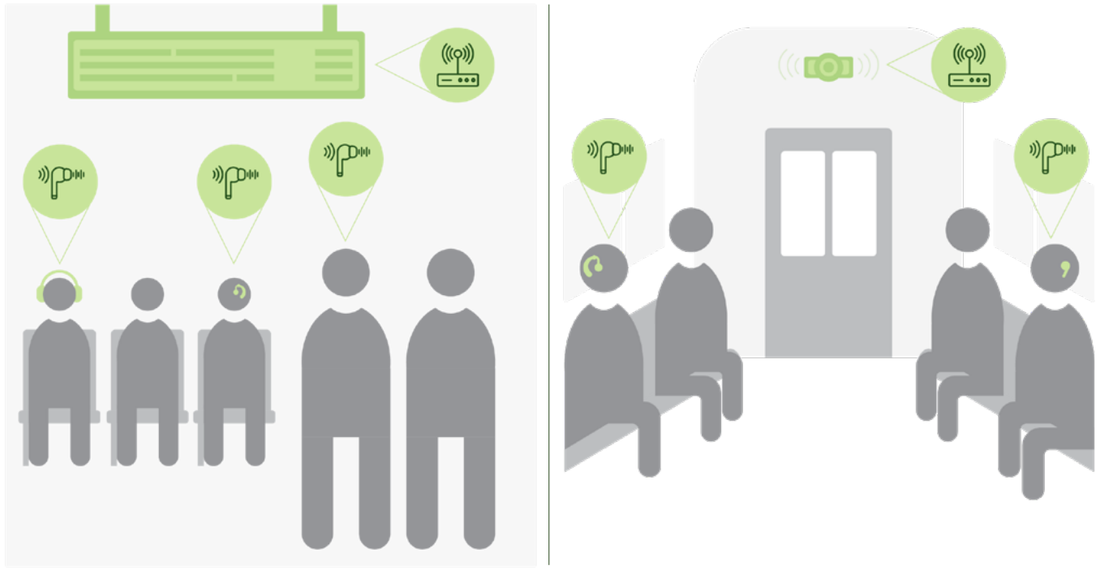
Streaming and captioning speech in medical consultations needs to be done with careful consideration of privacy. A Data Protection Impact Assessment (DPIA) will be required. To avoid excessive duplication of resources, we suggest that equipment manufacturers understand DPIA requirements in healthcare settings and provide guidance to help customers overcome this administrative hurdle.



PUBLIC TRANSPORT

Public address (PA) systems are used throughout the public transport network to convey various types of information. Service alteration and disruption announcements contain critical information that may require immediate action (such as moving to a different platform) or which will significantly affect a traveller's plans (such as a cancellation). The quality of PA systems, poor acoustics, and noise from vehicles mean that announcements are often difficult to understand for everyone.

The UK legislation acknowledges the need for assistive listening systems, but there are practical difficulties in retrofitting hearing loop systems over wide areas, in concrete platforms, and within the metal frame of trains and buses. Therefore, where these loop systems are provided, they generally require the passenger to wait/travel in restricted areas.



Waiting to board

Auracast can cover a large area using a single transmitter which can be easily installed. Using the same audio feed as the existing PA system, passengers will hear clear audio announcements directly on their hearing devices. We expect this will benefit passengers whether or not they have hearing loss.

Passengers who travel regularly will quickly get frustrated with the **pick-from-list paradigm** in this context. To make the experience frictionless, Auracast assistants could offer the option to remember and automatically reconnect to broadcasts.

On the way

Passenger Information Systems, where installed, typically display the next stop and the final destination on a continuous loop. This is supported by automated (prerecorded) PA announcements. While some people might be comforted by such information, regular commuters would most likely get frustrated if their personal media were interrupted at every stop. But no one wants to miss important service alteration announcements.

Taking this a step further, transport operators could offer a 'tourist' stream which includes additional information such as landmarks near each stop, interesting local information/history along the route, interchanges, etc.

Public transport operators could provide two Auracast streams. The first would broadcast all announcements while the second would only broadcast service alteration and emergency announcements. The broadcast names should clearly distinguish between these stream types.

Unknowns

The potential benefits of Auracast in public transport are quite clear. However, there are some potential challenges too.

Spoofing:
Someone could create a fake Auracast stream which mimics that provided by the transport operator. Making malicious announcements (e.g. triggering an emergency evacuation) could cause panic. One mitigation against this could be for hearing devices to only play a stream if the content of that stream is also audible (to a hearing person) in the environment. This could be implemented by simply comparing the streamed audio to that picked up by microphones in the hearing device from the acoustic environment, for example, using a correlation-based approach. If the streamed signal cannot be "heard" in the local environment then a warning could be issued, or the stream could be muted/ignored altogether.

Congestion:
In busy areas, there could be several thousand devices all using the 2.4 GHz radio band at the same time. Practical tests are needed to determine how much of a problem this would be, if at all.

KEY QUESTIONS FOR CONSIDERING USER NEEDS

When designing individual products, it is important to consider how they might be used by different people in different situations. Here are some questions you can use when considering user needs.

Environmental

- Where is the interaction taking place?
- Is the broadcast transmitting continuously (e.g. a movie) or sporadically (e.g. PA announcements)?
- Do the transmitter and/or receiver need to move?
- How does use of the technology affect other people (bystanders)?
- How many broadcasts are likely to be discoverable in the same place?

Privacy and security

- What is the expectation of privacy? There is trade-off between privacy and convenience so making streams private which don't need to be could needlessly exclude people.

User needs

- How important is it to the user that they hear well? Tolerance of friction in the process of connecting to a stream might be lower for unimportant interactions.
- How should other streamed content be handled when sporadic streams are active?
- Who else is involved in the experience? Does the user need to be able to talk and listen to them.
- How long is a user likely to stream audio for? Tolerance of friction in the process of connecting to a stream might be lower for brief interactions.

User device capabilities

- Is an Auracast assistant available?
- If so, what form factor will it take?
- If not, what user interactions can be supported by the receiver?
- Does the Auracast receiver have a microphone? Could it be used for 'data over audio' or voice interaction?
- Is it possible to listen to more than one broadcast at the same time?

The flexibility of Auracast means that there is lots of opportunity to design inclusive solutions.

It also means that there is lots of scope for manufacturers to use their own terminology and approaches, which could end up confusing users. RNID is working with users and other stakeholders, to help system designers and implementers to harmonise user journeys across different platforms.

Hardware manufacturers: Use intuitive design for user interfaces. The encryption, password setup and pairing process for an Auracast assistant should be designed in a way that's simple and user-friendly. The goal is to make sure people can easily understand how to use security and connectivity features without frustration, so they feel comfortable to use them regularly.

Work with us: RNID's Research Panel

RNID's Research Panel offers businesses the opportunity to gain unique insights from a diverse group of people with lived experience of deafness, hearing loss, or tinnitus. By collaborating with our panel, you can:

Gather user insights: Conduct surveys, interviews, and focus groups to understand the needs of your target audience.

Co-design solutions: Work directly with panel members to create products and services tailored to their needs.

Test your products and services: Receive feedback on accessibility features, apps, and new technologies.

Contact us at **panel@rnid.org.uk** to learn more.

AURACAST ROLLOUT

Auracast-enabled devices started appearing in 2023 and the number of devices going through the formal qualification process, required to carry the Auracast trademark, is increasing all the time.

There are three possible ways to acquire Auracast capabilities

1. Software upgrade of existing equipment

Many devices have already shipped which contain the necessary Bluetooth hardware. Manufacturers could choose to add support for Auracast. This is the most environmentally friendly approach and customers will appreciate the added value.

2. External accessories

Also known as retrofit. Relatively simple devices containing little more than Auracast-capable Bluetooth hardware can be plugged in to existing equipment to add Auracast capabilities.

3. New devices with Auracast built in.

As existing product lines are refreshed and new designs created, incorporating the latest generation of chipsets will make including Auracast capabilities an obvious choice.

No one can predict the future, but this is how we expect Auracast availability to progress.

Mass market consumer audio will drive adoption
In the next two or three years, while awareness of Auracast is still quite limited, we expect current trends in the acquisition of mainstream consumer devices to drive a rapid growth in the prevalence of Auracast-enabled devices. Earbuds and portable speakers, in particular, are the highest volume segments in consumer audio. To begin with, we expect most people won't be aware that their devices support Auracast.

While we expect route three (new devices) to dominate the growth of Auracast; a relatively small number of big brands have the market share to influence whether route one (software upgrade) is significant or not. Samsung have led the field in upgrading their Galaxy Buds2 Pro earbuds.

Auracast benefits will only be realised when smartphone support is widespread
Once consumers have smartphones and tablets which support LE Audio, people will start to notice the benefits of low latency streaming when watching video content. If personal audio sharing using Auracast is easy to use, people will start to make use of this feature with family, friends and colleagues, and public awareness will increase.

Samsung already support Auracast on several of their Android devices. We expect to see wider support across manufacturers when Android 16 is released, later in 2025.

Apple have given no indication of when support will be available on their mobile platforms (i.e. iOS, iPadOS)

Increased awareness will drive demand for retrofit transmitters for personal use
People who have experienced Auracast by broadcasting from their mobile devices and receiving on headphones, earbuds and portable speakers, will want the same ease of access to their other equipment, such as TVs and computers.

Retrofit transmitters could interface to existing equipment in several ways.

Standalone – accept audio as analogue (e.g. 3.5 mm jack, phono, etc) or digital (e.g. S/PDIF optical, HDMI) input. Requires a separate power source.

USB soundcard compatible – uses a standard interface to appear to a host system as a standard audio output.

Client device – attached by USB to a host device, which requires drivers and OS support to know what to do with it.

The configurability of these transmitters will determine the user experience.

Auracast in venues
As retrofit and professional-grade transmitters become available, venues will start to install transmitters alongside loop systems or in place of existing infrared/WiFi-based systems. This will be a combination of standalone transmitters and front-of-house sound systems, such as mixing desks, loudspeakers and stageboxes, with Auracast transmitters built-in. International standards are currently being developed which will, ultimately, specify the expected performance of these systems.

Venues: Offer Auracast as an assistive listening system option as soon as practically possible.

Auracast in national infrastructure
The last domain to see widespread adoption will be national infrastructure such as public transport vehicles, stations, bus stops, etc. This will require advanced planning, pilot installations and budget allocation. RNID is engaging with a range of stakeholders in the transport sector to help them understand the benefits and challenges of adopting Auracast at scale.

National infrastructure: Should involve users in running pilots

National infrastructure: Should upgrade and extend ALS provision by installing Auracast wherever possible.

Auracast in hearing aids

All the major hearing aid manufacturers have announced new products which will support Auracast. GN Hearing supports it now in both their private (ReSound Nexia) and NHS (danalogic Extend) product ranges, while others have promised support through future firmware updates.

Most hearing aid wearers in the UK get their hearing aids from the NHS. For Auracast to become a viable assistive listening solution for UK hearing aid and hearing implant users, prescription hearing device models supplied to NHS patients need to support it.

NHS hearing aid users generally have their devices replaced every three to four years. Once Auracast-enabled hearing aids begin to be routinely provided on the NHS, the proportion of people who can benefit from Auracast ALSs will gradually increase. However, different regions adopt new technology at different rates and so, in reality, it will be more than three years before most people can access Auracast using their NHS-supplied hearing aids.

For cochlear implant and other hearing implant users, the cycle to replace their receivers is likely to be longer.

NHS Supply Chain and procurement: Source and supply Auracast-enabled hearing aids and cochlear implants, as standard, across the whole UK. Everyone should have access to this revolution in audio accessibility as soon as possible.

Audiologists: Support people to benefit from Auracast technology. Supporting patients to set up a prescription hearing device or be able to signpost to local services that are suitably trained and easily accessible.

Sensory services: Support people to benefit from Auracast technology. Supporting people will help get the most out of hearing devices in everyday life.

The future of hearing loops

Existing systems

Anywhere which currently has a hearing loop installed should continue to test and maintain it for the foreseeable future – at least the next five years and potentially nearer 10 years will be necessary.

As soon as they become more widely available, RNID would recommend adding an Auracast system alongside the hearing loop.

New systems

For the next five years or more, telecoils in hearing aids will continue to be the most ubiquitous way of accessing assistive listening systems. Therefore, anyone planning a new building or equipping a new facility now should install a hearing loop, if it is feasible, as well as an Auracast system.

For spaces where hearing loops are not a practical or effective solution, it is already acceptable to install an alternative technology, such as Infrared or WiFI-based systems, provided users are lent a compatible receiver which is appropriate for their needs. Auracast would be a better solution in such cases because, in time, people will be able to use their own receivers.

Bridging the gap

As Auracast transmitters, especially mobile devices, become more common, it is imperative that people who are deaf or have hearing loss are not excluded.

An LE Audio-enabled neckloop receiver would offer the potential for someone with a telecoil-enabled hearing device to access the capabilities of LE Audio. This includes streaming audio and calls from a paired smartphone and picking up Auracast broadcasts from any source. We expect the retail price of these devices to be less than £100, and for bulk-purchase discounts to make them substantially cheaper. However, hearing aid users will only be able to use one if their audiologist sets up a telecoil programme.

Audiologists: Until Auracast-enabled hearing devices are available on the NHS, it should be the norm to setup a telecoil programme, unless there is an individual reason that this would not be appropriate for the hearing aid user.

Sensory services: Continue to work with audiologists to ensure telecoils are enabled.

SECTOR-SPECIFIC RECOMMENDATIONS

This report has demonstrated the potential for Auracast to revolutionise audio accessibility and the wide range of use cases in which it could transform people's experience. To realise this potential, Auracast must provide a seamless and inclusive user experience for everyone, including for people who are deaf, have hearing loss or tinnitus.

Auracast involves an ecosystem of compatible products and service providers. All stakeholders need to play their part if Auracast is to meet user needs and deliver on its potential of making life inclusive for people who are deaf or have hearing loss.

RNID is ready to collaborate with stakeholders to make the UK's Auracast rollout inclusive and world-leading.

Venues

- Offer Auracast as an assistive listening system option as soon as practically possible.
  P35
- Continue to maintain hearing loops so that customers and service users on old technology are not excluded during the transition.
  P37
- Continue to improve the environment acoustics.
  P8

Mobile/PC platform developers (Apple, Samsung, Google, Microsoft)

- **Use an inclusive design approach for OS-level user interfaces.** Devices need to provide access to the core Auracast functionality whilst considering accessibility requirements.
  P16
- Provide open APIs to allow third-party apps to function as an Auracast transmitter, receiver and/or assistant.
  P15

Sensory services

- **Support people to benefit from Auracast technology.** Supporting people will help get the most out of hearing devices in everyday life.
  P36
- Continue to work with audiologists to ensure telecoils are enabled.
  P37

National infrastructure

- Test Auracast with user groups to improve people's experience of spaces and services and to ensure the UK's rollout is world leading.
  P35
- Upgrade audio broadcast infrastructure to ensure infrastructure for public spaces and services are fit for the future.
  P35

NHS Supply Chain and procurement

- **Source and supply Auracast-enabled hearing aids and cochlear implants, as standard, across the whole UK.** Everyone should have access to this revolution in audio accessibility as soon as possible.
  P36

Audiologists

- **Support people to benefit from Auracast technology.** Supporting patients to set up a prescription hearing device or be able to signpost to local services that are suitably trained and easily accessible.
  P36
- **Enable patient access to Auracast by activating their telecoil.** Activating a patient's telecoil will enable them to access Auracast now (via a neckloop receiver), even if Auracast-enabled hearing aids are not yet available.
  P37

Hardware manufacturers (earbuds, hearing aids, transmitters)

- **Use intuitive design for user interfaces.** The encryption, password setup and pairing process for an Auracast assistant should be designed in a way that's simple and user-friendly. The goal is to make sure people can easily understand how to use security and connectivity features without frustration, so they feel comfortable to use them regularly.
  P16
- **Use intuitive design for encryption, passwords and pairing with a third-party Auracast assistant.** It needs to feel easy to understand and navigate for people to routinely use it.
  P32
- **Consider the needs of people who do not have a smartphone.** People need to fully benefit from their prescription hearing devices even if they cannot afford, or are not confident using, one.
  P16

APPENDIX 1 – THE NEED FOR ASSISTIVE LISTENING

The challenge of noise and reverberation

Speech understanding is assessed using two key measures: speech intelligibility and listening effort. Speech intelligibility refers to how accurately words are heard. Listening effort focuses on how hard it is to process what is heard. Even with perfect intelligibility, high listening effort can make it harder to retain information and can cause fatigue.

We will describe the sound you want to listen to as the target. This might be speech from a partner, someone talking from the front of a lecture theatre or dialogue coming from a TV.

Noise refers to sounds other than the target. If the level of the noise, compared to the target, is too high it becomes difficult to understand the target. We can improve intelligibility by making the target louder and/or the noise quieter.

Reverberation refers to the persistence, or in some cases echo, caused by sound reflecting off walls and hard surfaces. Reverberation is a blurring of the sound – making the target louder makes the reverberation louder too and does not improve intelligibility. Increasing the amount of acoustic absorption in a room reduces the reverberation and is helpful.

Noise and reverberation make speech understanding harder for everyone but people with hearing loss are disproportionately affected.Speech understanding can be improved for everyone by making changes to the environment.

Hearing loss

Hearing loss also makes it harder to understand speech, especially in noisy, reverberant conditions. Situations where lots of people are talking at once are particularly challenging. Some people have no difficulty hearing quiet sounds but struggle with ‘speech in noise’.

To make speech more intelligible, hearing devices use a variety of algorithms which reduce the noise and reverberation. These can be very effective, but ultimately, there are many situations where people need more support to hear well.

Ultimately, there are many situations where people need more support to hear well.

Delivering a clean signal

Assistive listening overcomes the challenges of noise and reverberation by giving the user access to a clean target signal which can be played directly into the ear. Several ALS technologies are routinely used by people who are deaf or have hearing loss, each with their advantages and disadvantages. These are discussed in detail in the next section.

To gain the benefit from an ALS, the local sound, i.e. the ambient sound at the listener’s ears, must be attenuated compared to the target signal. For certain types of hearing loss, it may be sufficient to amplify the target signal while leaving the local sound alone. However, some people will benefit from hearing devices which occlude the local sound (e.g. passive attenuation from ear moulds) and/or use signal processing to suppress it, a process known as active noise cancellation (ANC).

APPENDIX 2 – CURRENT ASSISTIVE LISTENING TECHNOLOGY

Assistive listening systems (ALSs) come in various types, often defined by how they wirelessly transmit sound from the source to the listener. Sometimes, the transmitter is built into the sound source, and the receiver is part of the hearing device. Other times, extra equipment is needed either at the source, to connect it to the transmitter, or at the listener's end, to connect the receiver to the hearing device.

Listener side

All assistive listening systems require a means of getting clean audio into the hearing device, such that it can be amplified and conveyed to the user. There are three common technologies which can be built-in to a hearing aid:

Direct Audio Input (DAI)
An analogue electrical connection which allows a special cable or receiver device to be plugged into the hearing aid.

Hearing aids which can receive a DAI normally need a manufacturer-specific adapter (sometimes called a shoe or boot) to do so. An audiologist will need to set up a DAI programme to listen to the DAI signal.

Telecoil
A small loop of wire which picks up a magnetic field using a process called induction.

The majority of hearing aids supplied through the NHS are fitted with a telecoil. To listen to the signal received by the telecoil the user must choose the 'T'-setting. In the past, users could do this directly using a physical switch on the hearing aid. Now, selecting the 'T'-setting is done by choosing an appropriate preset mode or 'programme'. This can be done using a button on the hearing aid or, in many cases, remotely using a smartphone app.

An audiologist must set up a telecoil programme as part of the fitting process for the 'T'-setting to be available to the user. A UK market survey in 2022 found that only 15% of hearing aid users were aware that they had a telecoil, so most people either do not have this setting, or don't know that they have.

Digital streaming
Uses radio waves in the 2.4 GHz band to carry digital signals.

There are a number of standards supported by different manufacturers, which are not interoperable. These include Made For iPhone (MFi) for iOS, Audio Streaming for Hearing Aids (ASHA) for some compatible Android devices, and manufacturers' own proprietary formats.

Sonova (which owns the Phonak and Advanced Bionics brands) is unusual in that it can also pickup Bluetooth Classic Audio and Roger signals directly.

To listen to signals from an ALS using a technology not supported by the prescription hearing device directly, additional hardware is required.

Some small receiver devices plug into the DAI (e.g. FM systems and Roger).

Some receiver devices use a neckloop to create an inductive field which can be picked up using a telecoil (e.g. Infrared, Roger).

Some receiver devices retransmit the received signal using the manufacturer's proprietary digital streaming format. This is mainly used for Bluetooth Classic Audio. These devices often contain a microphone, turning the hearing aid into a headset.

Source side

Any ALS can only ever be as good as the quality of the signal it transmits. In some cases, the sound comes from a media source, such as TV, cinema screen, media app on a smartphone, or CD player. In these cases, the audio is essentially perfect. In other cases, live speech is picked up using a microphone system. The type and position of microphone system is critical, especially in environments where there is a lot of noise and/or reverberation.

TV streamer
An audio signal can come from anywhere but most often these devices are marketed for use with TVs. The audio signal is input using analogue and/or digital interconnects.

Wired microphone
The simplest way of picking up sound, a wired microphone can be plugged in to a transmitter directly or routed through a mixing desk. In general, the closer the microphone is to the talker the better the signal will be.

Remote microphone
A device which integrates a microphone, or array of microphones, and wireless transmitter. Sometimes known as a radio aid, spouse mic or companion mic, depending on the intended usage. Some modern remote microphones have sophisticated features where their pickup properties can be adapted for different scenarios, for example, clipped to a shirt or lapel, or placed on a table.

Table microphone
Also known as a conference microphone, these devices contain several microphones. They can detect which direction sound is coming from and reduce the noise from other directions.

Wireless technologies

Different wireless technologies used in ALSs are described below.

Hearing loop
Hearing loops (also known as Audio Frequency Induction Loops (AFILs) have been used since the late 1930s and are, by far, the most common form of assistive listening system. They are based on very simple, analogue technology where the transmitter creates a magnetic field by passing an alternating current through a loop of wire.

The size, shape and orientation of the loop are important because they determine the region in which the signal can be picked up. Loops work less well where there is a lot of metal, such as in a vehicle or close to structural steel in buildings. Other sources of magnetic fields, such as motors, can cause interference.

To cover large areas, such as a lecture hall or place of worship, the loop surrounds the seating area. The height doesn't matter too much - it can be buried, laid on the floor, in the walls or in the ceiling. However, the magnetic field can 'spill' outside the area and be picked up by people nearby. This can be a problem for privacy (for example, being able to 'listen in' by standing outside a meeting room with a loop) or when looped rooms are stacked above each other in multistorey buildings. Specialist loop designs can reduce spill issues.

At customer service counters and points of sale, loops are installed in or on the service desk so that only someone directly in front can pick up the signal. Any spill is no worse for privacy than someone who might be standing within earshot.

Door entry intercoms and help points on station platforms have the loop built-in to the device enclosure, so the whole device must be positioned so that the magnetic field is created in an appropriate place, and height, for users who may be standing or in a wheelchair.

Portable hearing loop systems are battery powered so can be easily moved to different locations. For a small business or GP surgery, they are an affordable option, but it is important that staff are properly trained in their use.

A neckloop is worn around the neck like a lanyard and can be plugged into a standard headphone socket. They can be used to connect to devices like mobile phones, TVs and laptops, or as a bridge to other types of ALS which require specialised receiving devices.

Although many locations have a hearing loop installed, users regularly report that they are either turned off or not working correctly. It is very easy to **check that a hearing loop is working** using a low-cost loop listener device.

Infrared
Infrared (IR) systems use a transmitter to send the signal as non-visible light. Unlike hearing loops, the infrared light is not affected by the presence of metal or other sources of interference. Therefore, it is possible to get a much more consistent signal across an audience area. Light does not travel through walls or around corners. This makes IR systems good when privacy is important but also means that care must be taken to position the transmitter in a place where the signal will not be obstructed.

Infrared systems are often used in theatres and cinemas.

A special receiver is required to pick up the IR signal. Venues lend these to customers for the duration of their visit. Customers will generally get a choice of a receiver with headphones or a neckloop, depending on whether they want to listen using their hearing aids.

WiFi
WiFi-based systems allow users to receive the signal using an app on a smartphone. This has the benefit that customers who can 'bring their own device' do not need to borrow any equipment. It also means that standard networking equipment can be used to distribute the signal throughout a building, including through walls.

However, not all customers own or are comfortable using a smartphone, many hearing aids are not able to stream audio from a phone and those that can drain the battery more quickly. Also, the delay introduced by the network and the individual's device can be excessive.

FM systems
Frequency Modulation (FM) systems use an old analogue technology to transmit the signal. They are largely obsolete, but some people use this term as a synonym for radio aids.

Roger
A proprietary digital streaming format designed by Phonak, Roger is widely used in education as it can support several remote microphones, table microphones and 'multimedia hubs' (their term for a TV streamer). It is also used by individuals and was popularised by the Roger Pen microphone which the user could hold and point in the direction of the source they wanted to listen to.

APPENDIX 3: BLUETOOTH AUDIO

Bluetooth is a technology used to send and receive information over short distances using radio waves. There are many different versions of Bluetooth, with each new version offering the possibility of using new profiles (profiles are like different languages). Two devices both need to support the same profile for them to communicate.

Bluetooth Classic Audio

The earliest versions of Bluetooth, now sometimes called Bluetooth Classic to distinguish it from Bluetooth Low Energy, included two profiles for audio: Headset Profile (HSP), used for making phone calls, and Advanced Audio Distribution Profile (A2DP), used for streaming music. Most hearing aid manufacturers have chosen not to support Classic Audio (audio streaming using Bluetooth Classic) because it would drain the battery too quickly and it suffers from high latency.

Bluetooth Low Energy (LE)

Bluetooth 4.0 introduced a new way for devices to communicate which requires less power. Devices can support the original approach, Bluetooth Classic, the new approach, Bluetooth Low Energy (also known as Bluetooth LE or just BLE), or both.

Most (possibly all) “Bluetooth” hearing aids support Bluetooth LE connections to a smartphone for controlling hearing aid settings, such as changing between preset programmes and adjusting volume.

Proprietary derivatives of Bluetooth LE

Bluetooth 4.0 did not specify a way to do audio streaming using Bluetooth LE. This has led to proprietary standards being developed, where manufacturers designed their own protocols for streaming audio from own-brand accessory devices.

The mobile device platforms have also developed their own standards. While all Apple devices support “Made For iPhone (MFi) hearing aids”, only a limited number of Android devices support Google’s Android Streaming for Hearing Aids (ASHA) protocol. In short, there are several systems, but they are not interoperable.

Bluetooth LE Audio

Bluetooth 5.2 introduced Low Energy Audio (LE Audio). This is a complete redesign of the Bluetooth audio architecture designed in collaboration between the hearing aid and consumer audio industries. There are a few key features which will make using hearing aids with phones, tablets and computers much better.

Low latency

Latency is the delay between audio being sent from one device and it being heard through the receiving device. If latency is too high, it can be disturbing. Examples include lip synchronisation problems when watching videos, and audio artefacts when multiple copies of the same sound are heard.

Interoperability

All devices which conform to Bluetooth standards can work together. So, it won’t matter which brand of phone, computer or hearing aid you use.

Connectivity

Classic Audio only allows a hearing device to be paired with one source device at a time. With LE Audio, hearing aids can be paired to a laptop and a phone at the same time, ensuring that users don’t need to choose which audio matters to them the most.

Low power

The increased connectivity and interoperability will likely increase the amount of time users want to spend streaming audio. For audio streaming over extended periods of time it has to be power efficient since hearing aids have tiny batteries. Whereas earbuds can be recharged during the day using a charging case, rechargeable hearing aids are expected to last for a whole day.

Broadcast audio

The Public Broadcast Profile (PBP) is a new profile which enables audio to be sent by one device and picked up by others, without having to pair them first. This new broadcast capability was designed, in partnership with the hearing aid industry, to be used in assistive listening systems and is the basis of Auracast.

Supporting people who are deaf, have hearing loss or tinnitus