







## **AVAILABLE ASSISTIVE LISTENING TECHNOLOGIES**





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### FORWARD

With decades of combined experience in hearing loop and assistive listening technologies, IHLMA members are uniquely placed to support, guide, inform and to promote best practice in delivery of services to those who experience hearing loss.

There are many assistive listening technologies available on the market, all offering their own unique advantages and benefits depending on situational requirements and circumstances.

It is intended that this guide will be updated frequently and will go some way towards clarifying the differences and advantages of each available technology.

At IHLMA we are committed to working with all stakeholders in the industry, with the objective of improving the ability of people who experience hearing loss to access clear and intelligible audio through working assistive listening equipment and systems.

## ABOUT IHLMA

world.

The association can provide support and guidance to anyone interested in hearing loop or assistive listening systems.

CONTACT IHLMA

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Andrew Thomas **Chairman IHLMA** 

The International Hearing Loop Manufacturers Association (IHLMA) is an association of the major manufacturers of audio induction loop equipment, aiming to support good quality loop installations around the

If you would like further information on assistive listening technologies or for all general, membership and technical enquiries, please contact:

# INTRODUCTION

## ASSISTIVE LISTENING TECHNOLOGIES

In line with legislation, assistive listening systems help to safeguard people who experience hearing loss. In law their rights include:

- equality before the law without discrimination
- an inclusive education and a decent standard of living
- support to participate in society and live in the community
- · accessible physical environments and information

If used correctly, such systems consistently meet or exceed nationally and internationally agreed performance standards.

People with hearing loss of all levels, frequently exhibit a disproportionate amount of difficulty understanding speech in the presence of noise. This is especially the case in situations where desired speech signals are weakened by distance, and contaminated by noise and reverberation, before arriving at

the listeners' ears or hearing aids. This is where assistive technologies can be of help. Source: Rephrased from RERC Assistive Listening Devices Project by Mark Ross, Ph.D., Matthew Bakke, Ph.D.

People who experience significant hearing loss require a volume (signal to noise ratio) increase of about 15 to 25 dB in order to achieve the same level of understanding as people with normal hearing. An assistive listening system allows them to achieve this gain for themselves without making it too loud for everyone else. *Source: "Benefits of Assistive Listening Systems," by David Baquis, www.nad.org.* 

To help dispel some of the confusion over which assistive listening technology should be used in any given situation, IHLMA, in collaboration with contributors from around the globe, have produced this general guide on the solutions currently available.

There are a myriad of assistive listening technologies available today and some exciting developments to come. This guide highlights the advantages for end users and operators, user experience, system limitations, applications, compliance and applicable standards associated with each technology, along with a brief description of how each technology works.







## HEARING LOOPS AND TELECOILS (T-COILS)

## HOW IT WORKS

Sound is transmitted from a sound source, for example a person speaking, through a sound system to an induction loop driver.

The driver converts the source to a magnetic field via a wire loop, which is picked up wirelessly by the T-coil in a hearing aid or cochlear implant. This is converted back into an audio signal within the hearing aid.

For more information on how loops and T-coils work together see https://ihlma.org/

## HOW TO ACCESS

Look for hearing loop signs. Switch to the 'T' or 'MT' setting on the hearing aid(s).

## USER EXPERIENCE

- Hearing aid wearers must know how to access the T-coil setting(s) on their device
- Adequate signage must communicate a loop system is available
- Many people prefer loops as they are directly compatible with their own hearing assist devices

## EQUIPMENT PERFORMANCE STANDARDS

- A correctly installed system is inherently compliant with IEC 60118-4
- A suitable loop driver will always be compliant with IEC 62489-1

## ACCESSIBILITY STANDARDS

- Fully compliant per ADA Standard 219
- BS 8300 Design of an accessible and inclusive built environment
- EN-17210 Accessibility and usability of the built environment

## **APPLICATIONS**

- Classrooms and courtrooms
- Conference and meeting rooms
- Auditoriums and theatres
- Houses of worship
- Arenas and stadiums
- Museums and theme parks
- Hotels and hospitality
- Hospitals, retirement and nursing homes
- TV and home theatre lounges
- Service counters in: banks, retail stores, food stores, airport, bus and train hubs
- Taxis, busses, trains
- Ticket machines, ATMs, automatic check outs, door entry, lifts / elevators and intercom systems

## ADVANTAGES (OPERATORS)

- Minimal time and capital overhead for facility providing assistance to T-coil users
- Non T-coil users can use loop
   receivers with headsets
- Can be used outdoors
- Well suited for walk up / walk
   through (transient) locations
- Have sound quality standard (IEC60118-4) for installations
- More options for integration in various applications and OEM

## ADVANTAGES (END USERS)

- T-coil users receive sound invisibly, simply and directly to their own hearing aid:
  - Maintains privacy/discretion
  - No hygiene concerns
- No latency due to end-to-end analogue transmission

- T-coils can pick up electromagnetic interference – avoidable with an IEC60118-4 compliant installation
- Sound privacy requires appropriate loop design
- More complex and costly
- No stereo transmission
- Limited coverage area for one system
- Sensitivity to metal content







# INFRARED

## HOW IT WORKS

Sound is transmitted from a sound source, for example a person speaking, through a sound system to an Infrared transmitter with modulator, which sends the signal wirelessly into an area flooded with infrared light to a compatible receiver worn by the listener.

Sound is delivered from the receiver to the ear via a headset or to the hearing aid / cochlear T-coil coupler via a personal inductive neckloop<sup>\*\*</sup>.

## HOW TO ACCESS

Look for assistive listening system signs. Ask the venue staff for a receiver. If using a neckloop be sure to switch to the 'T' or 'MT' setting on the hearing aid(s).

## USER EXPERIENCE

- Requires hearing aid users to seek, use and return receivers with neckloops, stethoscopes or headsets\*
- Can identify the wearer as someone with hearing loss
- Neckloop users may experience weak signals and possible electromagnetic interference<sup>\*\*</sup>

## EQUIPMENT PERFORMANCE STANDARDS

- Neckloop must provide a signal compliant with IEC 60118-4
- Compliant with IEC 62489-1 if used
   with a neckloop

## ACCESSIBILITY STANDARDS

Compliant if receivers provided as defined by ADA Table 2193

## **APPLICATIONS**

- Classrooms and courtrooms
- Conference and meeting rooms
- Auditoriums, cinemas and theatres
- Hotels and hospitality
- Houses of worship
- Arenas and indoor stadiums
- Museums
- Retirement and nursing home lounges
- TV and home theatre lounges

 Approximately 1 in 8 persons with hearing loss prefers technology that requires a separate receiver
 IHLMA supports a precautionary approach for people with cardiac pacemakers. Users should maintain a 15 cm (6 inch) distance between the pacemaker and the neck loop cable. If in any doubt check with your physician.

## ADVANTAGES (OPERATORS)

- Relatively simple installation
- Sound signal does not transmit through walls (provides privacy)
- Multi-channel audio available

## ADVANTAGES (END USERS)

- Good alternative in terms of audio performance where hearing loops are not available
- Allows access to different/multiple
   audio streams
- Low latency

- Receivers required for all users
   (approx 1/25 seats)
- Receivers require battery
   replacement or recharging after use
- Facility owner time required to provide, explain, retrieve, and maintain receivers (hygiene concerns)
- Not suited for outdoor or walk up / walk through locations
- May require "line of sight" between transmitter and receiver
- Infrared technology is susceptible to strong sunlight, thus not suitable for venues with a high level of glass or glossy surfaces in sunlight



# FM / RADIO

## HOW IT WORKS

Sound is transmitted from a sound source, for example a person speaking, through a sound system into a FM radio frequency transmitter wirelessly to a receiver worn by the listener.

Sound is delivered from the receiver to the ear via a headset or to the hearing aid / cochlear T-coil coupler via a personal inductive neckloop<sup>\*\*</sup>.

## HOW TO ACCESS

Look for assistive listening system signs. Ask the venue staff for a receiver. If using a neckloop be sure to switch to the 'T' or 'MT' setting on the hearing aid(s).

## USER EXPERIENCE

- Requires hearing aid users to seek, use and return receivers with neckloops, stethoscopes or headsets\*
- Neckloop users may experience weak signals and possible electromagnetic interference<sup>\*\*</sup>
- Not suited for walk up / walk through locations
- Can identify the wearer as someone with hearing loss

## EQUIPMENT PERFORMANCE STANDARDS

- Neckloop must provide a signal compliant with IEC 60118-4
- Compliant with IEC 62489-1 if used
   with a neckloop

## ACCESSIBILITY STANDARDS

Compliant if receivers provided as defined by ADA Table 2193

## APPLICATIONS

- Classrooms
- Conference and meeting rooms
- Auditoriums and theatres
- Houses of worship
- Arenas and stadiums
- Museums and theme parks
- Hotels and hospitality
- Hospitals, retirement and nursing homes
- TV and home theatre lounges
- Tour groups
- Factories and manufacturing sites

\* Approximately 1 in 8 persons with hearing loss prefers technology that requires a separate receiver \*\* IHLMA supports a precautionary approach for people with cardiac pacemakers. Users should maintain a 15 cm (6 inch) distance between the pacemaker and the neck loop cable. If in any doubt check with your physician.

## **ADVANTAGES (OPERATORS)**

- Relatively simple installation
- Flexible listening locations
- Can be used outdoors
- Has a range of approximately 500
   feet / 153 metres
- Some systems offer secured signal
- Multi-channel audio available

## ADVANTAGES (END USERS)

- Ability to assist groups of people with hearing loss during tours or travel outdoors or indoors
- Allows access to different/multiple
   audio streams
- Low latency

- Receivers required for all users
   (approx 1/25 seats)
- Receivers require battery
   replacement or recharging after use
- Facility owner time required to provide, explain, retrieve, and maintain receivers (hygiene concerns)
- Frequency range can vary in different locations
- Some systems require license for FM/radio
- Can conflict with other RF devices in narrow license free frequency bands
- Privacy concerns if not encrypted



# AUDIO OVER WIFI

## HOW IT WORKS

Sound is transmitted from a sound source, for example a person speaking, through a sound system to an audio server connected to a WiFi network accessible wirelessly via a personal device i.e. a tablet or a smartphone.

Sound is then delivered from the device to a bluetooth equipped hearing aid or to the hearing aid / cochlear T-coil via a Bluetooth enabled neckloop or headset.

## HOW TO ACCESS

Ensure visitors are informed before they attend the venue to bring their own their device.

Provide secure access to and instructions on the required app. Provide alternative receivers for those without a Smartphone.

## USER EXPERIENCE

- Good for use in sports bars and fitness clubs
- Not yet widely available for assistive listening
- There can be significant latency (delay time) between voice and ear

## FQUIPMENT PERFORMANCE **STANDARDS**

- Neckloop must provide a signal compliant with IEC 60118-4
- Compliant with IEC 62489-1 if used with a neckloop

## ACCESSIBILITY STANDARDS

 Venue cannot guarantee compliance with ADA Table 219.3 if bring your own device is expected

## **APPLICATIONS**

- Airport, railway stations, bus stations
- Universities and colleges
- Conference halls and meeting rooms
- Auditoriums and theatres
- Houses of worship
- Arenas and stadiums
- Hotels and hospitality
- Hospitals
- Museums and parks

## ADVANTAGES (OPERATORS)

- Smartphones are widely available
- Freedom of movement across large areas without fluctuation of signal strength
- Multi-channel audio available
- "Bring your own devices" reduce venue management and hygiene concerns

- Requires a specific app for each network and each hearing aid manufacturer,
- Privacy limited by availability of WiFi access point log-on and password
- No sound quality installation standards
- A significant segment of the demographic do not have a smartphone
- Users must have head or earphones or the ability to connect via Bluetooth or a neckloop to their hearing aids
- Some hearing aid users do not have the cognitive and / or physical abilities to setup the smartphone
- Venues must ensure they have the infrastructure in place, and a highspeed local area network connection
- No peer reviewed studies are available on the benefits of WiFi systems for people with hearing loss

- audio streams



# COMPARISON TABLES

	"Hearing Loops and T-coils"	Infrared	FM / Radio	WiFi
APPLICATIONS	T-coil enabled device	IR receiver	FM receiver	Smartphone or receiver
Education				
Schools	√ √ √	$\checkmark \checkmark$	√	$\checkmark \checkmark$
Colleges	$\sqrt{\sqrt{\sqrt{1-1}}}$	$\checkmark \checkmark$	$\checkmark$	$\checkmark \checkmark$
Universities	$\sqrt{\sqrt{\sqrt{1-1}}}$	$\checkmark \checkmark$	$\checkmark$	$\checkmark \checkmark$
Entertainment and leisure				
Outdoor arenas and stadiums	$\sqrt{\sqrt{\sqrt{1-\frac{1}{2}}}}$	×	$\checkmark \checkmark$	$\checkmark$
Indoor arenas	√ √ √	$\checkmark \checkmark$	$\checkmark \checkmark$	√ √
Auditoriums, cinemas and theatres	√ √ √	$\checkmark \checkmark$	√	√
Museums	√ √ √	$\checkmark \checkmark$	√	√ √
Theme parks (outdoor use only)	√	×	$\sqrt{\sqrt{\sqrt{2}}}$	~~
Tour groups	-	-	$\sqrt{\sqrt{\sqrt{2}}}$	√
Corporate				
Conference centres and meeting rooms	√ √ √	$\checkmark \checkmark$	√	$\checkmark \checkmark$
Hotels and hospitality	√ √ √	$\checkmark \checkmark$	√	$\checkmark \checkmark$
Justice, law, prisons and probation				
Courtrooms	√√	$\checkmark \checkmark \checkmark$	✓ (if encrypted)	~~
Custody suites	√√	$\checkmark \checkmark \checkmark$	✓ (if encrypted)	~~
Interview rooms	√√	$\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{$	✓ (if encrypted)	√ √
Retail and service areas				
Service counters in banks, retail stores, food stores, airport, bus and train hubs	√ √ √	-	-	-
Ticket machines, ATMs, automatic check outs, door entry, lifts / elevators and intercom systems	~~~	-	-	-
Healthcare				
Hospitals, retirement and nursing homes	$\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{$	$\sqrt{}$	x	√
Medical devices	×	×	×	√



# COMPARISON TABLES

APPLICATIONS	"Hearing Loops and T-coils"	Infrared	FM / Radio	WiFi		
Requires	T-coil enabled device	IR receiver	FM receiver	Smartphone or receiver		
Transport						
Airports, railway stations, bus stations	$\checkmark \checkmark \checkmark$	×	$\checkmark \checkmark$	$\checkmark \checkmark$		
On board taxis, busses, trains, trams	$\checkmark \checkmark \checkmark$	×	×	$\checkmark \checkmark$		
In the home connections						
Beacons	-	-	-	$\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{$		
TV and home theatre lounges	$\checkmark \checkmark$	$\checkmark$	_	$\sqrt{\sqrt{\sqrt{1}}}$		
Places of worship	<ul> <li>✓✓</li> <li>Highly recommended</li> </ul>					
Halls of worship		$\sqrt{}$	$\sqrt{}$	$\sqrt{}$	<ul> <li>✓ Suitable</li> <li>✓ Ok but there are better alternatives</li> <li>× Unsuitable</li> <li>- Not applicable</li> </ul>	
Meeting rooms		$\sqrt{}$	$\checkmark$	$\sqrt{}$		
Counselling spaces	$\checkmark \checkmark$	$\checkmark \checkmark \checkmark$	×	×		

COMPLIANCE AND STANDARDS	"Hearing Loops and T-coils"	Infrared	FM / Radio	WiFi
Equipment performance standards	IEC 60118-4 IEC 62489-1	Neckloop must provide signal compliant with IEC 60118-		
Accessibility standards	ADA Standard 219 BS 8300 EN-17210	Compliant if receivers provided as defined by ADA Table 219.3		WiFi receivers be provided ac to ADA table in order to er complian



# CLARIFICATION REGARDING BLUETOOTH DEVICES

At the time of writing this guide there is a considerable amount of confusion and ambiguity surrounding Bluetooth technology in the world of assistive listening. To clarify:

**Bluetooth Classic** is available now and is used for personnel use, for example, pairing hearing aids to mobile phones, televisions and cars.

Currently hearing aid manufacturers work from a number of different and largely incompatible platforms. This means that personal accessories such as Bluetooth TV listening solutions from one manufacturer cannot be used with hearing aids from a different manufacturer.

In addition, Bluetooth Classic technology is not suitable for, or used in, public applications that require broadcast audio such as classrooms and courtrooms, conference and meeting rooms, auditoriums and theatres or houses of worship, to name just a few.

There has been some mention of a potentially new technology, Bluetooth LE, being developed to support multi-stream audio for a range of hearable products, for example ear buds, headsets, and over the counter hearing aids.

This technology is **not yet available** and before it becomes avaialable hearing aid manufacturers will require common protocols and standardisation across all brands.

If common standards and protocols are agreed upon then the introduction of this technology will not happen overnight and will have to be developed in stages. It will also need to meet any relevant technical *and* accessibility standards including those of:

- audio quality
- audio latency
- access and availability
- impact on the hearing aid
- access for non-hearing aid users
- coverage
- security
- signage and instruction
- monitoring and maintenance
- compatability

Like any new technology, Bluetooth LE or its equivalent, will have to prove that it is fit for purpose and that it can provide a benefit to people who experience hearing loss.

It will take a considerable period of time to transition to new technologies even if they successfully meet the requirements of a fully functional assistive listening solution.

As a group we at IHLMA expect this transition to take several years and feel it is paramount that any new systems are delivered in conjunction with existing technologies to ensure end users are provided with the appropriate access suited to their needs via their preferred channels.

This guide will be updated periodically to include any new developments in any of the assistive listening technologies available or in development.



# USEFUL SOURCES OF INFORMATION

## **ADVOCACY GROUPS**

- Age UK
- British Deaf Association
- Carers UK
- Deafness Resource Centre
- DeafPlus
- Healthy Hearing
- Hearing Loss Association of America
- RNID
- Saga
- The Deaf Institute
- The Hearing Review
- The Salvation Army

## PROFESSIONAL BODIES

- British Society of Audiology •
- British Society of Hearing Aid • Audiologists
- British Academy of Audiology
- American Academy of Audiology
- National Deaf Children's Society
- Academy of Doctors of Audiology • (ADA)
- National Institute on Deafness and Other Communication Disorders (NIDCD)
- International Society of Audiology •
- Canadian Academy of Audiology
- American Speech-Language-Hearing Association (ASHA)
- Danish Association for Better Hearing • (organisation for the hard of hearing)

- European Federation and Hard of Hearing (EFHOH)
- Other Audiological societies
- Nordic Audiological Society
- Estonian Society of Audiology (ESA)
- Finnish Audiological Society
- Société Française d'Audiologie
- Deutsche Gesellschaft für Audiologie
- Icelandic Audiological Society
- Icelandic Hearing Society
- (organisation for the hard of hearing)
- Icelandic Otolaryngological Society
- Irish Academy of Audiology iada.ie
- The Israeli Speech Hearing and Language Association
- Italian Society of Audiology and Phoniatry - Società Italiana di Audiologia e Foniatria (S.I.A.F.)
- Italian Society of Audiometry
- Technicians Associazione Italiana Tecnici Audiometristi (AITA)
- Nederlandse Vereniging voor Audiologie (NVA)
- Norsk Audiografforbund (The Norwegian Association of Audiologists)
- Norwegian Association of Audiology Assistants
- Norges Døveforbund (The Norwegian Association of the Deaf)
- Hørselshemmedes Landsforbund (The Norwegian Association for the Hard of Hearing)

- Norsk Forening for otorhinolaryngology hode- og halskirurgi
- (Norwegian Assosiation for Otorhinolaryngology, Head - and Neck surgery)
- Norsk Audiopedagigisk Forening (Norwegian Association of Audiotherapists)
- Norsk Teknisk Audiologisk Forening (Norwegian Association for Technical Audiology)
- Audiological Section, Polish Society of Otorhinolaryngologists, Head and Neck Surgeons
- Associação Portuguesa de Audiologistas (APtA)
- Romanian Society of Audiology
- Russian Society of Audiology
- Section of Audiology, Slovak Society of ORL HNS
- Associacion Espanola de Audiologistas (AEDA)
- Swedish Society of Audiology (Svenska Audiologiska Sällskapet, SAS)
- Audiologie-Kommission, Swiss Society of Oto-Rhino-Laryngology, Head and Neck Surgery

## FQUIPMENT PERFORMANCE **STANDARDS**

- IEC 60118-0:2015 Electroacoustics - Hearing aids
- IEC 60118-4:2014+AMD1:2017 CSV Electroacoustics - Hearing aids
- IEC 62489-1:2010+AMD1:2014+A MD2:2017 CSV Electroacoustics -Audio-frequency induction loop systems for assisted hearing
- IEC 62489-2:2014 Electroacoustics - Audiofrequency induction loop systems for assisted hearing
- IEC TR 63079:2017 Code of practice for hearing-loop systems (HLS)
- ETSI EN 300 422-4 V2.1.1 (2017-05) Wireless Microphones; Audio PMSE up to 3 GHz

## CONTACT IHLMA

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admin@ihlma.org +44 (0) 118 954 2175 www.ihlma.org

## ACCESSIBILITY STANDARDS

- ADA Standards for Accessible Design
- BS 8300 Design of an accessible and inclusive built environment.
- EN-17210 Accessibility and usability of the built environment.

## GLOSSARY

## А

### ADA Standard 219:

Refers to the American Disabilities Act (ADA) General Guidelines (2010) Section 219 which require assistive listening systems in spaces where communication is integral to the space and audio amplification is provided and in courtrooms.

#### Assistive Listening Technology:

A device or system that enables people with hearing loss to access sound being transmitted through a sound system or public address system.

#### Audio over WiFi:

Enables wireless transmission of audio via a WiFi network, allowing the user's own device (smartphone or tablet) to act as the receiver.

### В

### Bluetooth / Bluetooth Classic:

The Bluetooth Classic radio, also referred to as Bluetooth Basic Rate/ Enhanced Data Rate (BR/EDR), is a low power radio that can continuously stream data over 79 channels in the 2.4GHz unlicensed industrial, scientific, and medical (ISM) frequency band.

### Bluetooth LE (BLE):

The Bluetooth Low Energy (LE) radio is designed for very low power operation. Transmitting data over 40 channels in the 2.4GHz unlicensed ISM frequency band like Classic Bluetooth. However, BLE remains in sleep mode constantly except for when a connection is initiated. Power consumption is lower and data rates are higher than Classic Bluetooth but connection is not continuous.

### BS 8300:

Design of buildings and their approaches to meet the needs of disabled people. Code of practice.

BS 8300 looks at the design of buildings and their ability to meet the requirements of disabled people. By offering best-practice recommendations, this standard explains how architectural design and the built environment can help disabled people to make the most of their surroundings.

## D

### Decibels (dB):

A decibel (dB) is a unit measurement of amplitude, or the intensity, pressure or forcefulness of a sound. 0dB is near silence, 10dB is 10x louder than near silence, but as the dB scale is logarithmic 20dB is 100x louder than near silence.

### F

#### Electromagnetic interference (EMI):

EMI is the interference caused by one electrical or electronic device to another by the electromagnetic fields generated by its operation.

### BS EN 17210:

Accessibility and usability of the built environment. Functional requirement. This document describes basic, minimum functional requirements and recommendations for an accessible and usable built environment which will facilitate equitable and safe use for a wide range of users, including persons with disabilities.

## 

#### FM (frequency modulation) radio:

Radio waves are electromagnetic waves of frequency between 30 hertz (Hz) and 300 gigahertz (GHz). Frequency modulation or FM is a form of modulation of a radio signal which conveys information by varying the frequency of a carrier wave.

## Н

### Hearing Loop:

Hearing loops, audio induction loops, or audio frequency induction loops (AFILs) are an assistive listening technology that uses a loop or loops of cable or copper tape around a room or area. An amplified sound signal from a sound system or microphone is input into a hearing loop driver or amplifier which in turn drives a current around the loop creating an electromagnetic field. That field can then be picked up by a Telecoil / T-coil in a hearing aid, cochlear implant or loop receiver which transmits the received signal into the devices amplifier and speaker and into the ear.

### Hearing loss:

Hearing loss is a common problem caused by noise, aging, disease, trauma and heredity. The four different levels of hearing loss are defined as: Mild (25-45dB loss), Moderate (40-75dB loss), Severe (75-90dB loss) and Profound (>90dB loss)

## IEC60118-4:

60118-4 and include:

#### IEC 62489-1:

Electroacoustics - Audio-frequency induction loop systems for assisted hearing - Part 1: Methods of measuring and specifying the performance of system components This standard applies to the components of audio-frequency inductionloop systems for assisted hearing. This standard is intended to encourage accurate and uniform presentation of manufacturers' specifications, which can be verified by standardized methods of measurement.

System performance requirements. Electroacoustics – Hearing aids – Part 4: Induction-loop systems for hearing aid purposes.

The performance criteria for hearing loops are set out in standard IEC-

 low magnetic background noise - for intelligibility and comfort • correct field strength - setting a suitable signal level even field strength - for consistency of signal flat frequency response - essential to maintain intelligibility

### Infrared:

Infrared (IR), sometimes called infrared light, is electromagnetic radiation (EMR) with wavelengths longer than those of visible light. It is therefore invisible to the human eye.

An infrared sound system consists of infrared transmitters, radiators and receivers. The radiator produces infrared light from an input source supplied via the transmitter and captured via a microphone or PA source. Wireless, IR receivers convert the light signal into an audio signal that can be listened to using headphones or connected to a hearing aid via neck-loop.

### Latency:

Latency is a short period of delay (usually measured in milliseconds) between when an audio signal enters a system and when it emerges. Potential contributors to latency in an audio system include analogto-digital conversion, buffering, digital signal processing, transmission time, digital-to-analog conversion and the speed of sound in the transmission medium. Latency can be a critical for assistive listening solutions and sound reinforcement systems. Excessive audio latency can significantly a users experience

#### Loop receiver:

A loop receiver is a device fitted with a Telecoil / T-coil allowing it to pick up signals from a hearing loop. This enables those without hearing aids or cochlear implants to hear the audio output of a loop system.

### Ο

### OEM:

An original equipment manufacturer (OEM) is generally perceived as a company that produces parts and equipment that may be marketed by another manufacturer.

### S

#### Signage:

Signs indicating the availability of a hearing loop or other assistive listening technology are an essential part of an assistive listening system. It allows users to identify where a service is available and, in the case of hearing loops, hearing aids and cochlear implants, discreetly switch their device over to the T or MT setting giving them access to the audio output of the loop. For WiFi systems signs can point to an app using a QR code or web link. For other technologies

such as Infrared or FM/Radio correct signage indicates a service is available and where to obtain a receiver.

### Signal to noise ratio:

SNR or signal-to-noise ratio is the ratio between the desired information or the power of a signal and the undesired signal or the power of the background noise.

## Telecoils, T-coils:

A telecoil is a small coil of wire wrapped around a small rod inside most behind the ear, receiver in the ear and open fit hearing aids. The coil works as a small receiver which picks up signals from a hearing loop system or neckloop that acts as an electromagnetic field. Hearing aids with an activated telecoil can convert this electromagnetic field into a sound signal.

## W

Т

WiFi:

WiFi is a family of wireless network protocols, based on the IEEE 802.11 family of standards, which are commonly used for local area networking of devices and Internet access, allowing nearby digital devices to exchange data by radio waves.

> NHLMA International Hearing Loop Manufacturers Association

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## **INFORMATION SOURCES**

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5 Juliëtte P.M. Sterkens, AuD HLAA Professional Advisor for Hearing Loop Technology

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3. Unpublished document by R. Bishton, BC-HIS Created June 2010, Revised August 2010, March 2011, October 2011, Updated with BT and WiFi March

7 RERC Assistive Listening Devices Project by Mark Ross, Ph.D., Matthew

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