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Fast Forward: Bluetooth LE Audio Past Present and Future



Jill Mecklenburger, AuD
Principal Audiologist, ReSound

Learning Outcomes

- Explain the evolution of wireless technology
- Describe the recent changes to the applications of Bluetooth technology in hearing aids
- Discuss how Bluetooth Low Energy Audio will improve daily outcomes for patients



Wireless Foundations

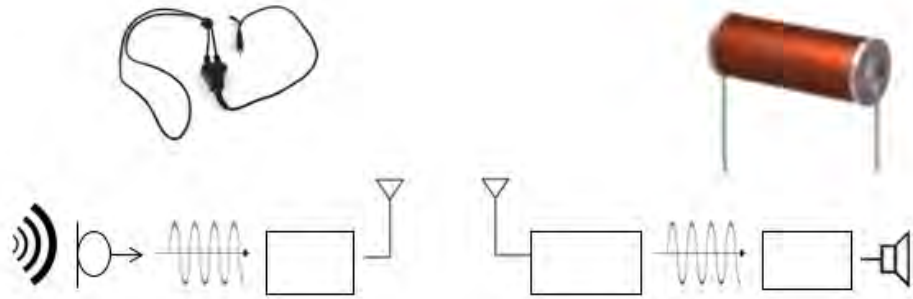


- People with hearing loss often struggle to hear well in public places with high reverberation and surrounding noise
- Loop systems and telecoil
- FM systems
- Infrared receivers

Telecoils: The First Wireless System

Loop systems and telecoils work together with hearing aids to help hard of hearing people hear better.

The signal is transmitted as an electromagnetic radiation and requires a telecoil in the hearing instrument.



Pros and cons of looping

Pros

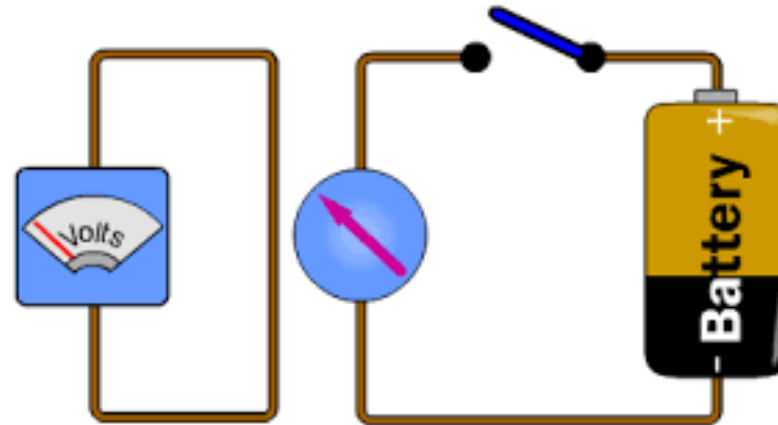
- Mature technology
- Easy to use
- Available in many hearing aids
- Standardized
- Signposts well-established

Cons

- Mediocre sound quality
- Susceptible to interference
- Complex installation
- Only commonly used in some countries
- Sound level varies with position

Radio Transmission

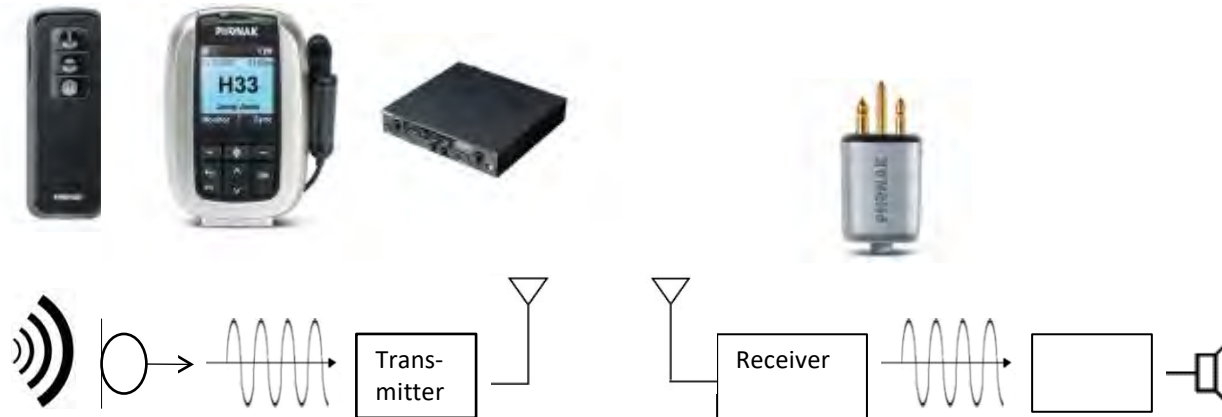
- Any wireless radio system requires 2 basic components
 - Transmitter & Receiver
- A basic example of a radio is demonstrated by placing two small wires in proximity and flipping the current on and off
- A volt meter attached to the second loop will measure a change in the distant loop



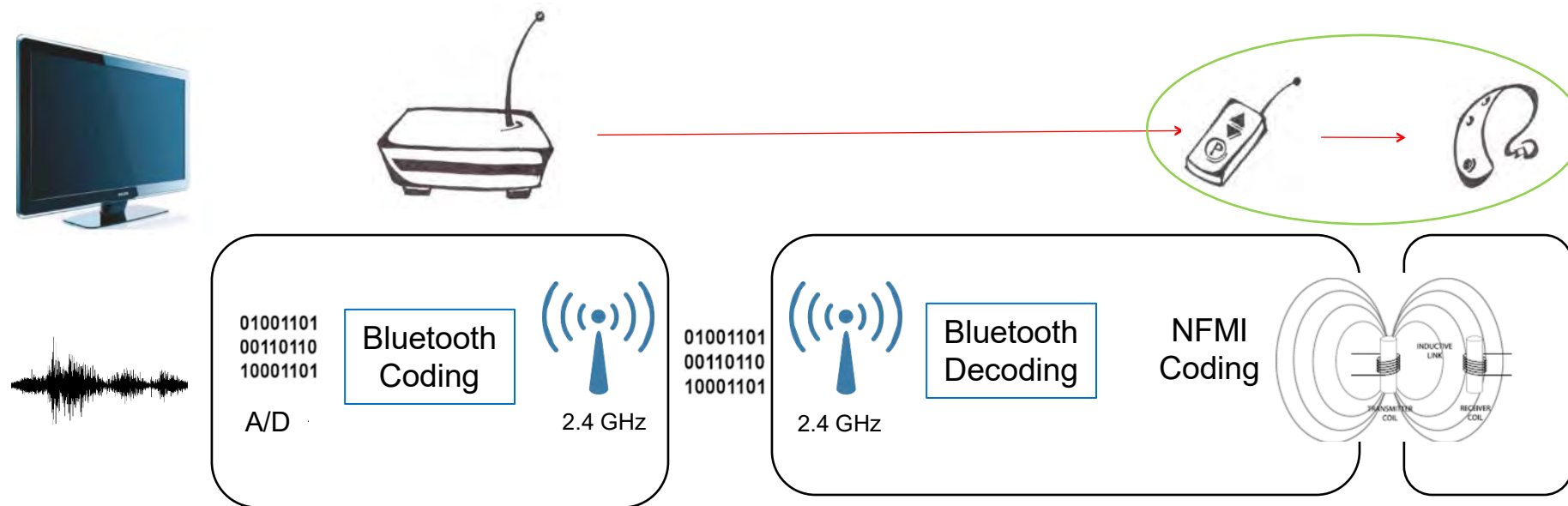
FM Systems: The Prior Industry Standard

The person speaking wears or holds a transmitter microphone, or the transmitter is placed in the middle of the group (picking up speech from all around).

Using radio waves, the FM system sends speech signal(s) to the listener, who wears an FM receiver.

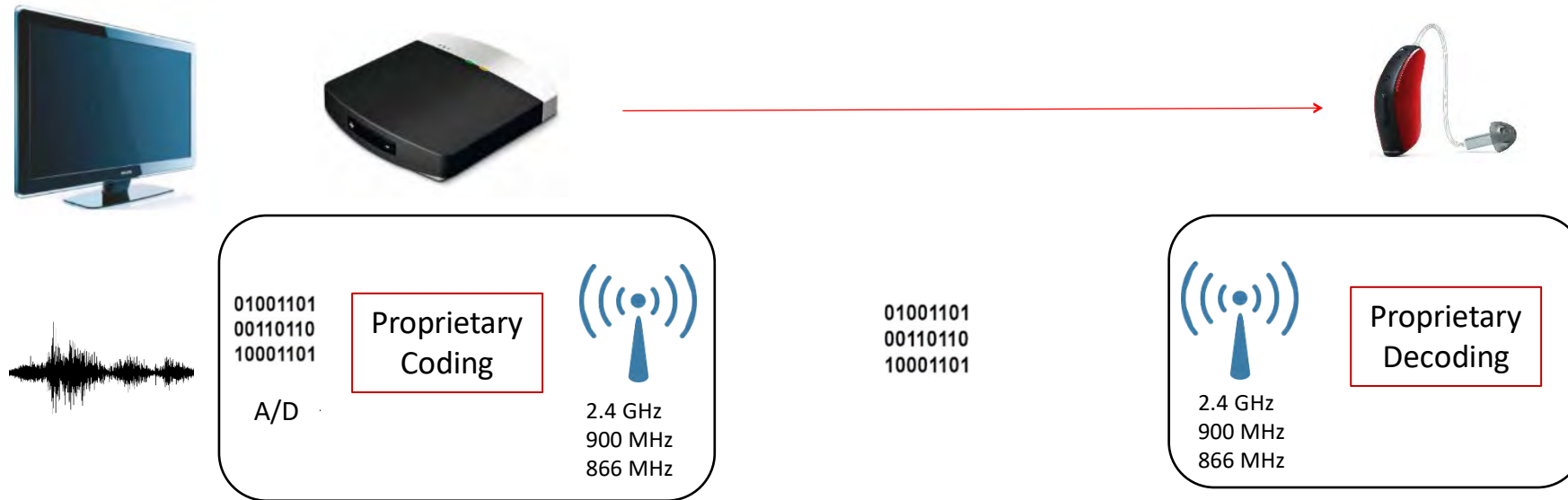


Near Field Magnetic Induction (NFMI): First BT radio in HAs

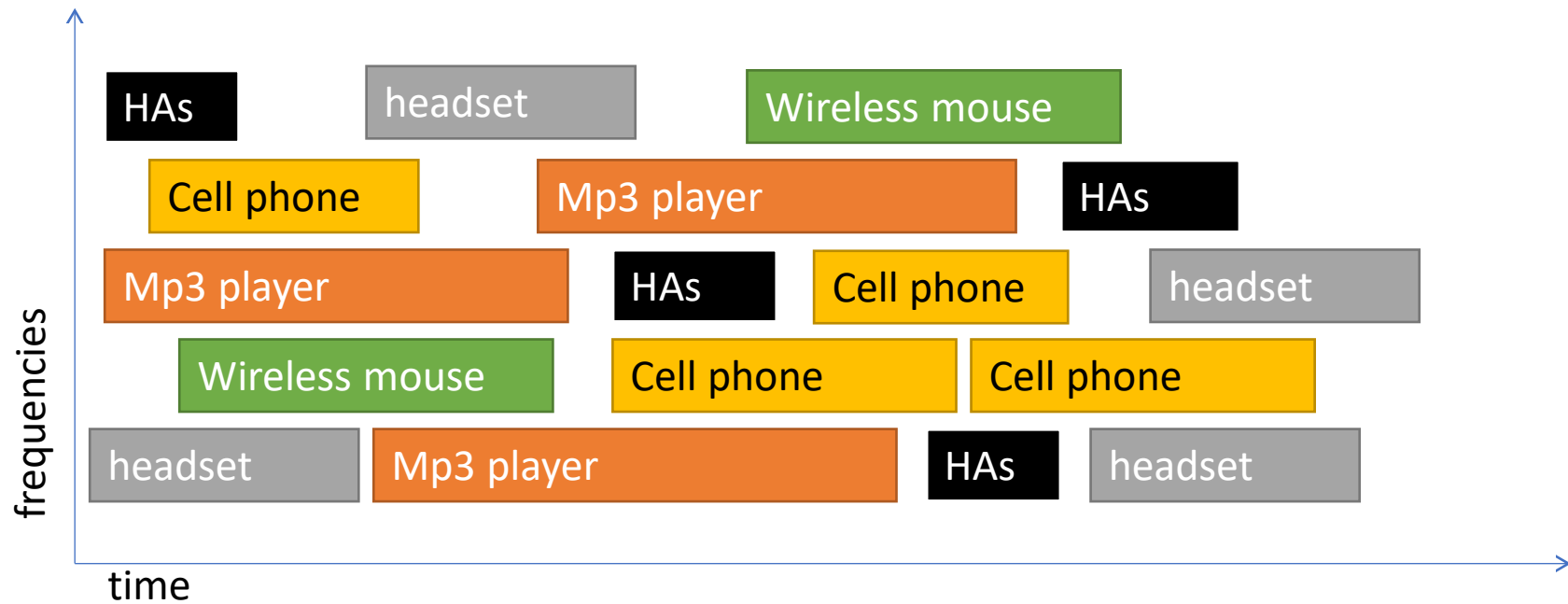


Bluetooth radio frequency used for communication between an accessory and a “Gateway device” and NFMI transmission is used from the “Gateway device” to the hearing instruments.

Proprietary Radio Frequency Systems



2.4 GHz radio frequency



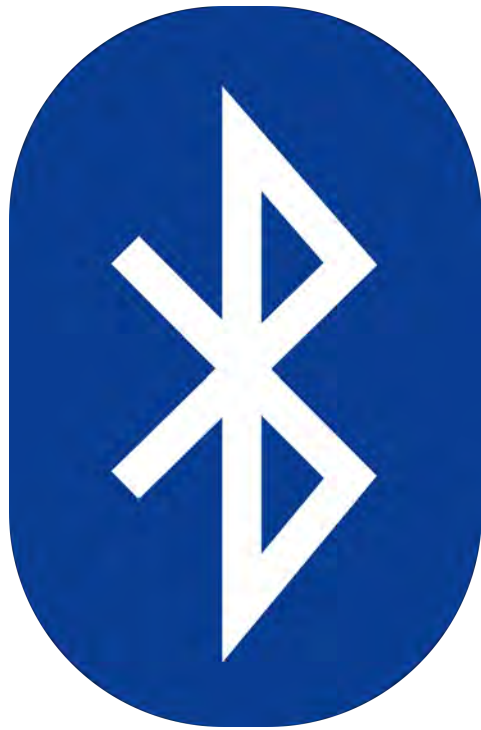
Devices agree on transmission frequency to send and receive each data packet

Bluetooth & Bluetooth Low Energy/Bluetooth Smart

- Latency for Bluetooth protocol exceeds 40ms and is often up to 125ms depending on the audio compression technique used
- Combinations of the streamed sound with amplified sound or direct sound of this magnitude are perceptible as echoes and even lip synch issues when watching television (Reeves & Voelker, 1993)
- Bluetooth Smart eliminated the 'audio' channel to allow for fast and efficient transmission of data



Fun Fact: What is the Origin of the Bluetooth Logo?



Bluetooth SIG Collaboration

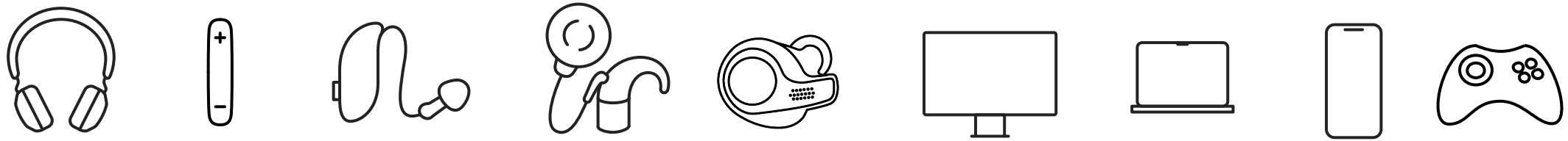
EHIMA
members

GN Hearing, Demant, Sonova, Starkey WS Audiology, Med-El, Amplifon

- In 2013 EHIMA approached the Bluetooth Special Interest Group (SIG) with a request to develop a new version to include hearing aids. The key requests were:
 - A dedicated hearing aid profile (HAP)
 - A new CODEC with lower latency
 - A broadcasting mode
- Bluetooth® is attractive because it works in the ISM band from 2.3 to 2.4 GHz.
- Bluetooth SIG accepted the challenge and a long journey started for the development of the next generation Bluetooth®



Bluetooth LE Audio



Connect to anything, anywhere

3 BILLION

Bluetooth LE Audio
enabled devices will ship
annually by 2027

ABI Research, 2023

Benefits of Bluetooth LE Audio



Higher sound quality,
lower power

The clearest streamed sound
with the lowest latency and
battery consumption for all-
day streaming



Multi-stream

Connect to multiple devices
simultaneously

Two-way communication:
makes possible hands-free
calls in Android phones



 **AURACAST™**

Broadcasting and audio
sharing

In personal electronic
devices and public places

NEW LC3 CODEC

Higher sound quality,
lower power

Preferred sound quality over
Classic Bluetooth even at
lower bit rates.

Bluetooth® Codec Comparison

Standard Stereo Listening Test



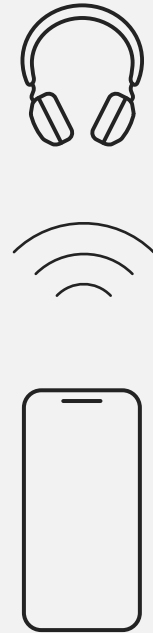
Source: FORCE Technology, SenseLab



Bluetooth versions: key distinctions

	Bluetooth Classic	Bluetooth Low Energy	
		MFi and Android Streaming	Bluetooth LE Audio
Pros	• Good sound quality • Widely used (more than 5 billion devices by 2021)	• Good sound quality • Low battery consumption • Low latency	• Enhanced sound quality • Low battery consumption • Low latency • Universal and future proof • Flexible, better for developers • Allows for new experiences and applications
Cons	• Battery hungry, not ideal for hearing aids • High latency • Not optimal for developers • Soon to be obsolete	• Not universal	• Emerging technology. Not yet broadly implemented

What is Auracast broadcast audio?



Classic Bluetooth

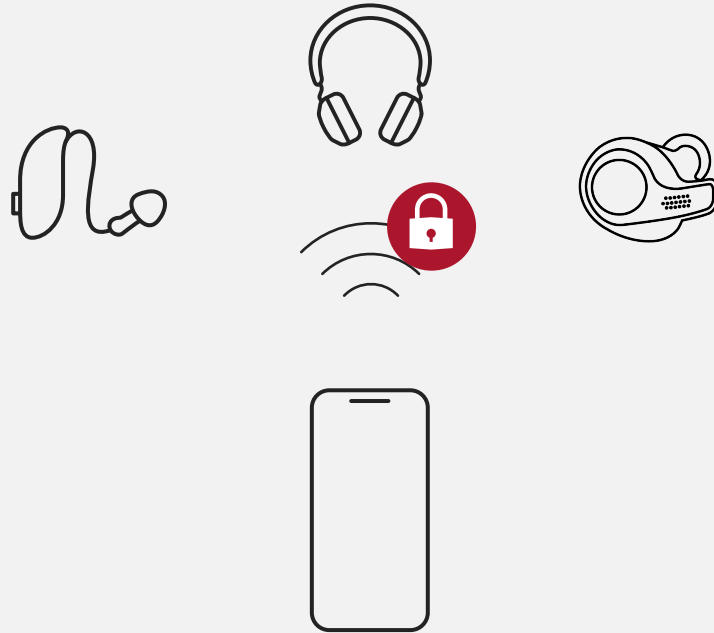
Only allows for one-to-one communication between devices



Auracast Broadcast Audio

Auracast will allow electronic devices to broadcast audio simultaneously to an unlimited number of nearby audio devices with Bluetooth LE Audio

Where can I enjoy Auracast?



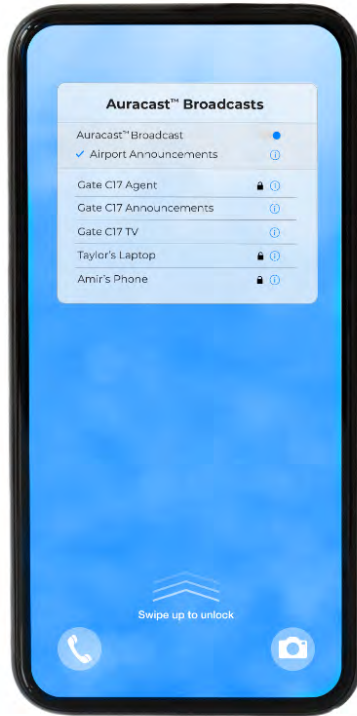
Personal electronic devices



Public places

Auracast broadcast audio can be public for everyone, or private with a password

3 easy ways to join Auracast



1 With a smartphone, similar to connecting to WIFI

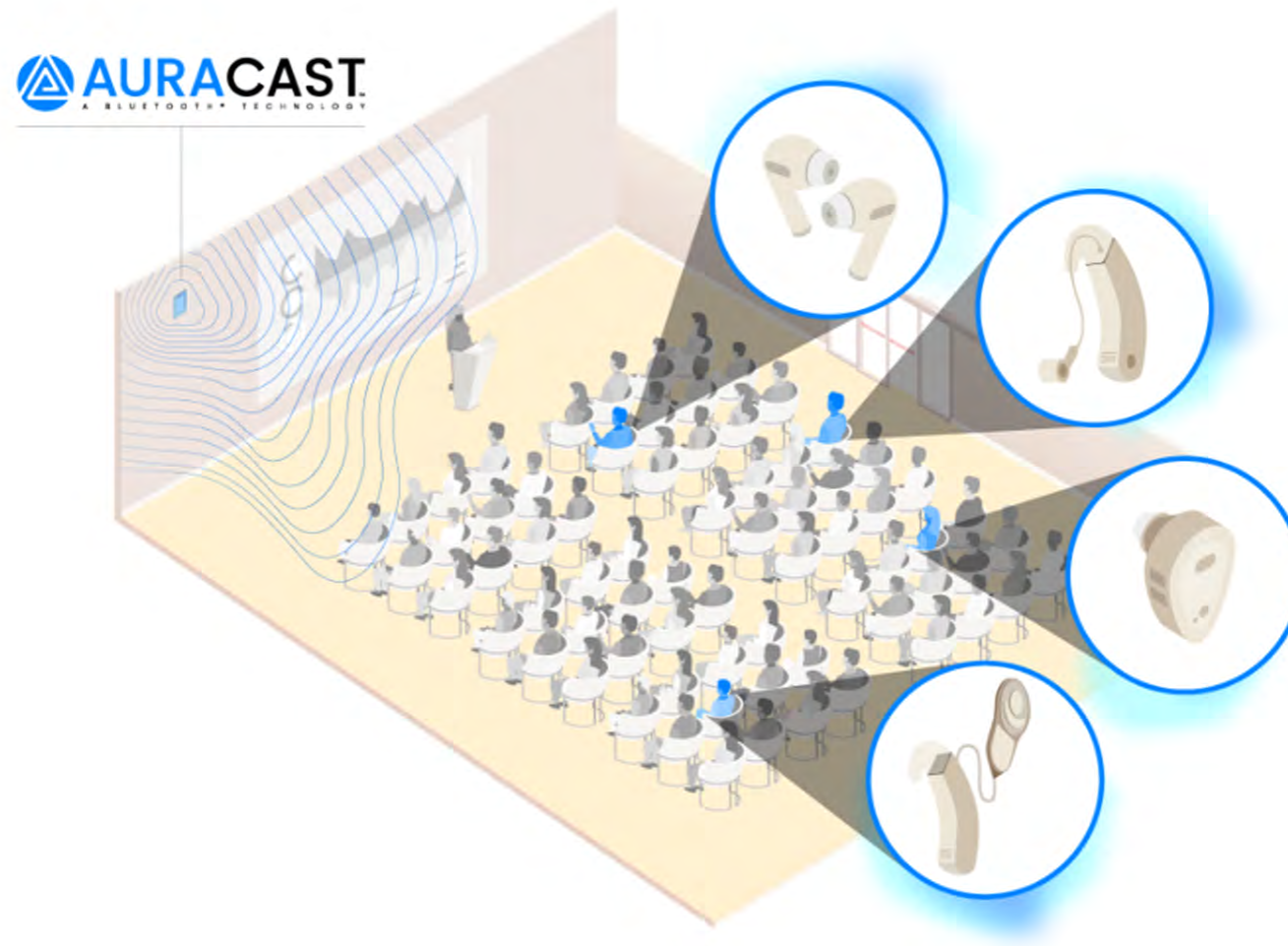


2 A simple scan of a QR code



3 Tapping a dedicated button

Broadcasting



Auracast will make the world more hearing friendly and accessible for everyone



Share your audio

Shared listening and watching from your personal device



Hear your best

Public address and assistive listening

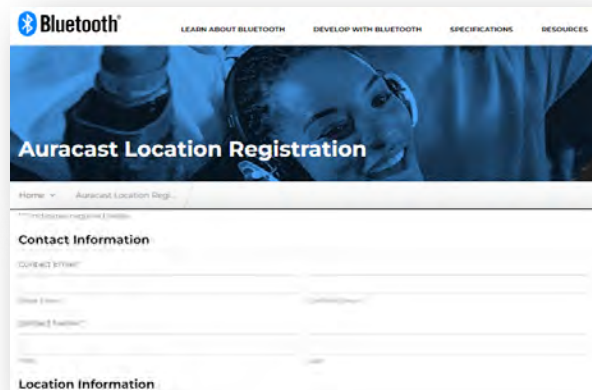


Unmute your world

Public TV watching

Auracast concept

- Detailed specifications and requirements – qualification is required
- Branding is in place with logos, signs and rules
- Guidelines for how to design Auracast™ transmitters
- Guidelines for how to deploy Auracast™ transmitters
- Registration database for locations with Auracast™ with public access



Auracast™ Simple Location Deployment Best Practices Guide

Bluetooth® Informational Publication

- **Revision:** r05
- **Revision Date:** 2022-11-08
- **Group Prepared By:** Market Development
- **Feedback Email:** aspt-main@bluetooth.org

Abstract:

This document provides recommendations to manufacturers and installers of Auracast™ broadcast audio transmitters and systems. The purpose of this document is to assist manufacturers in providing guidance to installers, ensuring uniform access to Auracast broadcast audio at any location or venue claiming support for Auracast. This document will focus on a simple location deployment configuration, recommendations and considerations. Deployment and configuration recommendations for more complex use cases may be inferred from this document but not explicitly covered.

Broadcasting to All

- Transmission sends out a “broadcast” similar to radio
- Bluetooth® has never allowed multiple users to share an audio stream
- Closest industry has is neck loops/hearing loops
 - Not everyone has a t-coil
 - Not all public venues
 - Sometimes less than ideal sound quality/ volume issues
- Single Bluetooth® signal will broadcast to anyone who has an Auracast™ enabled device



Endless Possibilities

Silent screens



Guided/audio tours



Multi-language support



Lecture halls



Theater/auditorium



Normalizing Hearing Loss

- Stigma deeply connected to hearing loss
- Stigma is one of the greatest challenges for hearing aid adoption
- Person sitting next to you can be receiving the same broadcast
- Breaking down the isolation barriers

Areas Of Impact On Patient / Daily Outcomes

- Aural rehab/Speech therapy
- School/University
- Workplace
- Quality of life (QoL)



Nexia Full Family

Custom made



NXCIC

NXITE-DWC

CIC

10A battery

ITE/ITC

Rechargeable

RIE



NX60S-DRWC

NX61-DRW

NX62-DRW

Micro RIE

Rechargeable

Standard RIE

312, 13 battery

BTE



NX77-DRW

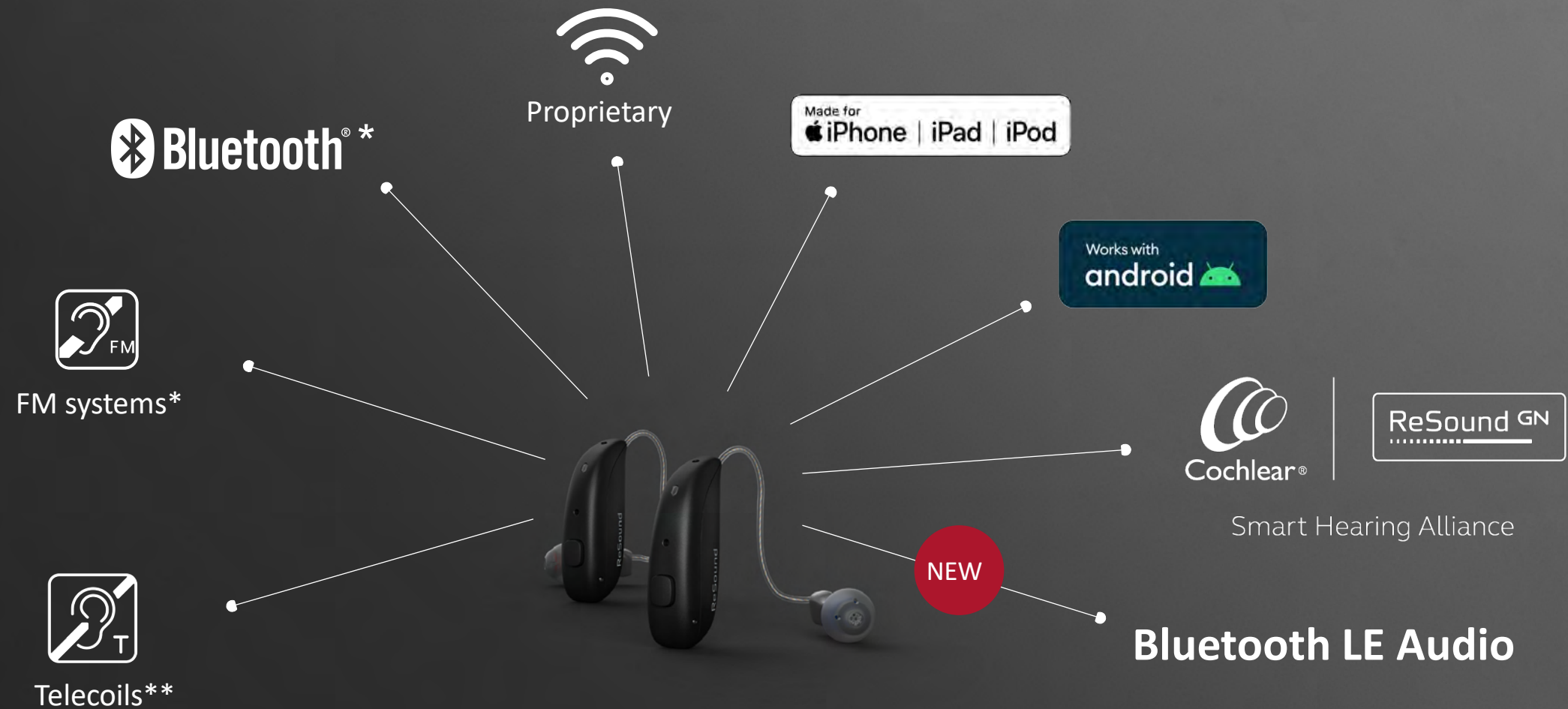
NX88-DWC

BTE

Rechargeable

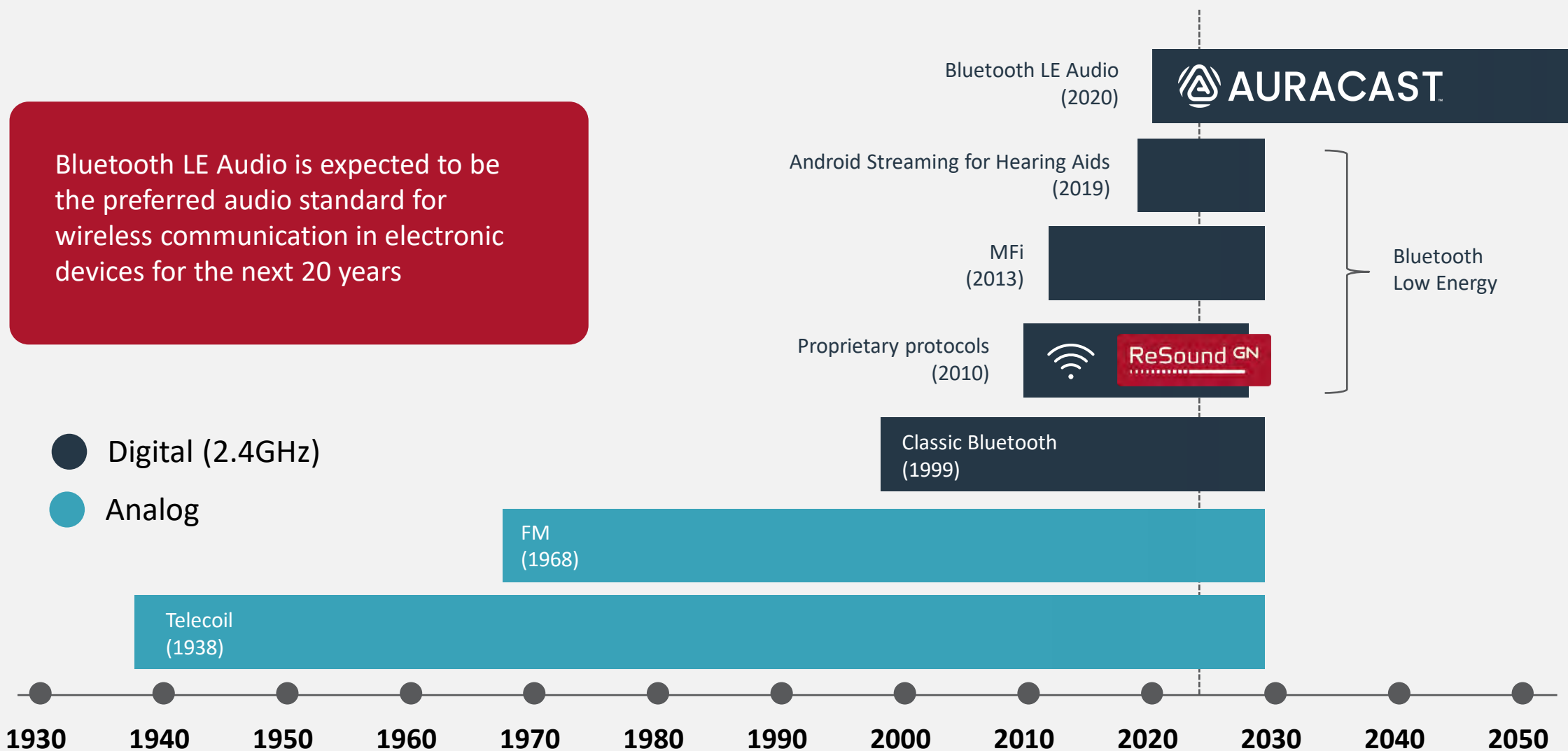
PBTE

ReSound Nexia: ready for the future



* With wireless accessory
** With wireless accessory or in selected models

Fast Forward: Past, Present and Future!



Key Takeaways

- Auracast will be the future system for wireless transmission of audio signals in multiple locations and for many types of users
- Auracast will exist in parallel with loop systems for several years
- Auracast will bring significant user benefits to hearing aid users
- All types of hearing aids will with time be Auracast™ enabled
- Broad applicability beyond hearing aids and modest cost will ensure rapid deployment