HEAD acoustics

APPLICATION EXAMPLES INCLUDED

Bluetooth®

AURACAST™
A B L U E T O O T H ® T E C H N O L O G Y

Code 7805/7788/7789

Bluetooth® LE Audio
*lab*CORE Extensions

Unicast Streams and Auracast™ Broadcast Audio with *lab*CORE

OVERVIEW

Bluetooth LE Audio *lab*CORE Extensions

coreBT2LE-EVO (Code 7805)

*lab*CORE I/O Module, Bluetooth reference access point Version 3, Base for Low Energy Audio (LC3)

*core*BT2LE-EVO is the base for the hardware platform *lab*CORE to become a reference access point for Bluetooth® Low Energy applications such as Unicast and Auracast™ broadcast audio. *lab*CORE requires further extensions such as *core*BT2LE-Unicast or *core*BT2LE-Auracast for enabling acoustic and electrical measurements of devices for speech and audio transmission via Bluetooth Low Energy. The applied audio codec for the signal transmission is LC3. It operates at low latency, low computational complexity, and has a low memory footprint. It assures high speech and audio transmission quality. *lab*CORE uses the supplied USB transceiver to connect to appropriate devices as well as for exchanging signals.

coreBT2LE-Auracast (Code 7788)

*lab*CORE Bluetooth Low Energy Audio (LC3), Option Auracast (*core*BT2LE-EVO Required)

*core*BT2LE-Auracast is a software extension for *core*BT2LE-EVO. *core*BT2LE-Auracast together with *core*BT2LE-EVO enables *lab*CORE to apply Auracast™ broadcast audio. Thus, *lab*CORE allows acoustic and electrical measurements of Auracast transmitters or Auracast receivers for speech and audio transmission.

KEY FEATURES

*core*BT2LE-EVO

Bluetooth Low Energy technology

Bluetooth Core v5.4

LC3 Audio Codec

Basic equipment for making *lab*CORE a Bluetooth reference access point to apply Bluetooth Low Energy Audio

Bluetooth LE Audio Transceiver

*core*BT2LE-Auracast

Bluetooth reference access point for application of Auracast™ broadcast audio

Supporting Auracast broadcast audio streams
› Apply *lab*CORE as Broadcast Media Receiver (BMR) or Broadcast Media Sender (BMS)

*core*BT2LE-Unicast

Bluetooth reference access point for application of Unicast audio

Enabling *lab*CORE to take profile roles as specified in the Bluetooth profile specification *Telephony and Media Audio Profile*:
› Apply *lab*CORE as Call Gateway (CG) or Call Terminal (CT)
› Apply *lab*CORE as Unicast Media Receiver (UMR) or Unicast Media Sender (UMS)

coreBT2LE-Unicast (Code 7789)

*lab*CORE Bluetooth Low Energy Audio (LC3), Option Unicast (*core*BT2LE-EVO Required)

*core*BT2LE-Unicast is a software extension for *core*BT2LE-EVO. *core*BT2LE-Unicast together with *core*BT2LE-EVO enables *lab*CORE to become a reference access point that applies the Unicast profile roles. Thus, *lab*CORE can send and receive Unicast streams. This allows acoustic and electrical measurements of Bluetooth Low Energy devices for speech and audio transmission.

APPLICATIONS

*core*BT2LE-Auracast

Performing acoustic and electrical measurements of capable devices for Auracast broadcast audio

Typical capable devices are:

› Headsets, earbuds, and headphones
› Wireless speakers
› Smartphones
› Hearing Aids
› Computers
› Laptops
› Televisions

*core*BT2LE-Unicast

Performing acoustic and electrical measurements of capable Bluetooth LE Audio devices

Typical capable devices are:

› Headsets, earbuds, and headphones
› Smartphones
› Automotive head units
› Hearing Aids
› Computers
› Laptops
› Wireless Speakers
› Televisions

DETAILS

Bluetooth Low Energy expands the communication topology of the Bluetooth signal, thus enhancing voice transmission, audio streaming, and broadcasting. This enables call transmission via Bluetooth LE Audio, one-way audio streaming, or broadcasting. Features, stats and functions are specified in the top-level profiles *Telephone and Media Audio Profile* (TMAP) and *Public Broadcast Profile* (PBP). In practice, this presents use cases like conducting a telephone call, listening to music, and receiving broadcasts with one device that applies the audio codec (LC3). The application of Unicast and Auracast broadcast audio via Bluetooth Low Energy together with HEAD acoustics measurement technology helps optimizing and enhancing the quality of audio signals of devices that apply to TMAP and/or PBP.

DESCRIPTION

*lab*CORE Bluetooth LE Stack

The stack for Bluetooth Low Energy included in the *lab*CORE firmware – combined with the corresponding controller – enables *lab*CORE to act as transmitter or receiver of Bluetooth Low Energy signals. The audio codec for applying Auracast broadcast audio with Bluetooth Low Energy is LC3. The codec operates at low latency, low computational complexity, and has a low memory footprint.

LC3 Codec

The LC3 codec assures high speech and audio transmission quality (super-wideband). Thus, the EVS speech quality in VoLTE/VoNR calls is maintained while using Bluetooth. Therefore, *core*BT2LE-Unicast enables measurements with super-wideband signal transmission of Bluetooth devices applying the hands-free profile. Furthermore, LC3 ensures high audio quality when transmitting audio media with a bit rates from 160 kbps to 345 kbps at a sampling rate of up to 48 kHz.

Unicast

*core*BT2LE-Unicast is a software extension for *core*BT2LE-EVO. It enables *lab*CORE to apply Unicast audio while connecting with devices that comply with TMAP profile roles. *core*BT2LE-Unicast supports different profile roles for two applications:
› Uincast telephone call
› Unicast Media

Unicast Telephone Call

*lab*CORE can take both profile roles in telephone calls via Unicast Audio. On the one hand, it acts as the call gateway (CG) and connects to the call terminal (CT) such as, e.g., a headset or a car head unit. On the other hand, *lab*CORE takes the role of the call terminal and the call gateway (e.g., a smartphone) connects to *lab*CORE.

Unicast Audio

*lab*CORE can take both profile roles for audio media via Unicast Audio. As a Unicast media sender (UMS), *lab*CORE transmits audio media to the connected Unicast media receiver (UMR) such as, e.g., headsets, headphones, or loudspeakers. Vice versa, *lab*CORE can receive audio media as UMR connected to a transmitting UMS like, e.g., a hi-fi system or a television.

AURACAST™ Broadcast Audio

HEAD acoustics provides *core*BT2LE-Auracast as a software extension for *core*BT2LE-EVO. It enables *lab*CORE to apply Auracast broadcast audio. There are two applications for *lab*CORE with Auracast broadcast audio. Firstly, *lab*CORE acts as Auracast transmitter. Hence, it provides Auracast audio streams for appropriate Auracast receivers to assess their audio quality. Connection parameters and encryption settings for the Auracast broadcast are determined via the general user interface in ACQUA. Secondly, *lab*CORE is also capable of receiving an Auracast broadcast from an Auracast transmitter and forwarding the audio signal to ACQUA for assessing the audio quality.

PROFILES AND SERVICES

Profiles and services of the Bluetooth LE Audio architecture specify requirements, behavior, and states for appropriate devices. Thus, devices can provide various features, operate different functions, or switch between functions.

Supported Profiles for Auracast

Public Broadcasting Profile (PBP)
› Basic Audio Profile (BAP)
   Profile for setting up and managing Auracast streams

Supported Profiles for Unicast

Telephony and Media Audio Profile (TMAP)
› Basic Audio Profile (BAP)
   Profile for setting up and managing Unicast streams
   » Published Audio Capabilities Service (PACS)
      Profile for sharing the device's features
   » Audio Stream Control Service (ASCS)
      Profile for defining the condition of the device which is required for setting up and maintaining a Unicast stream
› Volume Control Profile (VCP)
   Profile for determining the volume on the audio sink device
   » Volume Control Service (VCS)
      Defines the state of the volume for each audio sink
› Coordinated Set Identification Profile (CISP)/Coordinated Set Identification Service (CSIS)
   Profile and service for identifying multiple devices that belong together as a coordinated set (e.g., true wireless stereo earbuds)

GENERAL REQUIREMENTS

Hardware

*lab*CORE (Code 7700)
› Modular multi-channel hardware platform

Software

One of the following software applications:

ACQUA (Code 6810)
› Advanced Communication Quality Analysis Software, full license version
ACQUA Compact (Code 6860)
› Compact test system
RC-*lab*CORE (Code 6984)
› Remote control software for *lab*CORE

SCOPE OF DELIVERY

*core*BT2LE-EVO

*core*BT2LE-EVO (Code 7805)
› *lab*CORE I/O Module, Bluetooth reference access point version 3, Base for Low Energy Audio (LC3)
BTLE-Ctrl (Code 7800)
› Bluetooth LE Audio Controller for *lab*CORE, *core*BT2LE-EVO (USB-based)
CUSB VI.0.2 (Code 9869.02)
› Adapter USB-C to USB-A

*core*BT2LE-Auracast

*core*BT2LE-Auracast (Code 7788)
› *lab*CORE Bluetooth Low Energy Audio (LC3), Option Auracast (*core*BT2LE-EVO required)

*core*BT2LE-Unicast

*core*BT2LE-Unicast (Code 7789)
› *lab*CORE Bluetooth Low Energy Audio (LC3), Option Unicast (*core*BT2LE-EVO required)

OPTIONS

coreBT2LE-IMP (Code 7810)
› *lab*CORE Bluetooth Reference Access Point Vers. 2
Low Energy Audio (LC3) Statistical Impairments

TECHNICAL DATA

BTLE-Ctrl (Bluetooth LE Audio Controller for *lab*CORE)

Antenna connection	SMA
Data transmission and energy supply	USB-C
Impedance	50 Ω
Frequency range	2400 GHz – 2500 GHz
	5150 GHz – 5875 GHz
RF power	approx. 5 dBm
RF sensitivity	-98 dBm

CONTROL SOFTWARE

Connection Establishment in ACQUA/RC-labCORE

*lab*CORE and its features are operated and controlled via ACQUA. The user interface enables users to allocate channels from and to the Bluetooth LE Audio module. Parameters for establishing a stream or a broadcast are adjustable to fit the capabilities respectively to cause certain attributes of the connected device. Log messages help understanding the connection status as well as solving potential connection issues.
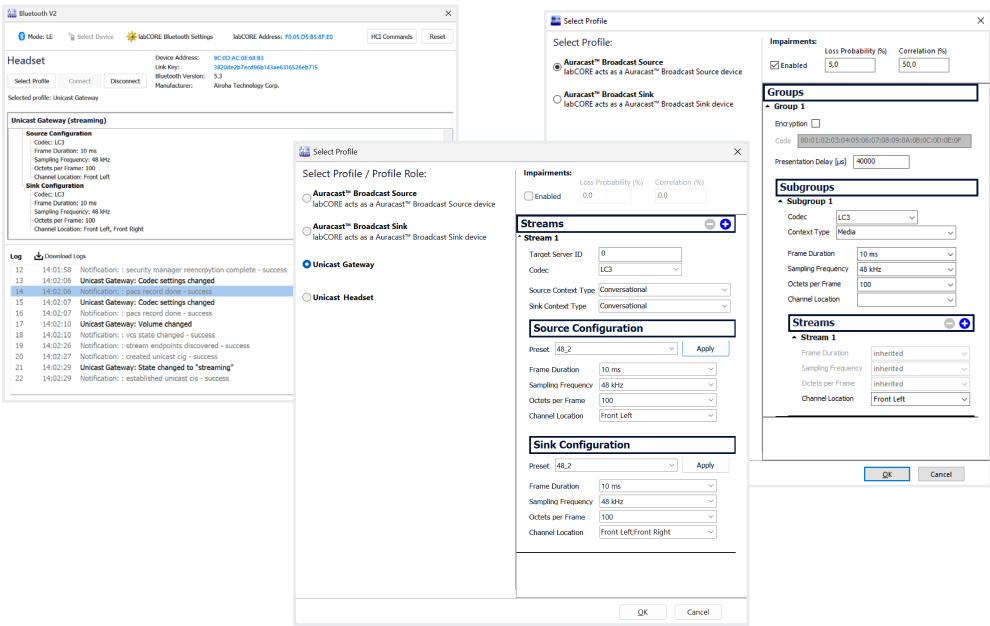
IN PRACTICE

APPLICATION EXAMPLES

Telephone Call Measurement of a Headset

*lab*CORE connects via *core*BT2LE-Unicast to the headset which is positioned on HMS II.3 LN HEC. It transmits and receives signals to/from connected devices to ACQUA. ACQUA generates signals for playback via the headset and/or via HMS II.3 LN HEC. Further, ACQUA receives and analyzes signals from the headset's microphones and from the ear microphones of HMS II.3 LN HEC. Background noise is simulated with 3PASS *lab*. For full repeatability of measurements, background noise playback and measurement signal are synchronized by *lab*CORE through a pulse connection to the *lab*BGN hardware platform.
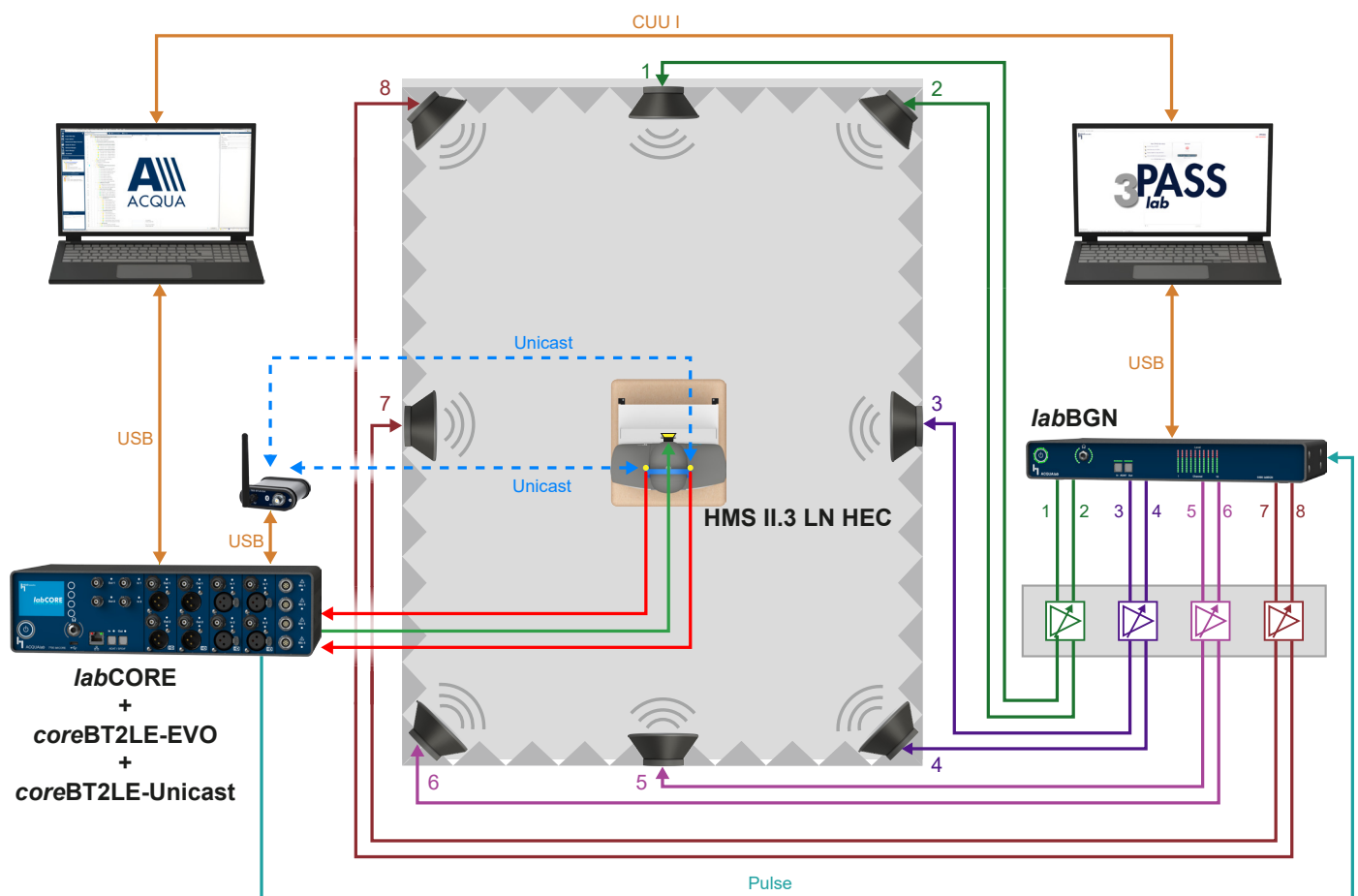
Unicast Measurement of an Automotive Head Unit

*lab*CORE connects via *core*BT2LE-Unicast to the automotive head unit. It transmits and receives signals to/from connected devices to ACQUA. ACQUA generates signals for playback via the headset and/or via HMS II.3. Further, ACQUA receives and analyzes signals from the headset's microphones and from the ear microphones of HMS II.3. Background noise is simulated with 3PASS *lab*. For full repeatability of measurements, background noise playback and measurement signal are synchronized by *lab*CORE through a pulse connection to the *lab*BGN hardware platform.

# Measurement of a Headset with Auracast Receiver
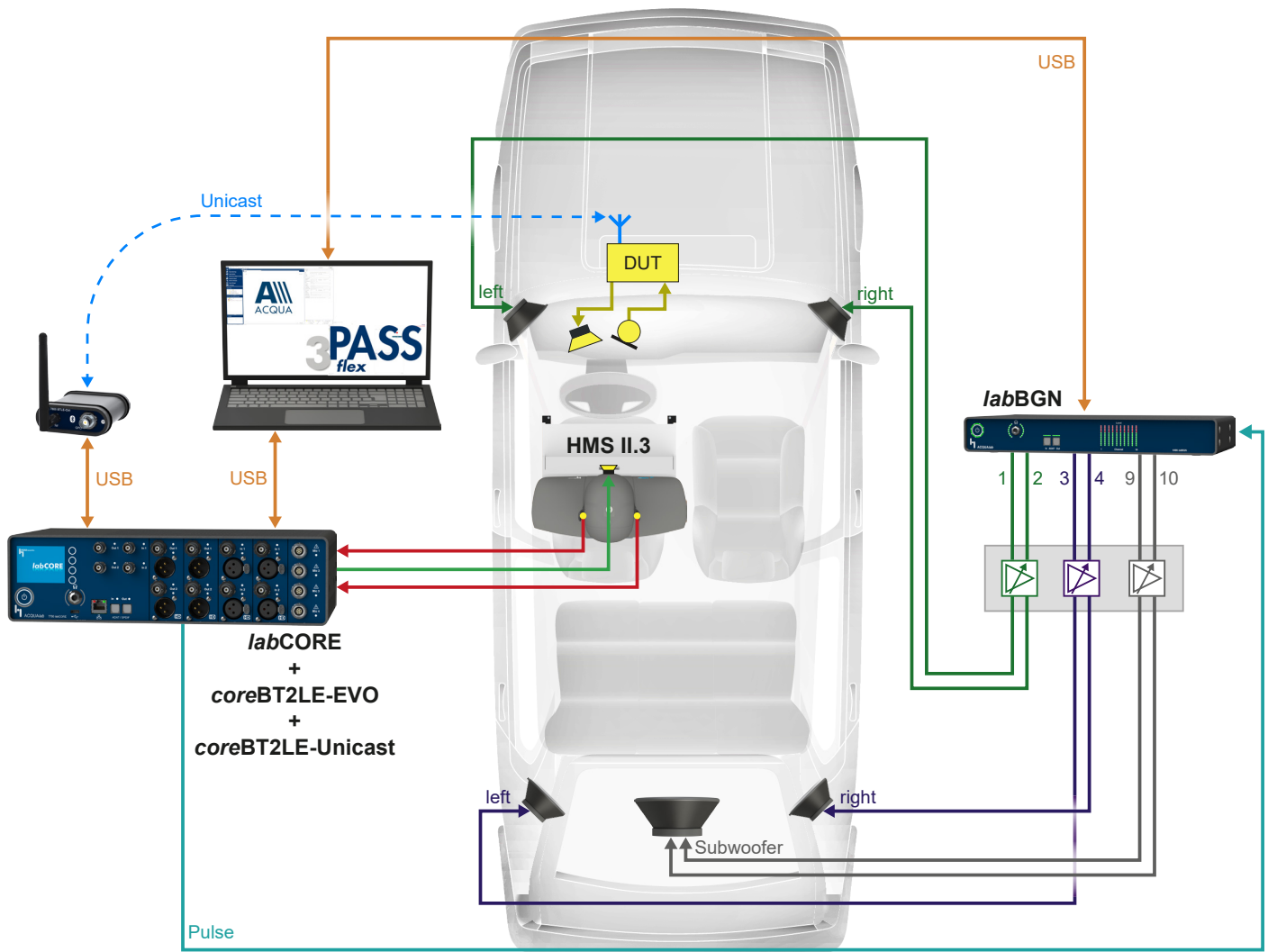
*lab*CORE sends the broadcast via *core*BT2LE-Auracast. An Auracast assistant (e.g., smartphone) initially connects the headset to the Auracast broadcast. Once the headset is connected, the assistant is not necessary anymore. Background noise is simulated with 3PASS *lab*. For full repeatability of measurements, background noise playback and measurement signal are synchronized by *lab*CORE through a pulse connection to the *lab*BGN hardware platform. ACQUA generates signals for the Auracast broadcast. Further, it receives and analyzes signals from HMS II.3 LN HEC.

Measurement of an Auracast Transmitter Including a Microphone

As preparation, *lab*CORE connects to the active Auracast broadcast from the Auracast transmitter. *lab*CORE sends an audio signal for playback to HMS II.3 LN HEC. The microphone of the Auracast transmitter receives the acoustic signal. The transmitter broadcasts the audio signal and *lab*CORE picks up the broadcast via *core*BT2LE-Auracast. Background noise is simulated with 3PASS *lab*. For full repeatability of measurements, background noise playback and measurement signal are synchronized by *lab*CORE through a pulse connection to the hardware platform *lab*BGN. ACQUA generates the speech signal, receives, and analyzes the signal from the Auracast broadcast.
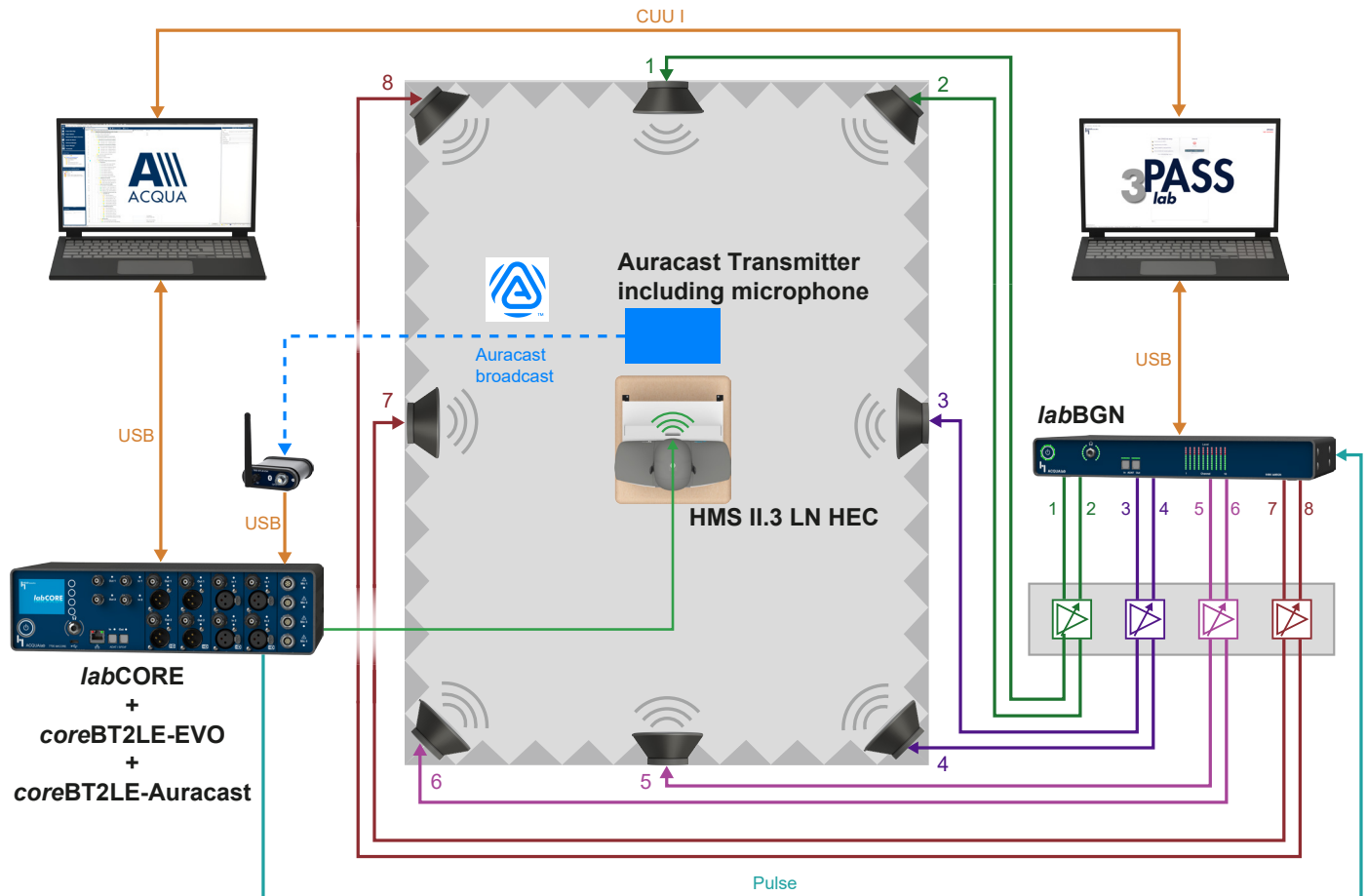
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HEAD acoustics

Contact Information

Ebertstraße 30a
52134 Herzogenrath, Germany
Phone: +49 2407 577-0
E-Mail: sales@head-acoustics.com
Website: www.head-acoustics.com