



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)

coreBT2LE-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 *coreBT2LE-Unicast* or *coreBT2LE-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 Bluetooth controller to connect to appropriate devices as well as for exchanging signals.

KEY FEATURES

coreBT2LE-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 Controller

coreBT2LE-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)

coreBT2LE-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-Auracast (Code 7788)

labCORE Bluetooth Low Energy Audio (LC3),
Option Auracast (coreBT2LE-EVO Required)

coreBT2LE-Auracast is a software extension for coreBT2LE-EVO. coreBT2LE-Auracast together with coreBT2LE-EVO enables *labCORE* to apply Auracast™ broadcast audio. Thus, *labCORE* allows acoustic and electrical measurements of Auracast transmitters or Auracast receivers for speech and audio transmission.

coreBT2LE-Unicast (Code 7789)

labCORE Bluetooth Low Energy Audio (LC3),
Option Unicast (coreBT2LE-EVO Required)

coreBT2LE-Unicast is a software extension for coreBT2LE-EVO. coreBT2LE-Unicast together with coreBT2LE-EVO enables *labCORE* to become a reference access point that applies the Unicast profile roles. Thus, *labCORE* can send and receive Unicast streams. This allows acoustic and electrical measurements of Bluetooth Low Energy devices for speech and audio transmission.

APPLICATIONS

coreBT2LE-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

coreBT2LE-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

labCORE Bluetooth LE Stack

The stack for Bluetooth Low Energy included in the *labCORE* firmware – combined with the corresponding controller – enables *labCORE* 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, *coreBT2LE-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

coreBT2LE-Unicast is a software extension for *coreBT2LE-EVO*. It enables *labCORE* to apply Unicast audio while connecting with devices that comply with TMAP profile roles. *coreBT2LE-Unicast* supports different profile roles for two applications:

- › Unicast telephone call
- › Unicast Media

Unicast Telephone Call

labCORE 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, *labCORE* takes the role of the call terminal and the call gateway (e.g., a smartphone) connects to *labCORE*.

Unicast Audio

labCORE can take both profile roles for audio media via Unicast Audio. As a Unicast media sender (UMS), *labCORE* transmits audio media to the connected Unicast media receiver (UMR) such as, e.g., headsets, headphones, or loudspeakers. Vice versa, *labCORE* 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 coreBT2LE-Auracast as a software extension for coreBT2LE-EVO. It enables *labCORE* to apply Auracast broadcast audio. There are two applications for *labCORE* with Auracast broadcast audio. Firstly, *labCORE* 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, *labCORE* 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

labCORE (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-*labCORE* (Code 6984)
- › Remote control software for *labCORE*

SCOPE OF DELIVERY

coreBT2LE-EVO

coreBT2LE-EVO (Code 7805)

- › *labCORE* I/O Module, Bluetooth reference access point version 3, Base for Low Energy Audio (LC3) BTLE-Ctrl (Code 7800)
- › Bluetooth LE Audio Controller for *labCORE*, coreBT2LE-EVO (USB-based)
- CBA III (Code 6598)
- › Bluetooth Antenna
- CUSB XI.1 (Code 9898-1)
- › Cable USB-A to USB-C for BTLE-Ctrl, USB 3.1, 1 m

coreBT2LE-Auracast

coreBT2LE-Auracast (Code 7788)

- › *labCORE* Bluetooth Low Energy Audio (LC3), Option Auracast (coreBT2LE-EVO required)

coreBT2LE-Unicast

coreBT2LE-Unicast (Code 7789)

- › *labCORE* Bluetooth Low Energy Audio (LC3), Option Unicast (coreBT2LE-EVO required)

OPTIONS

coreBT2LE-IMP (Code 7810)

- › labCORE Bluetooth Reference Access Point Vers. 2
- Low Energy Audio (LC3) Statistical Impairments

CSM II.10 (Code 6115-10)

- › Antenna cable, SMA plug <> SMA socket, RG 174, 10 m

TECHNICAL DATA

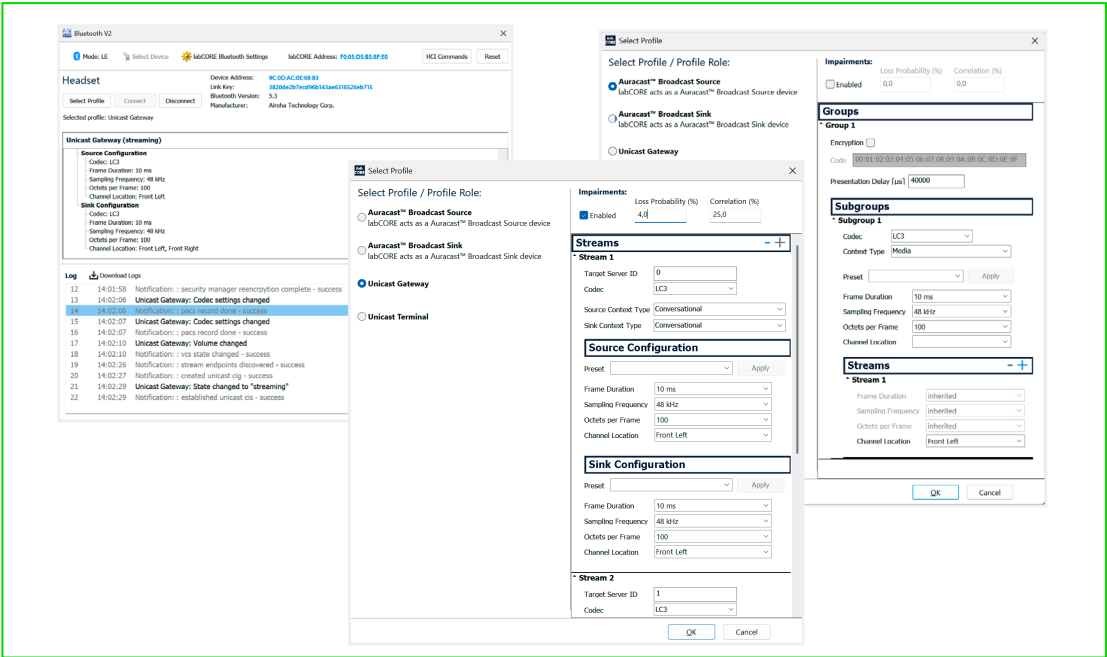
BTLE-Ctrl (Bluetooth LE Audio Controller for labCORE)

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

CONTROL SOFTWARE

Connection Establishment in ACQUA/RC-labCORE

labCORE 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.

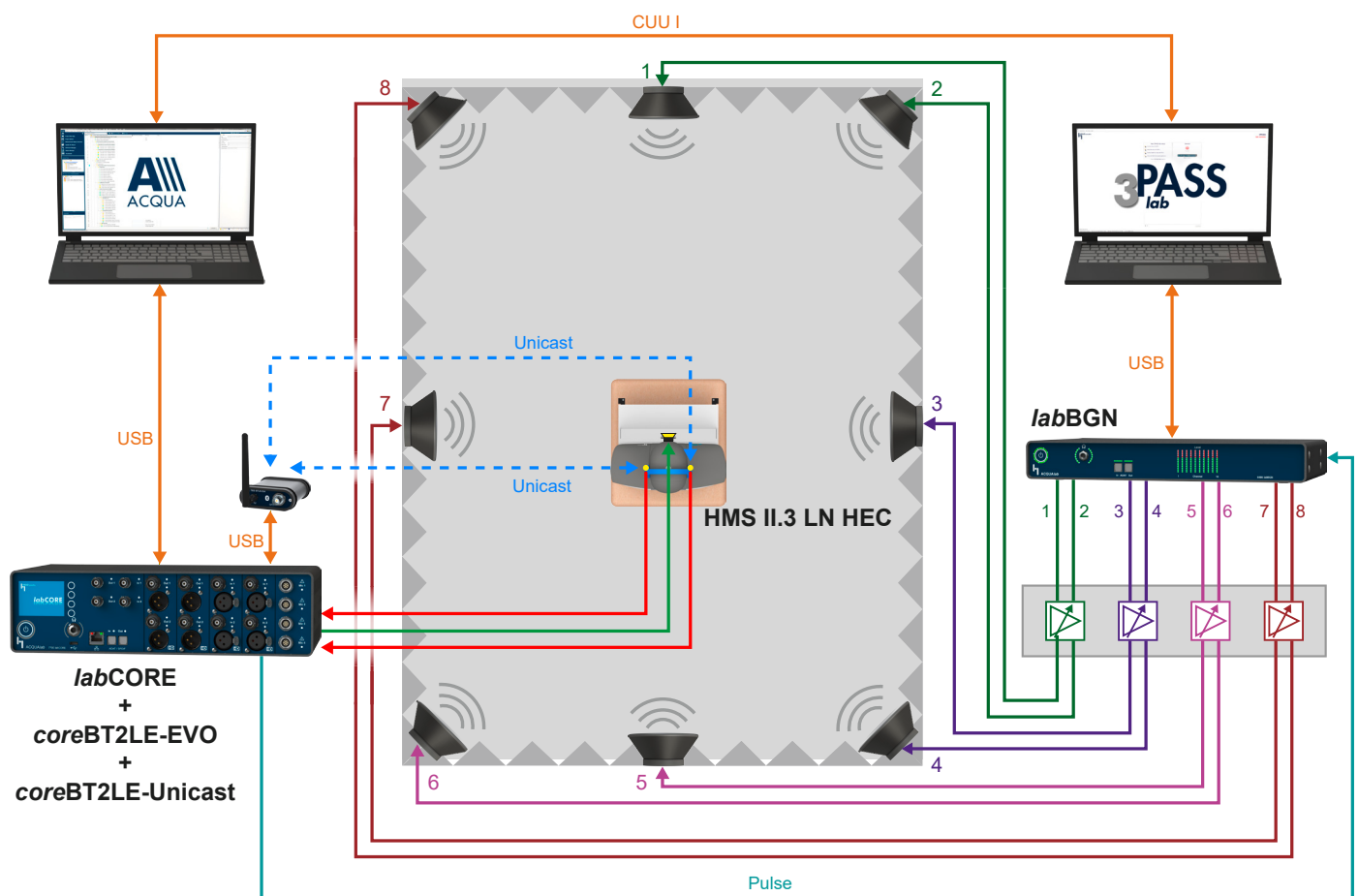


IN PRACTICE

APPLICATION EXAMPLES

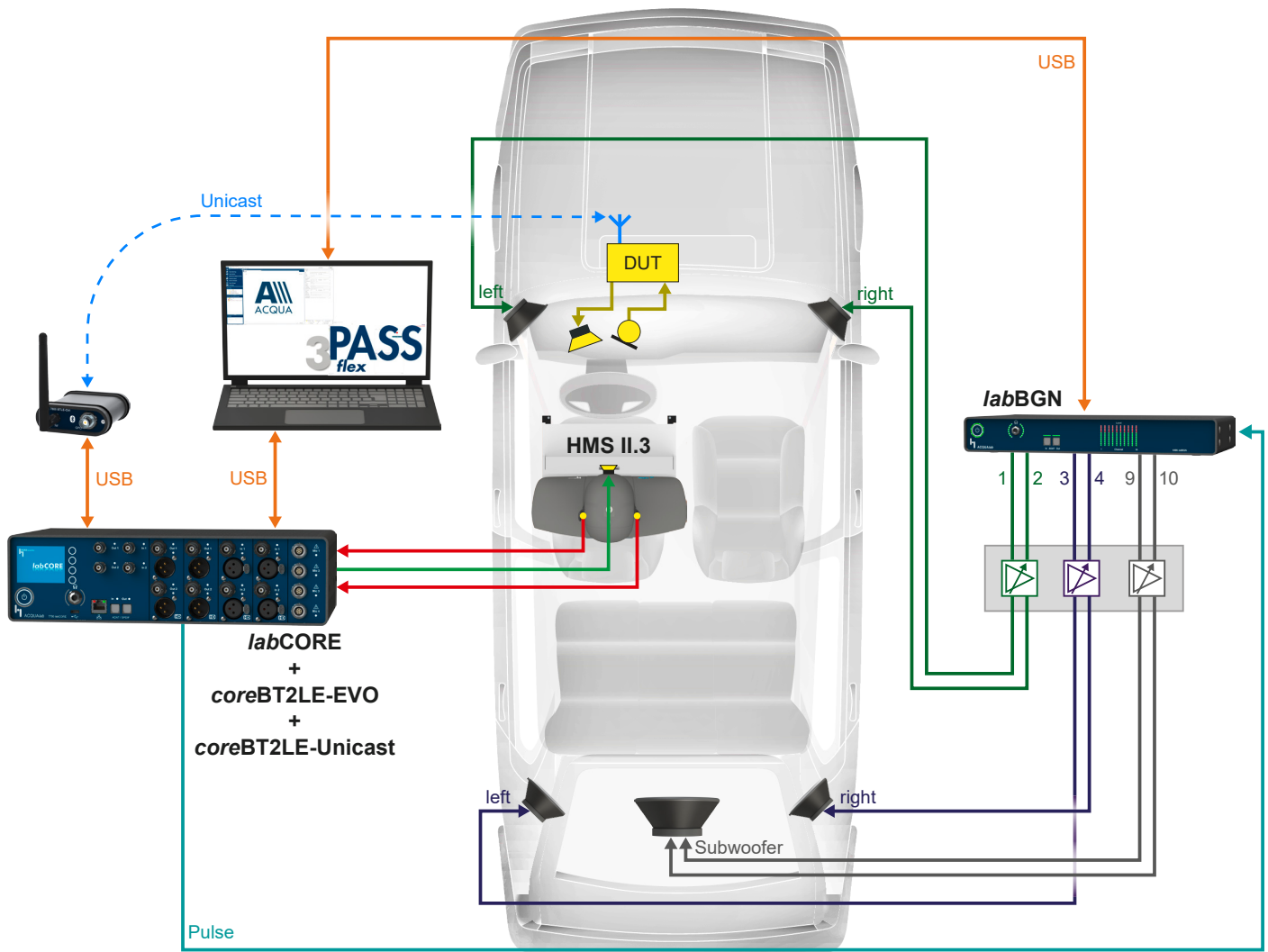
Telephone Call Measurement of a Headset

labCORE connects via *coreBT2LE-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 *labCORE* through a pulse connection to the *labBGN* hardware platform.



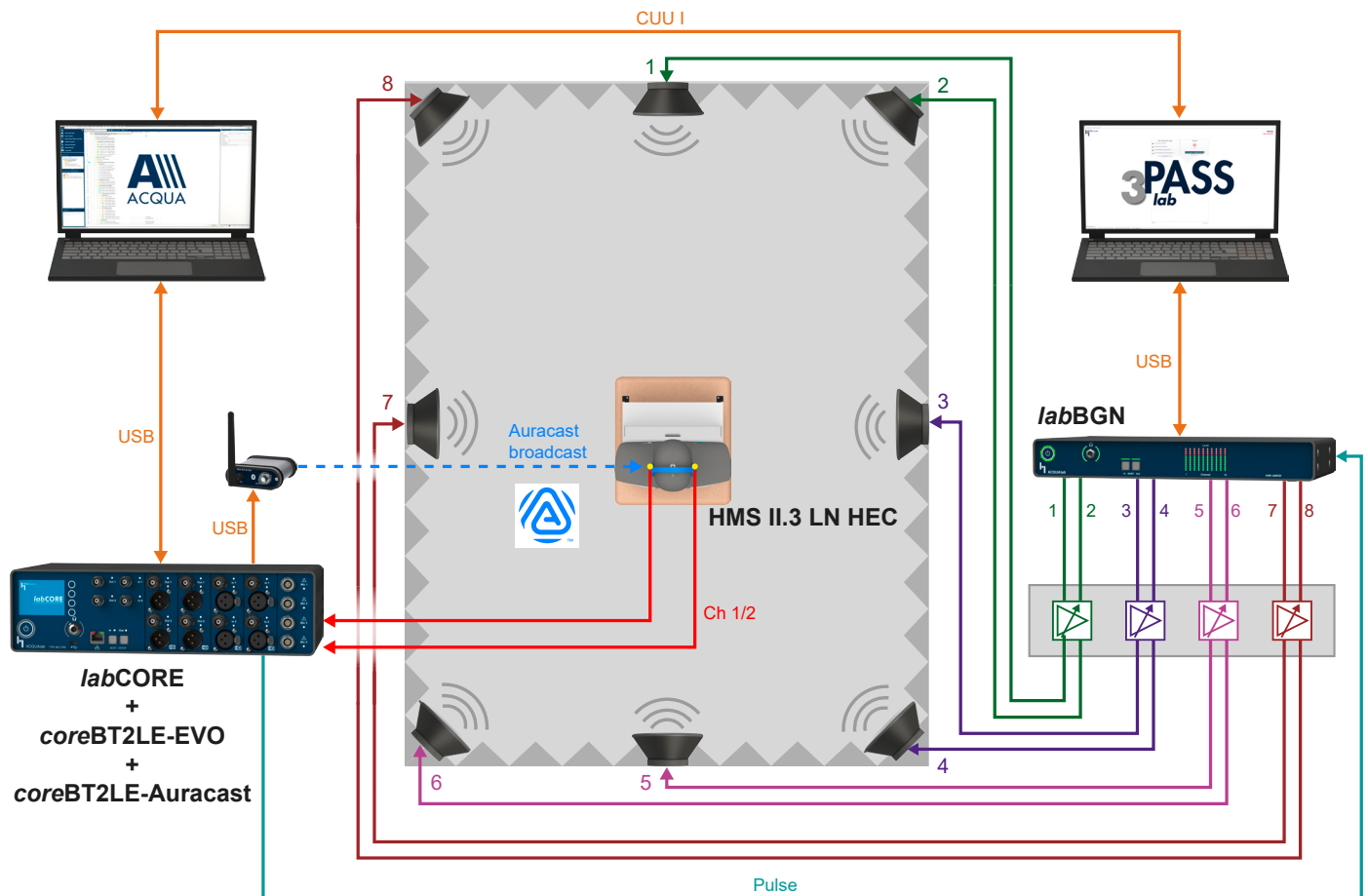
Unicast Measurement of an Automotive Head Unit

labCORE connects via *coreBT2LE-Unicast* to the automotive head unit. It transmits and receives signals to/from connected devices to ACQUA. ACQUA generates signals for playback via the head unit and/or via HMS II.3. Further, ACQUA receives and analyzes signals from the head unit'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 *labCORE* through a pulse connection to the *labBGN* hardware platform.



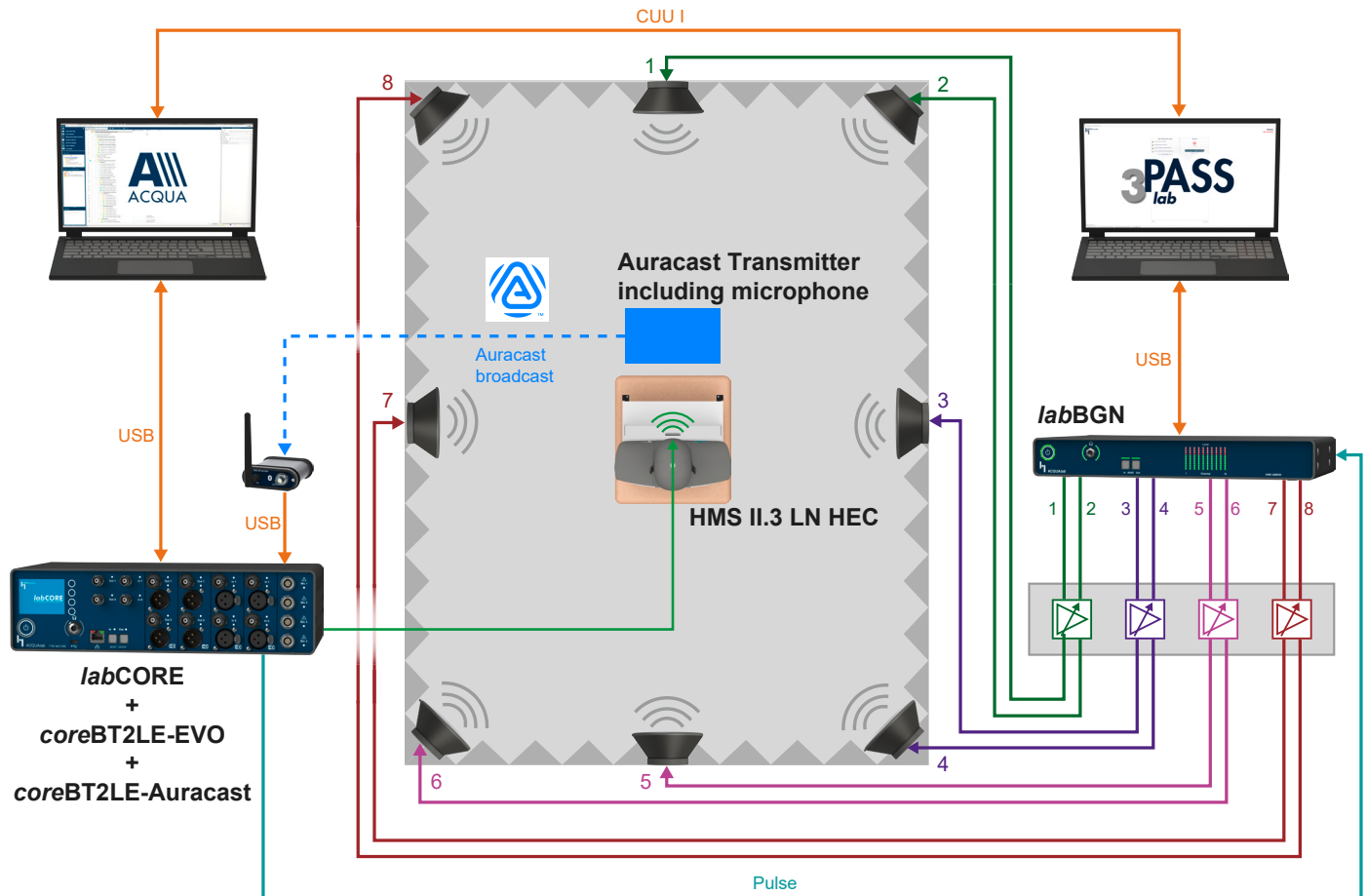
Measurement of a Headset with Auracast Receiver

labCORE sends the broadcast via *coreBT2LE-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 *labCORE* through a pulse connection to the *labBGN* 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, *labCORE* connects to the active Auracast broadcast from the Auracast transmitter. *labCORE* 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 *labCORE* picks up the broadcast via *coreBT2LE-Auracast*. Background noise is simulated with 3PASS *lab*. For full repeatability of measurements, background noise playback and measurement signal are synchronized by *labCORE* through a pulse connection to the hardware platform *labBGN*. ACQUA generates the speech signal, receives, and analyzes the signal from the Auracast broadcast.



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