

ViBRIDGE



Code 1703.3

HMS II.3 ViBRIDGE

HEAD Measurement System, Low-Noise, with Human-like ViBRIDGE Ear Simulators (Left & Right) & Artificial Mouth

OVERVIEW

HMS II.3 ViBRIDGE

Code 1703.3

HEAD Measurement System, Low-Noise Version,
with Human-like ViBRIDGE Ear Simulators
(left & right) & Artificial Mouth

HMS II.3 ViBRIDGE is an artificial head measurement system with an artificial mouth and two low-noise ear simulators with a human-like ear canal and bone conduction simulation. The system is ideally suited for measuring intra-concha and insert-type devices that utilize human structure-borne sound.

The two ear simulators are fully compliant with the type 4.4 ear simulator laid out in Recommendation ITU-T P.57 (06/2021). They combine a very low self-noise level with a high upper SPL limit. The pinnae of HMS II.3 ViBRIDGE carry precision electro-mechanic actuators to simulate bone-conducted near-end speech to any intra-concha- or insert type device.

The P.58-compliant, two-way artificial mouth of HMS II.3 ViBRIDGE is capable of reproducing the full spectrum of human voice with lowest distortion, allowing high-quality measurements in super-wideband and fullband applications.

KEY FEATURES

Geometric and acoustic characteristics according to ITU-T P.58.

Modular design for easy retrofitting with compatible HMS components.

Ear simulators:

- › Anatomically shaped pinnae with human-like ear canals
- › Realistic simulation of structure-borne sound in sending direction by integrated precision actuators
- › Fully compliant with type 4.4 ear simulator laid out in Recommendation ITU-T P.57
- › Very low inherent noise floor & high SPL limit

Artificial mouth:

- › Low-distortion 2-way design with wide frequency range for super-wideband & fullband applications
- › Noise-free operation with coreOUT-Amp2

APPLICATIONS

Comprehensive testing of in-ear-headsets that utilize near-end structure-borne sound to improve:

- › Speech quality in sending direction (especially in the presence of background noise)
- › Echo cancellation
- › Double-talk performance in sending direction

DETAILS

HMS II.3 ViBRIDGE is an artificial head measurement system ideally suited for testing of in-ear headsets that utilize structure-borne sound. It comprises two artificial ears with human-like ear canals and simulation of structure-borne sound for the sending direction as well as an artificial mouth. In addition to state-of-the-art in-ear headsets, it can be used to test all kinds of transducers in e.g. handsets, headsets, headphones, hands-free devices, voice-operated equipment, hearing protectors and more.

Ear simulator & ViBRIDGE pinnae

The pinna and ear simulator of HMS II.3 ViBRIDGE accurately replicate the anatomy of the human outer ear. The microphone capsule in the ear simulator of HMS II.3 ViBRIDGE has a very low inherent noise floor of 16 dB_{SPL}(A). As such, it is qualified for any measurement scenario with signal levels close to the human hearing threshold. The very high sound pressure level limit of 148 dB_{SPL} ensures full usability of HMS II.3 ViBRIDGE for measurements up to high levels, too.

HMS II.3 ViBRIDGE is delivered with two anatomically shaped pinnae fully compliant with the type 4.4 ear simulator laid out in Recommendation ITU-T P.57 (06/2021). Both pinnae carry embedded electromechanical actuators that can accurately simulate the vibrations of structure-borne sound in sending direction to in-ear headsets. The actuators are powered by the second amplifier channel of the *labCORE* hardware extension board *coreOUT-Amp2*.

Artificial mouth

The artificial mouth of HMS II.3 ViBRIDGE is fully compliant with Recommendation ITU-T P.58. It realistically reproduces the acoustic behavior of a talking person. The two-way loudspeaker design provides an excellent frequency response. The wide frequency range is superior to existing one-way designs in the market, making it ideally suited for measurements in super-wideband and fullband applications. The mouth is optimized for use with the *labCORE* hardware extension board *coreOUT-Amp2*, offering high performance without any notable self-noise.



HMS II.3 ViBRIDGE mounted on the supplied torso box HTB VI

Modularity

The modular design of the HMS artificial ear allows to quickly add or change ear simulator(s) and pinnae. This can be used to retrofit HMS II.3 ViBRIDGE with basic ear simulators with straight ear canals together with pinnae type 3.3, e.g. for testing according to standards that require a type 3.3 ear simulator.

HMS II.3 ViBRIDGE includes TEDS (Transducer Electronic Data Sheet) technology that allows ACQUA to determine the type and serial number of the HEAD Impedance Simulators (HIS) as well as the HATS itself.

Playback and recording

For measurements, HMS II.3 ViBRIDGE connects to the communication analysis system ACQUA via the hardware platform *labCORE* equipped with the optional hardware board *coreIN-Mic4*. In combination with the necessary hardware modules including *coreBEQ*, equalization of binaural acoustical signals using various equalization variants is possible.

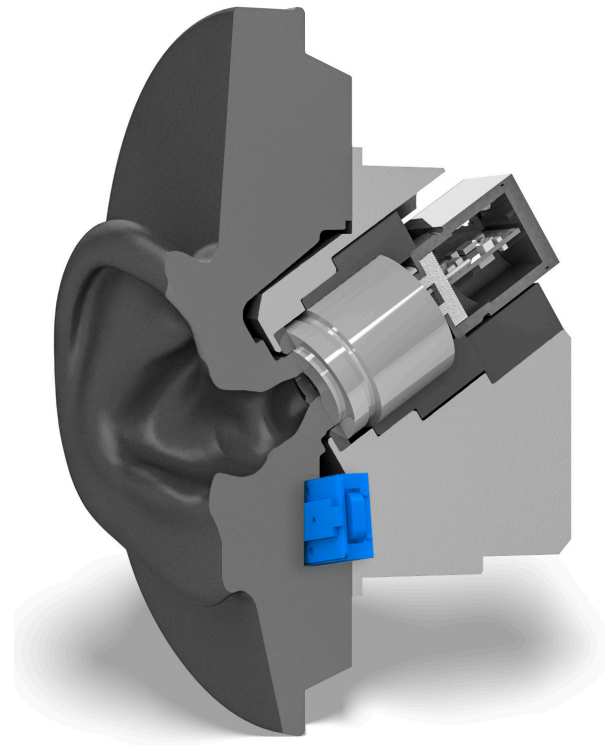
The artificial mouth as well as the actuators for bone conduction simulation of HMS II.3 ViBRIDGE are both powered by the optional hardware extension board *coreOUT-Amp2* for *labCORE*. Based on the speech signal for the mouth combined dedicated digital filtering, the signal for the actuators is derived in real time.

Accessories

Of course, HMS II.3 ViBRIDGE is fully qualified for any measurement scenario outside of state-of-the-art in-ear headset testing. For measurements of telephony handsets, HMS II.3 ViBRIDGE can be equipped with the optional handset positioners HHP IV (motorized) or HHP III.1 (manual). Both allow precise positioning of any handset as well as precise adjustment of application forces to the pinna, ensuring meaningful and repeatable measurement results.

For own background noise recordings and to perform equalization of a background noise simulation system (e.g. 3PASS *lab/flex*), the microphone surround arrays MSA I or MSA II can be mounted on top of the artificial head. For precise alignment of HMS, the triaxial laser pointer TLP can be mounted here alternatively.

The supplied Torso Box HTB VI acoustically simulates a human torso. Its compact design allows easy handling and transportation of the complete system, e.g. for mobile applications.

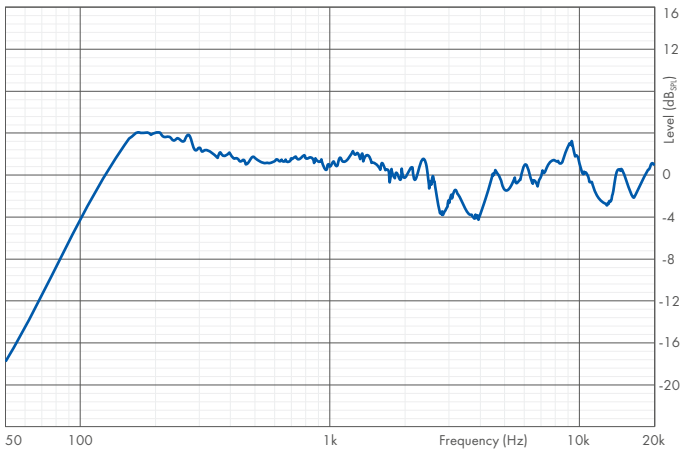


The ear canal and the acoustic coupler of the HMS II.3 ViBRIDGE ear simulator meet at the reference plane defined in Recommendation ITU-T P.57.

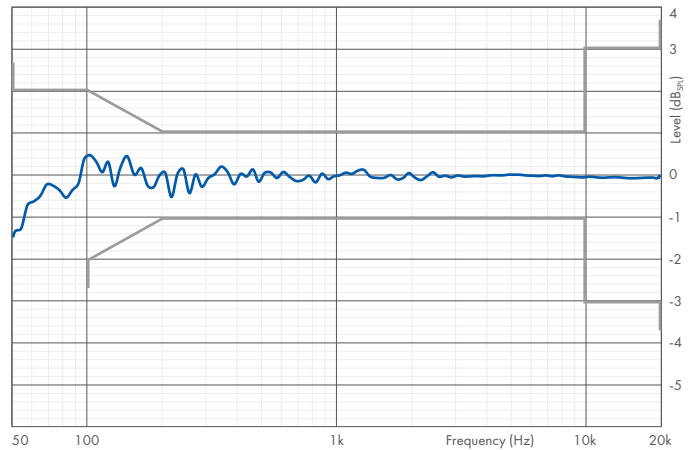
The ear simulator of HMS II.3 ViBRIDGE combines a physically modeled outer ear canal and Pinna with a coupler that precisely simulates the acoustic properties of the inner ear canal via specific geometry. This combination allows conclusive measurements of intra-concha and insert-type devices while ensuring high dynamics and very low self-noise via the integrated high-sensitivity microphone capsule.

The ViBRIDGE precision actuator (highlighted in blue) generates vibrations to accurately simulate structure-borne near-end speech for inserted devices.

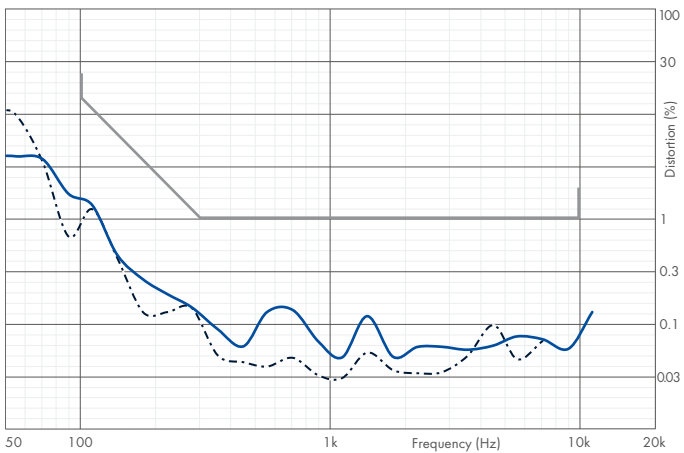
Total Harmonic Distortion (THD) > @ 0 dBPA (94 dB _{SPL}) > @ +6 dBPA (100 dB _{SPL}) > @ +12 dBPA (106 dB _{SPL}) > @ +18 dBPA (112 dB _{SPL})	(at MRP, equalized, with coreOUT-Amp2) < 4 % (100 Hz), < 0,5 % (200 Hz – 20 000 Hz), exceeds ITU-T P.58 < 6 % (100 Hz), < 1 % (200 Hz – 20 000 Hz) < 10 % (100 Hz), < 2 % (200 Hz – 20 000 Hz) < 3 % (200 Hz – 20 000 Hz)
Max. continuous output level > Pink noise > Sine > Real speech acc. ITU-T P.501	(at MRP, equalized, with coreOUT-Amp2) min. 112 dB _{SPL} (50 Hz – 16 000 Hz), min. 106 dB _{SPL} (20 Hz – 20 000 Hz) min. 112 dB _{SPL} (200 Hz – 6 000 Hz) @ THD < 3 %, min. 106 dB _{SPL} (100 Hz – 10 000 Hz) @ THD < 10 % No audible distortion up to approx. 110 dB _{SPL}



Typical frequency response of unequalized two-way mouth (—)



Typical frequency response of equalized two-way mouth (—) vs. ETSI TS 102 924 tolerance scheme (—)



2nd (—) and 3rd (---) order harmonic distortion of equalized two-way mouth at 0 dB_{Pa} vs. Recommendation ITU-T P.58 tolerance scheme (—)

Other

Dimensions and Weight	
Overall dimensions (Width × Height × Depth)	460 × 400 × 210 mm 460 × 790 × 400 mm on Torso Box
Weight	Approx. 6.8 kg (standard options) Approx. 14.8 kg with Torso Box (standard options)
Environmental Conditions	
Operating temperature range	0°C – 50°C (32°F – 122°F)
Storage temperature range	-20°C – 70°C (-4°F – 158°F)
Humidity	20% – 80% relative humidity (non-condensing environment)

FEATURES & OPTIONS

MSA II

A centrally embedded thread at the top of HMS holds top-mounted accessories such as the Microphone Arrays MSA I, MSA II (shown) or the Triaxial Laser Pointer TLP.

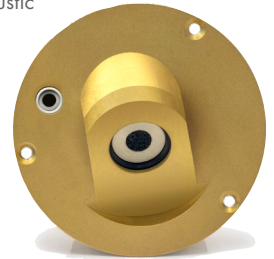
Two additional threads towards the back of the head protect against accidental skew when using rotatable top-mounted accessories.



IMPEDANCE SIMULATOR AND VIBRIDGE PINNA

The anatomically shaped pinna of HMS II.3 ViBRIDGE replicates the geometry of a human auricle and ear canal. Its integrated actuator realistically simulates bone conduction for in-ear headsets. Beyond, the accompanying impedance simulator HIS R (shown) precisely recreates the human ear's acoustic properties.

The modular design of HMS II.3 ViBRIDGE allows to retrofit compatible ear simulators and pinnae (see next page).



HHP IV

Four neck bolts provide sturdy mounting points for an optional handset positioner such as the motorized HHP IV (shown), applicable e.g. for testing handsets according to Recommendation ITU-T P.64 (07/2022).



ARTIFICIAL NOSE & ARTIFICIAL MOUTH

The optional Artificial Nose AN-HMS can be fixed at the facial crosshair of HMS II.3 ViBRIDGE.

The artificial mouth's two-way loudspeaker design provides excellent frequency coverage, a high maximum SPL and very low distortion.



BOTTOM PLATE

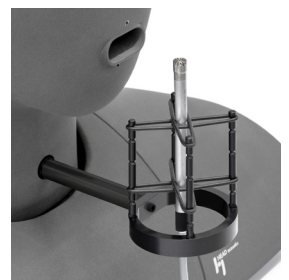
The bottom plate offers a 4-pin speakON connector for the artificial mouth and the ViBRIDGE actuators as well as two 7-pin LEMO connectors for left and right ear simulator.

A quick-clamping mechanism allows easy and fast attaching of HMS to the supplied torso box HTB VI. The thread below allows to fasten HMS on e.g. the optional tripod HMT III.1.



MICROPHONE FIXTURE

A flange at the throat can accommodate the delivered microphone mount for calibration of the mouth. Durable rubber rings can accommodate optional microphones of different sizes.



EAR SIMULATOR & PINNA OPTIONS

The modular nature of HMS systems of the latest generation allows users to build numerous different configurations optimized for specific purposes.

HMS II.3 ViBRIDGE is delivered with two anatomically shaped pinnae type 4.4 with integrated actuators for simulating structure-

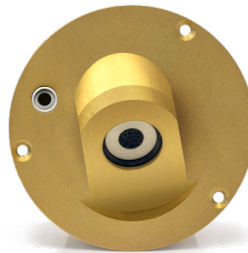
borne sound as well as with impedance simulators for both ears, all according to ITU-T P.57.

Further options for this HMS model are shown below for the right ear. The left ear can be equipped likewise. The type 4.4-pinnae (with and without ViBRIDGE) are also available in a light gray-colored version.



HMS II.3 ViBRIDGE

- › Low-noise impedance simulator with human-like ear canal
- › Anatomically shaped pinna type 4.4 with human-like ear canal and bone conduction simulation



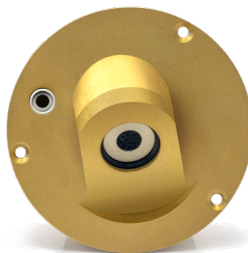
HMS II.3 / II.3 LN

- › Impedance simulator with straight ear canal (HMS II.3)
or
- › Low-noise impedance simulator with straight ear canal (HMS II.3 LN)
- › Anatomically shaped pinna type 3.3 with straight ear canal



HMS II.3 LN HEC

- › Low-noise impedance simulator with human-like ear canal
- › Anatomically shaped pinna type 4.4 with human-like ear canal

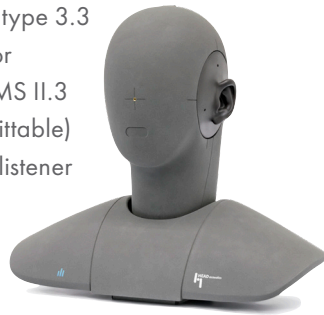


OTHER HMS MODELS

In addition to HMS II.3 ViBRIDGE and its three variants HMS II.3, II.3 LN and II.3 LN HEC, four additional models of the HEAD Measurement System are available.

HMS II.4

- › Anatomically shaped pinnae type 3.3
- › Right ear impedance simulator
- › Ear retrofitting options like HMS II.3
- › No artificial mouth (not retrofittable)
- › Can serve as e.g. a (second) listener



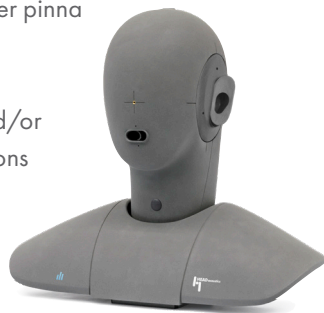
HMS II.5

- › Anatomically shaped pinnae type 3.3
- › No impedance simulators
- › Ear retrofitting options like HMS II.3
- › Artificial mouth like HMS II.3
- › Can serve as e.g. a (second) talker



HMS II.6/7

- › Binaural free-field microphones in solid pinnae with simplified geometry
- › HMS II.6 with high quality condenser microphones
- › HMS II.7 with high quality ICP® microphones
- › Not retrofittable with any other pinna or impedance simulator
- › Artificial mouth like HMS II.3
- › Can serve as e.g. a talker and/or listener in free-field applications



SCOPE OF DELIVERY

HMS II.3 ViBRIDGE (Code 1703.3)

- › HEAD measurement system, low-noise, with human-like ViBRIDGE ear simulators (l. & r.) & artificial mouth

HIS L LN HEC (Code 1701.2)

- › HEAD impedance simulator, left, low-noise, for HMS II.3/4/5, human ear canal version

HIS R LN HEC (Code 1702.2)

- › HEAD impedance simulator, right, low-noise, for HMS II.3/4/5, human ear canal version

HEL 4.4 ViBRIDGE (Code 1717)

- › Flexible pinna for HMS II.3/5, left ear, according to ITU-T P.57 Type 4.4, ViBRIDGE version

HER 4.4 ViBRIDGE (Code 1718)

- › Flexible pinna for HMS II.3/5, right ear, according to ITU-T P.57 Type 4.4, ViBRIDGE version

CLL-R I.3 (Code 1722-3)

- › Cable LEMO I 7-pin male ↔ LEMO I 7-pin male, red, 2.95 m

CSS V.3 (Code 1723-3)

- › Cable speakON plug ↔ speakON plug, 2.95 m

CSB II (Code 9849)

- › Adapter speakON male ↔ Banana plug

HTB VI (Code 1574)

- › HEAD Torso Box for HMS II/III/IV & HSU

HCC-HMS (Code 1741)

- › Carrying case for accessory parts HMS II.x containing:
 - › Microphone holder
 - › Lip ring & MRP pointer
 - › Calibration adapter
 - › 2.5 mm Allen key
 - › 3 × Allen screw for HIS (spare parts)
 - › 2 × Throat blind cap (spare parts)
 - › Manual

OPTIONAL ACCESSORIES

General

coreBEQ (Code 7740)

- › labCORE binaural equalization, incl. filter set for one artificial head (delivered with labCORE)
- › coreBEQ-Add (Code 7741)
labCORE binaural equalization, additional set of filters for one artificial head (coreBEQ required)
- › AN HMS (Code 1418)
Extension for HEAD measurement system HMS: Artificial nose

HSM V (Code 1520)

- › HEAD Seat Mount adapter for artificial head measurement systems or a head-shoulder unit

HSC V-V2 (Code 1525-V2)

- › Carrying case for HMS II.x

HMT III (Code 1961)

- › Height-adjustable tripod for HMS

TLP (Code 1967)

- › Triaxial laser pointer for HMS/HSU positioning incl. two batteries and carrying case

MSA I (Code 6487)

- › 8 channel microphone surround array, Asymmetrical, according to ETSI TS 103 224

MSA II (Code 6487.2)

- › 8 channel microphone surround array, Symmetrical, according to ETSI TS 103 224

Ear Simulator retrofitting

All ear simulators are delivered with a cable LEMO I 7-pin male ↔ LEMO I 7-pin male, black, 2.95 m (Code 1721-3)

HIS L (Code 1701)

- › HEAD impedance simulator, left, for HMS II.3/4/5

HIS R (Code 1702)

- › HEAD impedance simulator, right, for HMS II.3/4/5

HIS L LN (Code 1701.1)

- › HEAD impedance simulator, left, low-noise version, for HMS II.3/4/5

GENERAL REQUIREMENTS

Hardware

labCORE (Code 7700)

- › Modular multi-channel hardware platform

coreBUS (Code 7710)

- › I/O bus mainboard

coreOUT-Amp2 (Code 7720)

- › Power amplifier board, for sending direction

coreIN-Mic4 (Code 7730)

- › Microphone input board, for receiving direction

Software

One of the following HEAD acoustics Software:

ACQUA (Code 6810)

- › Advanced Communication Quality Analysis Software, Full-license Version (Version 6 or newer)

ACQUA Compact (Code 6860)

- › (Version 6 or newer)



ViBRIDGE pinnae are available in the regular dark gray color as well as in this light gray variant. The light gray pinnae can be retrofitted, but HMS II.3 ViBRIDGE can also be initially delivered with light gray pinnae (Code 1703.3-V1).

HIS R LN (Code 1702.1)

- › HEAD impedance simulator, right, low-noise version, for HMS II.3/4/5

Pinna retrofitting

Please note that only certain combinations of ear simulators and pinnae are viable, see page eight for further details.

HEL 3.3 (Code 1711)

- › Flexible pinna for HMS II.3/4/5, left ear, according to ITU-T P.57 type 3.3

HER 3.3 (Code 1712)

- › Flexible pinna for HMS II.3/4/5, right ear, according to ITU-T P.57 type 3.3

HEL 3.4 (Code 1713)

- › Flexible pinna for HMS II.3/4/5, left ear, according to ITU-T P.57 type 3.4

HER 3.4 (Code 1714)

- › Flexible pinna for HMS II.3/4/5, right ear, according to ITU-T P.57 type 3.4

HEL 4.4 (Code 1715)

- › Flexible pinna for HMS II.3/4/5, left ear, according to ITU-T P.57 Type 4.4

HER 4.4 (Code 1716)

- › Flexible pinna for HMS II.3/4/5, right ear, according to ITU-T P.57 Type 4.4

HEL 4.4-V1 (Code 1715-V1)

- › Flexible pinna for HMS II.3/4/5, left ear, according to ITU-T P.57 Type 4.4, gray color

HER 4.4-V1 (Code 1716-V1)

- › Flexible pinna for HMS II.3/4/5, right ear, according to ITU-T P.57 Type 4.4, gray color

HEL 4.4 ViBRIDGE-V1 (Code 1717-V1)

- › Flexible pinna for HMS II.3/5, left ear, gray color, according to ITU-T P.57 Type 4.4, ViBRIDGE Version

HER 4.4 ViBRIDGE-V1 (Code 1718-V1)

- › Flexible pinna for HMS II.3/5, right ear, gray color, according to ITU-T P.57 Type 4.4, ViBRIDGE Version



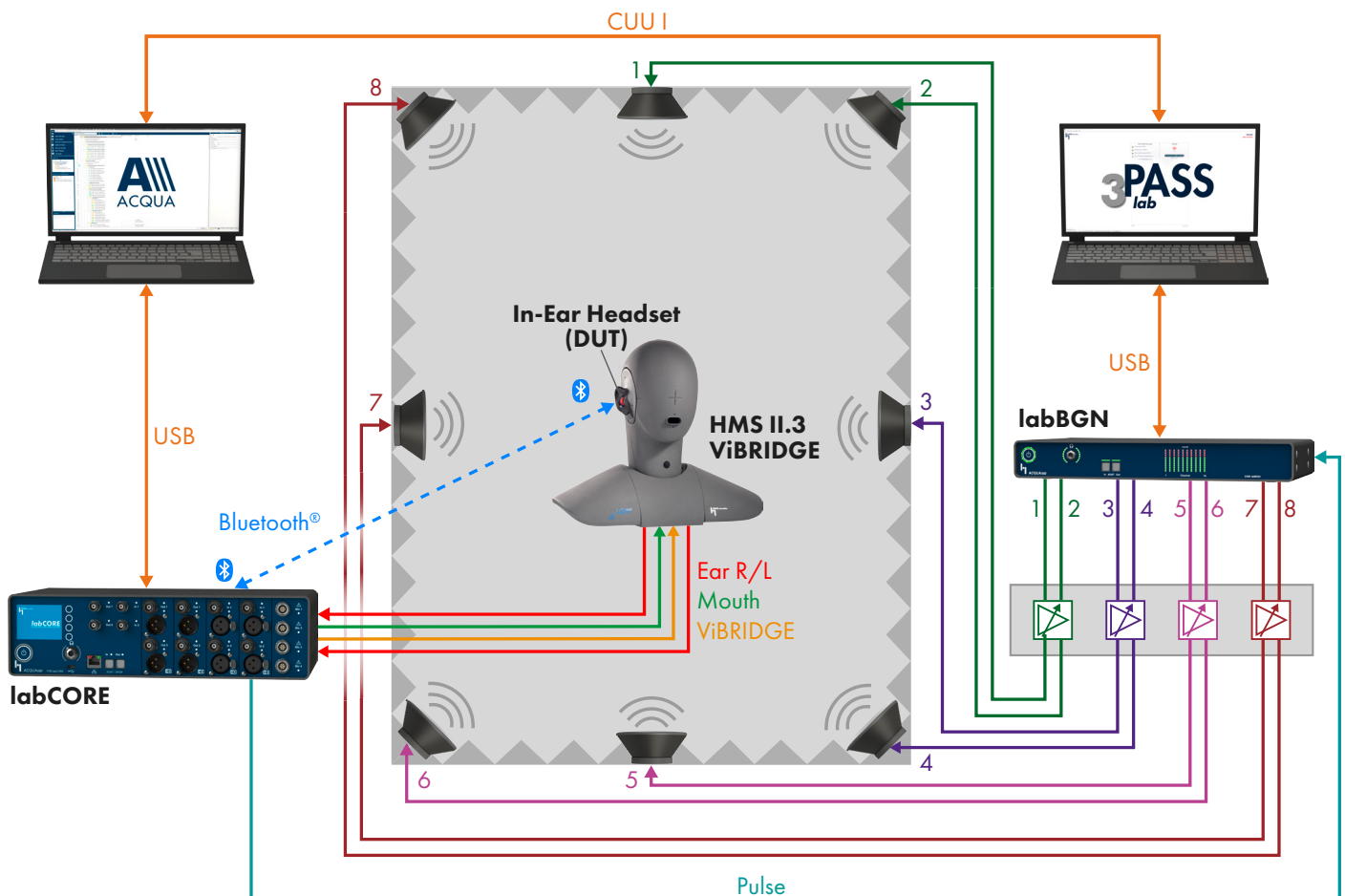
IN PRACTICE

APPLICATION EXAMPLE

Measurement of an In-Ear Headset with HMS II.3 ViBRIDGE

This exemplary test scenario depicts testing an in-ear headset that utilizes bone-conducted sound to improve speech quality in sending direction with HMS II.3 ViBRIDGE. *labCORE* powers the artificial mouth as well as the ViBRIDGE actuators with the two amplified channels of *coreOUT-Amp2*. The ear simulators of HMS II.3 ViBRIDGE are connected to *coreIN-Mic4*. Background

noise is simulated with *3PASS lab*. For full repeatability of measurements, background noise playback is synchronized by *labCORE* through a pulse connection to the hardware platform *labBGN*. *ACQUA* operates in conjunction with *labCORE* to generate, receive and analyze signals.



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