



Code 1704

HMS II.4

**HEAD Measurement System with Right Ear Simulator and 3.3 Pinna
(without Artificial Mouth)**

OVERVIEW

HMS II.4

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HMS II.4 is an artificial head measurement system with an ear simulator compliant with IEC 60318-4. Without an artificial mouth, the system is ideally suited for use-cases that do not include measurements in sending direction. It can also be used in complement to an existing HATS if an artificial mouth is not required for the second unit, e.g. as a listener.

The pinnae and the right ear simulator are fully compliant with the type 3.3 ear simulator laid out in Recommendation ITU-T P.57. It combines a low self-noise level with a very high upper SPL limit. A type 3.3 left ear simulator can be added as needed.

KEY FEATURES

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

Modular design for easy retrofitting with compatible HMS components.

Ear simulator:

- › Anatomically shaped pinnae (left & right) and right ear simulator
- › Precision microphone with low inherent noise floor & high SPL limit
- › Fully compliant with type 3.3 ear simulator laid out in Recommendation ITU-T P.57

APPLICATIONS

Comprehensive testing of audio playback systems & devices

Simulating a (second) listener

DETAILS

HMS II.4 is an artificial head measurement system ideally suited for precision measurements in receiving direction. It comprises two anatomically shaped pinnae and a right side ear impedance simulator. It can be used to test all kinds of audio playback equipment such as transducers, devices and complete systems. In telecommunication testing, it can be applied as e.g. a (second) listener.

Ear simulator & pinnae

HMS II.4 is delivered with two anatomically shaped pinnae compliant with the type 3.3 artificial ear laid out in Recommendation ITU-T P.57 (06/2021) as well as with a right side ear simulator compliant with ITU-T P.57 and IEC 60318-4.

The pinnae of HMS II.4 accurately replicate the anatomy of the human auricle. The microphone capsule in the ear simulator beyond provides a low inherent noise floor of 23 dB_{SPL}(A) and a very high sound pressure level limit of 165 dB_{SPL}. As such, HMS II.4 is qualified for any measurement scenario from signal levels close to the human hearing threshold up to very high sound pressure levels.

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.4 with other ear simulator configurations, e.g. with low-noise impedance simulators for measurements at very low sound pressure levels. Another option are type 4.4 ear simulators as laid out in ITU-T P.57 (06/2021). With their human-like ear canal they are ideally suited for testing in-ear headsets.

HMS II.4 can not be retrofitted with an artificial mouth for technical reasons. If a HMS shall be used for purposes other than measurements exclusively in receiving direction, several HMS variants with an artificial mouth are available, e.g. HMS II.3.

All HMS of this generation include TEDS (Transducer Electronic Data Sheet) technology that allows ACQUA to electrically determine the type and serial number of the HEAD Impedance Simulator (HIS) as well as the HATS itself.



HMS II.4 mounted on the supplied torso box HTB VI

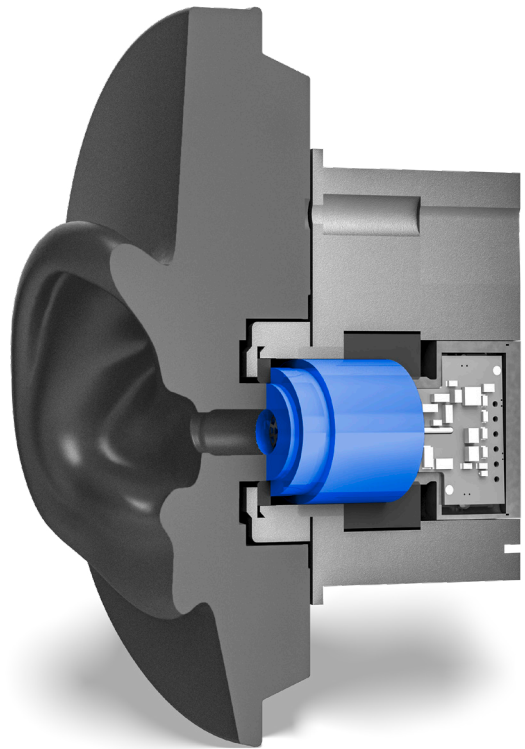
Recording

For measurements, HMS II.4 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.

Accessories

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.



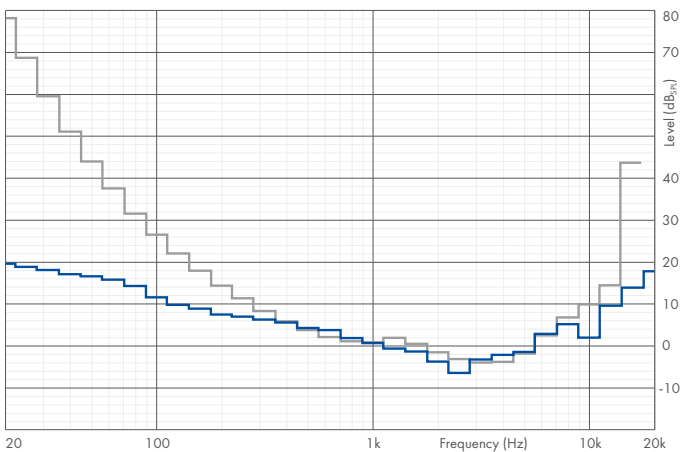
A cut through the right artificial ear of HMS II.4 shows its inner construction. A straight ear canal is followed by a coupler (highlighted in blue) that simulates the human ear's acoustic impedance. The coupler houses a high-quality condenser microphone with a dynamic range from close to the human hearing threshold up to 165 dB_{SPL}. The ear simulator is compliant with Recommendation ITU-T P.57 as well as with IEC 60318-4.

The anatomically shaped pinna according to type 3.3 described in Recommendation ITU-T P.57 accurately simulates the properties of the human auricle. This makes HMS II.4 ideally suited for precision measurements in various close-to-the-ear scenarios, e.g. testing the transfer characteristics of handsets in receiving direction, as well as for arbitrary far-from-the-ear test scenarios in receiving direction.

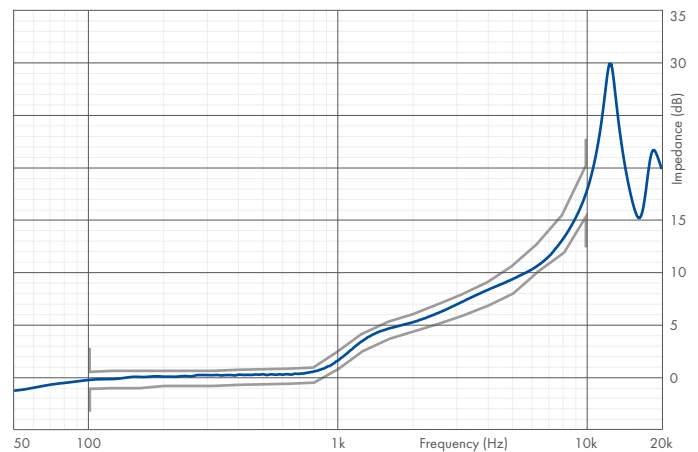
TECHNICAL DATA

Artificial Ear

Frequency range	3 Hz – 20 000 Hz
Frequency responses (freefield/diffuse field)	Compliant with ITU-T P.58
Directivity characteristics	Compliant with ITU-T P.58
Transfer impedance	Compliant with IEC 60318-4 and ITU-T P.57
Dynamic range	25 dB _{SPL(A)} – 164 dB _{SPL}
Self-noise	Compliant with ITU-T P.57
Microphone sensitivity	12.5 mV / Pa
Polarization voltage	200 V
Supply voltages	
› U (recommended)	± 60 V
› U (possible)	+ 120 V



Typical self-noise of HMS II.4 ear simulator (—) vs. average human hearing threshold (—)¹



Typical transfer impedance of HMS II.4 ear simulator (—) vs. ITU-T P.57 tolerance scheme (—)²

1. All curves diffuse-field equalized, HMS II.4 measured with 4096 FFT, average hearing threshold according to ISO 389-7
2. Curve and tolerance scheme normalized to 500 Hz

Other

Dimensions and Weight	
Overall dimensions (Width × Height × Depth)	460 × 400 × 210 mm 460 × 790 × 400 mm on Torso Box
Weight	Approx. 5.1 kg (standard options) Approx. 13.1 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.



ARTIFICIAL NOSE

The optional Artificial Nose AN-HMS can be fixed at the facial crosshair of HMS II.4. It is held by one screw and can be removed at any time.

AN-HMS serves as a mechanical support for head-worn devices, e.g. AR/VR headsets.



BOTTOM PLATE

The bottom plate offers two 7-pin LEMO connectors for the right and left ear microphones.

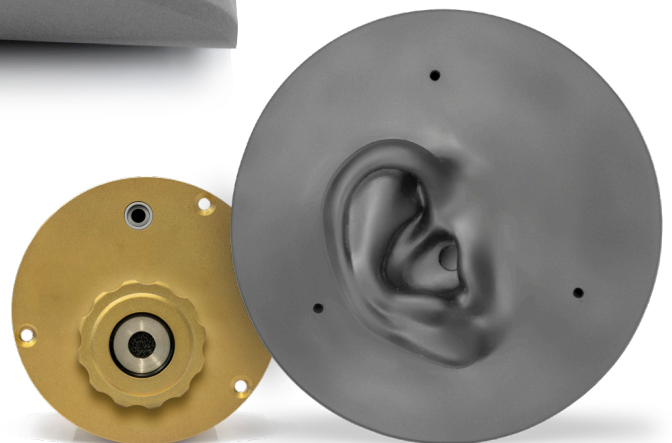
A quick-clamping mechanism allows easy and fast attaching of HMS to the supplied torso box HTB VI. The thread below allows to fasten HMS on e.g. the optional tripod HMT III.1.



IMPEDANCE SIMULATOR AND PINNA

The anatomically shaped pinna of HMS II.4 replicates the geometry of a human auricle. Beyond, the accompanying HEAD Impedance Simulator HIS R precisely recreates the ear's acoustic properties.

The modular design of HMS II.4 allows to retrofit compatible ear simulators and pinnae (see next page).



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.4 is delivered with two anatomically shaped pinnae type 3.3 as well as an impedance simulator for the right ear, all according to ITU-T P.57. This standard configuration is the top

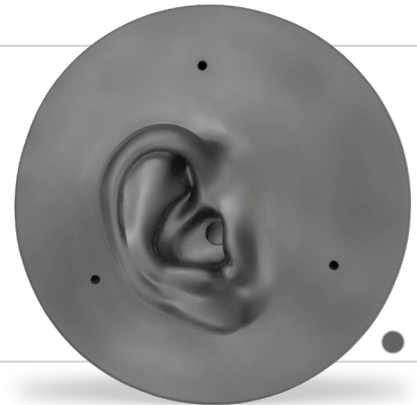
example below. Retrofit options for this HMS are shown further below.

All configurations on this page are for the right ear, the left ear can be equipped likewise for binaural applications. The type 4.4-pinnae are also available in a light gray-colored version.



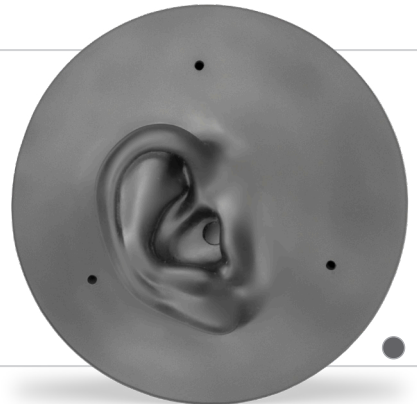
HMS II.4

- › Impedance simulator with straight ear canal
- › Anatomically shaped pinna type 3.3 with straight ear canal



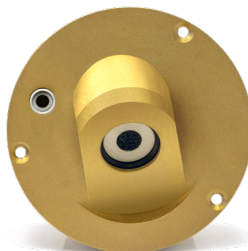
HMS II.3 LN (without mouth)

- › Low-noise impedance simulator with straight ear canal
- › Anatomically shaped pinna type 3.3 with straight ear canal



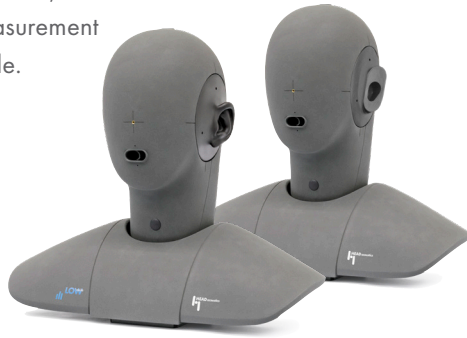
HMS II.3 LN HEC (without mouth)

- › 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.4, seven other models of the HEAD Measurement System are available.



HMS II.3

- › Anatomically shaped pinnae type 3.3
- › Right ear impedance simulator
- › 2-way artificial mouth
- › Retrofit options: HIS, pinnae
- › Best application: universal near- or far-field talker/listener

HMS II.3 LN

- › HMS II.3 variant with right ear low-noise impedance simulator
- › Best application: near- or far-field talker/listener at low SPL

HMS II.3 LN HEC

- › Anatomically shaped pinnae type 4.4 with human-like ear canal
- › Right ear low-noise impedance simulator with human-like ear canal
- › 2-way artificial mouth
- › Retrofit options: HIS, pinnae
- › Best application: in-/on-/over-ear headset talker/listener

HMS II.3 ViBRIDGE

- › HMS II.3 LN HEC variant with pinnae type 4.4 with ViBRIDGE bone conduction simulation for near-end speech
- › Best application: bone conduction in-ear headset talker/listener

HMS II.5

- › Anatomically shaped pinnae type 3.3
- › 2-way artificial mouth
- › Retrofit options: HIS, pinnae
- › Best application: (second) talker

HMS II.6 / HMS II.7

- › Simplified solid pinnae with free-field microphones
- › Condenser microphones (HMS II.6) or ICP® microphones (II.7)
- › 2-way artificial mouth
- › Retrofit options: none
- › Best application: universal far-field talker/binaural listener

SCOPE OF DELIVERY

HMS II.4 (Code 1704)

- › HEAD Measurement System, with right ear simulator and 3.3 pinna (without artificial mouth)

HIS R (Code 1702.2)

- › HEAD impedance simulator, right, for HMS II.3/4/5, version 2021

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

CLL-L I.3 (Code 1721-3)

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

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

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

HTB VI (Code 1574)

- › HEAD Torso Box for HMS & HSU

HCC-HMS (Code 1741)

- › Carrying case for accessory parts HMS II.x containing:
 - › Calibration adapter
 - › 2.5 mm Allen key
 - › 3 × Allen screw for HIS (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 two cables LEMO I 7-pin male ↔ LEMO I 7-pin male, 2.95 m (Codes 1721-3 / x1722-3)

HIS L (Code 1701)

- › HEAD impedance simulator, left, 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

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 4.3.100 or newer)

ACQUA Compact (Code 6860)

- › (Version 4.3.100 or newer)

RC-*labCORE* (Code 6984)

- › (Version 1.1.100 or newer)

VoCAS Core (Code 7970)

- › Voice Control Analysis System (Version 3.0.100 or newer)

HIS R LN (Code 1702.1)

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

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

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

Pinna retrofitting

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



IN PRACTICE

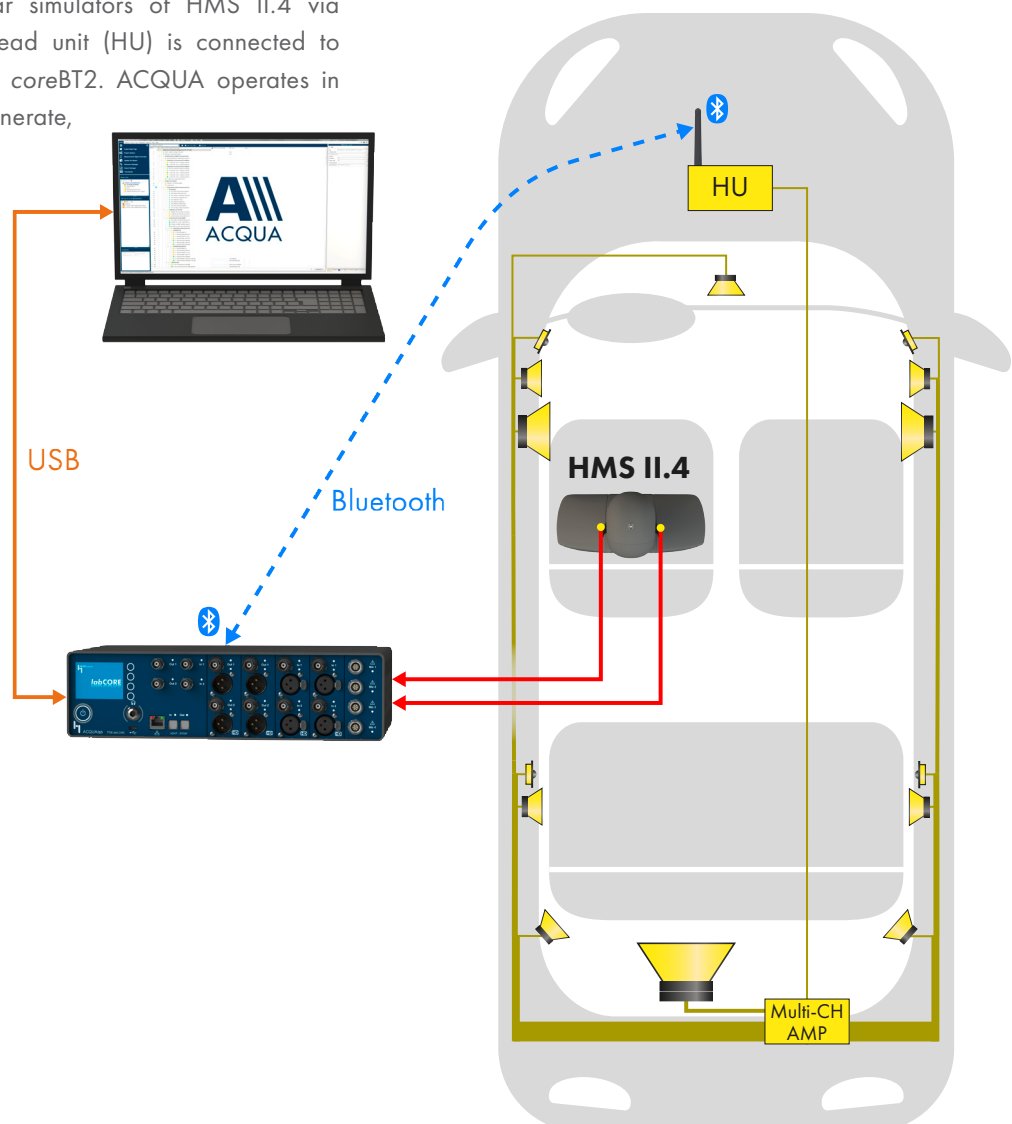
APPLICATION EXAMPLE

Measurement of an OEM in-vehicle loudspeaker system with HMS II.4

This exemplary test scenario depicts testing the audio playback quality of the OEM high-grade multichannel loudspeaker system in a vehicle. HMS II.4 simulates the driver of the vehicle to test the system's performance at the commonly occupied position.

labCORE connects to the ear simulators of HMS II.4 via coreIN-Mic4. The vehicle's head unit (HU) is connected to labCORE by Bluetooth® using coreBT2. ACQUA operates in conjunction with labCORE to generate, receive and analyze signals.

Analysis of audio quality is performed with the MDAQS (MultiDimensional Audio Quality Score) algorithm. It performs an instrumental assessment of the loudspeaker system's playback quality. MDAQS is added to ACQUA as ACQUA OPTion (ACOPT) 36.



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