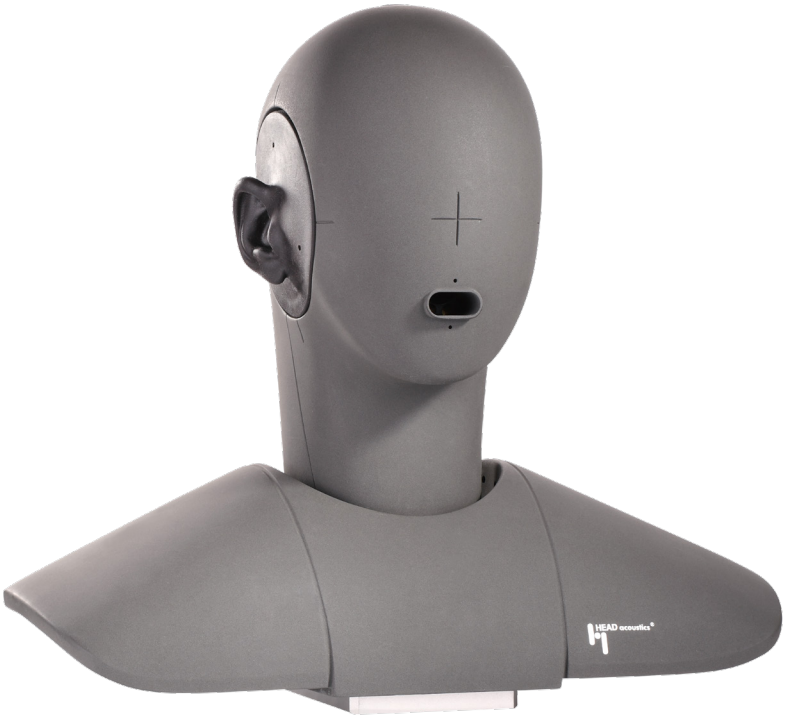
HEAD acoustics
Ebertstraße 30a
52134 Herzogenrath, Germany
Tel.: +49 2407 577-0
Fax: +49 2407 577-99
Email: telecom@head-acoustics.de
Web: www.head-acoustics.com

DATA SHEET

HMS II.3-LN (Code 1230.3)

HEAD Measurement System with Low-Noise Ear Simulator and Artificial Mouth



Overview

HMS II.3-LN contains a low-noise ear simulator based on IEC 60318-4. Besides all measurement scenarios covered by HMS II.3 (handheld/hands-free telephony), it is ideally suited for high precision acoustic measurements of headsets, headphones, earphones and in-ears with and without active noise cancellation. Its exceptionally low intrinsic noise level of 16 dB_{SPL}(A) allows measurements at very low SPL levels. Combined with an upper SPL limit of 148 dB_{SPL}, HMS II.3-LN sets a new standard unrivaled by other artificial heads in the field.

Anatomically shaped pinnae (type 3.3) enable conclusive measurements of in-/on-/over-ear devices. By replicating the human anatomy according to ITU-T P.58, HMS II.3-LN also supports arbitrary free-field measurement scenarios.

The ITU-T P.58-compliant artificial mouth of HMS II.3-LN reproduces the complete spectrum of human voice with a low-distortion two-way design, allowing high-quality super-wideband and fullband measurements.

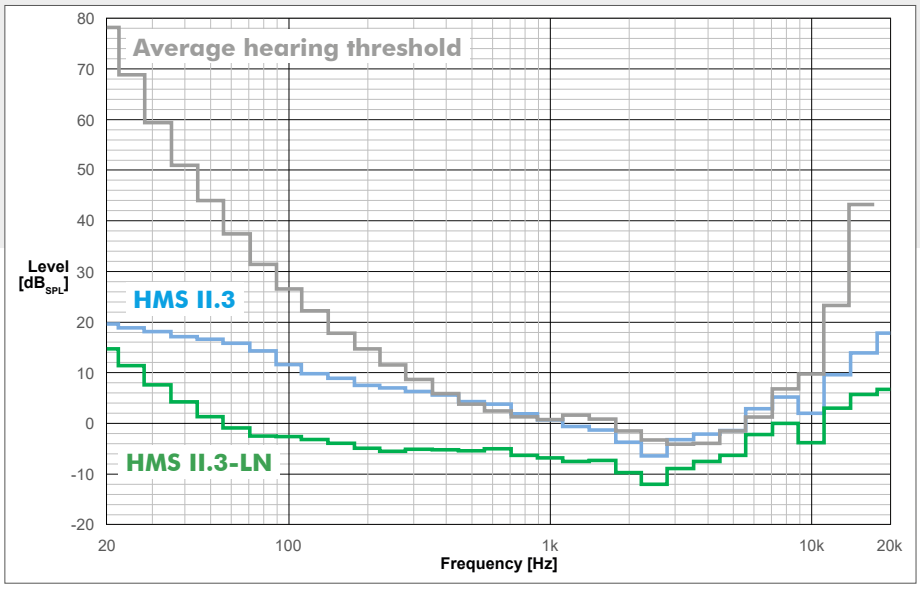
Description

Head-worn audio devices like headsets, headphones, earphones and in-ears are able to cover a very wide SPL range – from signal levels close to the human hearing threshold (e.g. idle noise of ANC headsets) to the impressive dynamic peaks generated by high-end over-ear headphones. Thus, specialized equipment capable of mastering both extremes is essential for conclusive measuring and testing. The HEAD Measurement System HMS II.3-LN is the ideal tool for this purpose.

Ear simulator and pinnae

The ear simulator of HMS II.3-LN provides an exceptionally low inherent noise floor of 16 dB_{SPL}(A). As such, it is fit for any measurement scenario with levels close to and below the human hearing threshold.

Low-noise ear simulator



The artificial ear of the regular HMS II.3 already offers a low level of self-noise close to the human hearing threshold. The ear simulator of HMS II.3-LN undercuts the regular artificial ear as well as the human hearing threshold significantly, giving ample headroom for all acoustic measurements at very low sound pressure levels.

- All curves are diffuse-field equalized
- HMS II.3 and HMS II.3-LN are measured with 4096 FFT
- Average hearing threshold according to ISO 389-7

Beyond high precision measurements at low signal levels, HMS II.3-LN is ideally suited for determining self-noise and higher order distortion of audio equipment, background noise level of quiet acoustic environments and more.

The high upper SPL limit of 148 dB_{SPL} ensures full usability of HMS II.3-LN for arbitrary medium and high level measurements. Its artificial ear covers the complete human hearing range without internal filtering or special hardware – HMS II.3-LN connects directly to ACQUA and *lab*CORE like other HMS systems.

HMS II.3-LN comes with two anatomically shaped pinnae type 3.3 according to ITU-T Recommendation P.57, ideally suited for measurements of intra-concha headsets, hearing protection and hearing aids. The simplified pinna type 3.4 is available as an optional accessory.

The impedance simulator is based on IEC Standard 60318-4 (2010-01) as laid down in ITU-T P.57. Its specialized low-noise microphone supports TEDS and entails few small, acoustically irrelevant variations from the standard's formal requirements. For binaural measurements, the left ear of HMS II.3-LN can be equipped with the same low-noise ear simulator. Additionally, existing HMS II.3 can be retrofitted with the ear simulators of HMS II.3-LN at HEAD acoustics.

Thanks to geometric and acoustic characteristics according to ITU-T Recommendation P.58, HMS II.3-LN is appropriate not only for close-to-the-ear, but also arbitrary far-from-the-ear measurement scenarios.

Artificial mouth

The artificial mouth of HMS II.3-LN allows measurements in sending direction and application as a talker. Its two-way design provides low distortion, an excellent unequalized frequency response and a wide frequency range, making it ideally suited for super-wideband and fullband measurements. After equalization, the artificial mouth's frequency response easily complies with the tolerance scheme described in ETSI TS 102 924 as well as the stricter HEAD acoustics production tolerance scheme.

HMS II.3-LN also meets ITU-T Recommendation P.58 regarding the radiation characteristics of its mouth as well as its geometrical dimensions. It realistically reproduces the acoustic free-field behavior of a talking and listening person in diffraction and reflection as laid out in ITU-T P.58.

Key Features

- Geometric and acoustic characteristics according to ITU-T P.58
- Award-winning design
- Convenient mobile use in conjunction with portable hardware

Ear simulator:

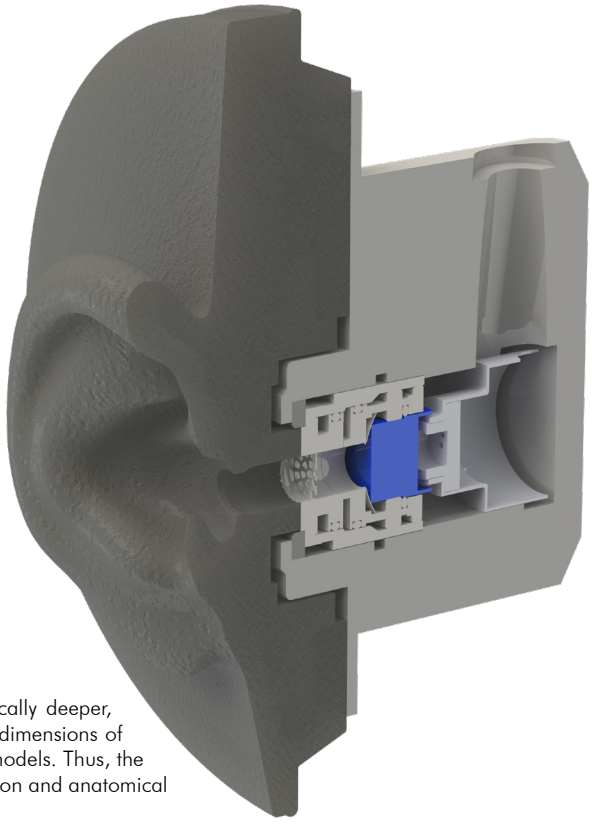
- High sensitivity microphone with
  - very low intrinsic noise floor (16 dB_{SPL}(A))
  - high upper SPL limit of 148 dB_{SPL}
  - TEDS support
- Anatomically shaped pinnae type 3.3 according to ITU-T P.57
- Ear simulator based on IEC 60318-4 (2010-01)
- Supports individual digital equalization in ACQUA

Artificial mouth:

- Low-distortion two-way design with wide frequency range for super-wideband and fullband measurements
- Radiation characteristics according to ITU-T P.58
- Supports digital equalization in ACQUA

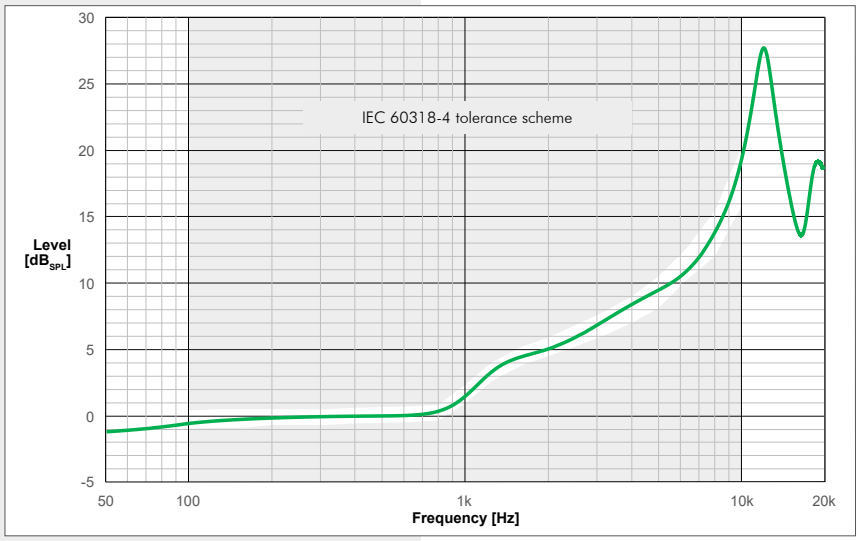
Applications

- High precision measurements of:
  - In-/on-/over-ear devices (headsets/headphones/earphones/in-ears)
  - Active and passive hearing protection systems
  - Hearing aids (e.g. intra-concha)
- Measurements of idle noise in ANC headphones/headsets/in-ears
- Low-level measurements of audio devices, e.g.:
  - Self-noise of audio devices
  - Higher order distortion
- Assessment of background noise level in quiet acoustic environments (e.g. in optimized office rooms, semi-anechoic chambers)



The high-sensitivity microphone capsule (blue) of HMS II.3-LN is physically deeper, requiring a revised impedance simulator body with adjusted depth. The dimensions of the ear canal as well as the 3.3 pinna remain identical with other HMS models. Thus, the low-noise ear simulator of HMS II.3-LN combines the impedance simulation and anatomical properties as laid out in IEC 60318-4 with a high-sensitivity microphone

Measurements - artificial ear



Typical transfer impedance of HMS II.3-LN ear simulator

• Curve and tolerance scheme standardized to 500 Hz

Technical Data	
Artificial Ear (receiving direction)	
Transmission range	3 Hz – 20000 Hz
Dynamic range lower limit	16 dB$_{SPL}$(A)
Dynamic range upper limit	148 dB$_{SPL}$
Microphone sensitivity	50 mV / Pa
Frequency response	According to ITU-T P.58
Polarization voltage	200 V
Supply voltage	± 60 V (recommended), + 120 V (possible)
Directivity characteristics	According to ITU-T P.58
Artificial Mouth (sending direction)	
Loudspeaker configuration	2-way
Transmission range	Approx. 50 Hz – 20000 Hz
Power limit	Max. 20 W (sine) Max. 50 W (music) (max. power is electrically limited beyond 6 kHz)
Impedance	4 Ω
Frequency response (equalized)	Exceeds ETSI TS 102 924
Distortion factor	Exceeds ITU-T P.58
Directivity characteristics	According to ITU-T P.58
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)
Dimensions	
Overall dimensions (W x H x D)	450 x 400 x 180 mm
Weight	Approx. 5.4 kg

Playback and recording

For measurements, HMS II.3-LN connects to the communication analysis system ACQUA via the hardware platform *lab*CORE. In combination with *core*BEQ, individual equalization of the ear simulator(s) is possible – including support for various equalization targets (as requested e.g. in ITU-T Recommendation P.581). Alternatively to *lab*CORE and *core*BEQ, the standalone Binaural Equalizer BEQ II.1 can be used.

Signals recorded in ACQUA are stored together with their individual measurement settings. This allows the system to automatically adjust the output accordingly during playback. *lab*CORE's optional hardware extension coreOUT-Amp2 provides amplification for one or two artificial mouths while ACQUA takes charge of their equalization.

In conjunction with the optional power box *lab*PWR I.2 for *lab*CORE, mobile recording and playback is also possible (e.g. in vehicles).

Accessories

The Torso Box HTB VI delivered with HMS II.3-LN acoustically emulates a human torso. Mounting HMS onto the torso box is quick and convenient with a tool-less Camlock fastener, opening the torso box is tool-less as well. The side-mounted handles of HTB VI allow easy transportation of the complete system, e.g. for mobile applications.

Another accessory for HMS II.3-LN is the artificial nose AN HMS, enabling measurements of nose-supported devices, e.g. AR/VR glasses and headsets.

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

General Requirements

Hardware

- ***lab*CORE (Code 7700)**, Modular multi-channel hardware platform
  - – ***core*BUS (Code 7710)**, I/O bus mainboard
  - – ***core*OUT-Amp2 (Code 7720)**, Power amplifier board, for sending direction
  - – ***core*IN-Mic4 (Code 7730)**, Microphone input board, for receiving direction
  - – ***core*BEQ (Code 7740)**, Binaural equalization

  or alternatively to *lab*CORE:
- **BEQ II.1 (Code 1347)**, Digital binaural equalizer (extended version with USB, pulse in, analog out)

Software

- **ACQUA (Code 6810)**, Basic analysis software, full-license version

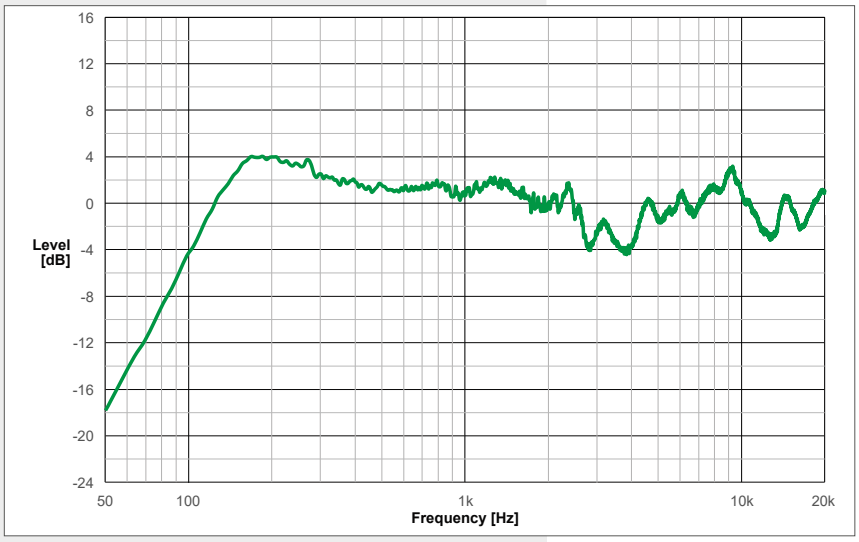
Options

- **HIS L-LN (Code 1231.3),** HEAD impedance simulator, left, low-noise version, for HMS II.3/4/5
- **HEL/HER III.1 (Code 1248/1249)**, Simplified pinna type 3.4 (left/right) according to ITU-T P.57
- **AN HMS (Code 1418)**, Extension for HEAD measurement system HMS: Artificial nose
- **HMT III (Code 1961)**, Height-adjustable tripod for HMS
- **HSC IV-V4 (Code 1524-V4)**, Carrying case for HMS II.x
- **TLP (Code 1967)**, Triaxial laser pointer for HMS/HSU positioning incl. two batteries and carrying case

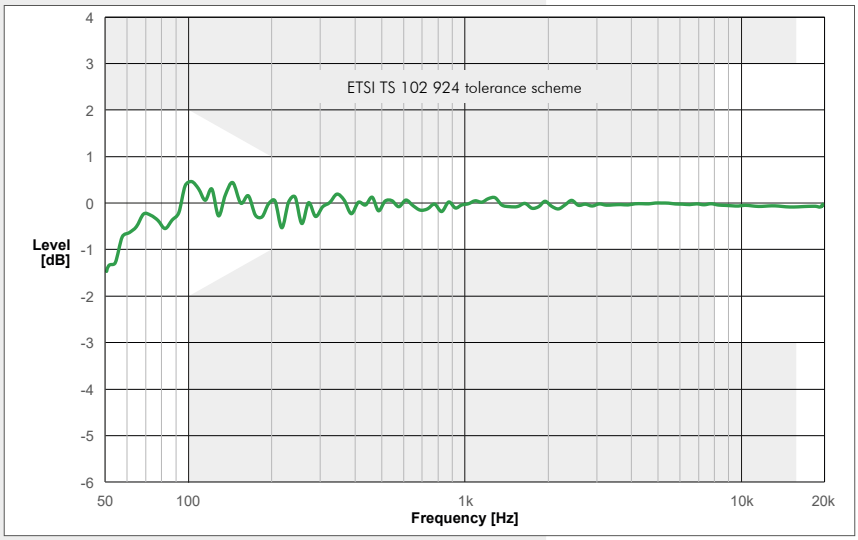
Delivery items

- **HMS II.3-LN (Code 1230.3)**, HEAD measurement system with low-noise ear simulator and artificial mouth
- **HIS R-LN (Code 1232.3),** HEAD impedance simulator, right, low-noise version, for HMS II.3/4/5
- **HEL/HER IV.2 (Code 1381/1382)**, Anatomically shaped pinna type 3.3 (left/right) according to ITU-T P.57
- **HTB VI (Code 1574)**, HEAD torso box for portable artificial head measurements
- **CSB II (Code 9849)**, Adapter Speakon male <-> Banana plug
- **Accessories case HCC-HMS (Code 1641)**, Containing: microphone holder with 1/2" clip-on adapter, MRP pointer, lip ring, calibration adapter, 2.5 mm Allen key, ear canal key
- **Manual**

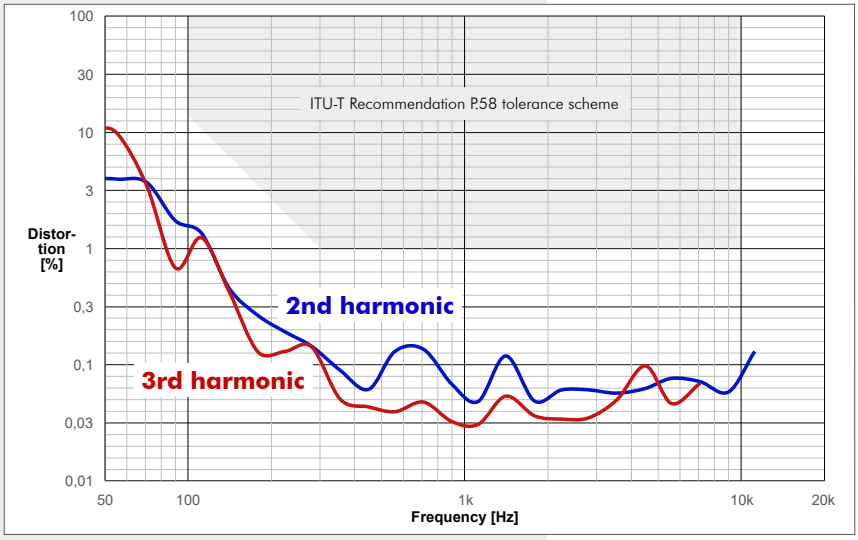
Measurements - artificial mouth



Typical unequalized frequency response of two-way mouth



Typical frequency response of equalized two-way mouth



Harmonic distortion of equalized two-way mouth at 0 dB_{Pa}