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DATA SHEET

HQS-ANC-Headset (Code 60056)

HEAD acoustics Quality Standard, Active Noise Cancellation Headsets

Overview

HQS-ANC-Headset is a quality standard developed by HEAD acoustics, ideally suited for testing headphones and headsets with and without active noise cancellation. HQS-ANC-Headset is applicable for any consumer and commercial device and supports all types of connectivity – analog (wired), USB and Bluetooth®.

In addition to elemental properties like audio playback quality, HQS-ANC-Headset also covers advanced metrics such as active and passive outside noise isolation, intelligibility of external speech / public announcements (listening effort), acoustic leak robustness and more. The database also includes tests for internationally recognized headset telecommunication metrics such as POLQA, EQUEST, 3QUEST and listening effort ABLE.

Measurements of HQS-ANC-Headset include the test methods and requirements specified in ETSI standard TS 103 640 v1.1.1.

Database rev.	ACQUA version
2	≥ 4.2.210

Description

The technical complexity of active noise cancellation (ANC) generates strong variation in day-to-day efficiency. Some scenarios allow very convincing noise suppression while other seemingly harmless acoustic situations "defeat" the system. As a result, thorough testing of ANC systems and devices should include a multitude of acoustic scenarios. The HEAD acoustics Quality Standard HQS-ANC-Headset puts this into operation. In addition to testing fundamentally important metrics like audio and communication quality of the DUT, it supports various tests with background noise, public announcements, a second talker and environmental impacts like wind noise. HQS-ANC-Headset tests in a laboratory environment and with full repeatability, allowing convenient experimental optimization and meaningful comparison of active noise cancellation systems.

The test suite is divided into three different measurement scenarios. Depending on the type of DUT and desired information, the measurements contained in one or more of these scenarios come into play.

*lab*CORE allows connection by Bluetooth®, USB and analog (via HIB I)

Key Features

- Comprehensive automated test suite for measurement, evaluation and experimental optimization of headphones with and without ANC
- Supports all types of devices:
  - Over-ear (circumaural)
  - On-ear (supra-aural)
  - In-ear (intra-concha and insert)
- Supports all types of connection: analog, USB, Bluetooth®
- Tests DUT behavior for different types of outside noise with full repeatability
- Tests for general audio and voice call communication quality

Applications

- Testing, comparison and experimental optimization of ANC systems (and passive noise isolation)
- Measuring general audio quality of any type of headphone
- Testing professional headsets (e.g. for private and commercial aviation)
- Testing voice call communication quality (NB, WB, SWB) of headsets

Scenario A: Isolation from ambient noise & external speech

These measurements aim at evaluating a DUT's passive noise isolation, the performance of ANC and the ANC circuitry's self noise. The artificial mouth of the HMS tests for self-speech performance.

The tests with general outside noise use 3PASS *lab* or 3PASS *flex* as a convenient and capable background noise simulation including full repeatability. For scenarios with a second talker (e.g. testing talk-through), HMS II.5 or an artificial mouth can be added. An external loudspeaker allows to determine DUT performance during public announcements. As some types of headphones are susceptible to performance decrease when coupling geometry changes (e.g. using eyeglasses with over-ear headphones), measurements also include tests for acoustic leak robustness.

ANC microphones can be highly susceptible to wind noise. Therefore, this scenario also supports measurements of ANC devices in a wind flow. As the wind's angle of attack is a determining factor, HQS-ANC-Headset supports the motorized turntable HRT I for rotating DUT (on HMS) in the flow field.

Scenario B: Audio playback

Measurement scenario B tests general audio performance of a DUT via defined noise and program test signals (music, speech). In addition to classic acoustic testing like frequency response and distortion, it includes comparisons with and without ANC to evaluate degradation of audio quality due to signal processing. Testing for decrease of listening effort in noisy environments is also part of these tests. To evaluate possible disturbance of nearby persons, sound leakage is measured as well.

Scenario C: Voice call communication

Scenario C aims at headsets with telecommunication capability. Measurements include typical benchmarks such as communication quality in send and receive direction, sidetone and echo performance (NB, WB & SWB). The measurements also include metrics from various internationally recognized telecommunication tests such as POLQA, EQUEST, 3QUEST and listening effort ABLE.

Primary SMDs in ACQUA database*
Use case scenario A: Isolation from ambient noise & external speech
Self-noise Spectrum
Self-noise Loudness level (ISO 532-1)
Self-speech Insertion loss
Self-speech Loudness level reduction (ISO 532-1)
External speech (HATS or LS) insertion loss
External speech (HATS or LS) Loudness level reduction (ISO 532-1)
External speech (HATS or LS) Listening effort (ABLE, acc. to ETSI TS 103 558)
Ambient noise (BGN) Insertion loss
Ambient noise (BGN) Loudness level reduction (ISO 532-1)
Ambient noise (BGN) Downlink Speech Intelligibility Index (SII) improvement (ANSI S3.5-1997)
Ambient noise (BGN) Level vs. Time (temporal performance)
Acoustic leak robustness of DUT - Self-speech insertion loss
Acoustic leak robustness of DUT - Self-speech Loudness level reduction (ISO 532-1)
Acoustic leak robustness of DUT - External speech (HATS or LS) insertion loss
Acoustic leak robustness of DUT - External speech (HATS or LS) Loudness level reduction (ISO 532-1)
Acoustic leak robustness of DUT - External speech (HATS or LS) Listening effort (ABLE, acc. to ETSI TS 103 558)
Acoustic leak robustness of DUT - Ambient noise (BGN) insertion loss
Acoustic leak robustness of DUT - Ambient noise (BGN) Loudness level reduction (ISO 532-1)
Acoustic leak robustness of DUT - Ambient noise (BGN) Downlink Speech Intelligibility Index (SII) improvement (ANSI S3.5-1997)
Acoustic leak robustness of DUT - Ambient noise (BGN) Level vs. Time (temporal performance)
ANC automatic activation threshold
ANC automatic activation time
ANC acoustic overload point
Test setup for wind noise measurements (turntable) (Wind generation not included)
Use case scenario B: Audio playback
Square wave response
Playback level range
Frequency response (measured with noise, music & speech signals)
Tracking response
Left/Right Crosstalk
Loudness level (measured with noise, music & speech signals) (ISO 532-1)
Listening effort in the presence of BGN (ABLE, acc. to ETSI TS 103 558)
Sound leakage (a.k.a. "bleed") of audio playback
Use case scenario C: Voice call communication (NB, WB & SWB)
Sidetone delay
Sidetone masking rating (STMR) (ITU-T P.79)
Loudness rating in RCV (RLR) (ITU-T P.79)
Sensitivity in RCV (for analog/wired DUT)
Frequency response in RCV
Idle channel noise in RCV, level & spectral peaks
Distortion in RCV
Speech quality (POLQA) in RCV (ITU-T P.863)

General requirements

Software

- **ACQUA (Code 6810)**, Advanced Communication Quality Analysis, Version 4.2.210 or later
- One of the following **background noise simulation systems**
  - **3PASS *lab* (Code 6990)**, background noise simulation system

  or
  - **3PASS *flex* (Code 6995)**, background noise simulation system
- **ACOPT 37 (Code 6869)**, Option ABLE - Assessment of Binaural Listening Effort according to ETSI TS 103 558

Hardware

- ***lab*CORE (Code 7700)**, modular multi-channel hardware platform **with**
  - ***core*BUS (Code 7710)**, I/O bus mainboard
  - ***core*OUT-Amp2 (Code 7720)**, power amplifier output module (two channels) analog output module
  - ***core*IN-Mic4 (Code 7730)**, microphone input module (four channels)
  - ***core*BEQ (Code 7740)**, binaural equalization
- One of the following **HEAD measurement systems**
  - **HMS II.3 (Code 1230)**, HEAD measurement system with ear simulator, pinna type 3.3 or 3.4 **with**
  - **HIS L (Code 1231)**, HEAD impedance simulator, left ear

Primary SMDs in ACQUA database*
Use case scenario C: Voice call communication (continued)
Listening Effort in the presence of BGN (ABLE, acc. to ETSI TS 103 558)
Loudness rating in SND (SLR) (ITU-T P.79)
Sensitivity in SND (for analog/wired DUT)
Frequency response in SND
Idle channel noise in SND, level & spectral peaks
Distortion in SND
Speech quality (POLQA) in SND (ITU-T P.863)
Quality of transmitted speech in the presence of BGN (3QUEST) (ETSI EG 202 396-3)
Terminal coupling loss (TCLw for narrowband, TCL for wideband and super-wideband)
Perceptual based Echo assessment (EQUEST)
Attenuation range double talk in SND (ITU-T P.502)

*These tables only list a part of the total amount of SMDs in the HQS-ANC-Headset database. All listed analyses are performed for various DUT modes (ANC OFF / ON, Talk-Through), comparisons between modes are provided

or

- **HMS II.3-LN (Code 1230.3)**, HEAD Measurement System, low-noise version with 3.3 Pinna, right ear simulator & artificial mouth (based on IEC 60318-4, low-noise, high dynamics) **with**
- **HIS L-LN (Code 1231.3)**, HEAD Impedance Simulator, left, for HMS II.3/4/5

- **MSA II (Code 6487.2)**, 8-channel Microphone Surround Array, symmetrical (for System Equalization & Recording)

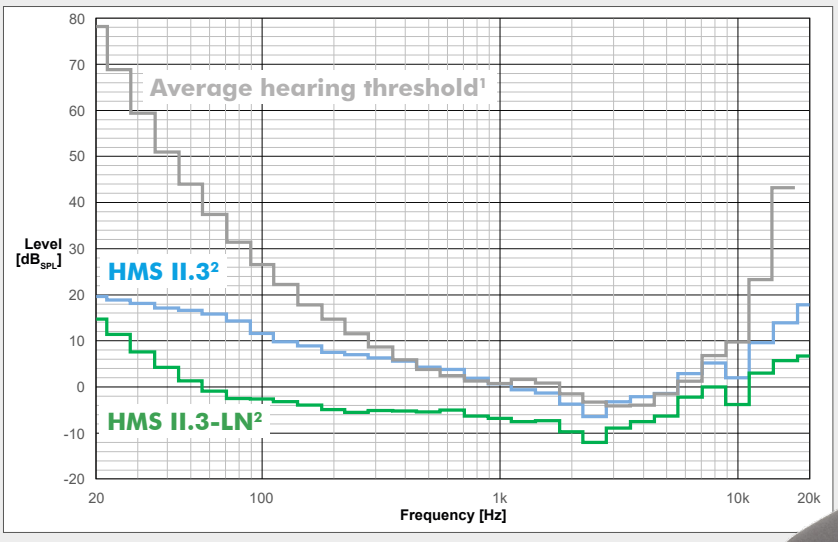
Options

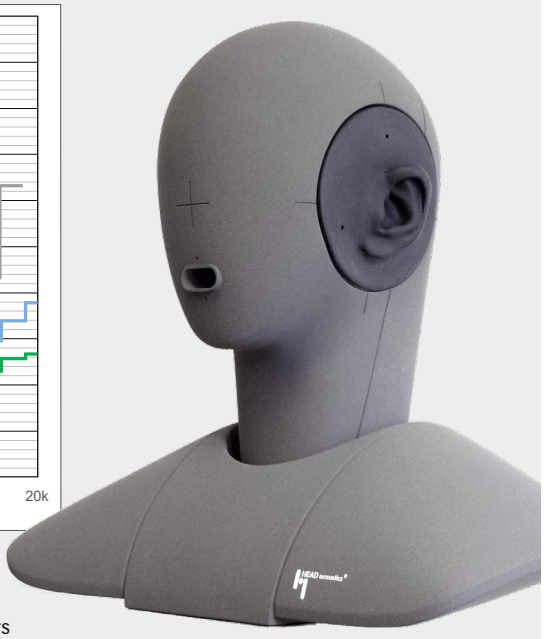
Please see the decision tree and the table on the next page to determine hardware and software options for your individual application.

Delivery items

- **HQS-ANC-Headset (Code 60056)**, as ACQUA database
- **V2C File** (for ACQUA)
- **Manual** as PDF

Low noise ear simulator of HMS II.3-LN





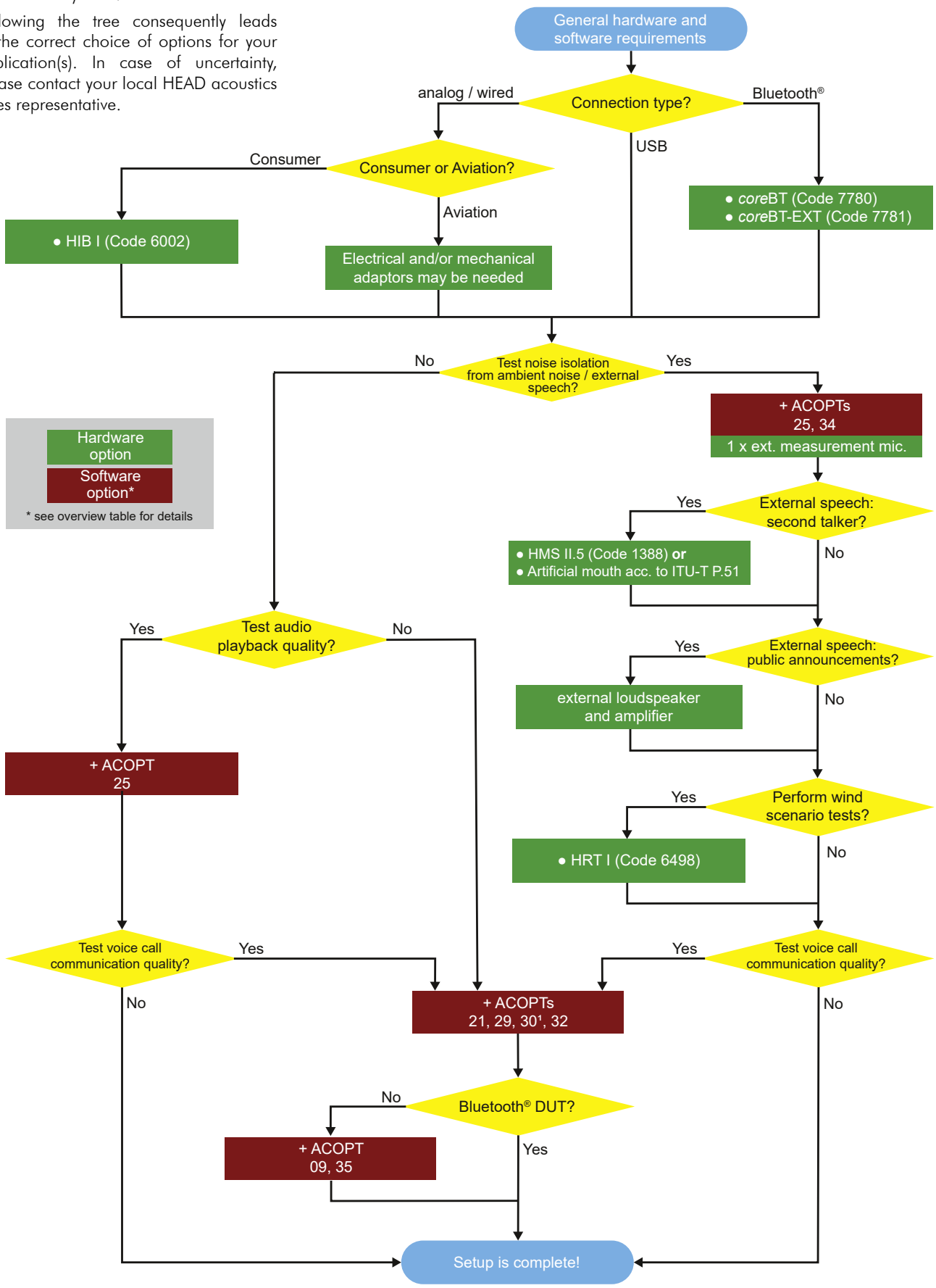
For measurements at very low SPL levels, e.g. measuring idle noise of ANC systems, microphones with a very low inherent noise floor are required. For this purpose, HEAD acoustics has developed HMS II.3-LN. The self-noise of its ear simulator undercuts the regular artificial ear of HMS II.3 as well as the human hearing threshold significantly. It is ideally suited for precision measurements at very low SPL levels and therefore an advisable choice for testing ANC devices.

1) According to ISO 389-7
2) Measured with 4096 FFT
All curves are diffuse-field equalized

Hardware & software options

This tree serves as a decision-making tool to identify the hardware and/or software options based on use cases. The previously listed general requirements are needed in any case.

Following the tree consequently leads to the correct choice of options for your application(s). In case of uncertainty, please contact your local HEAD acoustics sales representative.

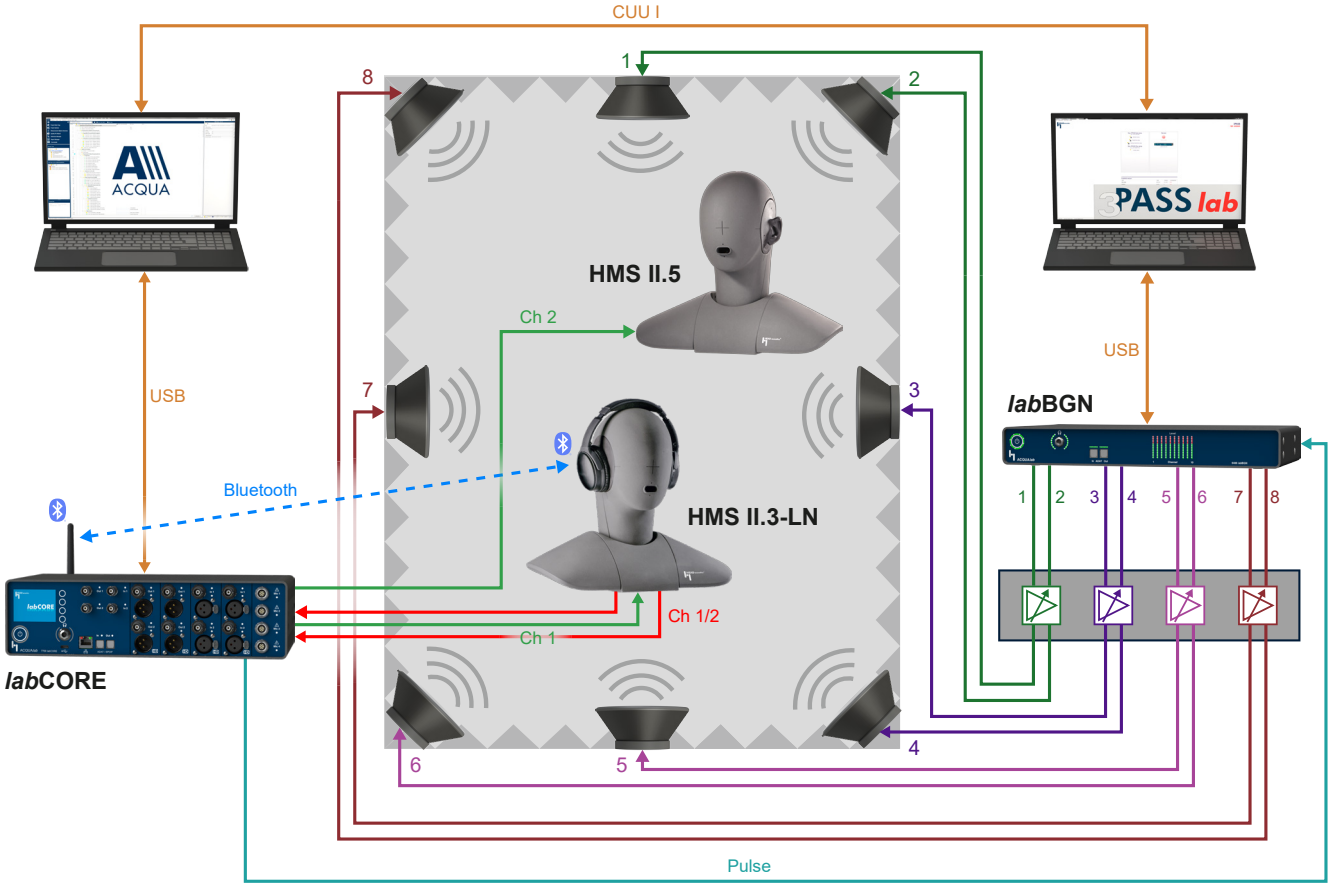


ACQUA options overview			
Scenario	**A: Isolation from ambient noise / external speech**	**B: Audio playback**	**C: Voice call communication**
ACOPT 09 (Code 6819), Speech Level Voltmeter	–	–	Only for analog / USB
ACOPT 21 (Code 6844), 3QUEST	–	–	●
ACOPT 25 (Code 6852), Psychoacoustics	●	●	–
ACOPT 29 (Code 6856), EQUEST	–	–	●
ACOPT 30 (Code 6857), POLQA[1]	–	–	●
ACOPT 32 (Code 6859), Speech-based Double Talk	–	–	●
ACOPT 34 (Code 6865), Speech Intelligibility Index according to ANSI S3.5-1997	●	–	–
ACOPT 35 (Code 6866), 3QUEST-SWB/FB	–	–	Only for analog / USB
ACOPT 37 (Code 6869), ABLE - Assessment of Binaural Listening Effort according to ETSI TS 103 558 (general requirement)			

Configuration example: Measurement of a Bluetooth® headset with a second talker

This exemplary test scenario depicts testing of a Bluetooth® headset on HMS II.3-LN. A HMS II.5 simulates a second talker to test the headset's performance with external speech.

*lab*CORE connects to the headset via *core*BT. Background noise is simulated with 3PASS *lab*. For full repeatability of measurements, background noise playback is synchronized by *lab*CORE through a pulse connection to the hardware platform *lab*BGN. ACQUA operates as the central software to generate, receive and analyze signals.



1) Measurements to verify compliance with ETSI TS 103 640 require POLQA 3