HEAD acoustics

DATA SHEET

APPLICATION EXAMPLE INCLUDED

Code 60066

HQS-ANC-Car

Active Noise-Cancellation (ANC) in Cars

OVERVIEW

HQS-ANC-Car

Code 60066

Active Noise-Cancellation (ANC) in Cars

HQS-ANC-Car helps assessing in-vehicle active noise cancellation (ANC) systems. It is applicable for testing fully/ partially integrated and standalone ANC systems in all types of consumer and commercial vehicles.

HQS-ANC-Car provides multiple scenario assessments for the ANC system of a vehicle. That includes the general performance of the ANC system, self-noise of the ANC system, and its effect on listening effort as well as audio playback.

KEY FEATURES

Supports different types of ANC systems
› Fully integrated
› Partly integrated
› Standalone

Assessment of ANC system behavior for arbitrary road noise scenarios

Assessment of influence from ANC on voice playback quality and listening effort

Assessment of influence from ANC on audio playback quality

A²B® compatibility

APPLICATIONS

Testing, comparison, and tuning of in-vehicle ANC systems

Assessment of functionality and effectiveness of in-vehicle ANC systems

Investigation of the impact from in-vehicle ANC systems on other voice and audio systems (ICC, telephony, vehicle audio)

DETAILS

The occupants of vehicles are exposed to a multitude of disturbing noises such as engine noise, wind noise, tire rolling noise, as well as noise emission from HVAC (Heating, Ventilation, Air conditioning). The intensity and permanent presence of these noises – especially when traveling over a long period of time – are annoying and exhausting for driver and passengers.

INTRODUCTION

Challenge

Driving noises are exhausting for driver and passengers of a vehicle. The combination of this soundscape with concentrating on piloting the vehicle through traffic introduces dangers such as fatigue and dropping concentration levels.

Besides introducing stress, driving noises make conversations more difficult. Vehicle occupants are forced to speak up to be intelligible while conversational partners have to make an effort to understand. This creates additional distraction from traffic events.

Active noise cancellation in vehicles

Ongoing advancements in the field of active noise cancellation enable the technology for application in vehicles. Digital signal processors receive information from a network of microphones and other sensors for capturing the soundscape in the vehicle cabin. Based on this information, loudspeakers play back anti-noise for creating quiet zones for driver and passengers.

Modern cars usually have several microphones for hands-free communication, various sensors such as accelerometers, and position/state sensors. The ANC system accesses and processes input from these sources for generating phase-inverted anti-noise immediately to counterbalance disturbing noises . The phase-inverted anti-noise signal is played back by either dedicated loudspeakers or the vehicle's regular audio system. Thus, it generates ANC zones for driver and passengers.

Testing solution

HQS-ANC-Car is the test suite for comprehensive and repeatable testing of in-vehicle ANC systems and devices. It enables basic and advanced development, experimental optimization, and benchmarking of ANC systems in a stationary car within a laboratory environment. The test suite includes measurements and analyses for assessing the functionality and effect of the ANC system, as well as its influence on listening effort during conversations.

DATABASE

Prerequisites

Testing with HQS-ANC-Car is performed with a stationary vehicle in a suitable room. The room is not required to have acoustic optimization. The required measurement equipment is provided by HEAD acoustics.

Recording background noise

*lab*CORE including *core*A2B enables to apply driving noise recordings from the microphones and acceleration sensors via the A²B® network of the vehicle. Further, the measurements require a binaural recording in the examined ANC zone at the same conditions as the A²B recordings.

Alternatively, background noise is recorded and simulated with 3PASS *flex*.

HQS-ANC-Car supports up to six customized recordings for each measurement object. They are not specified and have to be recorded by the user. Therefore, the background noises fit to the individual target applications.

Part A

Part A provides measurements and analyses for assessing the performance of the ANC system and its influence the listening effort if listening to speech signals in the ANC zone.

Part A: Measurements

Measurements are executed with and without background noise as well as enabled/disabled ANC system.
› Background noise playback and recording
› Self noise (only without background noise)
› Speech via secondary talker (Head and torso simulator (HATS))
› Speech via audio playback (infotainment system)

Part A: Assessments

› ANC performance at different HATS positions – Ambient noise reduction
  » Insertion loss
  » Loudness level reduction (loudness vs. time)
  » Level vs. time
› Self noise
  » Spectrum
  » Loudness level
› Listening effort improvement by ANC (speech by secondary HATS)
  » Listening effort (ABLE)
› Listening effort improvement by ANC (speech by audio playback)
  » Listening effort (ABLE)

Part B

Part B focuses on the impact of the ANC system on a secondary system. It applies if ANC system and infotainment system use the same loudspeakers within the vehicle. The generation of

GENERAL REQUIREMENT

Part A and B

Hardware platform

*lab*CORE (Code 7700)
› Modular multi-channel hardware platform
*core*BUS (Code 7710)
› *lab*CORE I/O bus mainboard
*core*IN-Mic4 (Code 7730)
› *lab*CORE microphone input board
*core*BEQ (Code 7740)
› *lab*CORE binaural equalization

HEAD measurement system

HMS II.3 LN
› HMS II.3 LN (Code 1703.1)
  » HEAD measurement system, low-noise version with right ear simulator, 3.3 pinna and artificial mouth
› HIS L LN (Code 1701.1)
  » HEAD impedance simulator, left, low-noise version

Measurement and analysis 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

Part A

Speech playback

HMS II.5 (Code 1705)
› HEAD measurement system, with 3.3 pinna and artificial mouth (without ear simulators)
*core*OUT-Amp2 (Code 7720)
› *lab*CORE power amplifier board
*core*BT2 (Code 7782)
› *lab*CORE I/O module, Bluetooth® reference access point, version 2

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phase-inverted anti-noise signals may degrade the quality of audio signals which play back via the same loudspeakers.

Part B: Measurements and assessments

Part B is only applicable for ANC systems that use the same loudspeakers as the infotainment system.

›   Non-linear distortion for enabled ANC during audio playback
  »   Intermodulation distortion
  »   Total harmonic distortion

RELEASE NOTES

Database revision and specification version	
Database revision	**ACQUA version**
Revision 01	at least 5.1.200 + Update 1

SCOPE OF DELIVERY

HQS-ANC-Car (Code 60066)
›   delivered as ACQUA database backup
V2C file
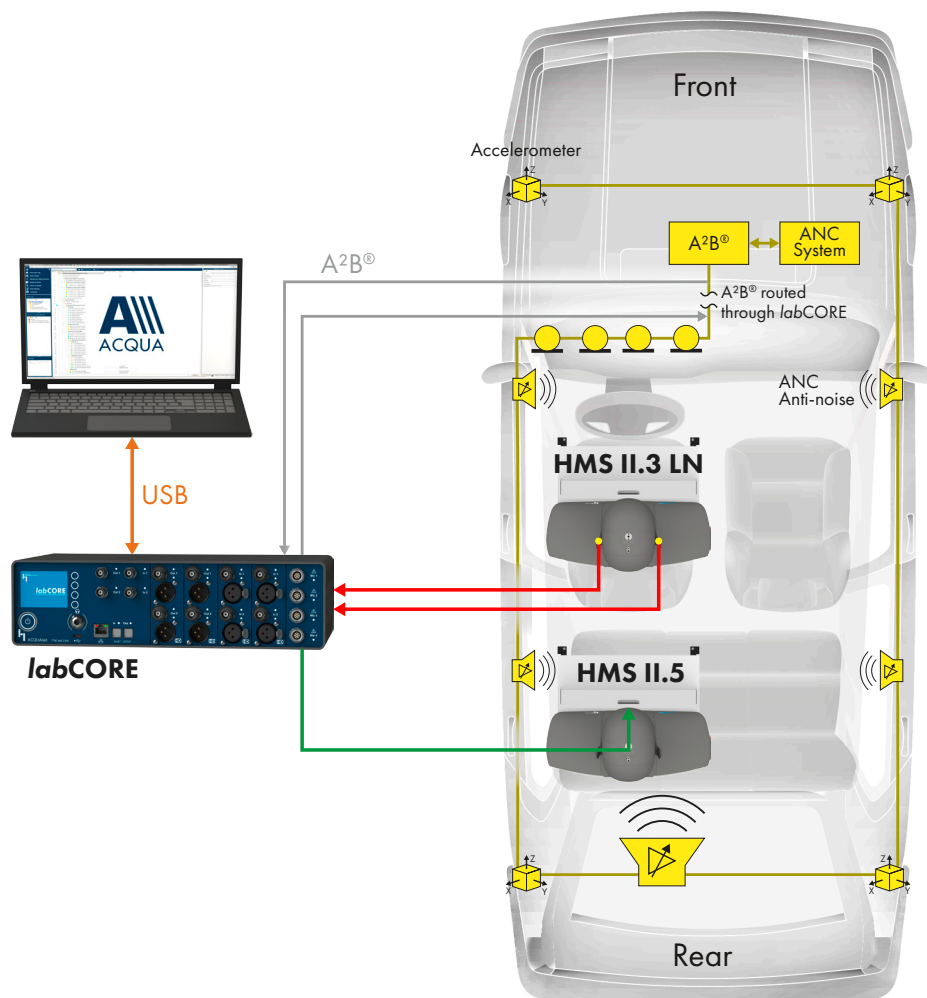›   License file for ACQUA dongle
Revision history
›   PDF file

GENERAL REQUIREMENTS

Background noise simulation

One of the following equipment:

Digitally injected background noise signal
›   *coreA2B* (Code 7790)
  »   *lab*CORE A^{2}B interface (32 channels)
Acoustic playback background noise signal
›   3PASS *flex* (Code 6990)
  »   Advanced background noise simulation system with automated equalization – flex version

ACQUA options

ACOPT 09 (Code 6819)
›   Option SLVM P.56
ACOPT 25 (Code 6852)
›   Option Psychoacoustics
ACOPT 37 (Code 6869)
›   Option ABLE – Assessment of Binaural Listening Effort according to ETSI TS 103 558

Part B

Playback via audio system

coreBT2 (Code 7782)
›   *lab*CORE I/O module, Bluetooth reference access point, version 2

IN PRACTICE

APPLICATION EXAMPLE

Measurement via A²B with secondary talker

Beforehand, background noise has been recorded at the vehicles microphones via A²B and binaurally at the ANC zone. The A²B bus of the vehicle is connected to *core*A2B at *lab*CORE. *core*A2B is in proxy mode and connects between main and the first subordinate node. ANC functionality is activated in the vehicle. ACQUA injects the background noise recordings electrically into the live measurements. Therefore, the ANC system generates the phase-reversed anti-noise according to the detected

background noise signals. Simultaneously, HMS II.5 plays back speech signals. HMS II.3 LN records the speech signals under influence of the phase-reversed anti-noise signal from the ANC system. ACQUA injects the binaural recording including background noise via *lab*CORE to the binaural live recording from HMS II.3 LN. *lab*CORE transmits the combined signal to ACQUA for analyzing.

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Contact Information