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HAE-car (Code 6970)
Semi-automated Equalization for Car Cabins

Overview

HAE-car is a background noise simulation system for car cabins. The goal is to test in-car hands-free telecommunication equipment in the presence of typical car background noise in a stationary car and with full repeatability. With four loudspeakers and subwoofer HSW II.1, HAE-car reproduces previously recorded signals with high accuracy. Recording is possible either through the DUT's microphone (when accessible) or via a measurement microphone. For quick and easy setup, HAE-car features semi-automated equalization with help of the same microphone.

HAE-car works interactively with the hardware platforms labBGN and labCORE as an equalized recording and playback system.

Key Features

- Background noise simulation for car cabins
- Meets the requirements for in-car background noise simulation as described in:
  - VDA Specification for car hands-free terminals
  - ITU-T P.1100/P.1110
- Can utilize DUT microphone or measurement microphone for:
  - Recording of car background noise
  - Semi-automated digital equalization
- Minimal inherent noise and high dynamic range
- Synchronization of playback with ACQUA measurements to ensure full repeatability

Applications

- Background noise simulation for car cabins with semi-automated equalization, e.g. for speech quality evaluation of in-car hands-free telecommunication devices

Description

With an arrangement of four loudspeakers, HAE-car is able to reproduce previously recorded background noises in car cabins with high accuracy. The subwoofer HSW II.1 supports the loudspeakers at low frequencies, ensuring realistic playback and high dynamic range. At the same time, it leaves room for scaling of loudspeaker size and allows quick setup of HAE-car.

Semi-automated equalization allows fast and convenient calibration of the system, compensating the individual acoustic traits of loudspeakers and car cabin. The equalization procedure works on several levels, correcting frequency response, level and delay of the playback system. This results in high playback accuracy at the chosen reference position.

For recording typical background noise in cars, HAE-car can utilize either the car's built-in hands-free microphone or a dedicated measurement microphone. To ensure full repeatability of each test, HAE-car can be configured for triggered playback as shown in the above exemplary measurement configuration. Testing of the car's telecommunication equipment is performed via a HMS HEAD measurement system in conjunction with labCORE and ACQUA.

General Requirements
Software

- Microsoft Windows 8/8.1 Pro or Windows 10 Pro (English or German version, including all current service packs).

Hardware

- **PC** with multi-core processor, 1.6 GHz or faster, 4 GB RAM, 40 GB free disk space, 4 USB Ports
- *lab*BGN **(Code 6486)**, ACQUA*lab* (8+2)-Channel Background Noise Hardware Platform
- **Power amplifier(s)**, 4 channels
- 4 x **Loudspeakers**
- **CSO I.0 (Code 9822)**, Loudspeaker cable set for HAE-car/HAE-BGN/ 3PASS (4 speaker connections)
- **HSW II.1 (Code 2952)**, subwoofer with amplifier
- *lab*CORE **(Code 7700)**, Modular multi-channel hardware platform with
  - **coreBUS (Code 7710)**, *lab*CORE I/O bus mainboard
  - **coreIN-Mic4 (Code 7730)**, Microphone input board
- One of the following **soundboards**:
  - **DSB II (Code 2406)**, (internal, PCI) or
  - **DSB III (Code 2407)**, (internal, PCIe) or
  - **DSB IV (Code 2408)**, (external, USB)

- A **Measurement microphone** incl. cable and acoustic calibrator, for equalization type "Background Noise Reproduction (Car)"

Options
- **PSB III (Code 6001)**, pulse splitter box (for synchronization of non-stationary noise with ACQUA)
- 2 x **CXX II.3 (Code 5177-3)**, Cable AES/EBU XLR male 3-pin <> XLR female 3-pin, 2.95 m
- **CUU I (Code 6085)**, Adapter USB <> USB for Remote Control HAE (Connection ACQUA PC <> HAE PC)

Delivery Items
- **HAE-car (Code 6970)**, Software
- **Dongle** (USB)
- **Manual** as PDF
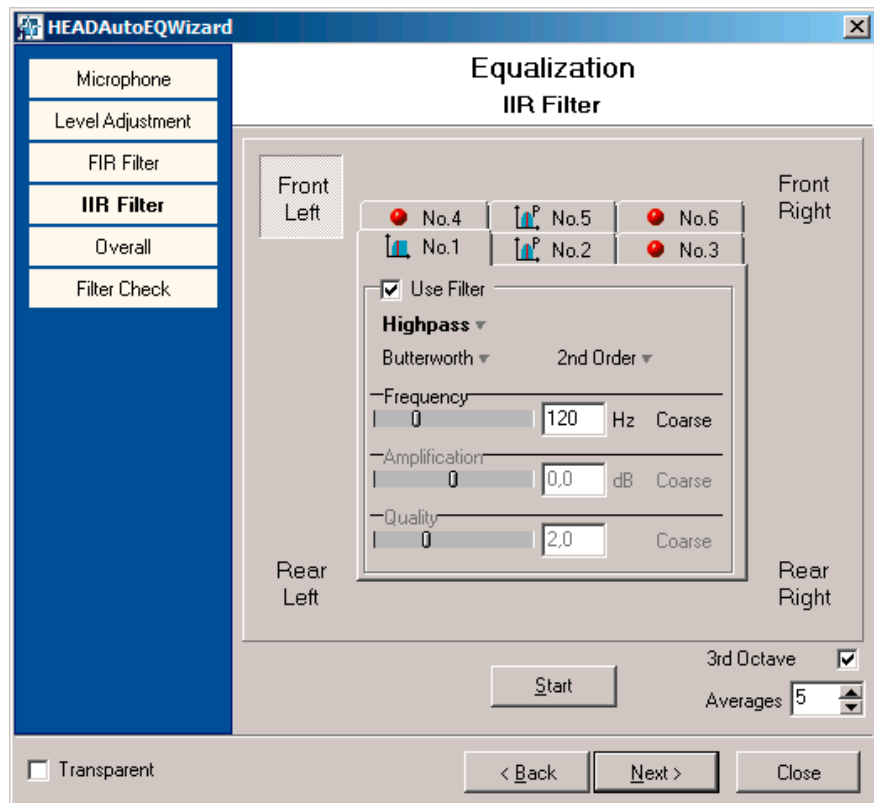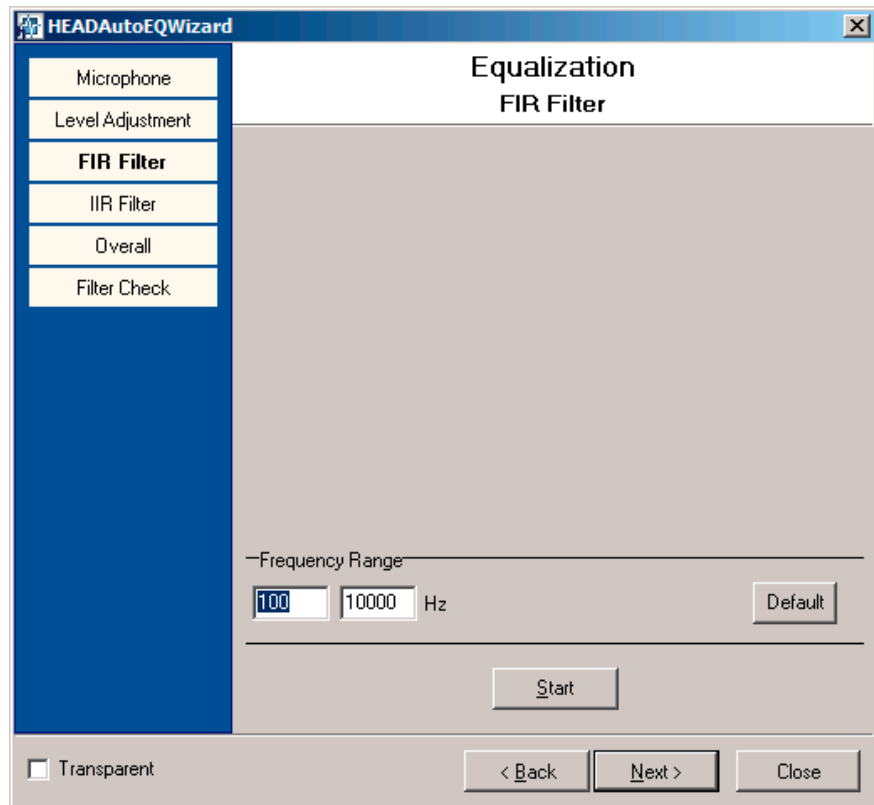
The EQ wizard of HAE-car guides the user through the equalization procedure. The system uses a combination of FIR and IIR filters (see screenshots) to equalize the loudspeaker setup