Standards for Business

High Quality Background Noise Simulation: the ETSI STF 273 Project

DEG 202 396-1: Background noise simulation technique and background noise database

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Introduction

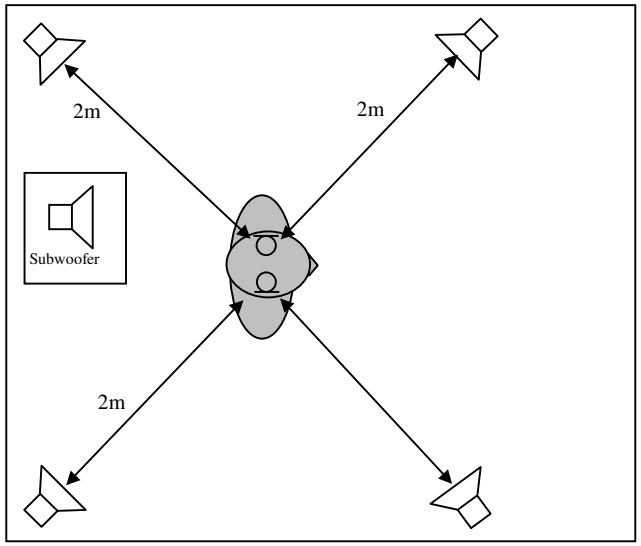
- **Scope:**
  - Background noise transmission contributes perceived overall speech quality
  - Background noise simulation scenario for laboraty use
  - Objective performance evaluation of terminals and codecs
  - Subjective evaluations in third party listening tests or conversational tests

Requirements

- Requirements for recording
  - Easy use
  - Easy to calibration
  - Capable for wideband recordings
  - reasonably priced
- Requirements for simulation arrangement
  - Easy to setup
  - Easy to calibrate
  - Insensitive concerning test rooms and positioning of test-objects
  - Various types of test-objects
  - Reasonably priced

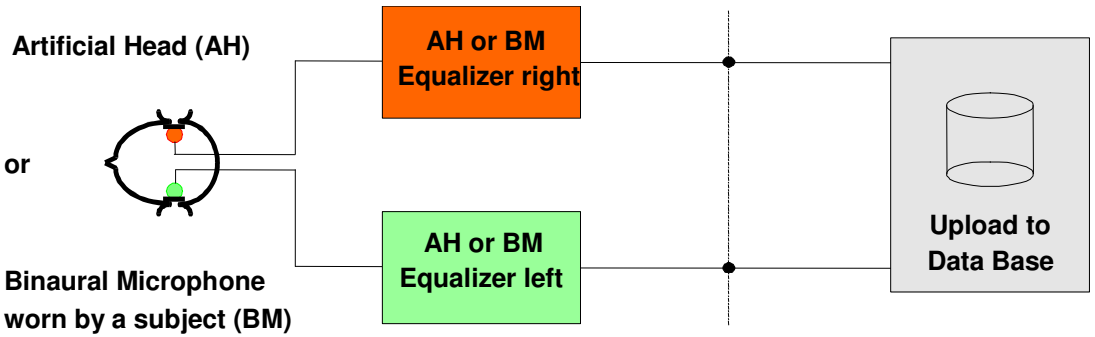
Reproductions methods

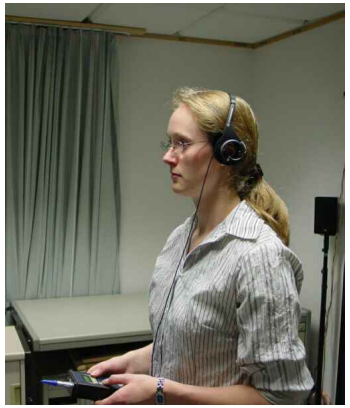
- Different methods available:
  - 5.1 surround sound technique
  - IOSONO
  - Eidophonie
  - 4.1 loudspeaker arrangement
  - NTT background noise database
- Selected method: 4.1 loudspeaker arrangement
  - Applicable in office rooms and cars



Recordings for 4.1 in office rooms

- Recordings for the setup in office rooms with
  - Artificial heads (ITU-T Rec. P.58) or
  - Binaural probe microphone (MIRE technique)

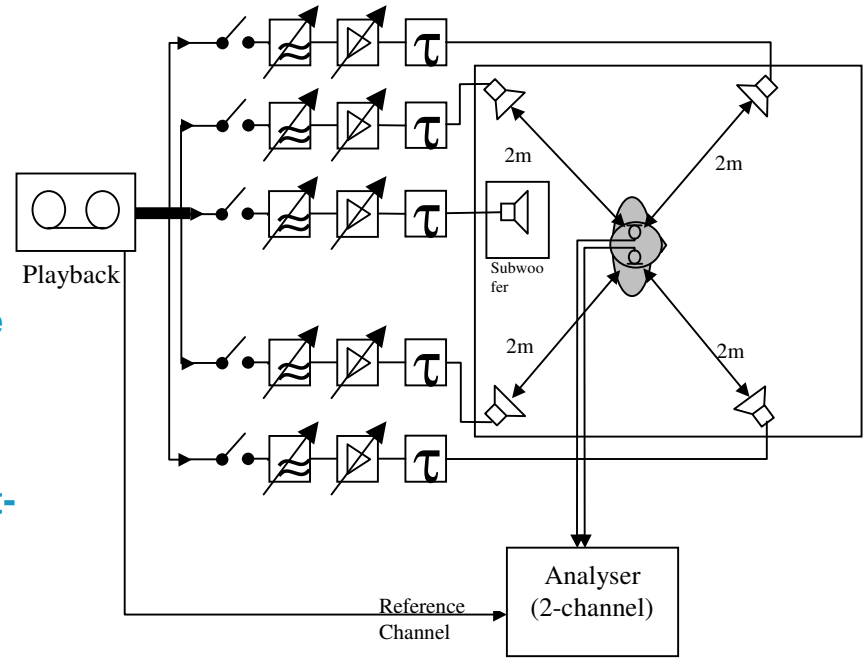




Calibration & equalization

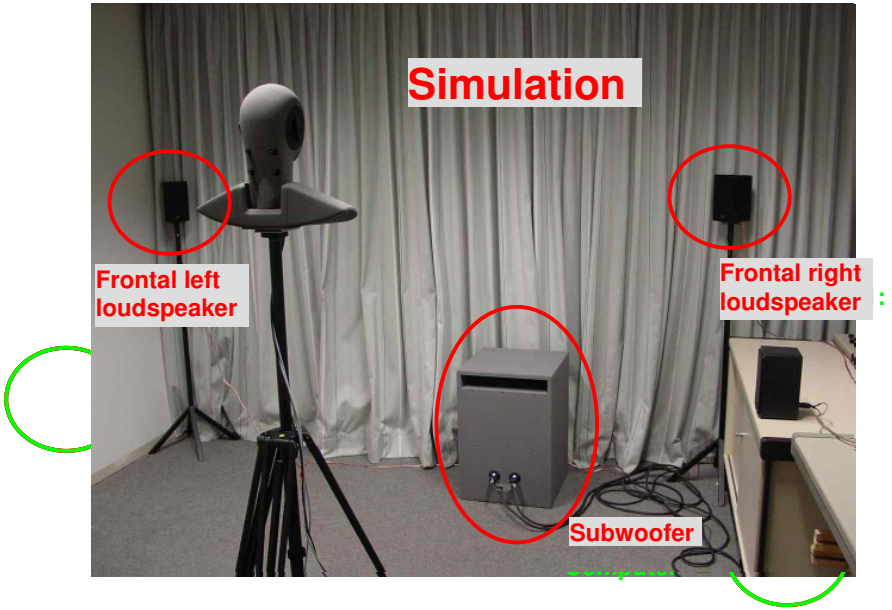
- Calibration & equalization setup for use in standard office rooms:

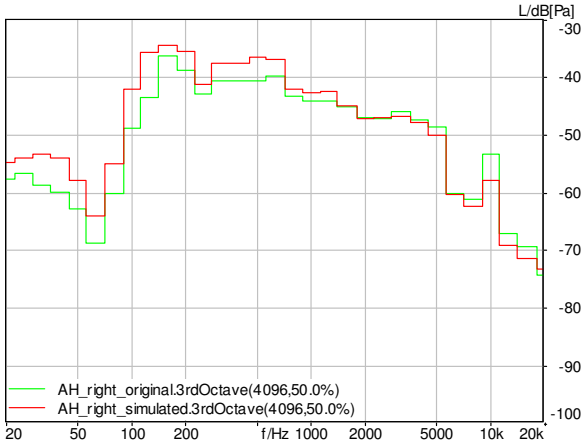
- Procedure:
  1. Equalization for each of the four loudspeakers
  2. Level adjustment for each loudspeaker
  3. Equalization for the two left-hand and two right-hand loudspeakers
  4. Equalization and level adjustment for the subwoofer
  5. Delay compensation
  6. Overall equalization

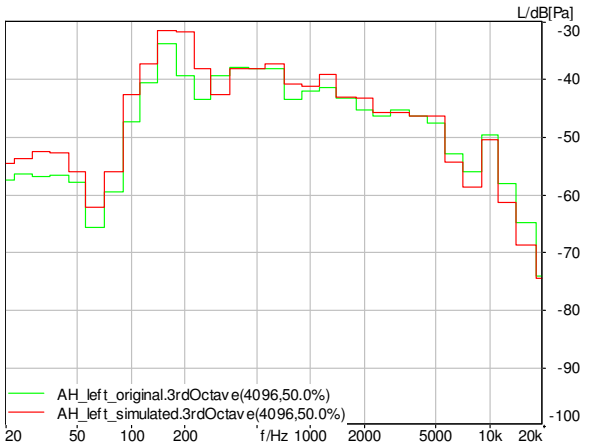


Accuracy of the 4.1 reproduction system

- Sound sources and simulation:
- Comparison of original and simulated sound field at the HATS left and right ear

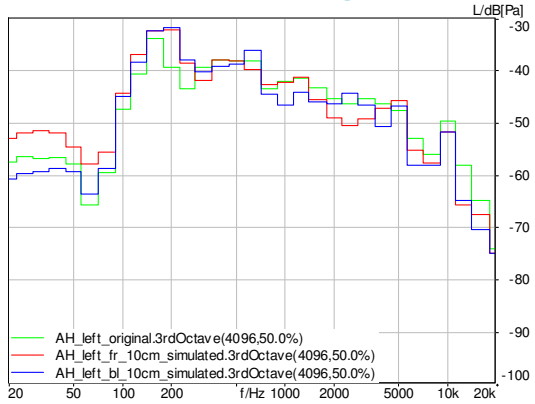


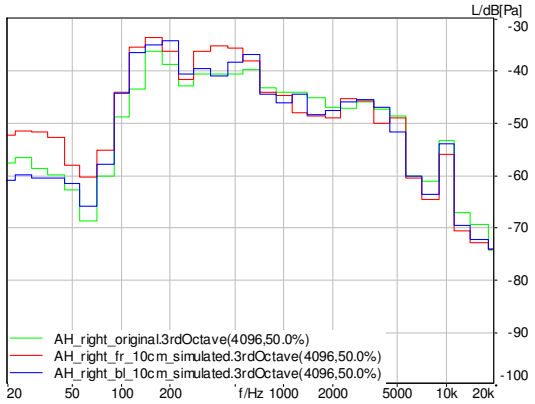




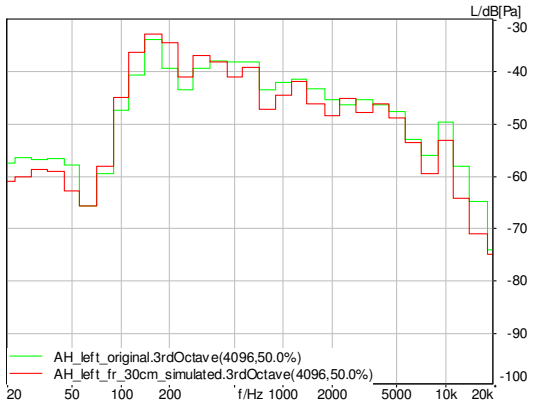
Accuracy of the 4.1 reproduction system

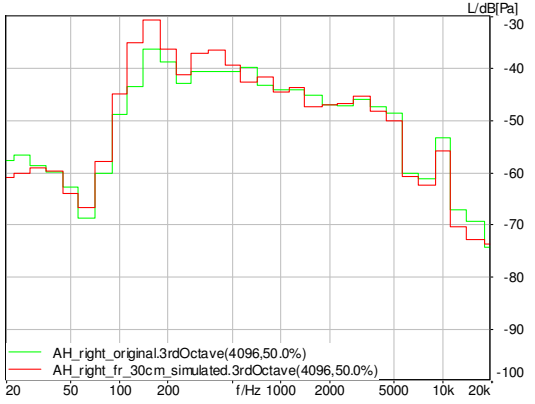
- **Simulation with displaced HATS**
  - **10 cm to frontal right, 10 cm backwards left**





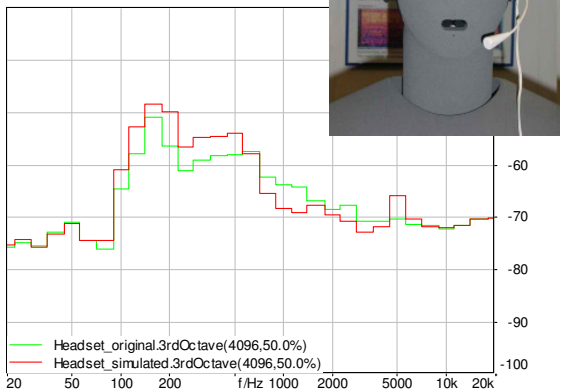
  - **30 cm to frontal right**



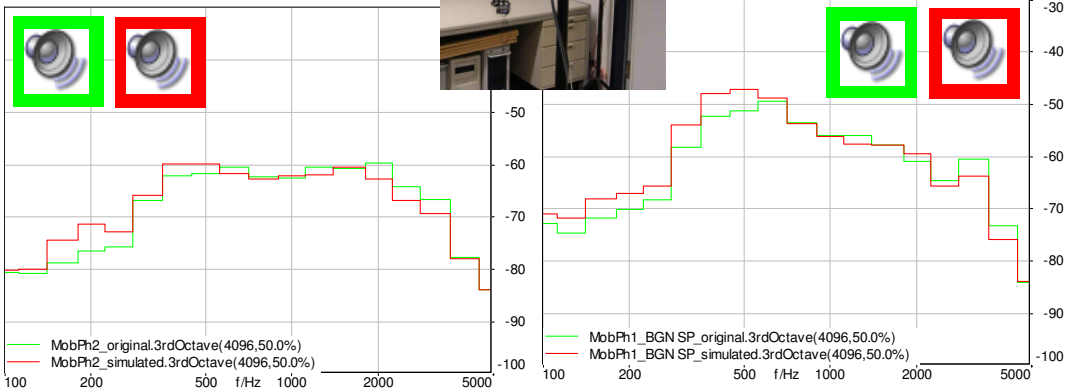


Comparison of terminal performance

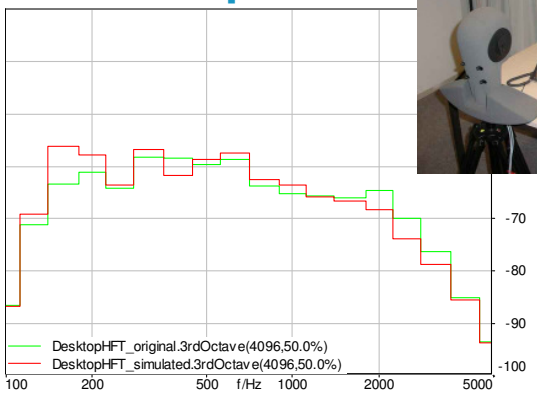
Headset



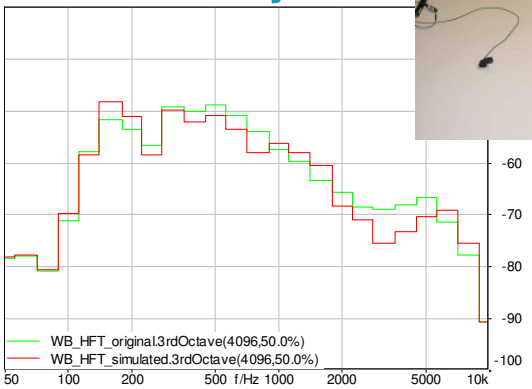
Mobile phones



Desktop HFT

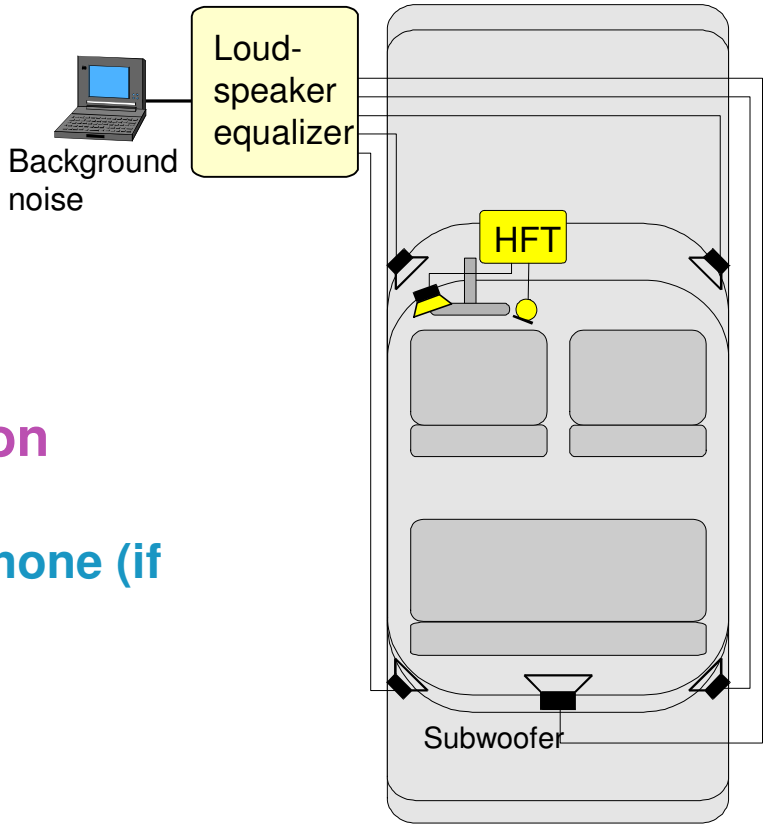


Wideband conference system



4.1 simulation system in cars

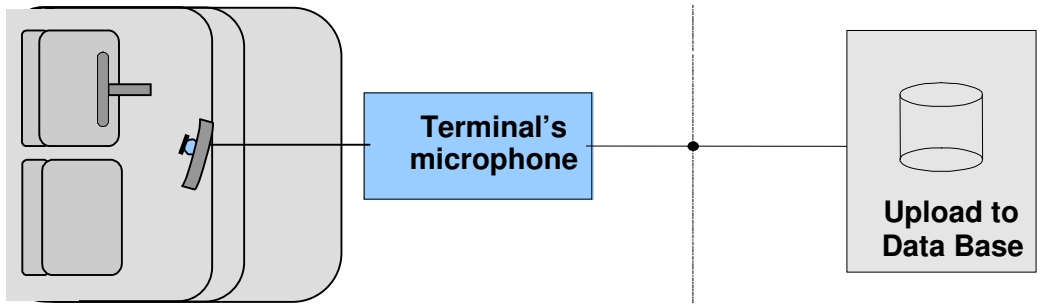
- **Modified setup:**



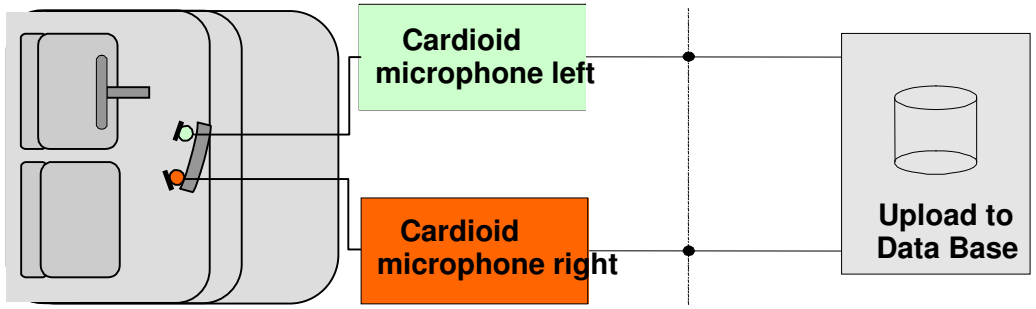
- **Choose equalization microphone:**
  - **Terminal microphone (if accessible)**
  - **Pair of cardioid microphones**

Recordings for 4.1 in cars

- Driving with constant speech
  - when equalizing with terminal microphone



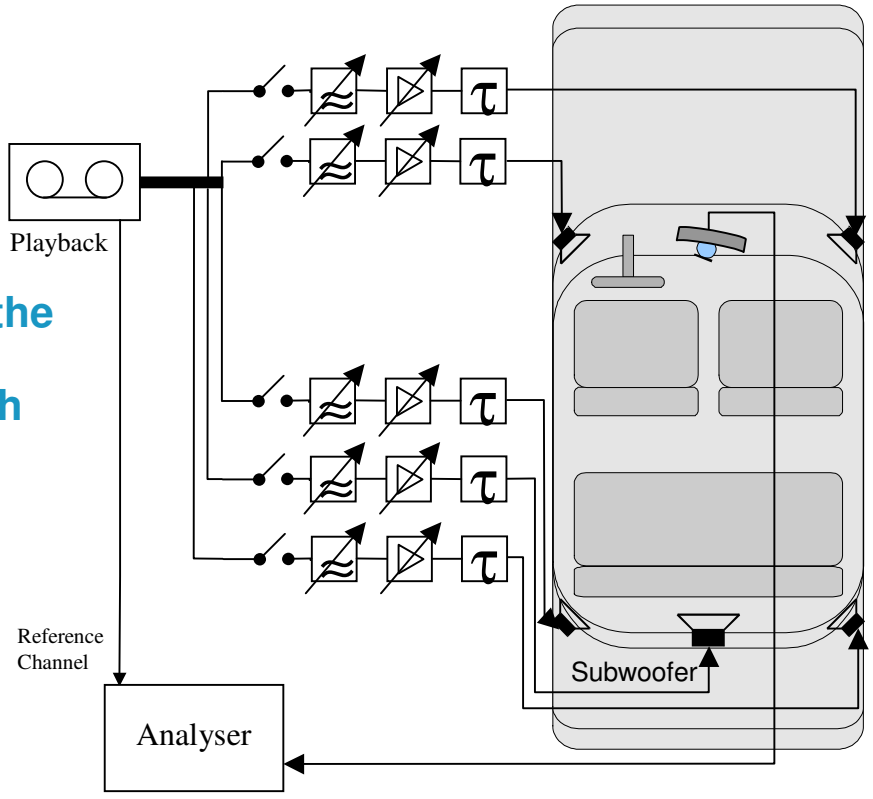
  - when equalizing with a pair of cardioid microphones



Calibration & equalization in cars

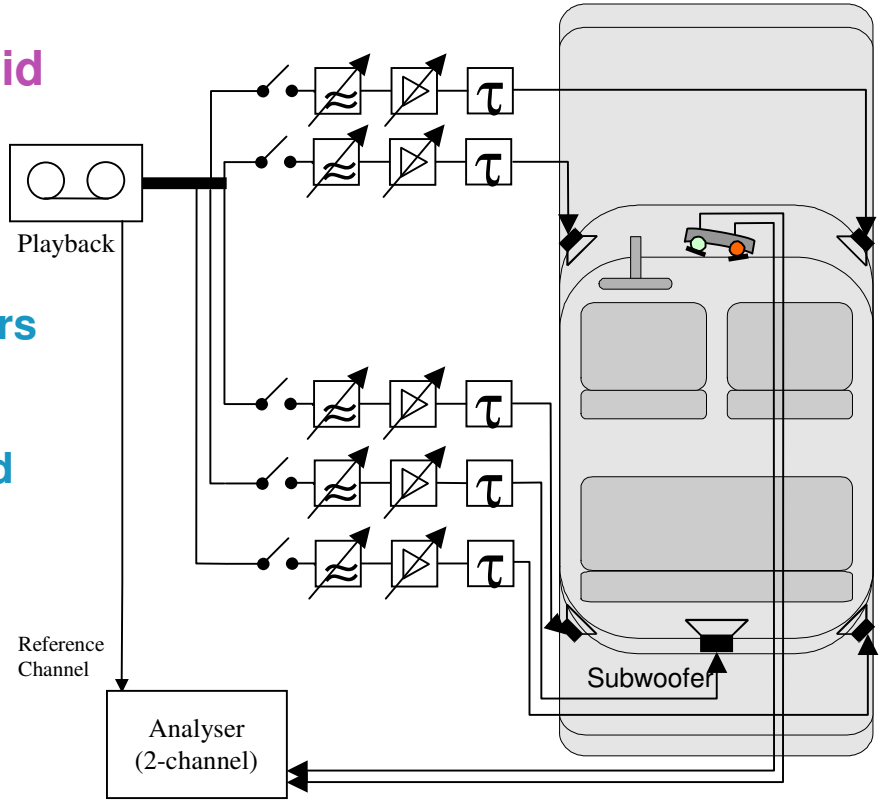
- Calibration & equalization setup with terminal microphone

- Procedure:
  1. Equalization for each of the four loudspeakers
  2. Level adjustment for each loudspeaker
  3. Equalization for the two left-hand and two right-hand loudspeakers
  4. Equalization and level adjustment for the subwoofer
  5. Delay adjustment
  6. Overall equalization



Calibration & equalization in cars

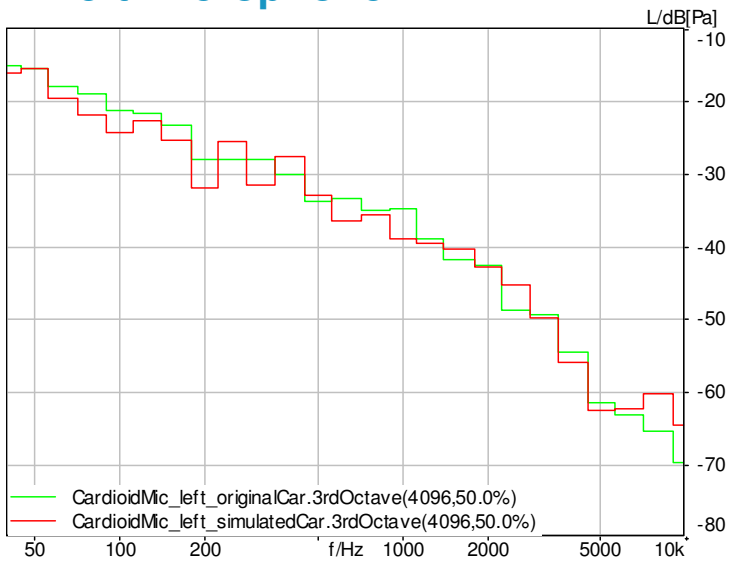
- Calibration & equalization setup with a pair of cardioid microphones
- Procedure:
  1. Pairwise equalization for the left-hand loudspeakers
  2. Level adjustment for the left-hand loudspeakers
  3. Pairwise equalization and level adjustment for the right-hand loudspeakers
  4. Equalization and level adjustment for the subwoofer
  5. Delay compensation
  6. Overall equalization



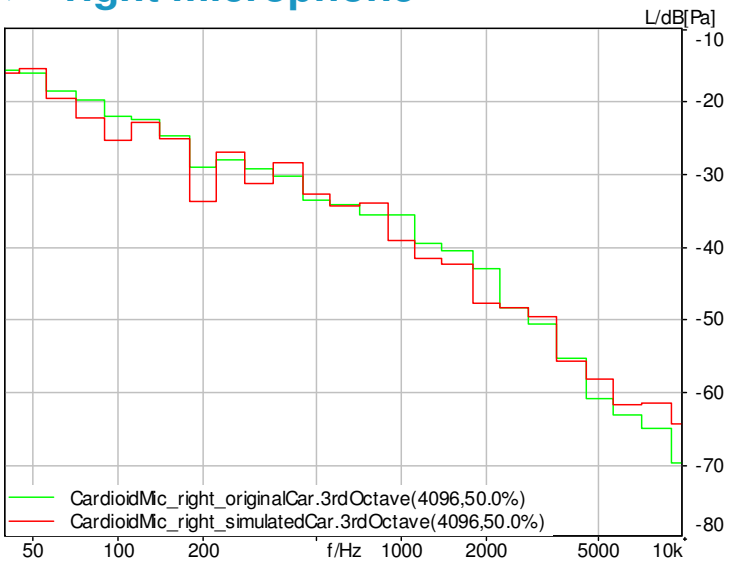
Accuracy of the 4.1 system in cars

- After equalization with a pair of cardioid microphones:

left microphone

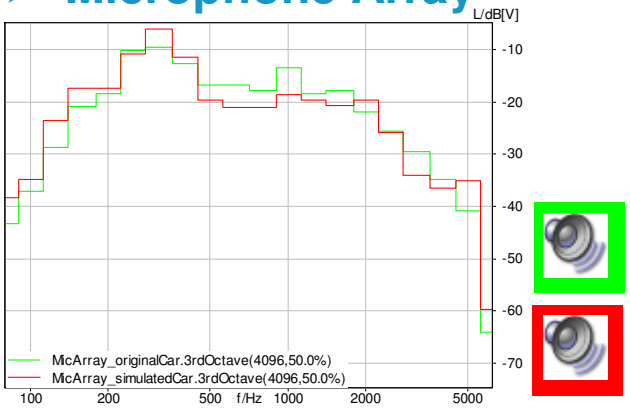


right microphone

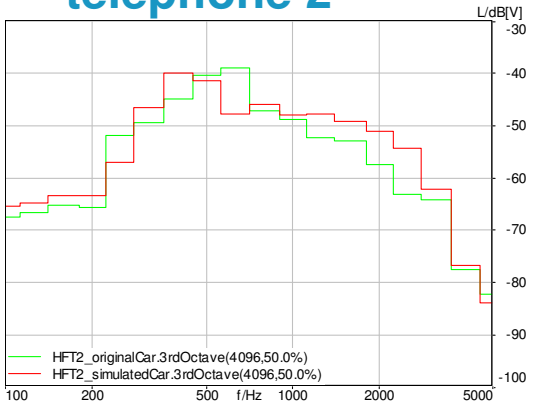


Comparison of terminal performance

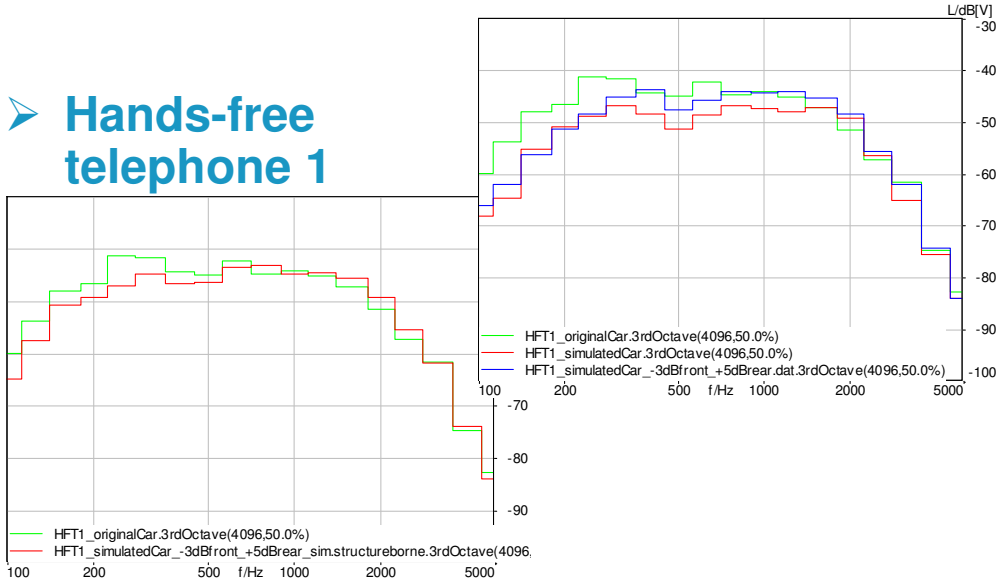
Microphone Array



Hands-free telephone 2



Hands-free telephone 1



Content of the draft DEG 202 396-1

- Introduction
- Overview of existing methods
- Recording arrangement
- Setup & equalization description for the playback arrangement in office rooms and cars
- Verification of the accuracy in office rooms and cars
- Background noise database

Conclusion & Further steps

- 4.1 simulation system suitable for simulations in
  - standard office rooms
  - Cars
- Easy setup, calibration and equalization

- Next steps:
  - completion of the background noise database
  - recording of the reference wideband speech material for conducting the basic subjective tests in STF 294
  - Developing an objective method for speech quality evaluation in the presence of background noise (STF 294)