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Acoustics, Noise and Vibrations
RALC/RUE

Reg. Reverberation time measurement in The Concert Hall of Aarhus – Small Hall

1 Introduction

On behalf of Flex Acoustics, FORCE Technology (FT) has performed reverberation time measurements in the Concert Hall of Aarhus – Small Hall. The background of the reverberation time measurements is that Flex Acoustics has installed a variable acoustics system, Evoke, in the Small Hall and would like to document the reverberation time in the Small Hall with Evoke in two settings i.e. closed and open.

2 Measurement method

The reverberation time measurements were performed 29th March 2022 in the Concert Hall of Aarhus – Small Hall. The measurements were performed without an audience. The front seat row was not installed during the measurements. The measured humidity was 34.6 % and the temperature 21.3°C during the reverberation time measurements.

The reverberation time measurements have been performed using ISO 3382-1 "Acoustics – Measurement of room acoustic parameters – Part 1: Performance spaces" as guideline.

The measurements have been analyzed in 1/1-octave bands using T20 as the evaluation for the reverberation.

2.1 Measurement equipment

The reverberation time measurements have been performed with a Brüel and Kjær sound level meter type 2250. A Norsonic dodecahedron loudspeaker Type 213 with a Norsonic Power Amplifier type 280 was used for noise excitation of the room applying the interrupted noise method. Broadband pink noise was used as excitation. The omnidirectional loudspeaker was used to measure the reverberation time in the 1/1-octave bands 125 Hz to 4 kHz.

The sound level meter was calibrated with a Brüel and Kjær type 4231 before and after the measurements.

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2.2 Measurement object, measurement and loudspeaker positions

The seating capacity of the Small Hall is 319 seats. The layout and seating positions of the Small Hall are shown in Figure 1. Seating is upholstered and porous. Seats were raised during the measurements. The volume of small hall is approximately ~2500 m3. Measurements were performed at row #/seat #: 2/20, 2/10, 2/2, 2/13, 7/18, 7/3, 7/13, 7/25, 11/20, 11/12, 11/4, 11/15 and at three measurement positions on the stage i.e., a total of 15 position pr. loudspeaker position.

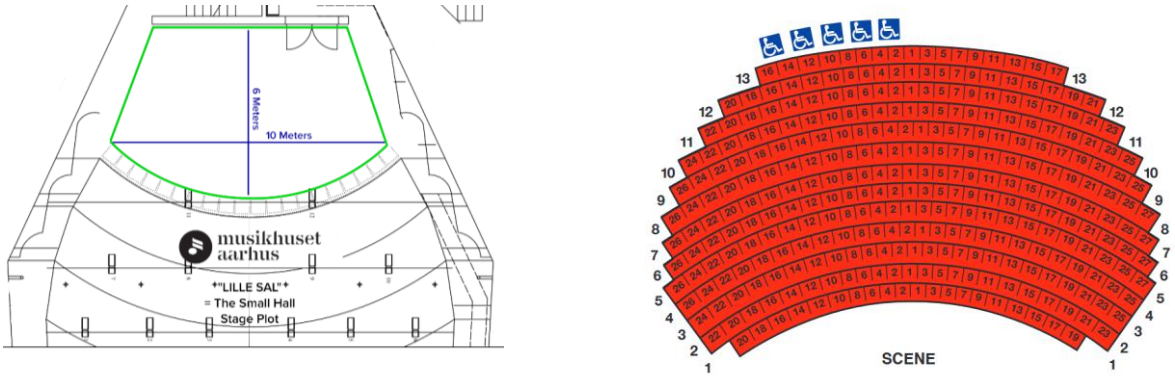

Figure 1 *The layout and seating arrangement of the Small Hall*

Figure 2 *Picture inside the Small Hall*

The measurements were performed at a height of 1.2 m above the floor at the different positions. The omnidirectional loudspeaker was placed at a height of 1.5 m at three different positions on the stage.

3 Results

The main results of the measurements are shown in the tables and figures below:

	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
T, Closed	1.2 s	1.2 s	1.2 s	1.2 s	1.1 s	1.0 s
T, Open	0.8 s	0.7 s	0.9 s	0.9 s	0.9 s	0.8 s

Table 1 *The measured reverberation time with the Evoke-system fully closed or fully open including the measurement positions on stage.*

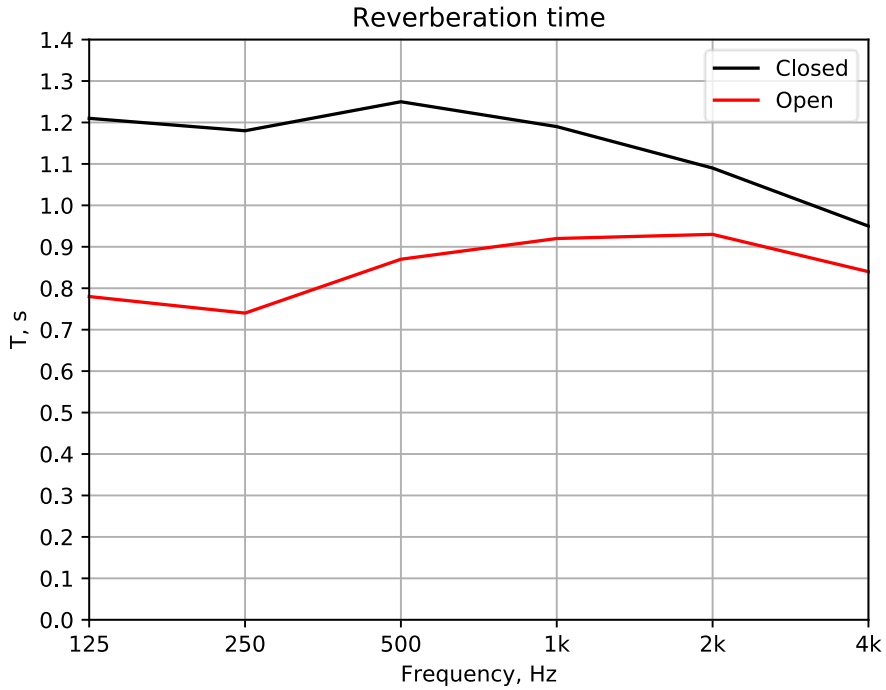

Figure 3 *The measured reverberation time with the Evoke-system fully closed or fully open including the measurement positions on stage.*

	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
T, Closed	1.2 s	1.2 s	1.3 s	1.2 s	1.1 s	1.0 s
T, Open	0.8 s	0.8 s	0.9 s	0.9 s	0.9 s	0.8 s

Table 2 *The measured reverberation time with the Evoke-system fully closed or fully open excluding the measurement positions on stage.*

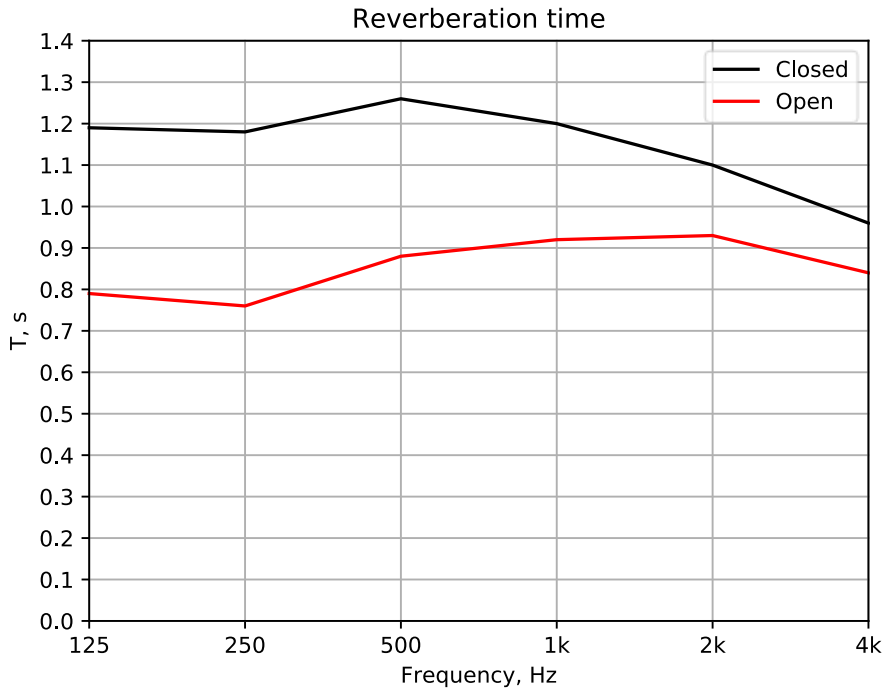

Figure 4 *The measured reverberation time with the Evoke-system fully closed or fully open excluding the measurement positions on stage.*