Laboratory for Acoustics

Determination of the insertion loss of different pipe (DN200) insulation systems, manufactured by Stenca Solutions Aps

Report number A 4188-4E-RA-001 d.d. May 23, 2022

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Principal	Stenca Solutions Aps Troensevej 6E DK-9220 Aalborg Ø Denmark
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mook – zoetermeer – groningen – düsseldorf – dortmund – berlijn – leuven – parijs – lyon – sevilla

Table of contents

1 Introduction

At the request of Stenca Solutions Aps based in Aalborg Ø (Denmark) sound insulation measurements (insertion loss) have been carried out on a:

different pipe (DN200) insulation systems
manufactured by Stenca Solutions Aps

in the Laboratory for Acoustics of Peutz bv, at Lindenlaan 41, 6584 AC Molenhoek, The Netherlands (see figure 1).

2 Norms and guidelines

The measurements have been carried out according to the Quality Manual of the Laboratory for Acoustics and to:

ISO 15665:2003	Acoustics - Acoustic insulation for pipes, valves and flanges
ISO 3741:2010[1,2]	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms

1 For these type of measurements the Laboratory for Acoustics has been accredited by the Dutch Accreditation Council (RvA).

The RvA is member of the EA MLA (**EA MLA**: **E**uropean **A**ccreditation Organisation **M**ulti**L**ateral **A**greement: http://www.european-accreditation.org).

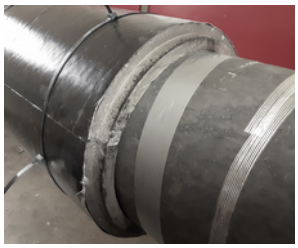
EA: "Certificates and reports issued by bodies accredited by MLA and MRA members are considered to have the same degree of credibility, and are accepted in MLA and MRA countries."

2 According to this norm, the report should include all measured sound pressure levels. Because these figures are not relevant for judging the quality of the product being tested, but merely for judging the accuracy of the calculations, they have been omitted in this report. It is possible of course to reproduce those figures at any time if the principal requests this.

3 Tested constructions

The description of the constructions was taken from the data supplied by the principal. The dimensions and masses have been checked by the staff of the laboratory.

Used materials:

Stenca pipe section #1 Length: 600 mm Internal diameter: 270 mm Thickness: 40 mm Mass: 3,2 kg Density: 137 kg/m^3	 
Stenca pipe section #2 Length: 600 mm Internal diameter: 325 mm Thickness: 40 mm Mass: 3,55 kg Density: 129 kg/m^3	
PX1000 mat #1 & #2 Thickness: 10 mm Mass: 1,2 kg/m^2	
Mass layer #2 Thickness: 3 mm Mass: 7,1 kg/m^2	
Spacers #1 & #2 Width: 10/17 mm Thickness: 11 mm	 

Tested variants (built up inside → outside);

#1; spacers c.t.c 300 mm – 1x PX1000 – Stenca pipe 270 mm

#2; spacers c.t.c 300 mm – 2x PX1000 – Mass Layer - Stenca pipe 325 mm

The results as presented here relate only to the tested items and laboratory conditions as described in this report. The laboratory can make no judgement about the representativity of the tested samples. The test report ahead is valid as long as the tested constructions and/or materials are unchanged.

4 Measurements

4.1 Method

The test was conducted in accordance with the provisions of the test method ISO 15665 in the Laboratory for Acoustics of Peutz bv in Mook. A detailed description of the test set up has been given in figure 2 of this report.

A steel pipe (219 mm outer diameter; wall thickness 6.1 mm) is installed crossing the reverberation room, both ends of the pipe penetrating through the walls of the room. The penetrations have been sealed adequately.

Noise is introduced in this pipe using a loudspeaker mounted in one end. The opposite end of the pipe is terminated by means of a closed anechoic termination.

A microphone on a rotating boom is used in the reverberation room in order to measure the noise radiated from the pipe before and after insulation is applied to the pipe.

The reverberation time of the room is also determined before and after insulation is applied to the pipe.

From each set of measurements (sound pressure level and reverberation time) the sound power level L_W radiated into the reverberation room is calculated according to ISO 3741 [3)]. The reverberation room of Peutz has been accredited for this kind of measurements.

The insertion loss D_W caused by the cladding is now calculated as

$$D_W = L_{W,b} - L_{W,c}$$

in which:

$L_{W,b}$ = the sound power level with the bare pipe

$L_{W,c}$ = the sound power level with the insulated pipe

4.2 Accuracy

The accuracy of the airborne sound insulation as calculated can be expressed in terms of repeatability (tests within one laboratory) and reproducibility (between various laboratories).

3 For this type of measurements the Laboratory for Acoustics has been accredited by the Dutch Council for Accreditation (RvA) as a test laboratory, registration number L334.

Based on various investigations there is indicated within ISO 3741:2010 which reproducibility may be expected, see table 4.1:

t4.1 Estimated upper values of the standard deviations of reproducibility of sound power levels determined in accordance ISO 3741:2010

Band width	midband frequencies [Hz]	upper values of standard deviation of reproducibility [dB]
1/3 octave	100[a] tot 160	3,0
	200 tot 315	2,0
	400 to 5000	1,5
	6300 tot 1000	3,0
1/1 octave	125[a]	2,5
	250	1,5
	500 to 4000	1,0
	8000	2,0
A-weighted per Annex E		0,5[b]
[a] Recommendations for frequencies below 100 Hz: are given in Annex C		
[b] Applicable to a source which emits noise with a relatively "flat" spectrum in the frequency range 100 Hz to 10000 Hz		

4.3 Classification according to table 1 of ISO 15665

In ISO 15665 a classification system is given in order to give a simple way to classify the material under test. It has to be mentioned that before comparison the octave-band insertion loss values have to be rounded to the nearest 0.5 dB.

Table 1 of ISO 15665 is reproduced here partly (table 4.2), it is simplified for the nominal diameter of the used pipe (less than 300mm outer diameter):

t4.2 Minimum insertion loss required for each class for a pipe with diameter D < 300 mm (ISO 15665).

Class	octave band centre frequency [Hz]						
	125	250	500	1000	2000	4000	8000
	minimum insertion loss [dB]						
A1	-4	-4	2	9	16	22	29
B1	-9	-3	3	11	19	27	35
C1	-5	-1	11	23	34	38	42

4.4 Environmental conditions during the tests

t4.3 Environmental conditions during the test (May 3th 2022)

Barometric pressure [kPa]	Temperature [°C]	Relative humidity [%]
101,6	19-20	43-46

4.5 Results

The results of the measurements are given in table 4.4 and in the figures 3 and 4.

Measurements and calculations are made in 1/3 octave bands form 50 to 10 000 Hz. From the final results the octave-band insertion loss has been calculated from 125 to 8000 Hz. From the rounded octave-band values the Class has been determined and stated.

t4.4 *Summary measurement results (rounded to the nearest 0,5 dB)*

record	insertion loss [dB]							Class	figure
no.	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		
	#1; spacers (c.t.c 300 mm) – 1x PX1000 (10 mm) – Stenca pipe (270 mm)								
#194	2,5	10,0	13,5	19,0	30,0	33,5	35,5	**A1, B1**	3
	#2; spacers (c.t.c 300 mm) – 2x PX1000 (10 mm) – Mass Layer (3 mm) - Stenca pipe (325 mm)								
#198	3,0	13,0	20,5	26,5	40,5	44,5	49,0	**A1,B1,C1**	4

The results were obtained using the described measurement set-up under laboratory conditions. In situations where the sound field excitation, the dimensions and/or method of mounting differ from the ones tested, different results may be found.

Mook,

R.T. Allan
(deputy) Laboratory Supervisor

dr. ir. M.L.S. Vercammen
Manager

This report contains; 10 pages and 4 figures.

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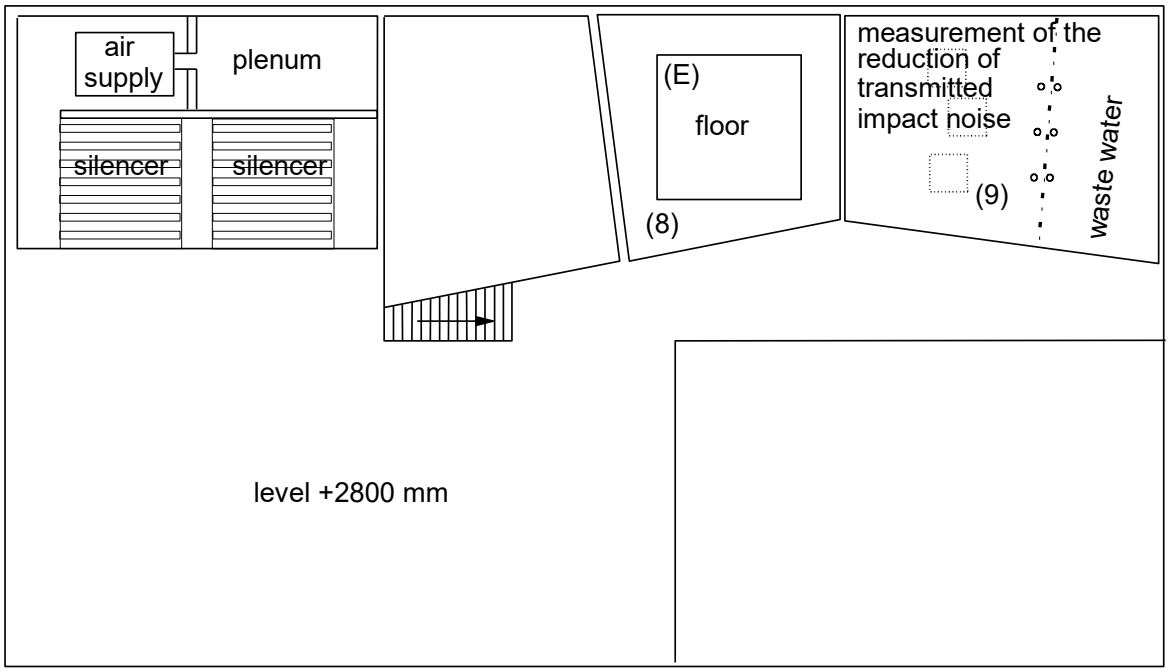
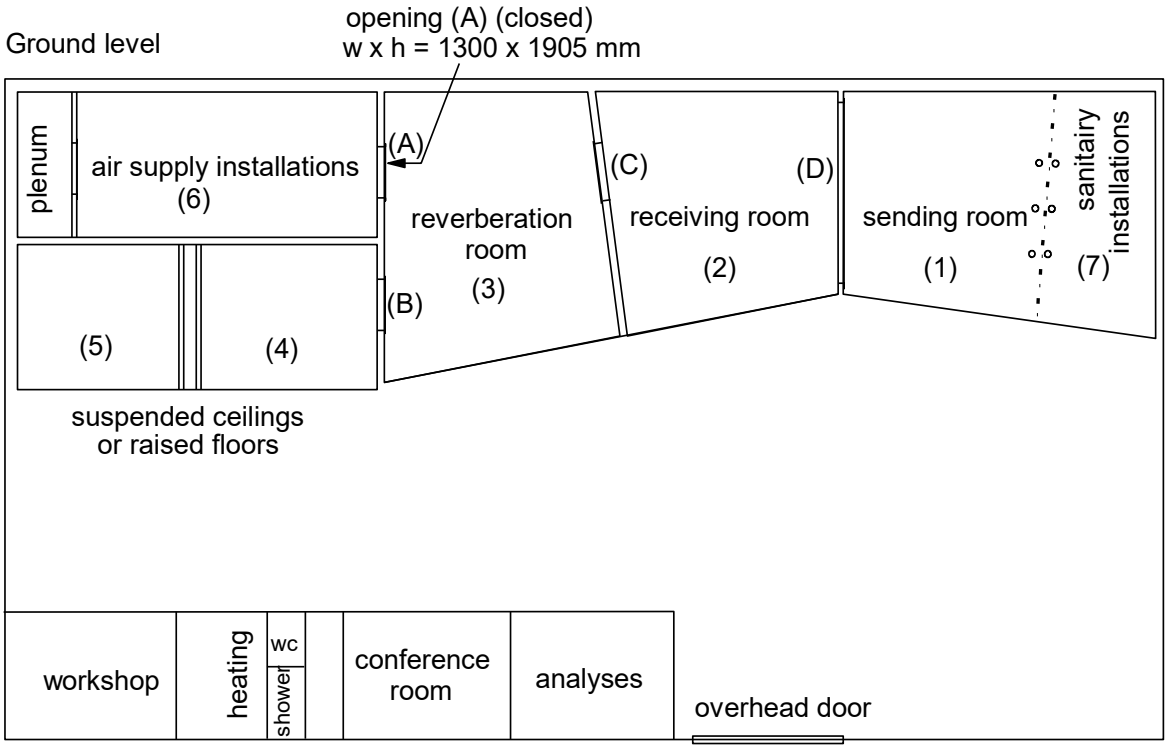
Lindenlaan 41, NL-6584 AC MOLENHOEK (LB), THE NETHERLANDS

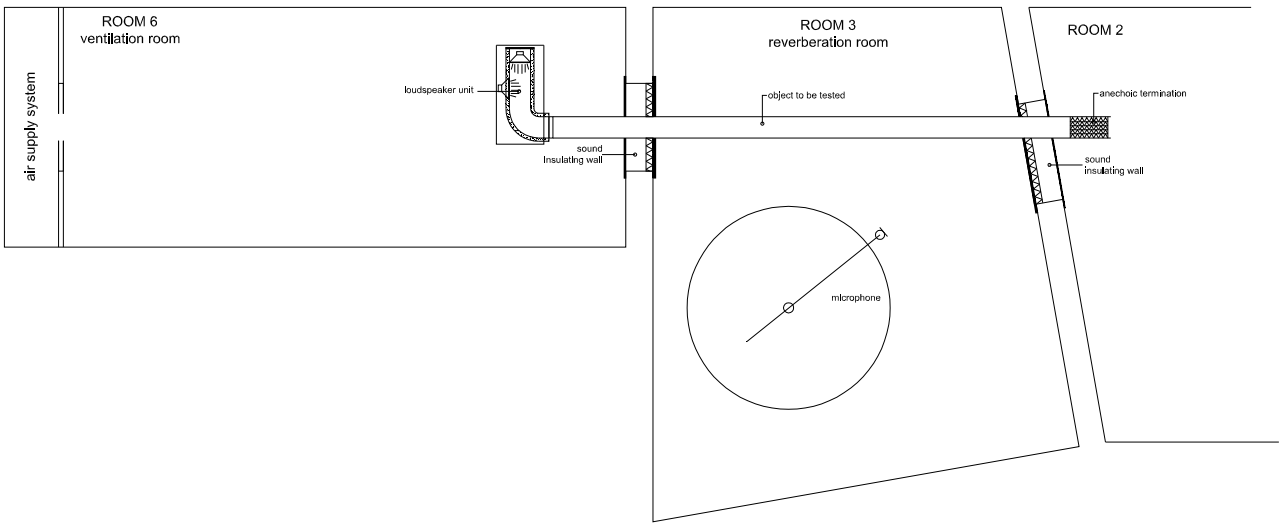
OVERVIEW





TEST OPENINGS (w x h in mm)
(B) 1000 x 2200
(C) 1500 x 1250
(D) 4300 x 2800
(E) 4000 x 4000

0 1 2 3 4 5 m
scale



Room 6

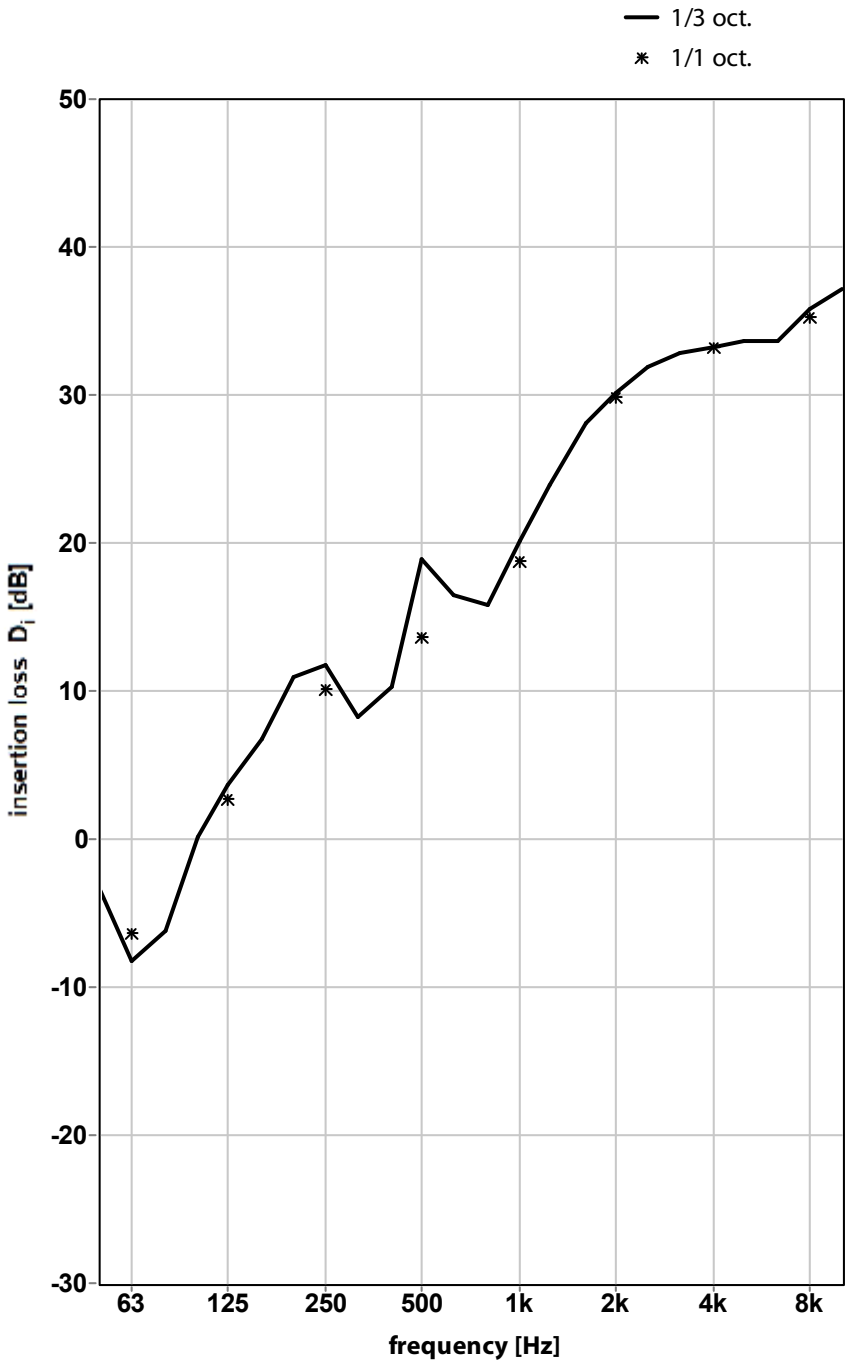
Room 3

Room 2

INSERTION LOSS ACCORDING TO ISO 15665:2003

Principal: Stenca Solution Aps

construction tested: #1 spacers (c.t.c 300 mm) – 1x PX1000 (10 mm) – Stenca pipe (270 mm)



	-3,4	0,1	11,0	10,3	15,8	28,1	32,9	33,7	
1/3 oct.	-8,2	3,6	11,7	18,9	20,2	30,2	33,3	35,8	dB
	-6,2	6,7	8,3	16,5	23,9	31,9	33,6	37,1	
1/1 oct.	**-6,4**	**2,7**	**10,1**	**13,7**	**18,8**	**29,8**	**33,3**	**35,3**	**dB**

volume: 214 m^3

measured at: Peutz
Laboratory for Acoustics

bandwidth: 1/3 octave

Class (ISO 15665): A1, B1

SoundPower 3.11.4 mode 9, PM: RA, file: a4188 Lwl #:38 Lwll #:192 D#:194

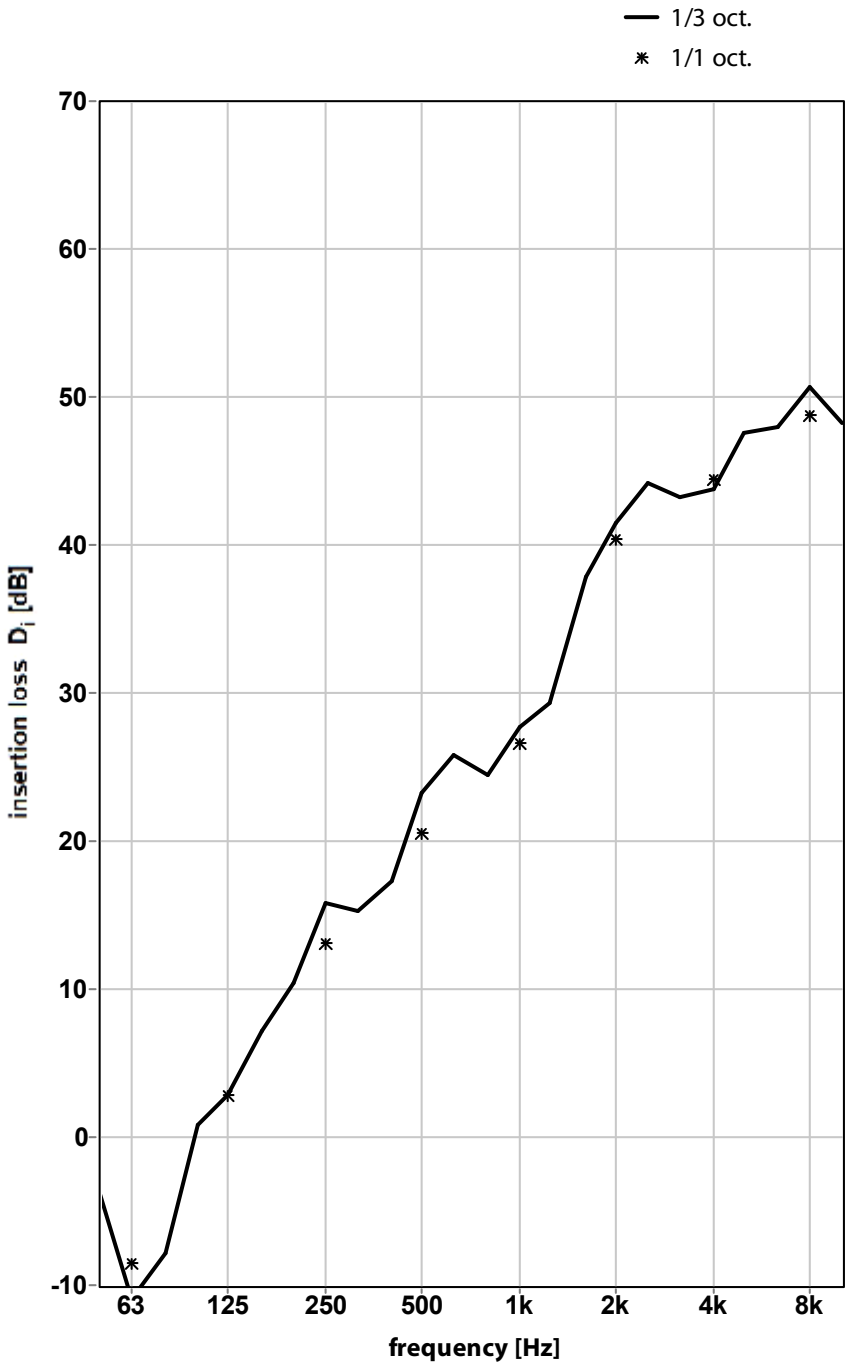
A 4188-4E-RA-001 050308D1E REMKO

Mook, measured at 03-05-2022

INSERTION LOSS ACCORDING TO ISO 15665:2003

Principal: Stenca Solution Aps

construction tested: #2 spacers (c.t.c 300 mm) – 2x PX1000 (10 mm) – Mass Layer - Stenca pipe (325 mm)



volume: 214 m³

measured at: Peutz
Laboratory for Acoustics

bandwidth: 1/3 octave

Class (ISO 15665): A1, B1, C1

	-3,8	0,8	10,4	17,3	24,4	37,9	43,2	48,0	
1/3 oct.	-11,0	2,8	15,8	23,2	27,7	41,5	43,8	50,7	dB
	-7,8	7,1	15,3	25,8	29,3	44,2	47,5	48,2	
1/1 oct.	**-8,5**	**2,9**	**13,1**	**20,6**	**26,6**	**40,4**	**44,5**	**48,8**	**dB**

SoundPower 3.11.4 mode 9, PM: RA, file: a4188 Lwl #:38 Lwll #:196 D#:198

A 4188-4E-RA-001 050308D1E REMKO

Mook, measured at 03-05-2022