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Laboratory for Acoustics

TESTEN
RvA L 334

Determination of acoustical characteristics of flexible ducted silencers type ACOUSTIC SEMIAFS, manufacturer AFS

Report number A 2692-3E-RA d.d. December 10, 2014

Laboratory for Acoustics

Determination of acoustical characteristics of flexible ducted silencers type ACOUSTIC SEMIAFS, manufacturer AFS

Principal	AFS Boru Sanayi A.S. 1468. Cadde No.: 153 Ostim 06370 Ankara Turkey
Report number	A 2692-3E-RA
Date	December 10, 2014
Reference	TS/RA/JW/A 2692-3E-RA
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1 Introduction

At the request of AFS Boru Sanayi A.S. based in Ankara (Turkey) sound measurements have been carried out in order to determine the acoustical characteristics of

flexible ducted silencers
type ACOUSTIC SEMIAFS
manufacturer AFS Boru Sanayi A.S.

The measurements have been carried out in the Laboratory for Acoustics of Peutz bv, at Mook, The Netherlands (see figure 1).

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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 Norms and guidelines

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

ISO 7235:2003	"Acoustics - Laboratory measurement procedures for ducted silencers and air-terminal units - Insertion loss, flow noise and total pressure loss"
N.A.	*The norm ISO 7235 is within all countries of the European Union accepted as European Standard Norm EN ISO 7235:2003*

Other related norms:

ISO 3741:2010[1]	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms
ISO 5135:1997	Acoustics - Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers and valves by measurement in a reverberation room
N.A.	*The norm ISO 5135 is within all countries of the European Union accepted as European Standard Norm EN ISO 5135:1997*

1 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 construction

The data presented here have been received from the principal (as thickness foils) or obtained by own observations.

Measurements have been carried out on the following flexible ducted silencers:

ACOUSTIC SEMIAFS Composition from inside to outside – corrugated perforated aluminium – 25 mm glasswool – aluminium jacket, thickness 45 µm, Diameter (inner duct) 80 / 100 / 125 / 160 / 200 mm Length 1,0 m	

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 Measurement setup

The measurements have been carried according to the reverberation room method as described in the norm ISO 7235.

4.2 Insertion Loss D_i

The specimens are mounted in an measuring duct as shown in figure 2.
Noise is introduced in the measuring duct using a loudspeaker system which is mounted at one and of this duct in ventilation room (6). The other end of the duct leads into the reverberation room (3). The sound pressure level in the reverberation room caused by the loudspeaker is measured in two situations:

- with the specimen to be tested installed in the measuring duct
- without the specimen. Instead of the specimen a substitution duct (dummy) with the same dimensions (length, diameter) is installed in the measuring duct

A microphone on a rotating boom is used in the reverberation room in order to measure the noise radiated from the measurement duct. The reverberation time of the room is also determined. 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[1]. The insertion loss D_i is now calculated as

$$D_i = L_{wII} - L_{wI} \quad (1)$$

in which:

L_{WI} is the level of the sound power in the frequencyband considered, radiating into the connected reverberation room when the test object is installed;

L_{WII} is the level of the sound power in the frequencyband considered, radiating into the connected reverberation room when the substitution duct replaces the test object.

The insertion loss is determined in third octave bands from 50 Hz to 10 kHz.

4.3 Transmission Loss D_t

The specimens are mounted in an measuring duct as shown in figure 3. Noise is introduced in the measuring duct using a loudspeaker system which is mounted at one and of this duct in ventilation room (6). The test duct is installed crossing the reverberation room, both ends of the pipe penetrating through the walls of the room. The penetrations have been sealed adequately. The opposite end of the pipe is terminated by means of a closed anechoic termination in room (2).

1 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.

The sound pressure level in the reverberation room caused by the loudspeaker is measured in two situations:
- with the specimen to be tested installed in the measuring duct in the reverberation room;
- without the specimen and a open test duct.

A microphone on a rotating boom is used in the reverberation room in order to measure the noise radiated from the measurement duct. The reverberation time of the room is also determined. 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. The wall insulation D_t is now calculated as

$$D_t = L_{wII} - L_{wI} + D_{td} \qquad (2)$$

in which:

L_{WI} is the level of the sound power in the frequencyband considered, radiating into the connected reverberation room when the test object is installed;

L_{WII} is the level of the sound power in the frequencyband considered, radiating into the connected reverberation room with the open end of the test duct

D_{td} reflection coefficient at the open end of the duct

The transmission loss at the open end of a straight and rigid duct is calculated from

$$D_{td} = 10\ lg \left[1 + \frac{\Omega}{\left(\frac{4\ \pi\ f\ \sqrt{S}}{c} \right)^2} \right] \text{ dB} \qquad (3)$$

in which:

Ω = the solid angle of radiation at the duct (here: $\Omega = 4\pi$)

c = speed of sound in air (340 m/s)

f = frequency [Hz]

S = cross-sectional area of the duct opening in the measuring room [m^2]

The wall insulation is determined in third octave bands from 50 Hz to 10 kHz.

4.4 Results measurements

4.4.1 Insertion Loss

The results of the measurements are summarized in the tables 4.1 up to and including 4.3 and presented in detail in the figures in Annex 1 of this report.

t4.1 Insertion loss ***ACOUSTIC SEMIAFS***

INSERTION LOSS [dB]								
AFS nr.	**17**		**18**		**19**		**20**	
diameter	**80 mm**		**80 mm**		**100 mm**		**100 mm**	
length	**1,0 m**		**1,0 m**		**1,0 m**		**1,0 m**	
record nr.	**#322**		**#323**		**#324**		**#325**	
figure nr.	**1.1**		**1.2**		**1.3**		**1.4**	
frequency [Hz]	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**
50	17,6		15,9		21,1		23,9	
63	31,0	22,0	26,6	20,0	15,1	14,1	17,6	16,9
80	30,6		27,2		11,1		14,0	
100	15,9		13,7		16,5		18,7	
125	23,1	19,9	21,6	17,8	23,7	20,3	26,8	22,7
160	35,9		32,3		28,3		32,6	
200	39,1		37,5		34,1		35,1	
250	40,1	37,8	41,1	38,4	35,5	35,7	32,0	34,3
315	35,6		37,5		38,7		37,9	
400	39,0		40,8		37,7		35,3	
500	39,4	38,7	39,4	39,4	35,7	36,8	33,1	33,7
630	37,8		38,4		37,4		33,1	
800	35,9		34,8		33,9		31,6	
1000	37,9	37,5	37,0	36,8	34,5	35,0	33,4	33,4
1250	39,3		40,4		37,2		36,4	
1600	40,2		41,7		39,2		42,9	
2000	42,9	39,5	44,7	40,8	38,9	33,9	36,9	29,4
2500	37,3		38,3		30,1		25,0	
3150	27,6		27,5		22,1		18,5	
4000	21,0	19,6	21,0	20,6	16,8	16,8	14,3	14,7
5000	16,4		17,8		14,4		12,9	
6300	18,4		19,1		13,8		12,3	
8000	17,6	16,5	17,8	16,9	12,5	12,1	10,5	10,4
10000	14,6		14,9		10,7		9,0	

t4.2 Insertion loss ***ACOUSTIC SEMIAFS***

INSERTION LOSS [dB]								
AFS nr.	**21**		**22**		**23**		**24**	
diameter	**125 mm**		**125 mm**		**160 mm**		**160 mm**	
length	**1,0 m**		**1,0 m**		**1,0 m**		**1,0 m**	
record nr.	**#328**		**#329**		**#361**		**#362**	
figure nr.	**1.5**		**1.6**		**1.7**		**1.8**	
frequency [Hz]	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**
50	20,3		20,8		26,1		26,3	
63	11,3	11,7	11,3	11,9	13,5	14,6	14,2	14,6
80	9,3		9,6		12,5		12,0	
100	15,6		15,6		22,1		21,2	
125	16,1	17,3	13,4	15,9	20,7	23,0	21,2	22,8
160	24,4		24,8		35,4		32,8	
200	29,7		28,4		35,0		33,3	
250	29,4	29,0	29,4	28,2	33,0	31,0	32,5	29,9
315	28,0		27,1		28,1		26,9	
400	30,7		30,4		27,8		27,2	
500	29,8	29,9	31,0	30,4	27,3	26,8	26,8	26,4
630	29,2		29,8		25,5		25,5	
800	28,8		29,4		25,4		25,9	
1000	29,6	29,8	29,6	30,1	27,0	27,0	27,6	27,6
1250	31,2		31,7		29,3		30,3	
1600	34,5		34,9		36,3		35,9	
2000	36,4	33,3	36,6	33,9	32,6	26,4	28,7	23,9
2500	30,9		31,6		22,2		19,7	
3150	22,2		23,0		15,6		14,1	
4000	14,8	14,6	16,1	15,9	11,2	11,4	10,2	10,5
5000	11,8		13,2		9,4		8,7	
6300	10,7		11,3		7,8		7,7	
8000	9,3	9,1	10,0	9,7	8,0	8,2	7,7	8,0
10000	7,8		8,3		8,9		8,5	

t4.3 Insertion loss ***ACOUSTIC SEMIAFS***

	INSERTION LOSS [dB]			
AFS nr.	**25**		**26**	
diameter	**200 mm**		**200 mm**	
length	**1,0 m**		**1,0 m**	
record nr.	**#341**		**#342**	
figure nr.	**1.9**		**1.10**	
frequency [Hz]	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**
50	11,2		10,7	
63	13,9	12,9	14,6	12,9
80	14,3		14,6	
100	8,3		7,9	
125	16,3	11,9	15,8	11,5
160	16,5		16,2	
200	21,9		23,1	
250	24,9	23,9	27,0	25,3
315	26,1		26,9	
400	24,1		24,5	
500	23,2	23,4	21,8	22,6
630	22,9		21,9	
800	22,7		23,2	
1000	23,8	24,2	24,7	25,0
1250	27,4		28,8	
1600	28,2		26,6	
2000	21,0	18,6	19,4	17,4
2500	15,0		13,9	
3150	11,2		10,6	
4000	8,4	8,5	8,4	8,4
5000	7,0		6,9	
6300	7,3		7,2	
8000	8,7	7,9	9,0	8,0
10000	7,9		7,9	

4.4.2 Transmission Loss

The results of the measurements are summarized in the tables 4.4 up to and including 4.6 and presented in detail in the figures in Annex 2 of this report.

*t4.4 Transmission loss **ACOUSTIC SEMIAFS***

TRANSMISSION LOSS [dB]								
AFS nr.	**17**		**18**		**19**		**20**	
diameter	**80 mm**		**80 mm**		**100 mm**		**100 mm**	
length	**1,0 m**		**1,0 m**		**1,0 m**		**1,0 m**	
record nr.	**#479**		**#480**		**#481**		**#482**	
figure nr.	**2.1**		**2.2**		**2.3**		**2.4**	
frequency [Hz]	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**
50	30,4		31,8		30,7		29,6	
63	23,2	24,7	25,3	26,3	21,7	23,0	22,2	23,4
80	23,5		24,7		21,3		21,9	
100	26,8		25,6		24,6		24,3	
125	23,1	23,9	22,0	22,7	20,9	22,3	21,2	22,7
160	22,7		21,6		22,2		23,3	
200	23,3		22,5		22,2		23,9	
250	24,4	21,6	24,4	21,3	21,0	18,5	22,8	20,6
315	19,1		18,9		15,4		17,8	
400	18,2		18,1		16,2		18,8	
500	17,0	17,7	16,3	17,1	14,5	14,6	17,7	18,3
630	18,0		17,0		13,4		18,5	
800	14,4		14,1		12,5		17,1	
1000	12,5	13,2	13,4	13,5	12,5	12,6	16,5	16,5
1250	12,9		13,2		12,7		16,0	
1600	13,6		13,7		12,9		15,5	
2000	14,3	14,1	14,2	14,5	13,2	13,4	15,5	15,6
2500	14,5		16,0		14,2		15,8	
3150	14,7		15,9		15,2		16,8	
4000	15,4	15,7	15,7	16,1	15,4	15,5	17,5	17,5
5000	17,4		16,8		16,1		18,5	
6300	17,7		17,2		16,7		18,3	
8000	19,1	18,9	18,9	18,6	17,9	17,9	19,9	19,8
10000	20,4		20,2		19,7		22,0	

t4.5 Transmission loss ***ACOUSTIC SEMIAFS***

TRANSMISSION LOSS [dB]								
AFS nr.	**21**		**22**		**23**		**24**	
diameter	**125 mm**		**125 mm**		**160 mm**		**160 mm**	
length	**1,0 m**		**1,0 m**		**1,0 m**		**1,0 m**	
record nr.	**#487**		**#488**		**#516**		**#517**	
figure nr.	**2.5**		**2.6**		**2.7**		**2.8**	
frequency [Hz]	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**
50	28,0		29,4		26,0		26,7	
63	22,5	23,2	22,1	22,8	20,9	22,0	21,4	22,5
80	21,5		20,7		20,9		21,3	
100	21,4		21,3		20,5		21,4	
125	17,0	19,0	16,9	18,7	15,2	17,0	16,1	17,3
160	19,6		18,9		16,8		16,2	
200	20,8		20,5		15,7		15,9	
250	20,3	15,6	20,5	16,2	16,1	14,6	15,9	14,5
315	11,9		12,6		12,8		12,6	
400	13,5		14,2		11,8		11,5	
500	9,7	11,0	10,5	12,1	11,1	11,1	11,5	11,1
630	10,7		12,3		10,4		10,5	
800	10,4		12,2		10,5		10,7	
1000	10,1	10,3	11,1	11,3	9,8	9,9	11,0	10,8
1250	10,5		10,8		9,6		10,8	
1600	10,4		11,1		10,0		10,7	
2000	11,2	10,8	11,4	11,2	9,5	9,9	10,3	10,6
2500	10,9		11,0		10,1		10,8	
3150	10,9		10,9		10,9		11,8	
4000	12,2	12,0	11,7	11,8	12,5	12,2	13,3	13,1
5000	13,3		13,0		13,7		14,8	
6300	15,5		15,2		14,9		16,0	
8000	17,4	17,1	16,8	16,8	16,5	16,3	17,7	17,4
10000	19,4		19,5		17,9		19,2	

t4.6 Transmission loss ***ACOUSTIC SEMIAFS***

	TRANSMISSION LOSS [dB]			
AFS nr.	**25**		**26**	
diameter	**200 mm**		**200 mm**	
length	**1,0 m**		**1,0 m**	
record nr.	**#500**		**#501**	
figure nr.	**2.9**		**2.10**	
frequency [Hz]	**1/3 oct.**	**1/1 oct.**	**1/3 oct.**	**1/1 oct.**
50	27,4		26,6	
63	22,8	23,2	21,3	22,0
80	21,3		20,4	
100	20,8		20,7	
125	15,1	17,4	15,8	18,1
160	18,1		19,4	
200	15,4		16,2	
250	14,1	13,5	15,6	14,9
315	11,7		13,5	
400	11,1		13,5	
500	9,6	10,0	11,9	12,2
630	9,4		11,4	
800	9,5		11,0	
1000	9,8	9,7	10,6	10,7
1250	9,8		10,5	
1600	10,5		10,8	
2000	10,6	10,6	10,5	10,6
2500	10,7		10,6	
3150	12,5		11,6	
4000	14,7	14,3	13,5	13,2
5000	16,5		15,4	
6300	17,9		16,4	
8000	18,6	18,8	17,3	17,4
10000	20,4		18,7	

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.

Mook,

Th. Scheers
Laboratory Supervisor

ir. G.M.A. Perquin
Manager

This report contains 15 pages, 3 figures and 2 annexes.

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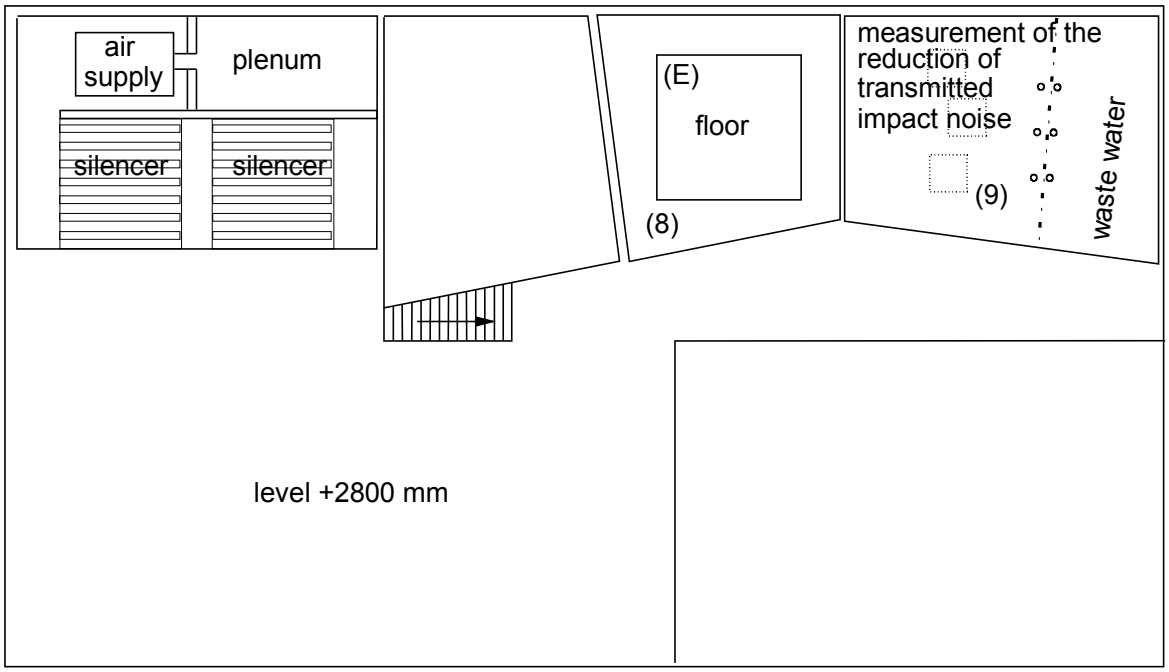
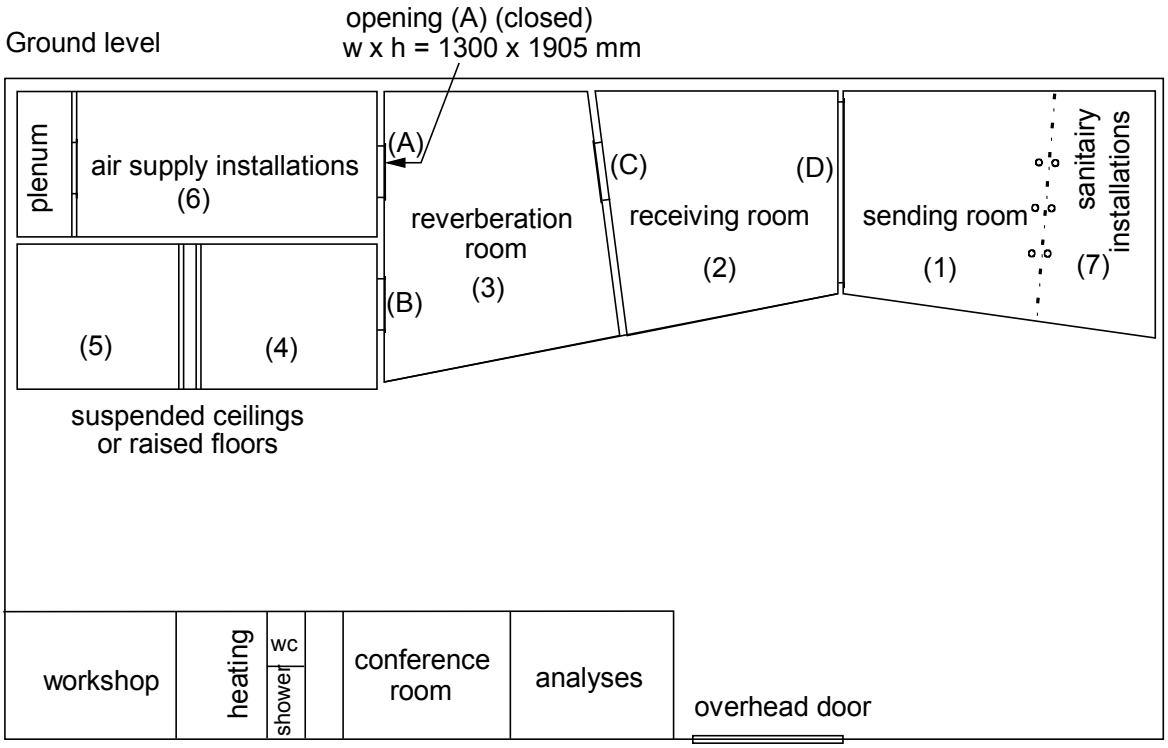
Lindenlaan 41, NL-6584 AC MOLENHOEK (LB), THE NETHERLANDS

OVERVIEW

Story

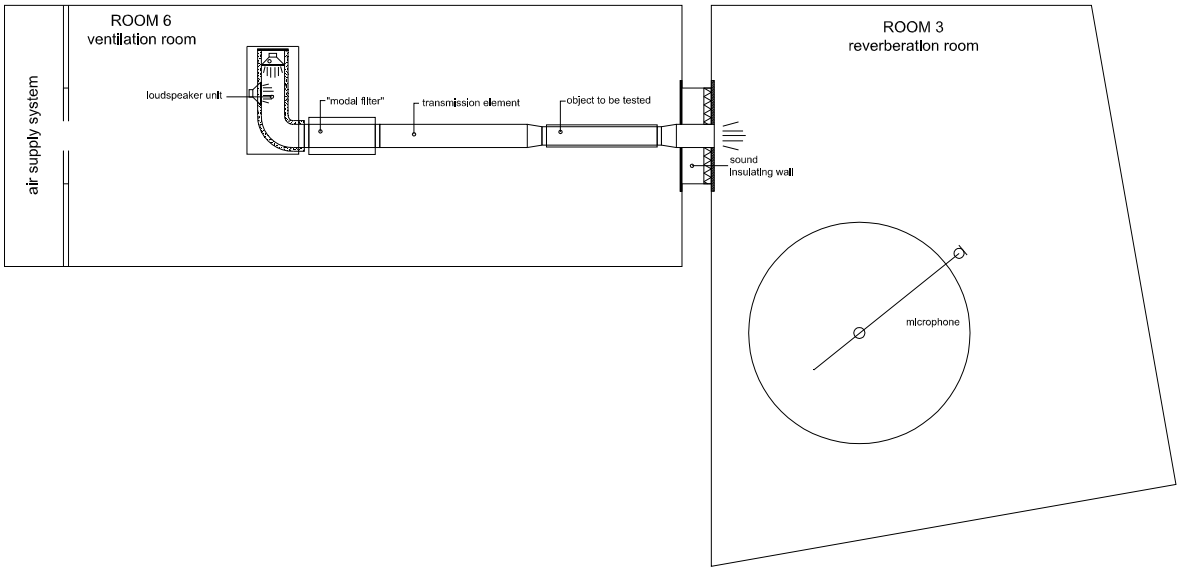


Ground level



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

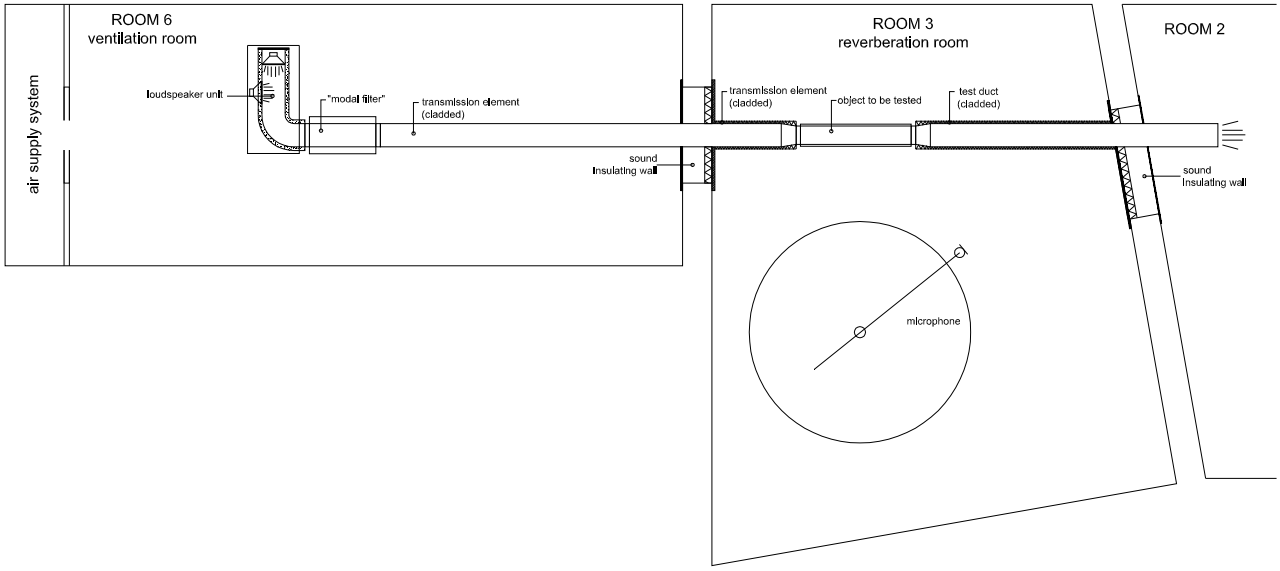
0 1 2 3 4 5 m
scale



Without silencer; L_{wII}

With silencer; L_{wI}

Measurement set-up insertion loss



Open end; L_{wII}

With silencer; L_{wII}

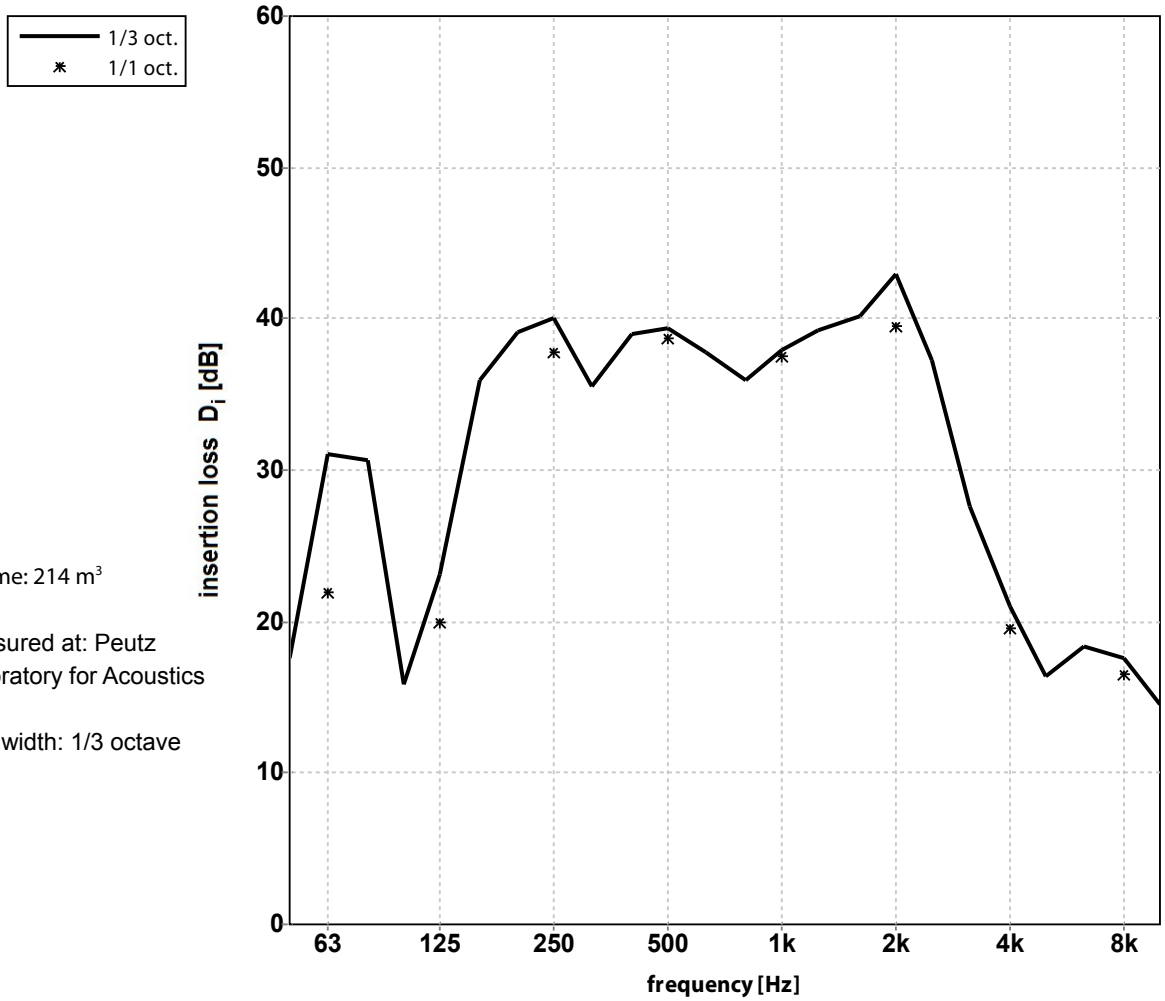
Measurement set-up transmission loss

LABORATORY FOR ACOUSTICS

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #17; ACOUSTIC SEMIAFS
diameter 80 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

		17,6	15,9	39,1	39,0	35,9	40,2	27,6	18,4	
1/3 oct.		31,0	23,1	40,1	39,4	37,9	42,9	21,0	17,6	dB
		30,6	35,9	35,6	37,8	39,3	37,3	16,4	14,6	
1/1 oct.		**22,0**	**19,9**	**37,8**	**38,7**	**37,5**	**39,5**	**19,6**	**16,5**	**dB**

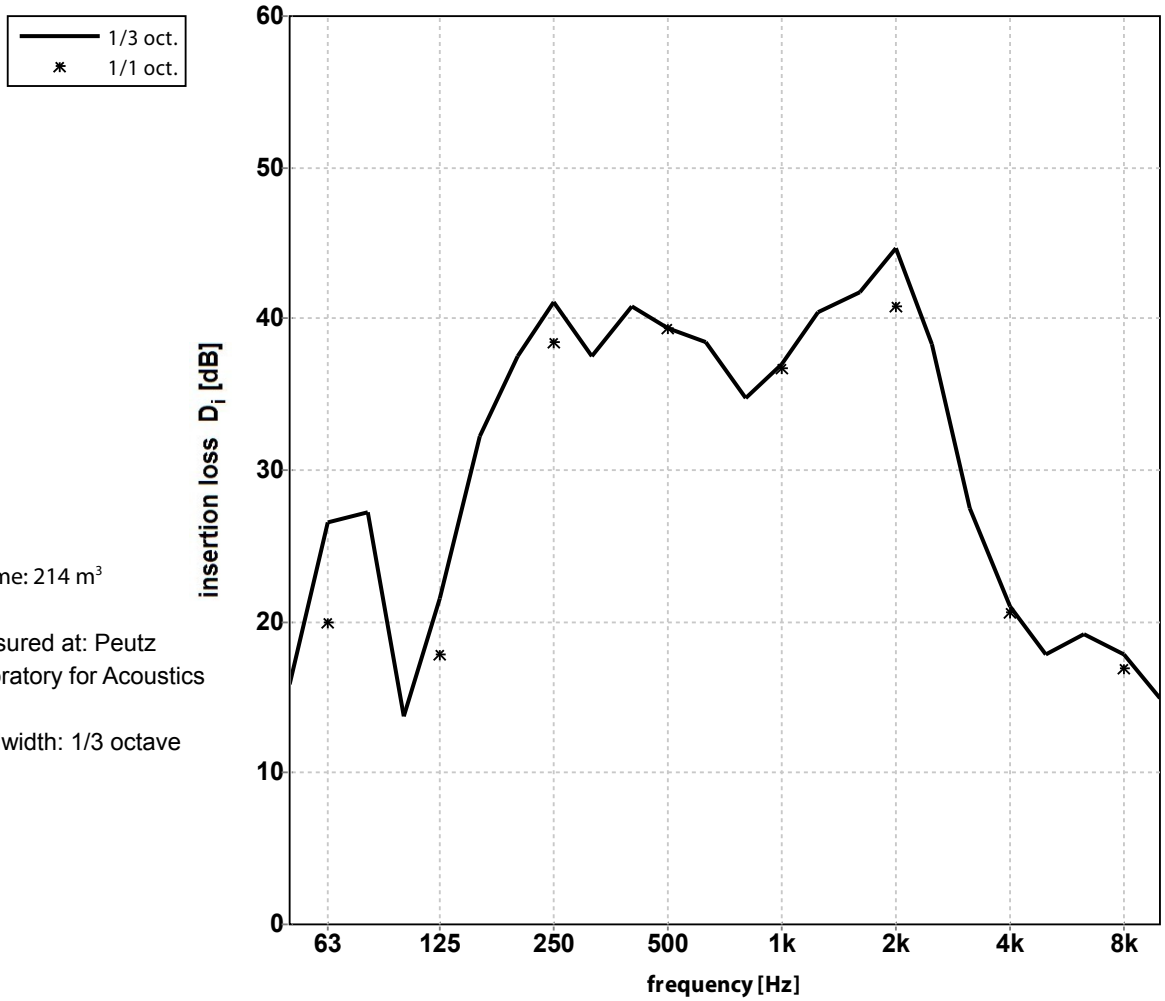
publication is permitted for the entire page only

Mook, 23-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #18; ACOUSTIC SEMIAFS
diameter 80 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

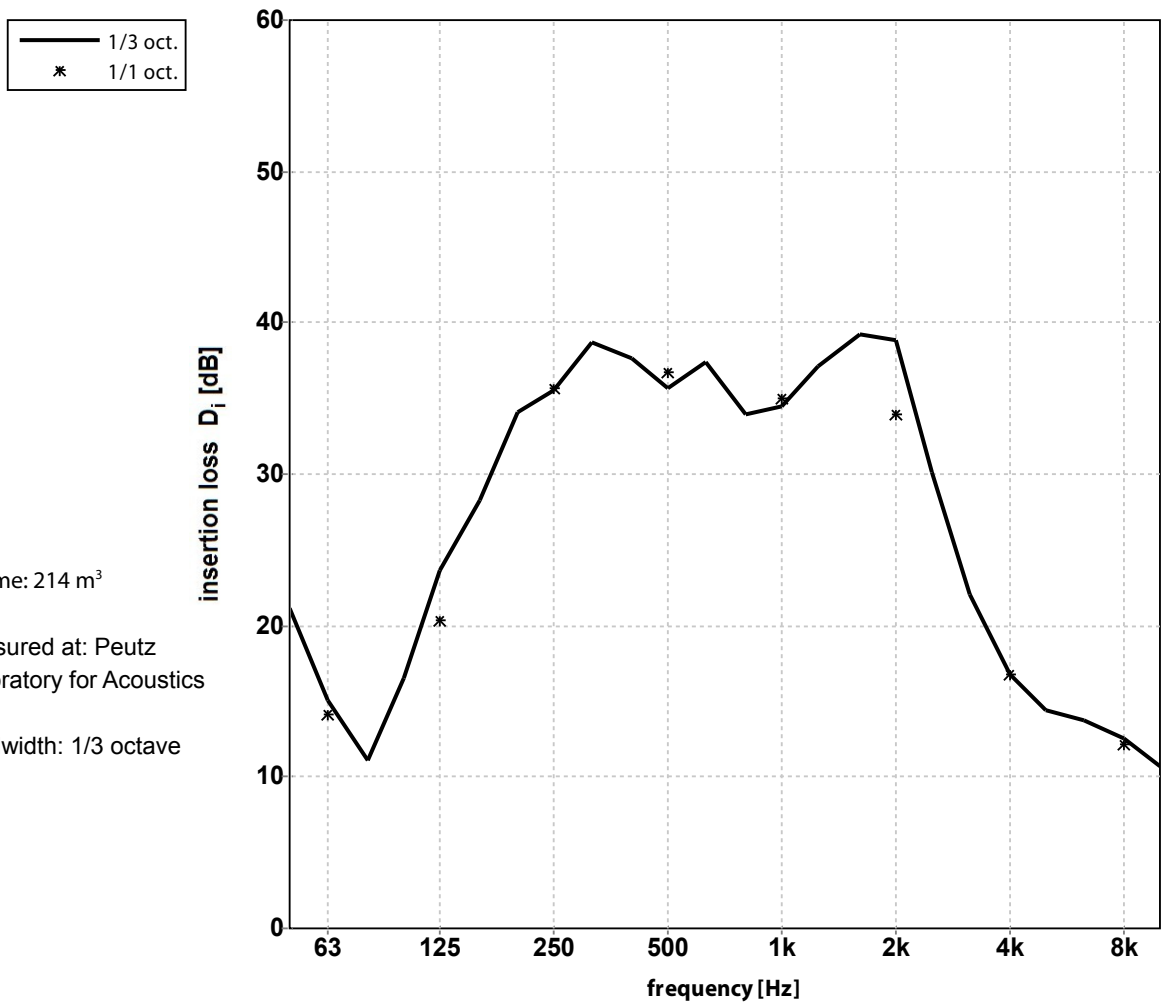
		15,9	13,7	37,5	40,8	34,8	41,7	27,5	19,1	
	1/3 oct.	26,6	21,6	41,1	39,4	37,0	44,7	21,0	17,8	dB
		27,2	32,3	37,5	38,4	40,4	38,3	17,8	14,9	
	1/1 oct.	**20,0**	**17,8**	**38,4**	**39,4**	**36,8**	**40,8**	**20,6**	**16,9**	**dB**

Mook, 23-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #19; ACOUSTIC SEMIAFS
diameter 100 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

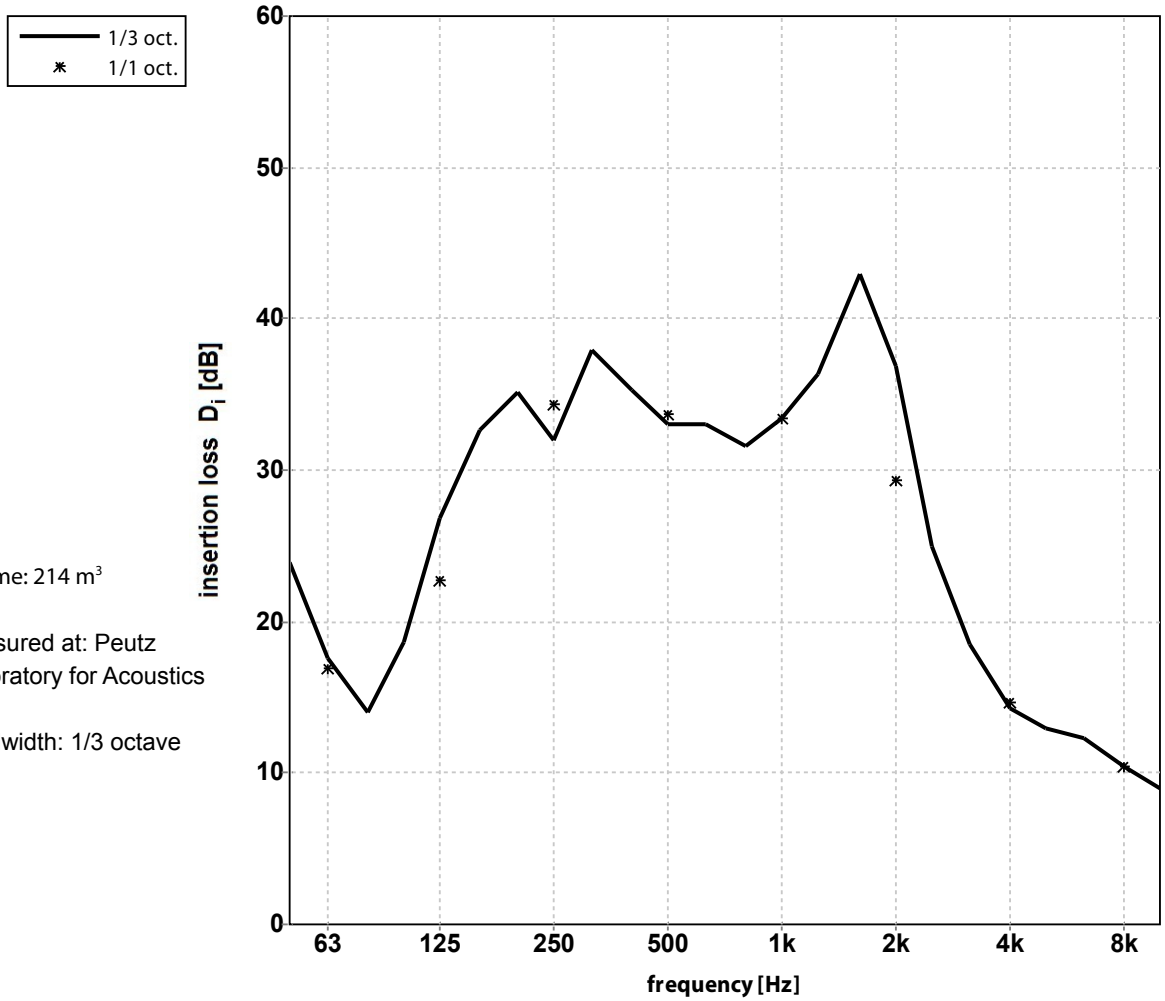
		21,1	16,5	34,1	37,7	33,9	39,2	22,1	13,8	
	1/3 oct.	15,1	23,7	35,5	35,7	34,5	38,9	16,8	12,5	dB
		11,1	28,3	38,7	37,4	37,2	30,1	14,4	10,7	
1/1 oct.		**14,1**	**20,3**	**35,7**	**36,8**	**35,0**	**33,9**	**16,8**	**12,1**	**dB**

Mook, 23-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #20; ACOUSTIC SEMIAFS
diameter 100 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	23,9	18,7	35,1	35,3	31,6	42,9	18,5	12,3	
1/3 oct.	17,6	26,8	32,0	33,1	33,4	36,9	14,3	10,5	dB
	14,0	32,6	37,9	33,1	36,4	25,0	12,9	9,0	
1/1 oct.	**16,9**	**22,7**	**34,3**	**33,7**	**33,4**	**29,4**	**14,7**	**10,4**	**dB**

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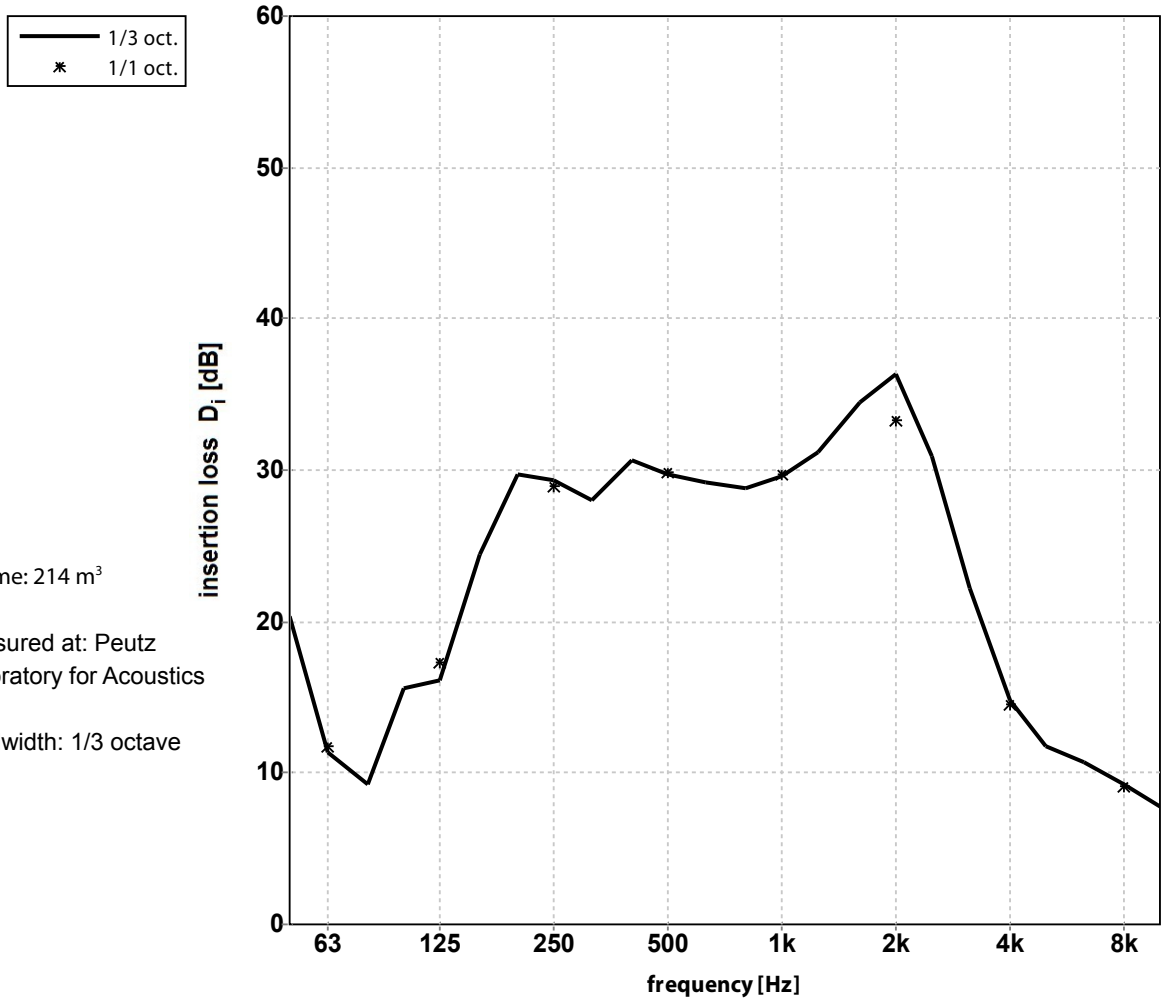
Mook, 23-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #21; ACOUSTIC SEMIAFS
diameter 125 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	20,3	15,6	29,7	30,7	28,8	34,5	22,2	10,7	
1/3 oct.	11,3	16,1	29,4	29,8	29,6	36,4	14,8	9,3	dB
	9,3	24,4	28,0	29,2	31,2	30,9	11,8	7,8	
1/1 oct.	**11,7**	**17,3**	**29,0**	**29,9**	**29,8**	**33,3**	**14,6**	**9,1**	**dB**

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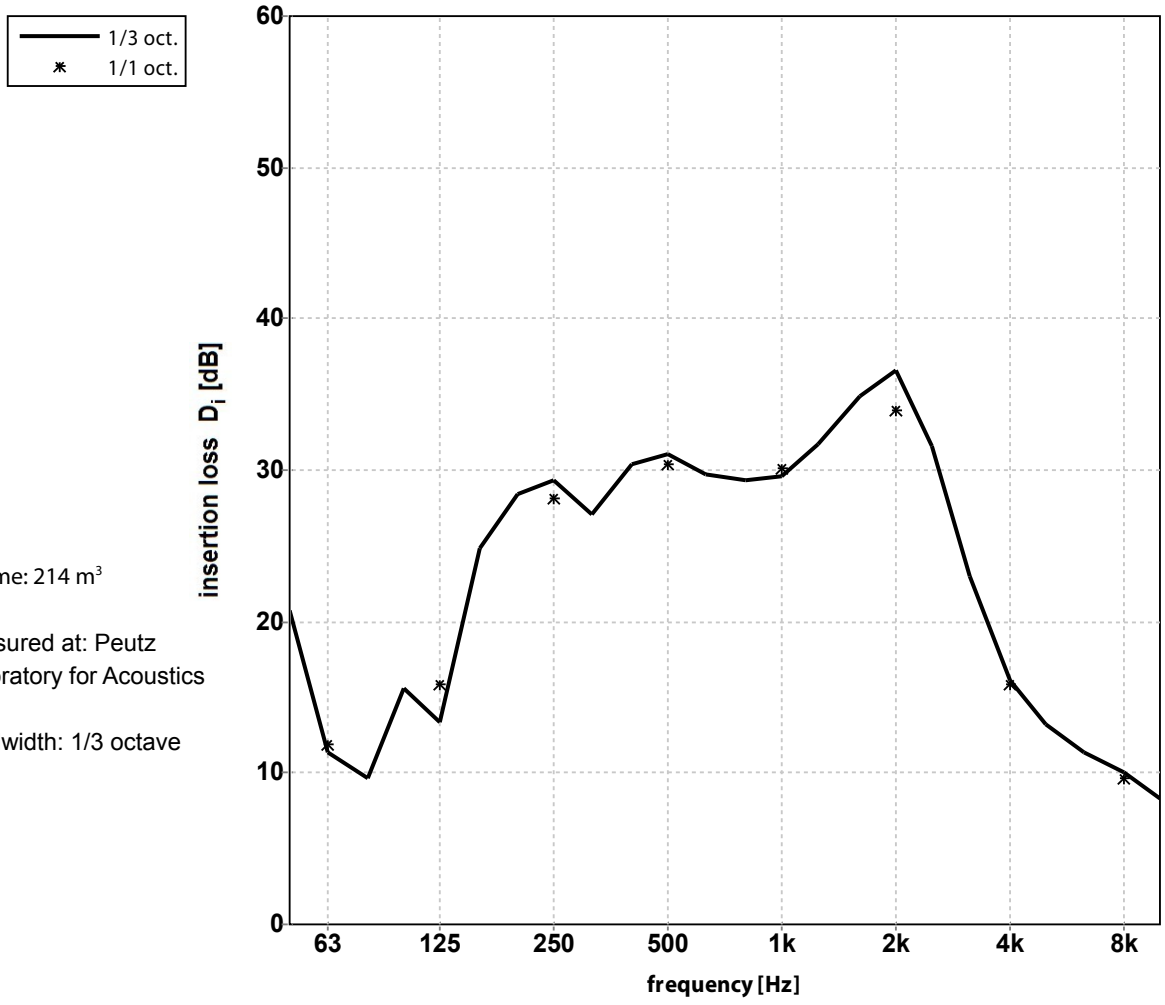
Mook, 24-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #22; ACOUSTIC SEMIAFS
diameter 125 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

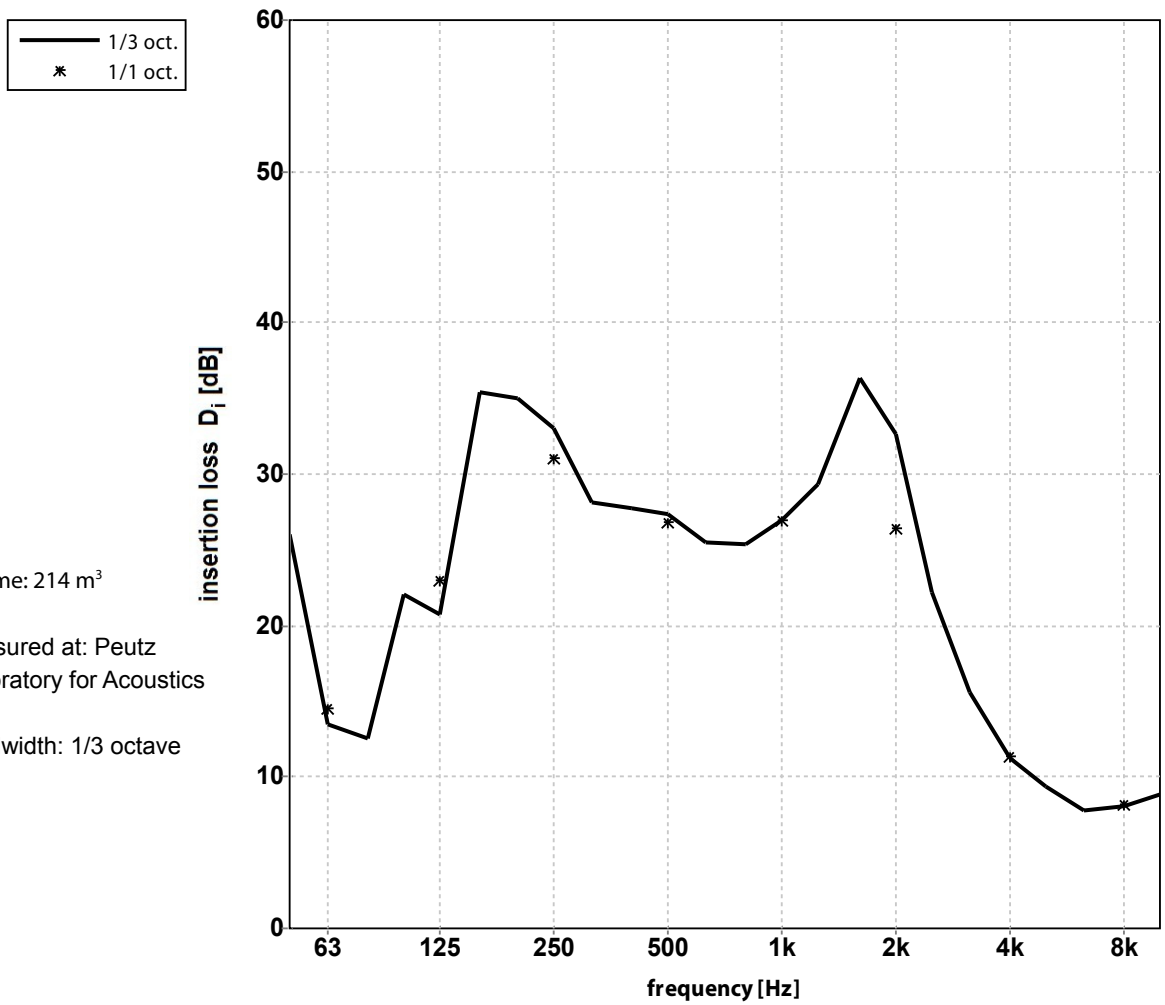
	20,8	15,6	28,4	30,4	29,4	34,9	23,0	11,3	
1/3 oct.	11,3	13,4	29,4	31,0	29,6	36,6	16,1	10,0	dB
	9,6	24,8	27,1	29,8	31,7	31,6	13,2	8,3	
1/1 oct.	**11,9**	**15,9**	**28,2**	**30,4**	**30,1**	**33,9**	**15,9**	**9,7**	**dB**

Mook, 24-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #23 ACOUSTIC SEMIAFS
diameter 160 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	26,1	22,1	35,0	27,8	25,4	36,3	15,6	7,8	
1/3 oct.	13,5	20,7	33,0	27,3	27,0	32,6	11,2	8,0	dB
	12,5	35,4	28,1	25,5	29,3	22,2	9,4	8,9	
1/1 oct.	**14,6**	**23,0**	**31,0**	**26,8**	**27,0**	**26,4**	**11,4**	**8,2**	**dB**

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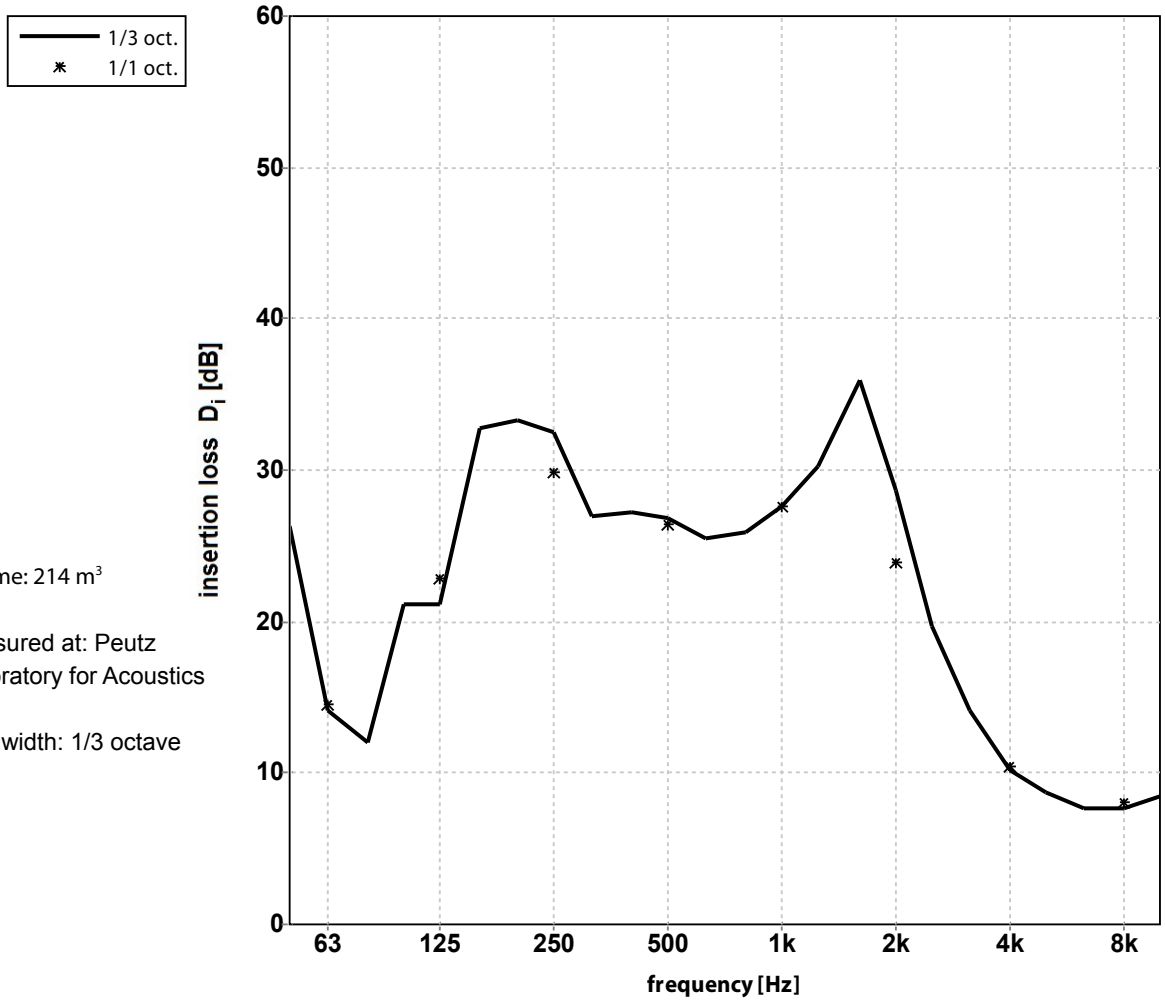
Mook, 02-05-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: # 24 ACOUSTIC SEMIAFS
diameter 160 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	26,3	21,2	33,3	27,2	25,9	35,9	14,1	7,7	
1/3 oct.	14,2	21,2	32,5	26,8	27,6	28,7	10,2	7,7	dB
	12,0	32,8	26,9	25,5	30,3	19,7	8,7	8,5	
1/1 oct.	**14,6**	**22,8**	**29,9**	**26,4**	**27,6**	**23,9**	**10,5**	**8,0**	**dB**

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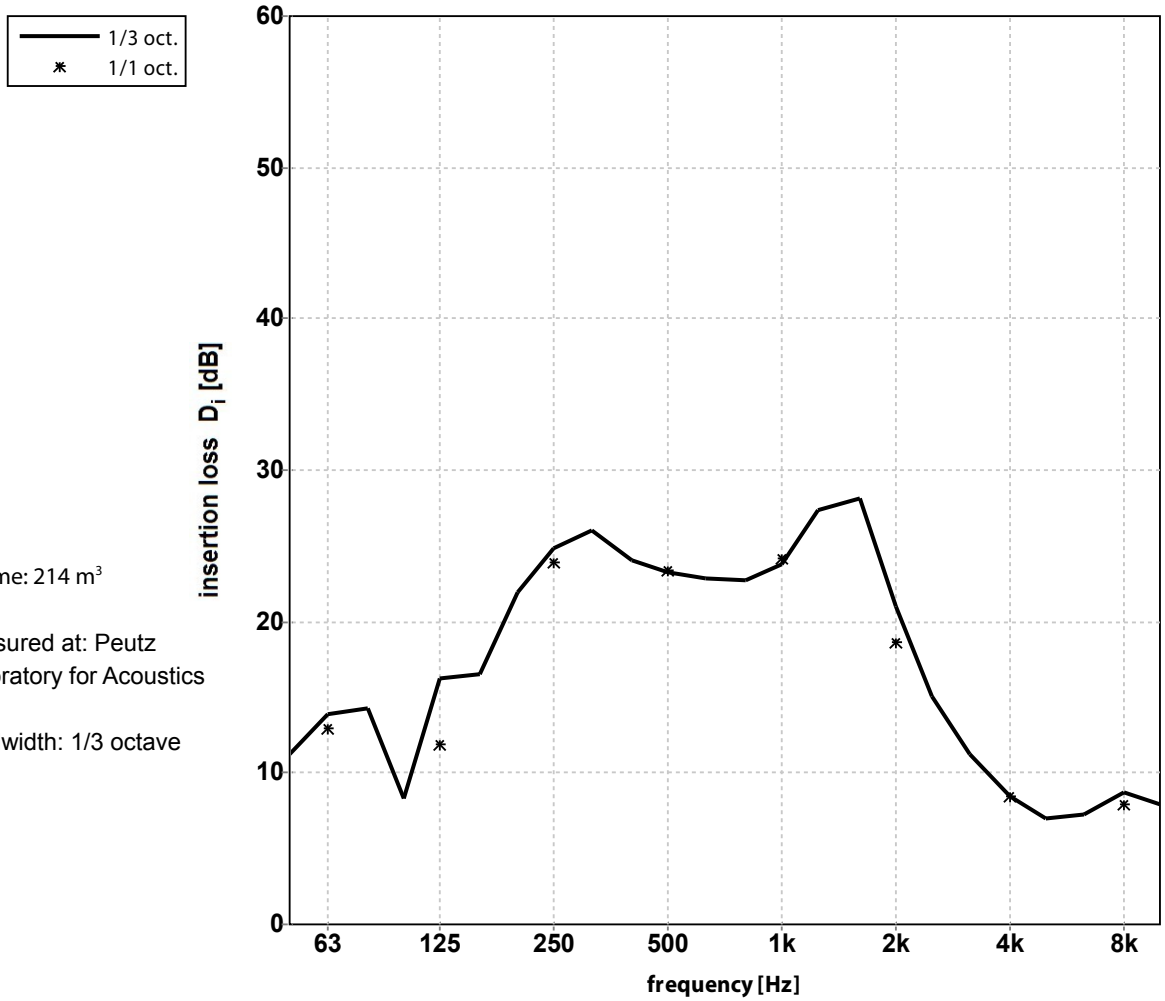
Mook, 02-05-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #25; ACOUSTIC SEMIAFS
diameter 200 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

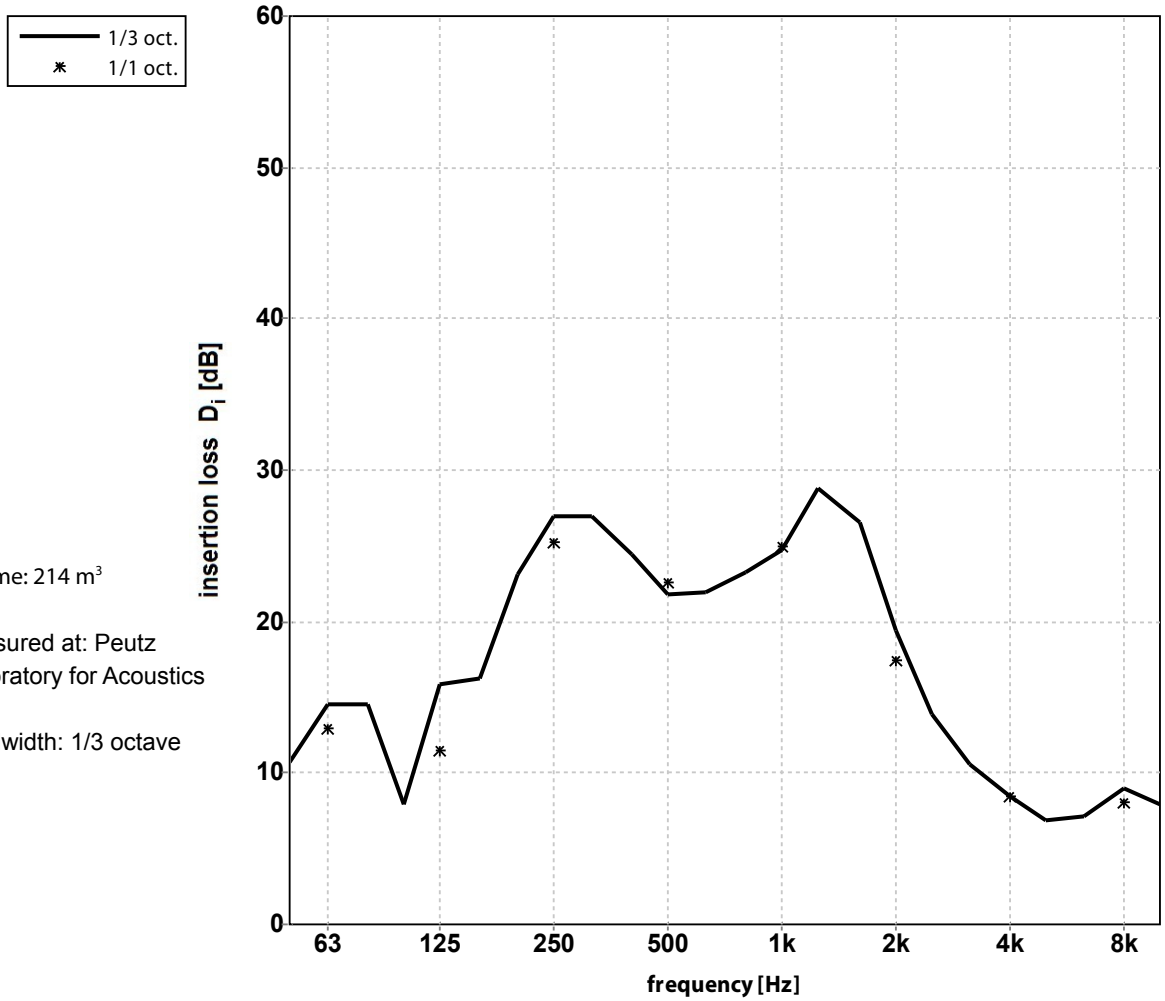
	11,2	8,3	21,9	24,1	22,7	28,2	11,2	7,3	
1/3 oct.	13,9	16,3	24,9	23,2	23,8	21,0	8,4	8,7	dB
	14,3	16,5	26,1	22,9	27,4	15,0	7,0	7,9	
1/1 oct.	**12,9**	**11,9**	**23,9**	**23,4**	**24,2**	**18,6**	**8,5**	**7,9**	**dB**

Mook, 25-04-2014

INSERTION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #26; ACOUSTIC SEMIAFS
diameter 200 mm
length 1,0 m



volume: 214 m³

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	10,7	7,9	23,1	24,5	23,2	26,6	10,6	7,2	
1/3 oct.	14,6	15,8	27,0	21,8	24,7	19,4	8,4	9,0	dB
	14,6	16,2	26,9	21,9	28,8	13,9	6,9	7,9	
1/1 oct.	**12,9**	**11,5**	**25,3**	**22,6**	**25,0**	**17,4**	**8,4**	**8,0**	**dB**

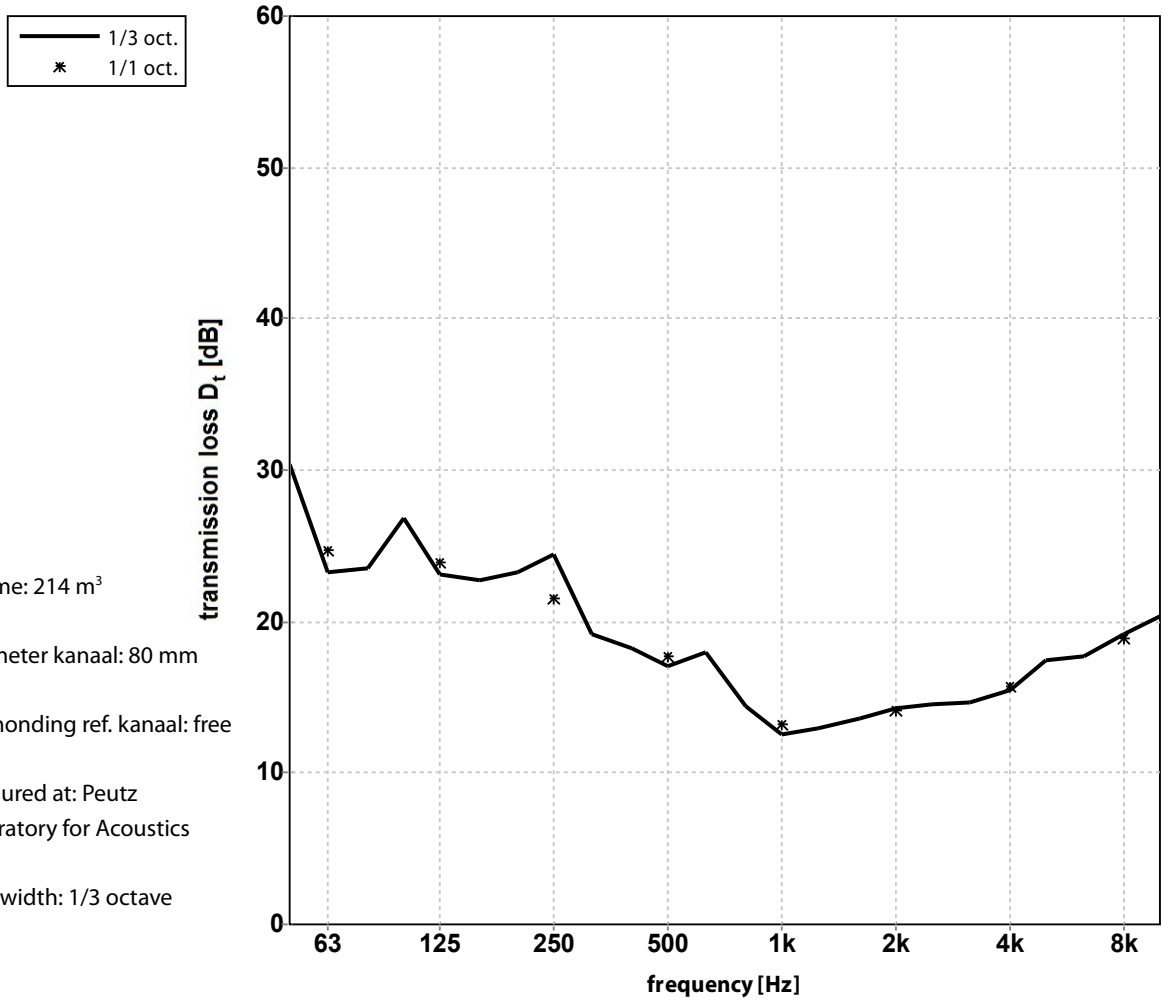
Mook, 25-04-2014

LABORATORY FOR ACOUSTICS

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #17; ACOUSTIC SEMIAFS
diameter 80 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 80 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	30,4	26,8	23,3	18,2	14,4	13,6	14,7	17,7	
1/3 oct.	23,2	23,1	24,4	17,0	12,5	14,3	15,4	19,1	dB
	23,5	22,7	19,1	18,0	12,9	14,5	17,4	20,4	
1/1 oct.	**24,7**	**23,9**	**21,6**	**17,7**	**13,2**	**14,1**	**15,7**	**18,9**	**dB**

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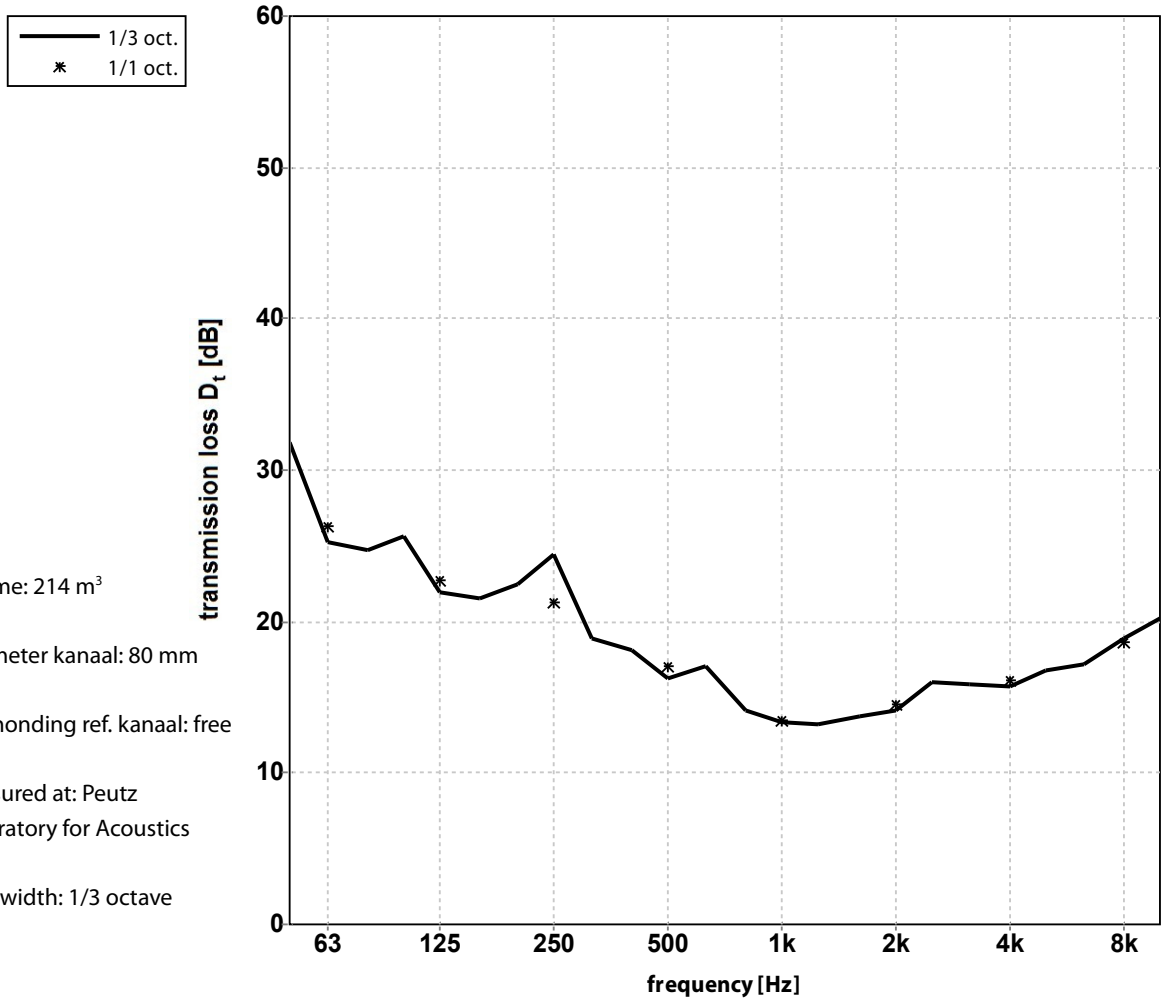
Mook, 22-05-2014

SoundPower 3.8.6b mode 10, PM:TS, file: a2692 Lwl #:367 Lwll #:365 D#:479

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #18; ACOUSTIC SEMIAFS
diameter 80 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 80 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

		31,8	25,6	22,5	18,1	14,1	13,7	15,9	17,2	
	1/3 oct.	25,3	22,0	24,4	16,3	13,4	14,2	15,7	18,9	dB
		24,7	21,6	18,9	17,0	13,2	16,0	16,8	20,2	
	1/1 oct.	**26,3**	**22,7**	**21,3**	**17,1**	**13,5**	**14,5**	**16,1**	**18,6**	**dB**

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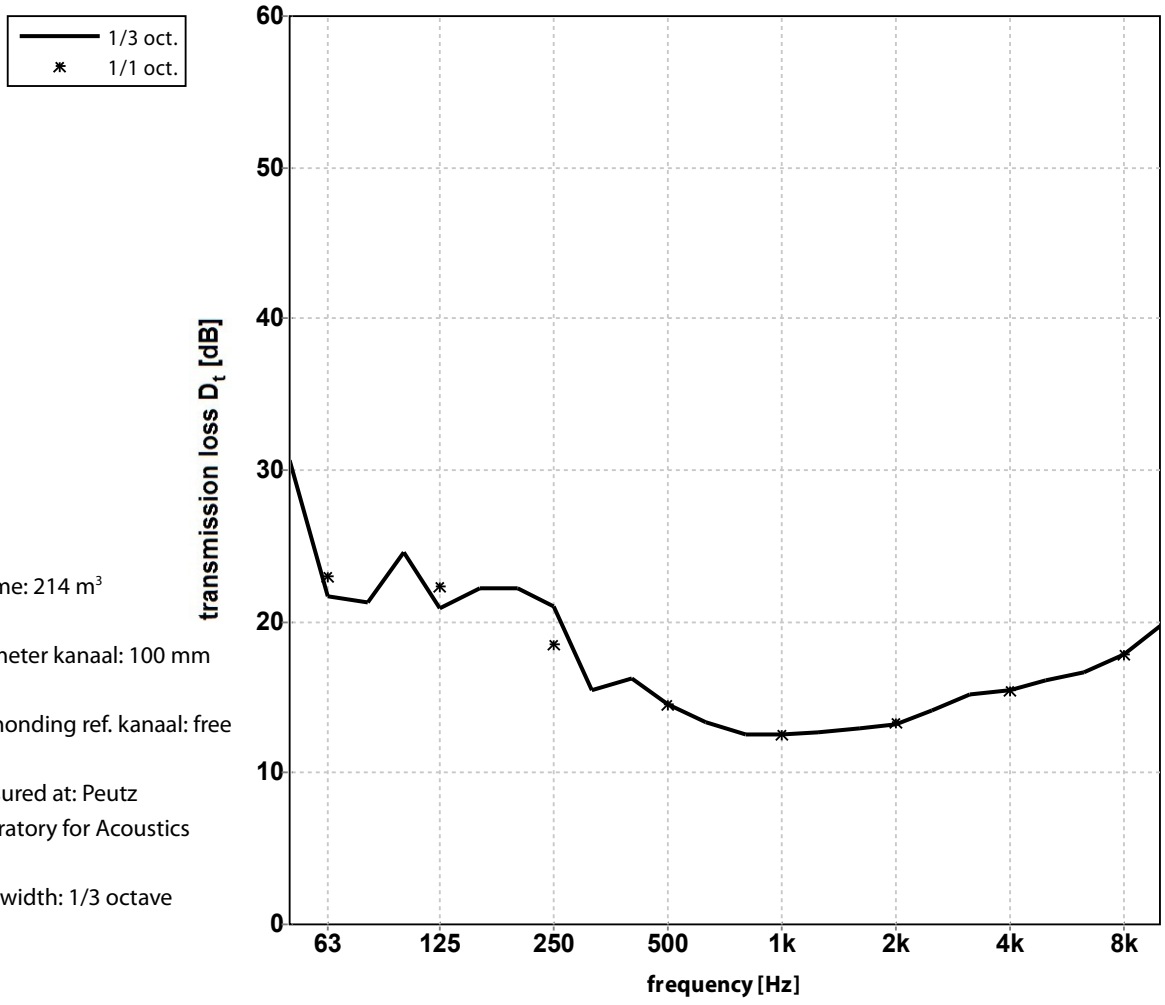
Mook, 22-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #19; ACOUSTIC SEMIAFS
diameter 100 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 100 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

		30,7	24,6	22,2	16,2	12,5	12,9	15,2	16,7	
	1/3 oct.	21,7	20,9	21,0	14,5	12,5	13,2	15,4	17,9	dB
		21,3	22,2	15,4	13,4	12,7	14,2	16,1	19,7	
	1/1 oct.	**23,0**	**22,3**	**18,5**	**14,6**	**12,6**	**13,4**	**15,5**	**17,9**	**dB**

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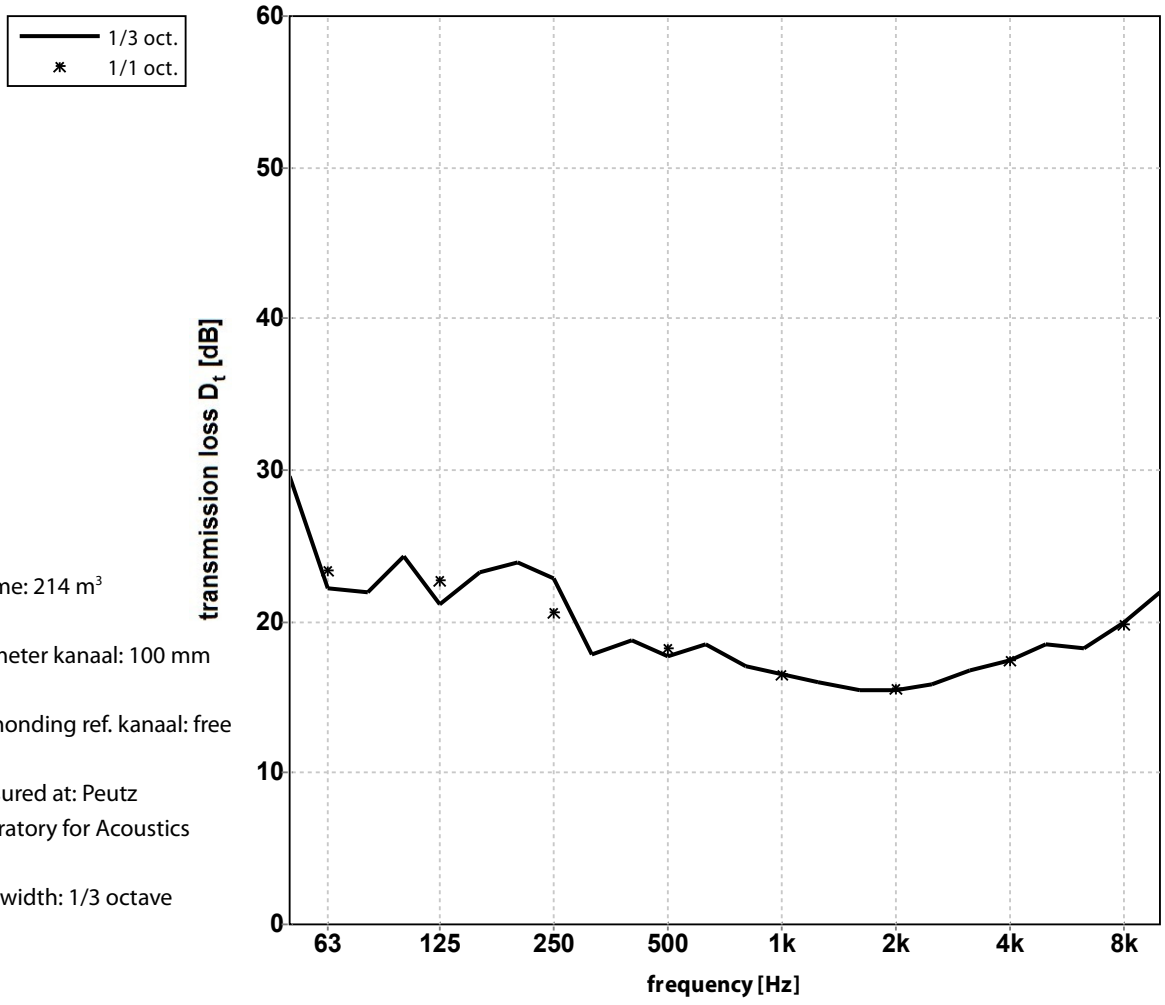
Mook, 22-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #20; ACOUSTIC SEMIAFS
diameter 100 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 100 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	29,6	24,3	23,9	18,8	17,1	15,5	16,8	18,3	
1/3 oct.	22,2	21,2	22,8	17,7	16,5	15,5	17,5	19,9	dB
	21,9	23,3	17,8	18,5	16,0	15,8	18,5	22,0	
1/1 oct.	**23,4**	**22,7**	**20,6**	**18,3**	**16,5**	**15,6**	**17,5**	**19,8**	**dB**

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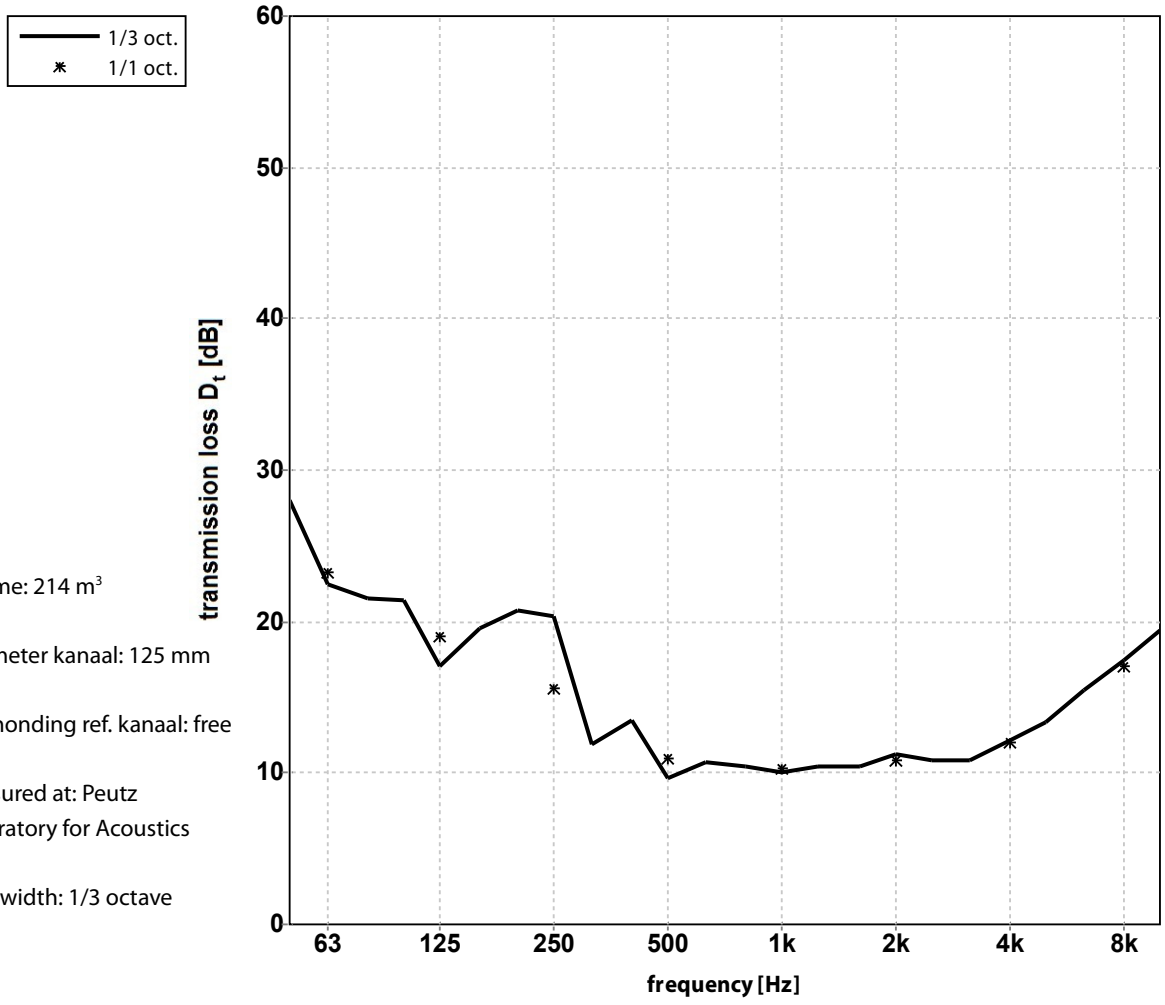
Mook, 22-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #21; ACOUSTIC SEMIAFS
diameter 125 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 125 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

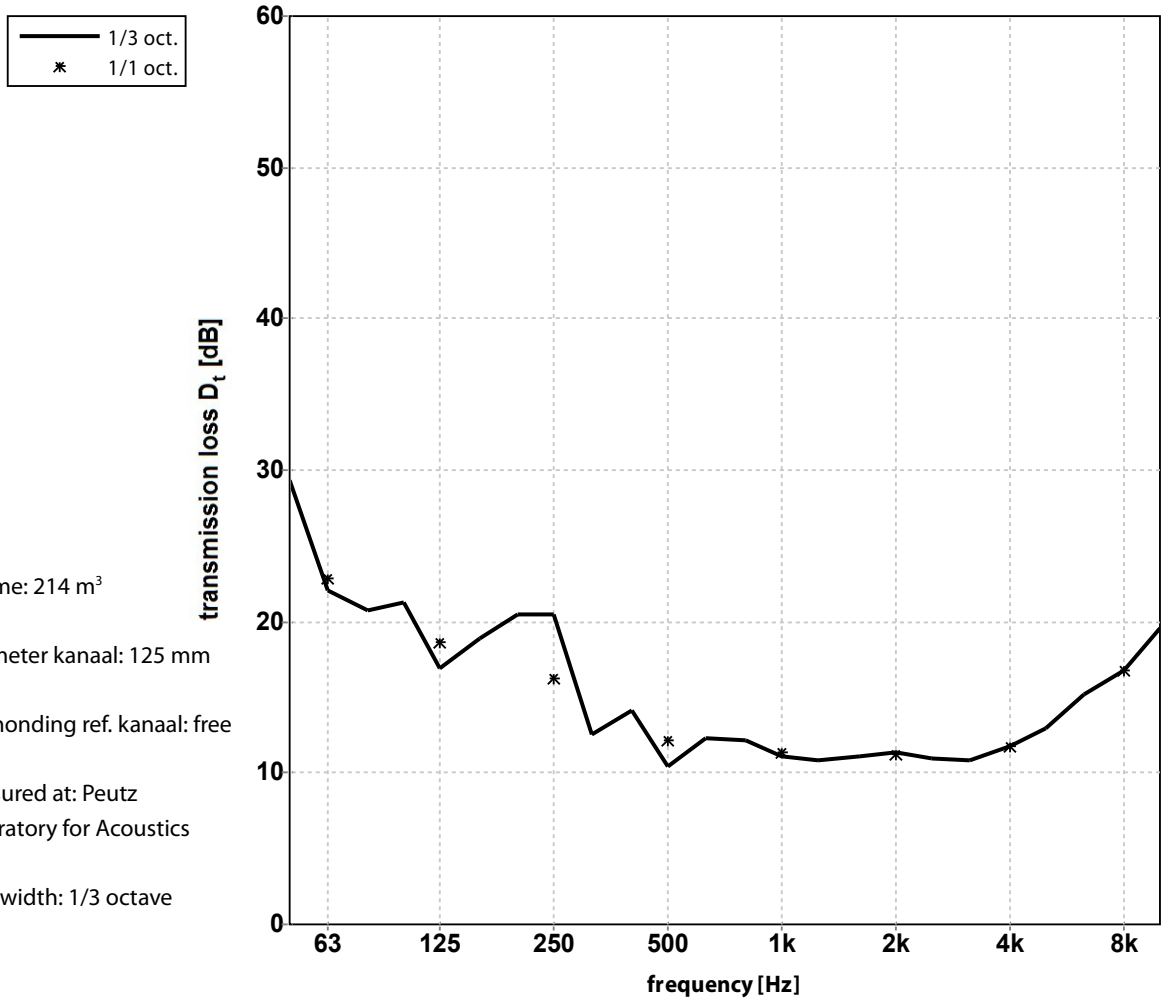
	28,0	21,4	20,8	13,5	10,4	10,4	10,9	15,5	
1/3 oct.	22,5	17,0	20,3	9,7	10,1	11,2	12,2	17,4	dB
	21,5	19,6	11,9	10,7	10,5	10,9	13,3	19,4	
1/1 oct.	**23,2**	**19,0**	**15,6**	**11,0**	**10,3**	**10,8**	**12,0**	**17,1**	**dB**

Mook, 22-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #22; ACOUSTIC SEMIAFS
diameter 125 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 125 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	29,4	21,3	20,5	14,2	12,2	11,1	10,9	15,2	
1/3 oct.	22,1	16,9	20,5	10,5	11,1	11,4	11,7	16,8	dB
	20,7	18,9	12,6	12,3	10,8	11,0	13,0	19,5	
1/1 oct.	**22,8**	**18,7**	**16,2**	**12,1**	**11,3**	**11,2**	**11,8**	**16,8**	**dB**

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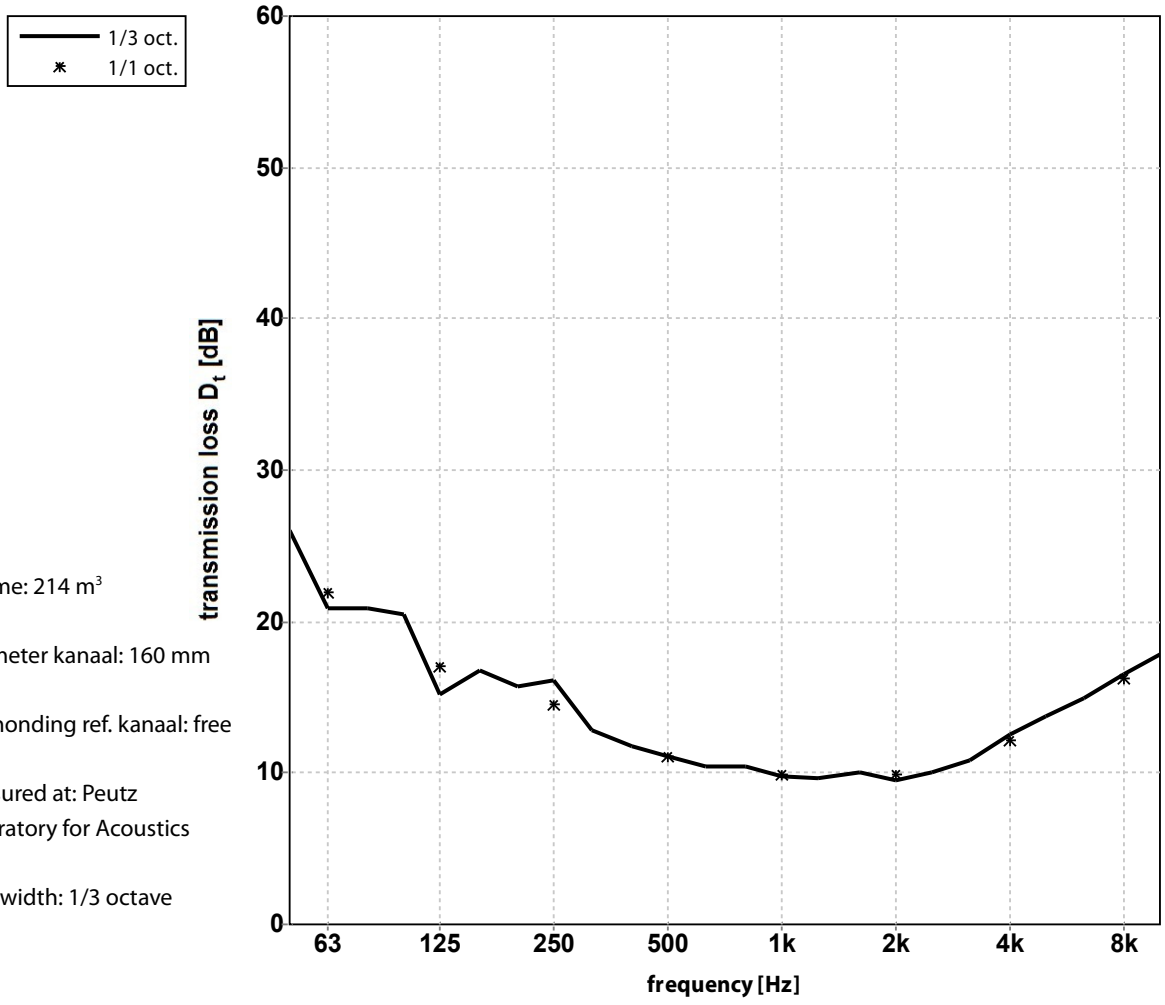
Mook, 22-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #23; ACOUSTIC SEMIAFS
diameter 160 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 160 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

		26,0	20,5	15,7	11,8	10,5	10,0	10,9	14,9	
	1/3 oct.	20,9	15,2	16,1	11,1	9,8	9,5	12,5	16,5	dB
		20,9	16,8	12,8	10,4	9,6	10,1	13,7	17,9	
1/1 oct.		**22,0**	**17,0**	**14,6**	**11,1**	**9,9**	**9,9**	**12,2**	**16,3**	**dB**

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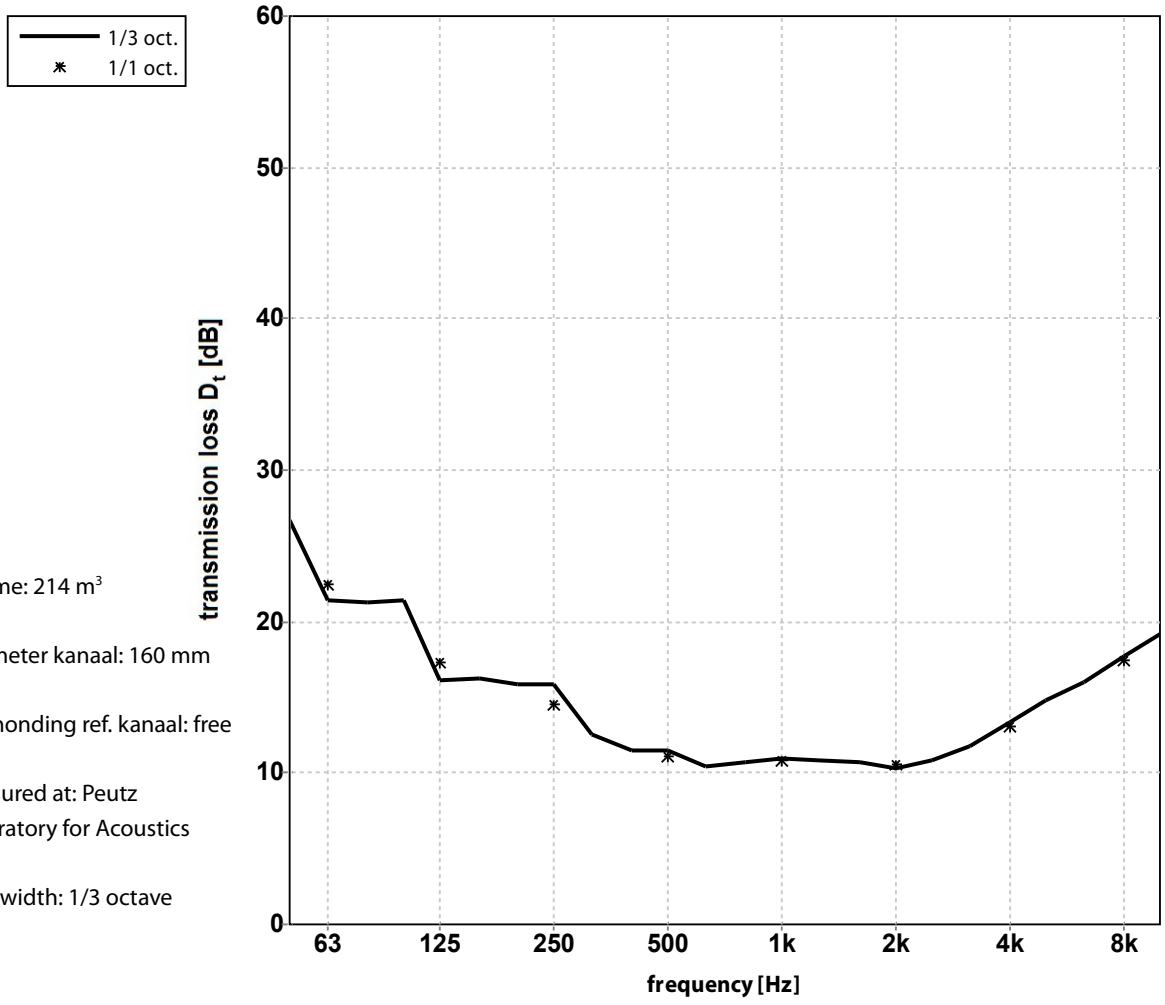
Mook, 23-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #24; ACOUSTIC SEMIAFS
diameter 160 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 160 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	26,7	21,4	15,9	11,5	10,7	10,7	11,8	16,0	
1/3 oct.	21,4	16,1	15,9	11,5	11,0	10,3	13,3	17,7	dB
	21,3	16,2	12,6	10,5	10,8	10,8	14,8	19,2	
1/1 oct.	**22,5**	**17,3**	**14,5**	**11,1**	**10,8**	**10,6**	**13,1**	**17,4**	**dB**

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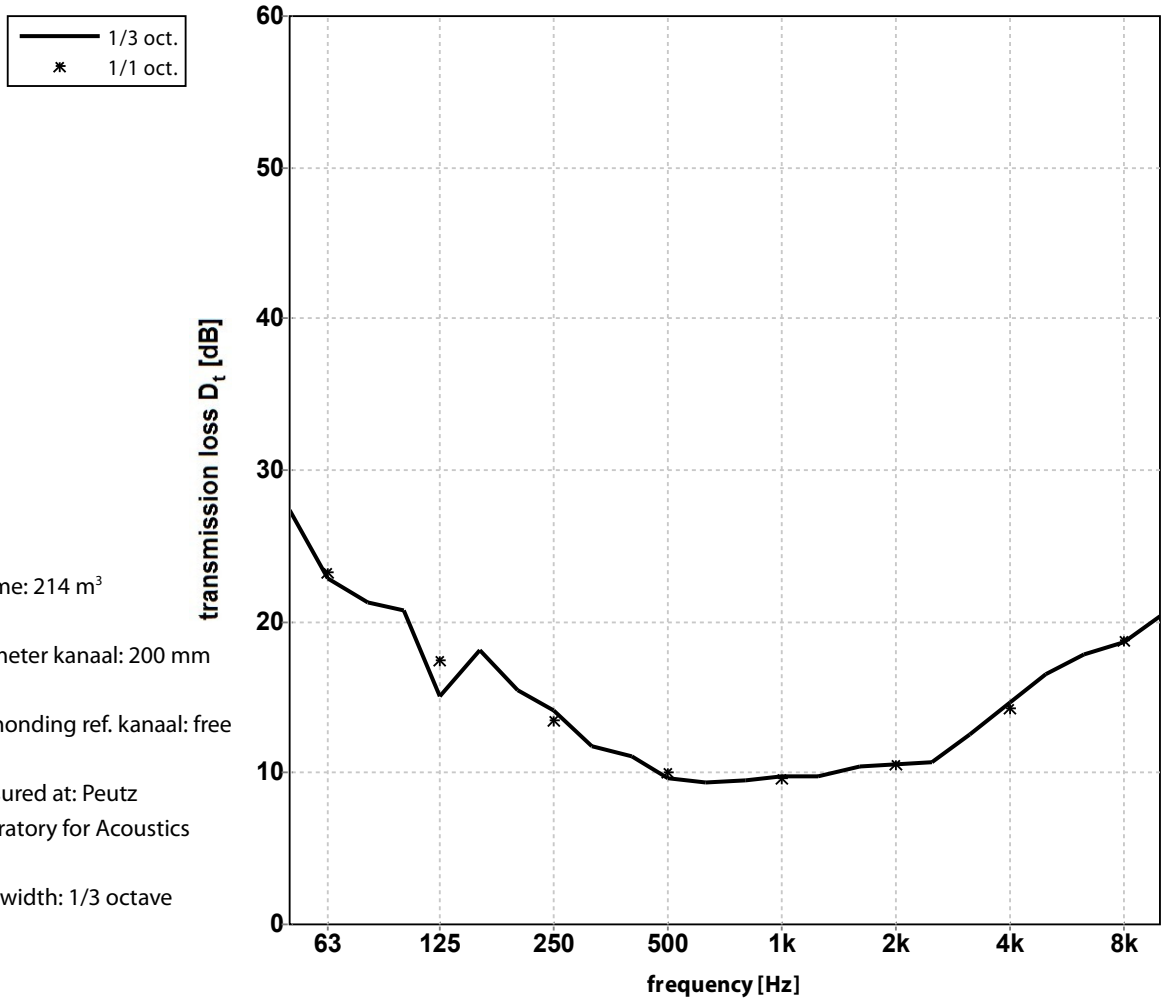
Mook, 23-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #25; ACOUSTIC SEMIAFS
diameter 200 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 200 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	27,4	20,8	15,4	11,1	9,5	10,5	12,5	17,9	
1/3 oct.	22,8	15,1	14,1	9,6	9,8	10,6	14,7	18,6	dB
	21,3	18,1	11,7	9,4	9,8	10,7	16,5	20,4	
1/1 oct.	**23,2**	**17,4**	**13,5**	**10,0**	**9,7**	**10,6**	**14,3**	**18,8**	**dB**

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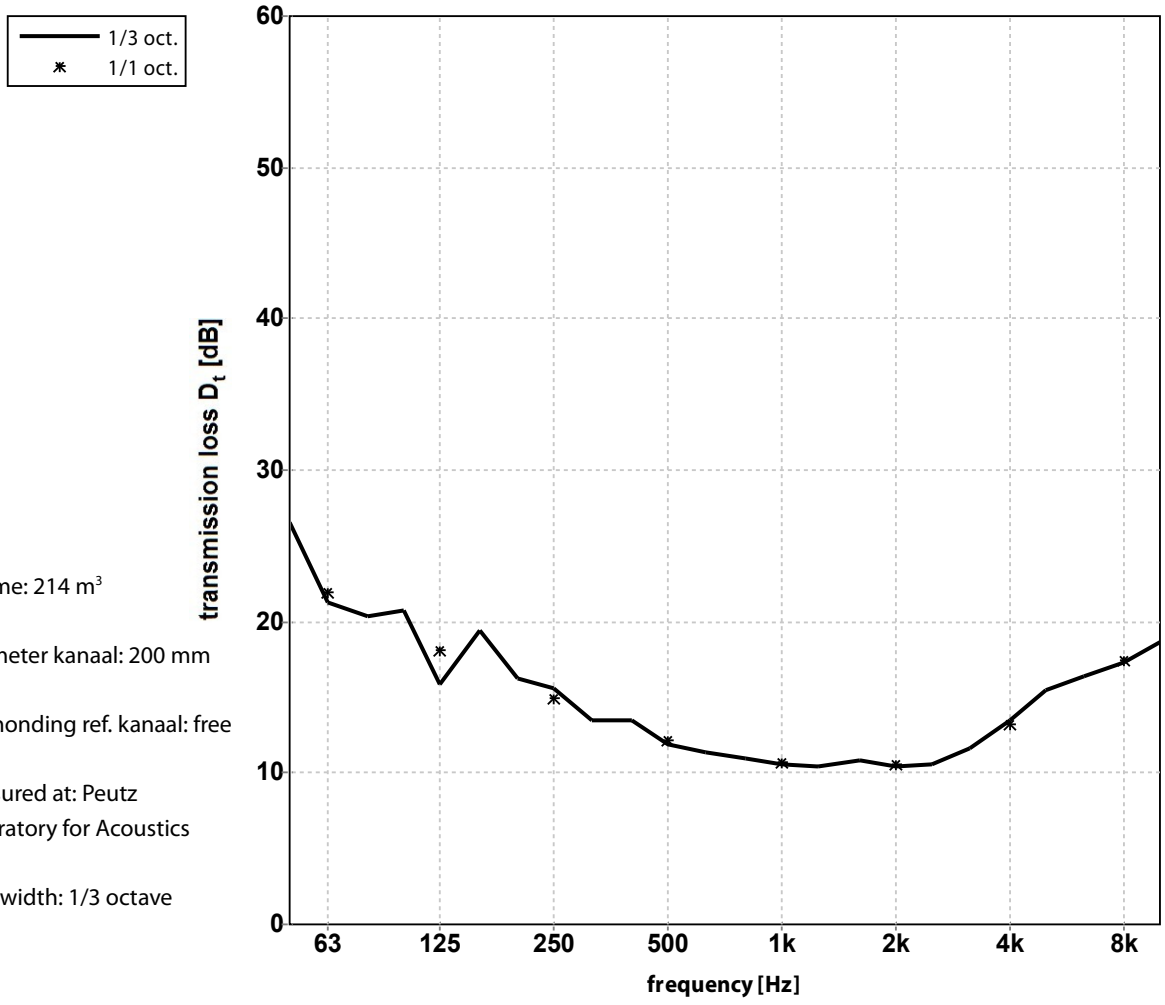
Mook, 22-05-2014

TRANSMISSION LOSS ACCORDING TO ISO 7235:2003

principal: AFS Boru Sanayi A.S.

construction tested: #26; ACOUSTIC SEMIAFS
diameter 200 mm
length 1,0 m



volume: 214 m³

*diameter kanaal: 200 mm

*uitmonding ref. kanaal: free

measured at: Peutz Laboratory for Acoustics

bandwidth: 1/3 octave

	26,6	20,7	16,2	13,5	11,0	10,8	11,6	16,4	
1/3 oct.	21,3	15,8	15,6	11,9	10,6	10,5	13,5	17,3	dB
	20,4	19,4	13,5	11,4	10,5	10,6	15,4	18,7	
1/1 oct.	**22,0**	**18,1**	**14,9**	**12,2**	**10,7**	**10,6**	**13,2**	**17,4**	**dB**

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Mook, 22-05-2014