DELTA Test Report

TEST Reg. no. 100

Laboratory measurement of airborne sound insulation of a FramelC top-guided window with a 6-18-4 mm argon-filled insulating glass unit

Performed for Idealcombi A/S

DANAK 100/2241
Project no.: 116-33698

9 March 2017

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FORCE Technology
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Title
Laboratory measurement of airborne sound insulation of a FrameIC top-guided window with a 6-18-4 mm argon-filled insulating glass unit

Journal no.	**Project no.**	**Our ref.**	**Date of test**
DANAK 100/2241	116-33698	LSS/MBH/ilk	10 February 2016

Client
Idealcombi A/S
Nørre Allé 51
P.O. Box 119
7760 Hurup
Denmark

Client ref.
Jan W. Andersen

Laboratory
DELTA
Agro Food Park 13
8200 Aarhus N
Denmark

Test conditions

Application rules for specific products:	EN ISO 10140-1:2010
Measurement of airborne sound insulation:	EN ISO 10140-2:2010
Measurement procedures and requirements:	EN ISO 10140-4:2010
Requirements for test facilities and equipment:	EN ISO 10140-5:2010
Evaluation:	EN ISO 717-1:2013

Results

Airborne sound insulation measured in the laboratory, weighted sound reduction index according to EN ISO 717-1:2013:

$$R_w\ (C;\ C_{tr}) = 35\ (-1;\ -5)\ dB$$

Graph Sheet no. 1 shows the sound reduction index of every one-third octave band in the frequency range 50-5000 Hz together with the shifted reference curve corresponding to the measured weighted sound reduction index. The one-third octave band values are shown both in tabular form and graphically. Additionally, the octave band values are calculated from the one-third octave band in the frequency range 63-4000 Hz and are shown in tabular form.

Remarks

Description of the test specimen:	See Annex A + B1-B3
Mounting in the laboratory:	See Annex A + B4
Measuring conditions and procedure:	See Annex C
Measurements at low frequencies:	See Annex D
Measuring equipment:	See Annex E

The test result applies to the tested specimen only.

DELTA – a part of FORCE Technology, 9 March 2017

Lars S. Søndergaard

Lars Sommer Søndergaard
Specialist, Acoustics

Laboratory measurement of sound reduction index according to EN ISO 10140:2010 part 1, 2, 4 and 5

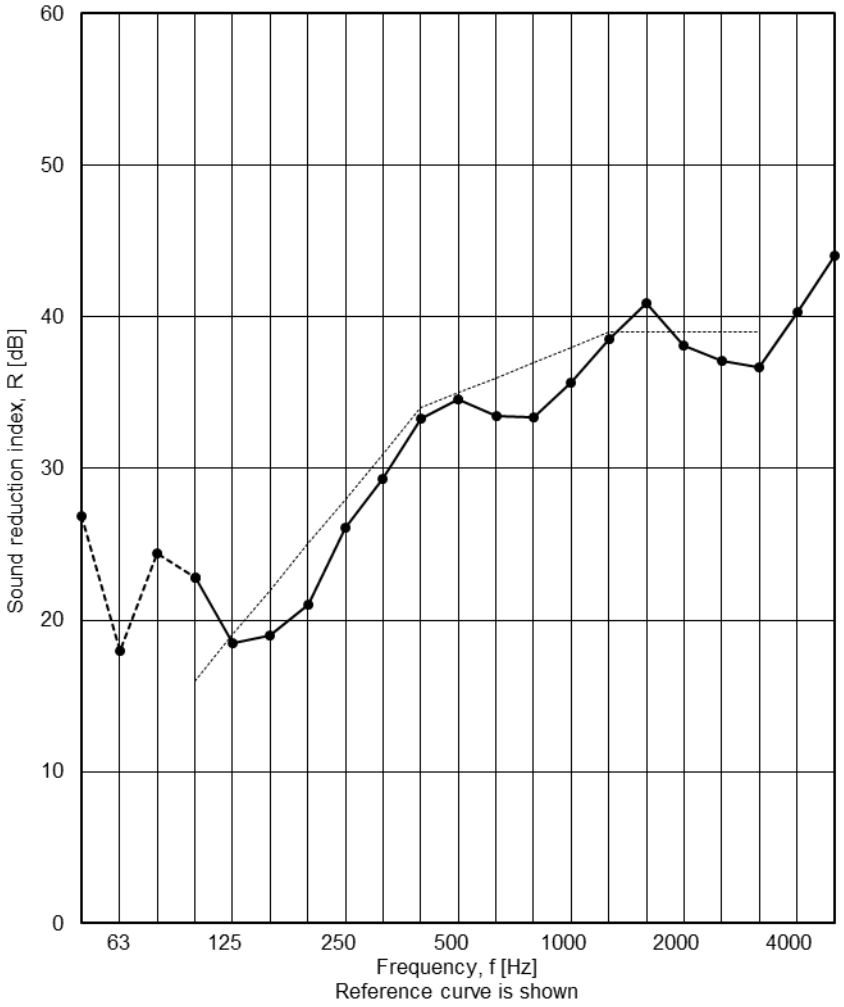
Client: Idealcombi A/S, Nørre Allé 51, P.O. Box 119, DK-7760 Hurup
Date of test: 10 February 2016
Test specimen received: 8 February 2016

Description of the test specimen: FrameIC top-guided window with a 6-18-4 mm argon-filled insulating glass unit. Description of the test specimen and mounting in the laboratory appears in Annex A-B.
Test specimen mounted by: The client

Area of test opening: 1.88 m^2
Mass per unit area: 32.1 kg/m^2
Air temperature: 18.8 °C
Air humidity: 41.0 % RH
Source room volume: 117.7 m^3
Receiving room volume: 64.8 m^3

Frequency f [Hz]	R 1/3 octave [dB]	R Octave [dB]
50*)	26.9	
63*)	18.0	21.4
80*)	24.4	
100	22.8	
125	18.5	19.7
160	19.0	
200	21.0	
250	26.1	24.1
315	29.3	
400	33.3	
500	34.6	33.8
630	33.5	
800	33.4	
1000	35.7	35.4
1250	38.5	
1600	40.9	
2000	38.1	38.4
2500	37.1	
3150	36.7	
4000	40.3	39.4
5000	44.0	

*) See Annex D



Weighted sound reduction index according to EN ISO 717-1:2013
R_w (C; C_{tr}) = 35 (-1; -5) dB
Evaluation based on laboratory measurement results obtained by an engineering method series: EN ISO 10140:2010

DELTA – a part of FORCE Technology, 9 March 2017

Lars Sommer Søndergaard, Acoustics

Description of the test specimen

The following description is provided by the client:

The window was made of a 50 x 122 mm frame, consisting of an inner part of softwood (pine) (50 mm x 59 mm) a thermal break in polyurethane foam (40 x 73 mm) and an exterior aluminium part. The sash profile (75 x 60 mm) was softwood (pine) inside with an exterior aluminium cladding. The total frame dimensions were 1230 mm x 1480 mm.

The softwood sash (1148 mm x 1398 mm) was fitted with a 28 mm (6-18-4) argon filled insulating glass unit (1074 mm x 1324 mm). The glazing was retained by the aluminium cladding. The sash was equipped with top-guided hardware (ref. ASSA TG40) and an espagnolette (ref. ASSA S1817) with two locking points at the bottom.

Gaskets and glazing tapes were made of solid or cellular EPDM rubber.

Elevation, sections, a list of materials and glass information are shown in annexes B1-B3 which were provided by Idealcombi A/S. The drawings have been reduced in size by DELTA and are not necessarily in true scale.

Mounting in the laboratory

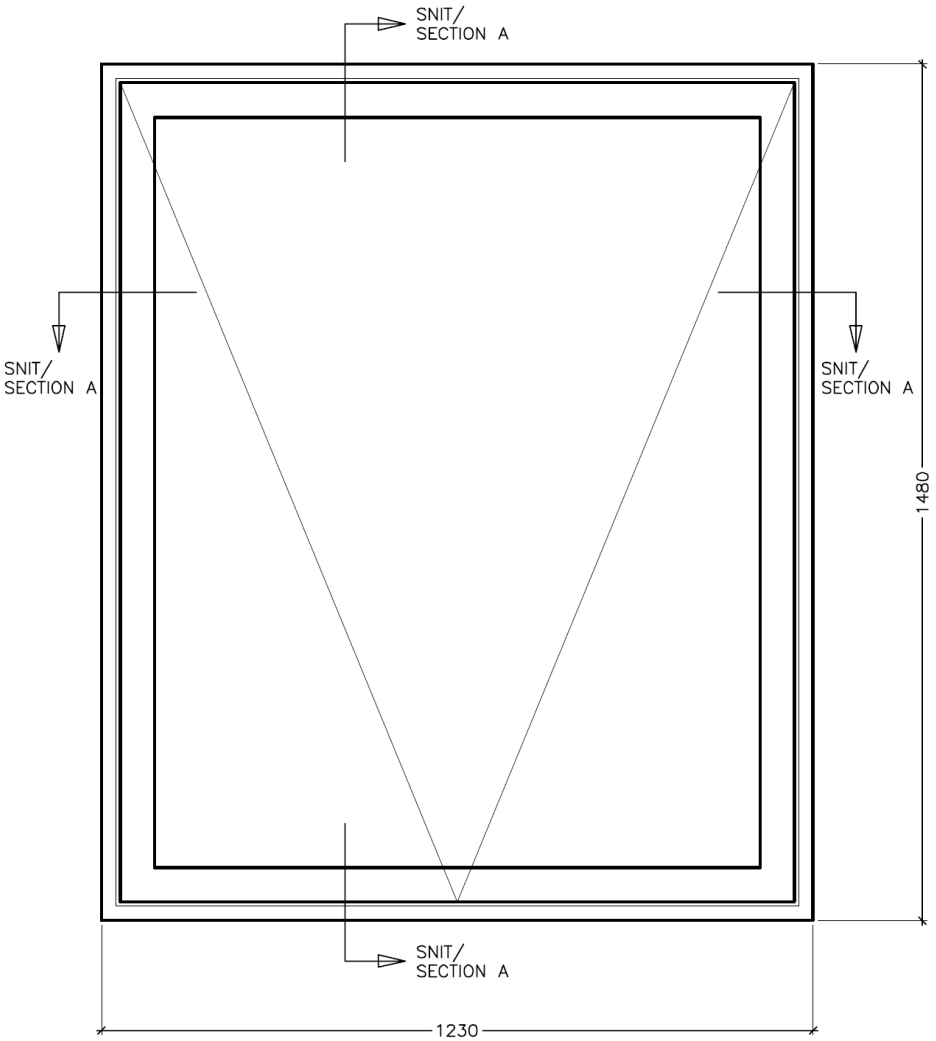
The window was fixed in the aperture with two screws in each jamb and two screws in head. Then a pre-compressed sealing tape was bonded to the frame forming the external seal. The joint was filled with mineral wool (glass wool) a backer rod and then sealed with acrylic sealant from the receiving room side.

The niche depth from the surface of the sash towards the source was approximately 80 mm.

A sketch of the mounting detail is shown in Annex B4, and was prepared by Idealcombi A/S.

The mounting was carried out by Idealcombi A/S.

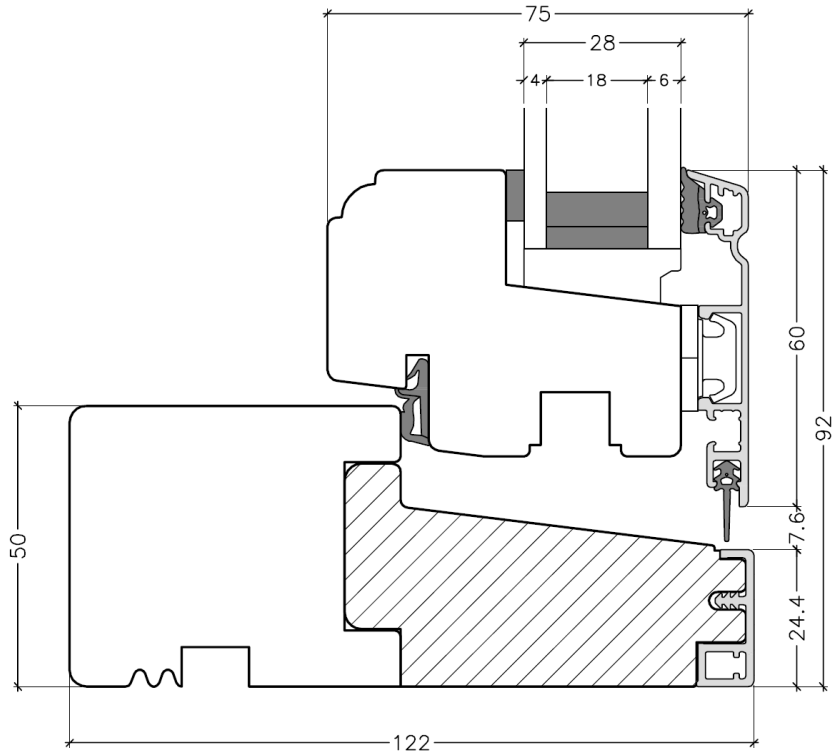
Notice: The drawing is reduced in size by DELTA and it is not necessarily in true scale



BUND, SIDE–& TOPKARM / SILL, JAMB –& HEAD

SAG TITLE **122 MM LYDVINDUE** **122 MM ACOUSTIC WINDOW** EMNE DETAIL OPSTALT ELEVATION						idealcombi TEGN. NR DRG. NO **OPSTALT**
TYPE TYPE FRAic	DATO DATE 20.05.16	MÅL DIM. 1:10	REV REV 00	INIT INIT RAN	GODK. APPR. JWA / PMN	CAD. NR CAD. NO FRAic–LYD0032

Notice: The drawing is reduced in size by DELTA and it is not necessarily in true scale



BUND, SIDE–& TOPKARM / SILL, JAMB –& HEAD

SAG TITLE **122 MM LYDVINDUE** **122 MM ACOUSTIC WINDOW** EMNE DETAIL RUDE: 6–18AR–4 GLAZING: 6–18AR–4						idealcombi TEGN. NR DRG. NO **SNIT A**
TYPE TYPE FRAic	DATO DATE 20.05.16	MÅL DIM. 1:1	REV REV 00	INIT INIT RAN	GODK. APPR. JWA / PMN	CAD. NR CAD. NO FRAic–LYD0032

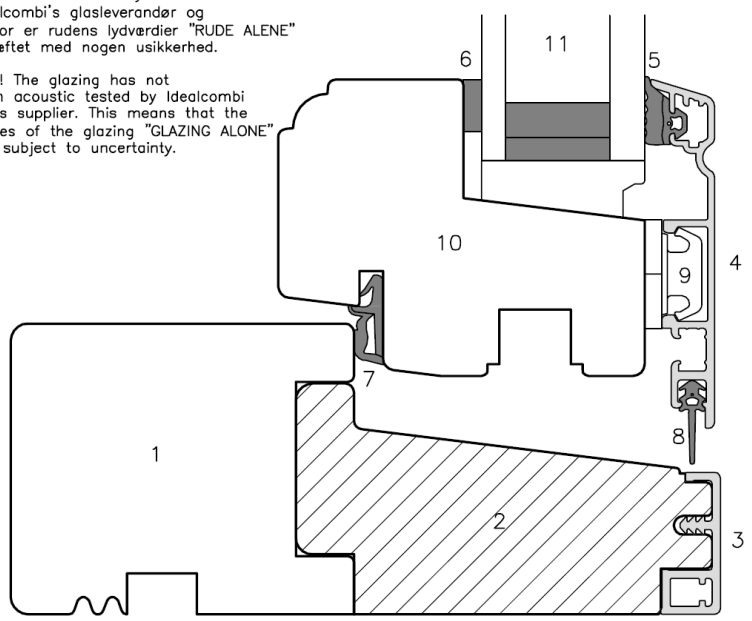
Notice: The drawing is reduced in size by DELTA and it is not necessarily in true scale

1. (KARM) TRÆ–DEL FYR (50 X 59MM) MIDDELDENSITET = 500kg/m³ (VED 12% FUGTINDHOLD)
1. (FRAME) PINEWOOD (50 X 59MM) MEDIUM DENSITY = 500kg/m³ (12% MOISTURE CONTENT)
2. (KARM) PUR–SKUM (40 X 73MM) (DENSITET = 500kg/m³)
2. (FRAME) PU–FOAM (40 X 73MM) (DENSITY = 500kg/m³)
3. ALUMINIUMS PROFIL (CBF 2501, SAPA)
3. ALUMINIUM PROFILE (CBF 2501, SAPA)
4. ALUMINIUMS PROFIL (CBF 2011, SAPA)
4. ALUMINIUM PROFILE (CBF 2011, SAPA)
5. TÆTNINGSLISTE EPDM (2522–2012, SEMPERIT)
5. GASKET EPDM (2522–2012, SEMPERIT)
6. KRONEBÅND 3 X 9MM OPSKUMMET EPDM (2639, SINDBY)
6. GLAZING GASKET 3 X 9MM CELLULAR EPDM (2639, SINDBY)
7. INDVENDIG TÆTNINGSLISTE EPDM (2522–2020, SAVA TECH)
7. INTERNAL GASKET EPDM (2522–2020, SAVA TECH)
8. UDVENDIG TÆTNINGSLISTE EPDM (2522–2025, SEMPERIT)
8. EXTERNAL GASKET EPDM (2522–2025, SEMPERIT)
9. PLASTIK CLIPS, POM (HARPUN)
9. PLASTIC CLIPS, POM (HARPUN)
10. (RAMME) TRÆ–DEL FYR (63 X 51MM) MIDDELDENSITET = 500kg/m³ (VED 12% FUGTINDHOLD)
10. (SASH) PINEWOOD (63 X 51MM) MEDIUM DENSITY = 500kg/m³ (12% MOISTURE CONTENT)

11. RUDE	= 6–18AR–4 ; RUDE ALENE Rw [dB]= 34dB
11. GLAZING	= 6–18AR–4 ; GLAZING ALONE Rw [dB]= 34dB

NB ! Ruden er ikke lydtestet af Idealcombi's glasleverandør og derfor er rudens lydværdier "RUDE ALENE" behæftet med nogen usikkerhed.

NB ! The glazing has not been acoustic tested by Idealcombi glass supplier. This means that the values of the glazing "GLAZING ALONE" are subject to uncertainty.

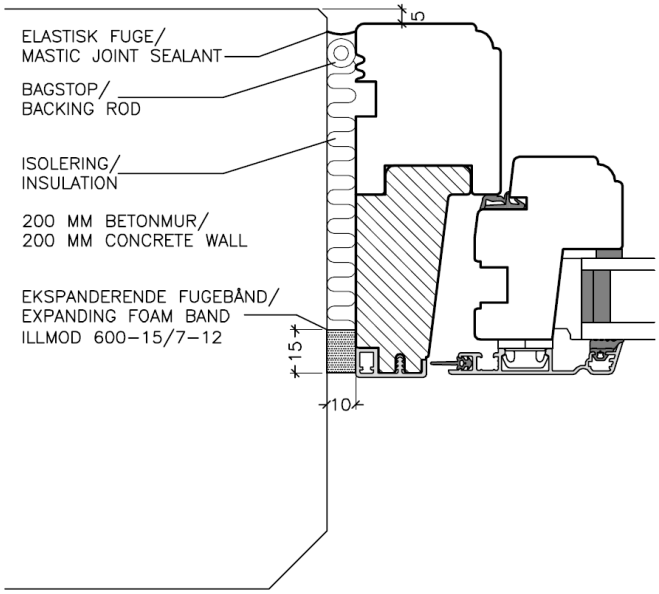


BUND, SIDE–& TOPKARM / SILL, JAMB –& HEAD

SAG TITLE **122 MM LYDVINDUE** **122 MM ACOUSTIC WINDOW** EMNE DETAIL MATERIALELISTE LIST OF MATERIALS						idealcombi TEGN. NR DRG. NO **MATERIALELISTE**
TYPE TYPE FRAic	DATO DATE 20.05.16	MÅL DIM. 1:1	REV REV 01	INIT INIT RAN	GODK. APPR. JWA / PMN	CAD. NR CAD. NO FRAic–LYD0032

Notice: The drawing is reduced in size by DELTA and it is not necessarily in true scale

BUND, SIDE–& TOPKARM / SILL, JAMB –& HEAD



SAG TITLE **122 MM LYDVINDUE** **122 MM ACOUSTIC WINDOW** EMNE DETAIL MONTERINGSDETALJE MOUNTING DETAIL							idealcombi TEGN. NR DRG. NO **MONTAGE**
TYPE TYPE FRAic	DATO DATE 20.05.16	MÅL DIM. 1:2	REV REV 00	INIT INIT RAN	GODK. APPR. JWA / PMN		CAD. NR CAD. NO FRAic–LYD0032

Measuring conditions and test procedure in the frequency range 100-5000 Hz

Source room:	Volume = 117.7 m^3 7 diffusing elements, 1.0 m × 1.2 m Reverberation time ≤ 1.4 s
Receiving room:	Volume = 64.8 m^3 5 diffusing elements, 1.0 m × 1.2 m Reverberation time ≤ 2.0 s
Test opening:	1.250 m × 1.500 m (source room side) 1.370 m × 1.560 m (receiving room side)
Depth of test opening:	0.45 m
Total partition wall area:	16.2 m^2
Loudspeaker system:	Dodecahedron loudspeaker moving along a traverse for measurements of sound pressure levels. Cycle time approx. 128 s. Open loudspeaker in one position for measurement of reverberation time.
Microphone system:	Rotating (32 s/rotation). Integration time: 256 s for measurements of sound pressure levels. The reverberation time is measured in 20 microphone positions distributed on the microphone path.
Sound signal:	Wideband pink noise
Filters:	One-third octave band filters with centre frequencies within the frequency range 100-5000 Hz

The octave band values in Graph Sheet no. 1 are calculated from the one-third octave band values in accordance with EN ISO 10140-2, clause 5.3

The sound reduction indices in Graph Sheet no. 1 have been corrected for sound transmission around the test specimen (flanking transmission). The correction value must not exceed 1.3 dB corresponding to a transmission ratio of 1:3. In Annex E the maximum obtainable sound reduction index, R'_{max}, that can be measured in the laboratory is listed together with the corrections which are included in the results in Graph Sheet no. 1. The calculated correction value was 0 dB for every one-third octave band.

The sound reduction indices in Graph Sheet no. 1 have been corrected for background noise. The correction value must not exceed 1.3 dB. The calculated correction value was 0 dB for every one-third octave band.

Measurement uncertainty

According to EN ISO 140-2:1992 precision of laboratory measurements expressed as the reproducibility of single-number quantities, including R_w, will normally be in the range of 1 dB to 3 dB.

Measurements in the low frequency range 50-80 Hz

Additional measurements in the frequency range 50-80 Hz were carried out. The measurement uncertainty of these measurements is larger than in the normal frequency range for building acoustic measurements 100-5000 Hz.

Generally, the measurements performed in the low-frequency range follow the procedure given for frequencies above 100 Hz (see previous annex).

For measurements in the 63 Hz and the 80 Hz one-third octave bands, the test procedure is identical to the procedure used for frequencies above 100 Hz.

Measurement in the 50 Hz one-third octave band is carried out using the reverse direction of measurement (source- and receiving room interchanged). Two corner positions (opposite the test wall) of a dodecahedron loudspeaker are used. Investigations have shown that in DELTA's test rooms, this procedure leads to measured sound reduction indices at 50 Hz, which are in good agreement with expected values. Details of the test procedure are given below.

The description and evaluation of the test procedure is reported in internal procedure DQP 87002.

Loudspeaker system:	Dodecahedron loudspeaker at two corner positions for measurements of sound pressure levels. Dodecahedron loudspeaker in one position for measurement of reverberation time.
Microphone system:	Rotating (32 s/rotation). Integration time: 2 × 64 s for measurements of sound pressure levels. The reverberation time is measured in twenty microphone positions distributed on the microphone path.
Sound signal:	Wideband pink noise
Filter:	One-third octave band filter with centre frequency 50 Hz

The sound reduction indices have not been corrected for sound transmission around the test specimen (flanking transmission) in the frequency range 50-80 Hz.

Spectrum adaptation terms for an enlarged frequency range

The spectrum adaptation terms given below are determined according to EN ISO 717-1:2013, Annex B.

$C_{50\text{-}3150}$	-2 dB	$C_{tr,50\text{-}3150}$	-5 dB
$C_{50\text{-}5000}$	-1 dB	$C_{tr,50\text{-}5000}$	-5 dB
$C_{100\text{-}5000}$	-1 dB	$C_{tr,100\text{-}5000}$	-5 dB

Correction for flanking transmission

Frequency [Hz]	R'_{max} [dB]	Correction [dB]
100	40.8	0.0
125	42.7	0.0
160	46.1	0.0
200	48.3	0.0
250	50.8	0.0
315	52.7	0.0
400	54.3	0.0
500	58.8	0.0
630	60.4	0.0
800	62.1	0.0
1000	63.6	0.0
1250	65.3	0.0
1600	67.7	0.0
2000	70.4	0.0
2500	73.5	0.0
3150	75.9	0.0
4000	77.4	0.0
5000	77.7	0.0

Measuring equipment

Instrument	Manufacturer	Type	DELTA no.	Calibration	
				Last	Next
Dual channel frequency analyzer	Norsonic	RTA 840-2	10L010	28-08-2015	08-2017
Power amplifier	Master	DL 1800	-	-	-
Equalizer	dbx	2031	-	-	-
Calibrator	Brüel & Kjær	4231	02L020	30-11-2015	05-2016
Microphone, source room	Brüel & Kjær	4166	06L019	01-12-2015	12-2016
Microphone, receiving room	Brüel & Kjær	4166	06L016	01-12-2015	12-2016
Microphone preamplifier, source room	Brüel & Kjær	2639	09L025	23-10-2014	10-2016
Microphone preamplifier, receiving room	Brüel & Kjær	2639	09L027	19-09-2014	09-2016
Rotating microphone boom, source room	Brüel & Kjær	3923	17L007	-	-
Rotating microphone boom, receiving room	Brüel & Kjær	3923	17L007	-	-
Dodecahedron loudspeaker	Norsonic	229	-	-	-
Open loudspeaker cabinet	DELTA	-	-	-	-
Loudspeaker unit	Celestion	G12H-100	-	-	-
Temperature and humidity data logger	Geo Fennel	FHT 70	17L052	21-03-2014	03-2016