

Messbericht

SGF DGF Serie



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**Grundsätzlich sind einschlägige
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1. Laboratorium

Dieser Messbericht würde in unserem Namen durch ein unabhängiges Laboratorium ausgeführt gemäß:

EN 15186-1-3:2011,

EN ISO 354:2003,

EN ISO 7235.

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20 rue Thalès de Milet
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<https://almacoustic.com>



2. Messergebnisse

2.1 Schalldämm-mass

SCHALLDÄMM-MASS SGF 140mm

gemessen nach EN 15186-1-3:2011

Bewertung gemäß EN ISO 717-1:2013

$R_w = 9 \text{ dB}$

$R_w(C_{tr}, 50-3150) = 8 \text{ dB}$

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Schalldämmung dB	3,98	4,22	5,32	5,57	9,12	12,27	11,64	12,98

SCHALLDÄMM-MASS DGF 280mm

gemessen nach EN 15186-1-3:2011

Bewertung gemäß EN ISO 717-1:2013

$R_w = 14 \text{ dB}$

$R_w(C_{tr}, 50-3150) = 10 \text{ dB}$

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Schalldämmung dB	5,99	5,96	5,77	8,01	15,31	23,35	20,54	22,05

SCHALLDÄMM-MASS SGF 300mm

gemessen nach EN 15186-1-3:2011

Bewertung gemäß EN ISO 717-1:2013

$R_w = 16 \text{ dB}$

$R_w(C_{tr}, 50-3150) = 13 \text{ dB}$

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Schalldämmung dB	7,88	7,52	7,06	12,62	18,13	18,11	15,57	15,92

SCHALLDÄMM-MASS DGF 600mm

gemessen nach EN 15186-1-3:2011

Bewertung gemäß EN ISO 717-1:2013

$R_w = 22 \text{ dB}$

$R_w(C_{tr}, 50-3150) = 15 \text{ dB}$

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Schalldämmung dB	7,65	4,52	9,79	21,02	31,39	31,85	26,64	26,87

2.2 Absorptionsgrad

ABSORPTIONSGRAD SGF 140mm

gemessen nach EN ISO 354:2003

Bewertung gemäß EN ISO 11654:1997

Schallabsorptionsgrad $\alpha_w = 0,60$

Schallabsorptionsklasse = C

NRC = 0,45

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Absorptionsgrad $\alpha(s)$	0,03	0,08	0,35	0,62	0,74	0,81	0,68	0,48

ABSORPTIONSGRAD DGF 280mm

gemessen nach EN ISO 354:2003

Bewertung gemäß EN ISO 11654:1997

Schallabsorptionsgrad $\alpha_w = 0,85$

Schallabsorptionsklasse = B

NRC = 0,65

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Absorptionsgrad $\alpha(s)$	0,14	0,35	0,59	0,79	0,89	0,84	0,73	0,56

ABSORPTIONSGRAD SGF 300mm

gemessen nach EN ISO 354:2003

Bewertung gemäß EN ISO 11654:1997

Schallabsorptionsgrad $\alpha_w = 0,70$

Schallabsorptionsklasse = C

NRC = 0,75

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Absorptionsgrad $\alpha(s)$	0,33	0,73	0,69	0,82	0,74	0,63	0,56	0,51

ABSORPTIONSGRAD DGF 600mm

gemessen nach EN ISO 354:2003

Bewertung gemäß EN ISO 11654:1997

Schallabsorptionsgrad $\alpha_w = 0,65$

Schallabsorptionsklasse = C

NRC = 0,70

Frequenz (Hz)	63	125	250	500	1000	2000	4000	8000
Absorptionsgrad $\alpha(s)$	0,80	0,62	0,74	0,78	0,76	0,60	0,49	0,38



2.3 Druckverlust

Type	v (m/s)	Dp (Pa)	Mittlerer Druckabfallkoeffizient
SGF140	0,50	0,50	4,35
	1,00	2,09	
	1,50	4,85	
	2,00	8,85	
	3,00	21,35	
DGF280	0,50	0,75	5,84
	1,00	3,25	
	1,50	7,25	
	2,00	12,80	
	3,00	30,90	
SGF300	0,50	0,68	7,62
	1,00	4,70	
	1,50	10,70	
	2,00	19,00	
	3,00	44,80	
DGF600	0,50	1,35	10,68
	1,00	6,60	
	1,50	14,50	
	2,00	24,50	
	3,00	56,80	

3. Messberichten

ALMACOUSTIC

STUDY REPORT

TRANSMISSION LOSS MEASUREMENT OF FOUR ACOUSTIC VENTILATION LOUVERS

Solflex GmbH – Campus 21 – Europaring F14 202-1, 2345 Brunn am Gebirge, AUSTRIA

Quotation: DEV2025-053 V2

Almacoustic study #: A250044

Customer order: signed quotation

Identifier: A250044-01/B

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IN COLLABORATION WITH Laurent BOUDE, Baudoin GAULIN

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1 INTRODUCTION

1.1 YOUR REQUEST

This report presents the results of the TL measurements of 4 different louvered acoustic grids conducted at Almacoustic for Solflex GmbH, following ISO 15186 and ISO 717 for the expression of the sound reduction index. Solflex references: GF3, GF6, GF14 & GF28

1.2 DATE AND LOCATION OF TESTS

Test conducted by: Côme OLIVIER, Baudouin GAULIN and Laurent BOUDE,
at Almacoustic, 20 rue Thalès de Milet, 72000 Le Mans, France
from Sept. 8 to Sept. 12, 2025.

2 REFERENCE DOCUMENTS

- NF EN 15186-1, Mars 2004, Mesurage par intensité de l'isolation acoustique des immeubles et des éléments de construction – Partie 1: Mesurages en laboratoire (*En: Acoustics – Measurement of sound insulation in buildings and of building elements using sounds intensity – Part 1: Laboratory measurements*)
- NF EN 15186-3, Août 2011, Mesurage par intensité de l'isolation acoustique des immeubles et des éléments de construction – Partie 3: Mesurages en laboratoire à de basses fréquences (*En: Acoustics – Measurement of sound insulation in buildings and of building elements using sound intensity – Part 3: Laboratory measurements at low frequencies*)
- NF EN ISO 717-1, Mai 2013, Acoustique – Evaluation de l'isolement acoustique des immeubles et des éléments de construction – Partie 1 : Isolement aux bruits aériens (*En : Acoustics – Rating of sound insulation in buildings and of building elements – Part 1 : Airborne sound insulation*)

3 TERMS AND DEFINITIONS

For the purposes of this document, the following terms and definitions apply.

3.1 AVERAGE SOUND PRESSURE LEVEL IN A SOURCE ROOM L_{p1}

ten times the logarithm to the base 10 of the ratio of the space and time average of the sound pressure squared to the square of the reference sound pressure, the space average being taken over the entire room with the exception of those parts where the direct radiation of a sound source or the near field of the boundaries (wall, window, etc.) is of significant influence. Expressed in dB.

3.2 SOUND INTENSITY I

time-averaged rate of flow of sound energy per unit area oriented normal to the local particle velocity; this is a vectorial quantity which is equal to

$$\vec{I} = \frac{1}{T} \int_0^T p(t) \cdot \vec{u}(t) \cdot dt$$

Where:

- $p(t)$ is the instantaneous sound pressure at a point, in pascals.
- $\vec{u}(t)$ is the instantaneous particle velocity at the same point, in meters per second.
- T is the averaging time, in seconds.

Expressed in W/m^2 .

3.3 NORMAL SOUND INTENSITY I_n

component of the sound intensity in the direction normal to a measurement surface defined by the unit normal vector directed out of the volume enclosed by the measurement surface $\vec{n}$ (expressed in W/m^2):

$$I_n = \vec{I} \cdot \vec{n}$$

3.4 NORMAL SOUND INTENSITY LEVEL L_{In}

ten times the logarithm to the base 10 of the ratio of the unsigned value of the normal sound intensity to the reference intensity $I_0 = 10^{-12} W/m^2$, (expressed in dB):

$$L_{In} = 10 \log \frac{I_n}{I_0}$$

3.5 SURFACE PRESSURE-INTENSITY INDICATOR F_{pI}

difference between the sound pressure level, L_p , and the normal sound intensity level, L_{In} , on the measurement surface, both being time and surface averaged (expressed in dB):

$$F_{pI} = L_p - L_{In}$$

3.6 PRESSURE-RESIDUAL INTENSITY INDEX δ_{pI0}

difference between the indicated sound pressure level, L_p , and the indicated sound intensity level, L_I , when the intensity probe is placed and oriented in a sound field such that the sound intensity is zero (expressed in dB):

$$\delta_{pI0} = L_p - L_I$$

4 METHODOLOGY

The international standard NF EN ISO 15186-1 specifies an intensity method to measure the transmission loss of a specimen.

The intensity sound reduction index is defined as follows:

$$R_I = L_{p1} - 6 - \left[L_{In} + 10 \log \left(\frac{S_m}{S} \right) \right]$$

Expressed in dB, with:

L_{p1} is the average sound pressure level in the emission room.

L_{In} is the average sound intensity level over the measurement surface in the receiving room.

S_m is the total area of measurement surface(s).

S is the specimen area that is subject to the test.

For each measurement, a quality index F_{pi} is calculated to estimate the measurements validity.

The NF EN ISO 15186-1 method is equivalent to measuring the incident acoustic power (emission room) according to NF EN ISO 10140-2 (formerly NF EN ISO 140-3), the transmitted acoustic power (reception room) according to ISO 9614, and computing the transmission loss according to NF EN ISO 10140-2 (formerly NF EN ISO 140-3).

According to NF EN ISO 15186-1: The reproducibility of this method is judged to be greater than or equal to that of ISO 140-3.

The international standard NF EN ISO 15186-3 specifies an extension method to measure the transmission loss at lower frequencies (3rd-octave bands below 200Hz down to 50Hz) as follows:

$$R_{I(LF)} = L_{pS} - 9 - \left[L_m + 10 \log \left(\frac{S_m}{S} \right) \right]$$

with:

L_{pS} is the average sound pressure level at the surface of the sample in the emission room. Expressed in dB.

The NF EN ISO 717-1 defines the single value index for transmission loss $R_{I,w}$ as the value (in dB) at 500Hz of a reference curve defined between 100Hz and 3150 Hz, offset by 1dB values so that to maximize the unfavorable deviation from the measurements.

The same standard also defines terms of adaptation to specific spectra, to be added to $R_{I,w}$:

- C is the adaptation index to A-weighted pink noise,
- C_{tr} is the adaptation index to A-weighted urban traffic noise.

These terms are to be computed for the standard frequency range (100Hz to 3150Hz) but may also be expressed for extended ranges.

4.1 TEST FACILITIES

The emission room is a 335m³ reverberant room with non-parallel walls and diffusers. This room is open via a 9m x 1m opening onto a semi-anechoic room with a volume of 1000m³. This is the reception room. A floor plan is provided in Appendix A.

4.2 MEASURING INSTRUMENTATION

4.2.1 Emission room

In the emission room, the instrumentation consists of six B&K and GRAS ½" microphones distributed throughout the room. These microphones measure the acoustic pressure field inside the reverberation room. The sensors are connected to a National Instruments acquisition card, with signal processing performed by INTAC software (Almacoustic). Each microphone was calibrated prior to acquisition using a B&K calibrator (Almacoustic code 1E1540, date of last calibration 25/10/2024).

The noise sources are placed in two corners of the room and directed towards the walls.

The references for the various elements of measurement instrumentation are given in

Table 1.

Table 1 – Characteristics of microphones in the emission room and of the intensity probe.

		capsule	Pre-amp	conditioner
Micro 1	designation	Brüel & Kjær 4943	Brüel & Kjær 2669	Brüel & Kjær 2690

	Serial number	2749959	2803630	3011296
	Almacoustic code	1A985	1O981	1O1442
	class	1	/	/
Micro 2	designation	Bruel & Kjaer 4943	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	2749962	2803631	3011296
	Almacoustic code	1A988	1O982	1O1442
	class	1	/	/
Micro 3	designation	Bruel & Kjaer 4190	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	2992946	2803632	3011296
	Almacoustic code	1A1211	1O983	1O1442
	class	1	/	/
Micro 4	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	485612	2804142	3011296
	Almacoustic code	1M1538	1O984	1O1442
	class	1	/	/
Micro 5	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	485602	2221277	2437911
	Almacoustic code	1M1536	1A046	1O247
	class	1	/	/
Micro 6	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	3188447	2221278	2437911
	Almacoustic code	1A1354	1A047	1O247
	class	1	/	/

For extended measurements at low frequencies, ISO 18186-3 requires 6 microphone positions close to the surface of the sample. Only three microphones (micro 3, 4 & 5) are used, with two different placements, thus procuring the 6 positions.

4.2.2 Reception room

In the reception room, intensity measurements were taken using an intensity probe, the technical characteristics of which are given in Table 2. The spacing between the probe microphones is 12mm for the standard frequency range and switched to 100mm for the low frequency extension of the range.

Table 2 – Intensity probe characteristics

Intensity probe	micro probe A	designation	GRAS type 40AK
		serial number	602823
		Almacoustic code	1A1561
		class	1
	micro probe B	designation	GRAS type 40AK
		serial number	602829
		Almacoustic code	1A1562
		class	1
	microphone preamplifier probe A	designation	GRAS type 26AA
		serial number	592751
		Almacoustic code	1O1563

	microphone preamplifier probe B	designation	GRAS 40AR
		serial number	GRAS type 26AA
		Almacoustic code	592752
	probe support	designation	1O1564
		serial number	GRAS type 50 AI-B
		Almacoustic code	132470
		class	1O1565

4.2.3 Acquisition system

Acquisitions were conducted using in-house software INTAC connected to a National Instruments 9174 chassis (Almacoustic reference: 1O1436) with two NI-9234 acquisition cards (Almacoustic references: 1O1584 and 1O1353). The broadband random noise emission was controlled by a National Instruments 9260 card (Almacoustic reference: 1O1198) connected to a QSC Rmx 4050a amplifier (Almacoustic reference: 1O1048).

4.2.4 Calibration, validity date

All microphones (emission and reception rooms) were checked before and after measurement using a calibration cavity Bruël & Kjaer type 4231 code Almacoustic 1E1540 (Last calibration 28/10/2024).

Table 3 – Sensitivities measured before and after testing.

Designation	Sensitivities before measurements (07/09/2025) (mV/Pa)	Sensitivities after measurements (12/09/25) (mV/Pa)
Micro 1	980.0	982.2
Micro 2	983.6	983.9
Micro 3	978.5	978.3
Micro 4	964.0	967.3
Micro 5	983.5	985.7
Micro 6	840.8	842.1
Micro probe A	931.0	933.8
Micro probe B	941.9	940.0

A specific feature of intensimetric probes is the residual field deviation δp_{i0} . This indicator is shown in Table 4.

Table 4 – Residual field deviation

Frequency (Hz)	δp_{i0} in cavity	Frequency (Hz)	δp_{i0} in cavity
100	16	1000	35
125	16	1250	35
160	20	1600	35
200	23	2000	35
250	26	2500	35

315	29	3150	35
400	32	4000	35
500	35	5000	35
630	35	6300	35
800	35	8000	35

The modulus and phase of the relative calibration function of the probe microphones are presented in Figure 1.

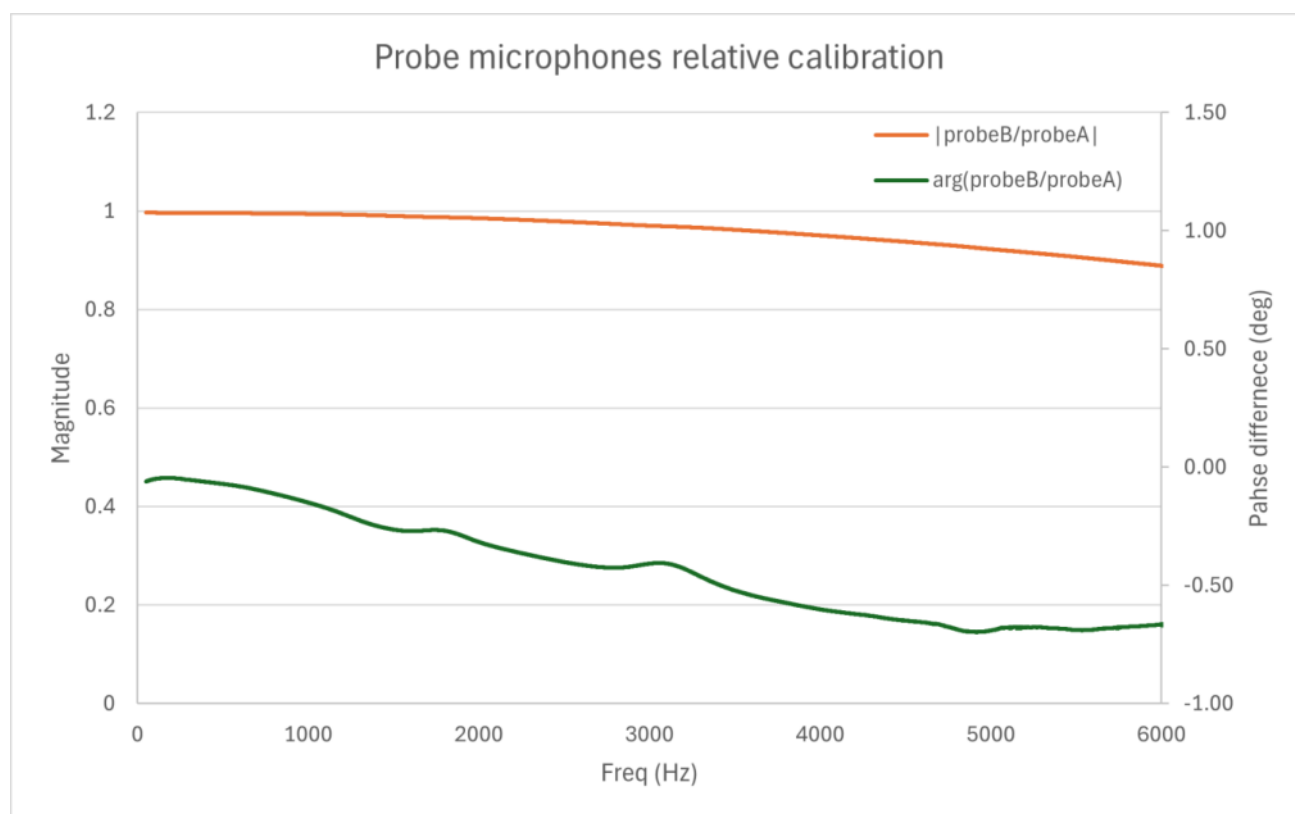


Figure 1 - Relative calibration of the probe microphones.

5 SAMPLES

5.1 RECEPTION - PREPARATION

Almacoustic has taken delivery of samples (6 pallets delivered by truck) on Aug. 25, 2025.

5.2 DESCRIPTION

Solflex References: GF3, GF6, GF14 & GF28 louvered acoustic ventilation grids

Serial numbers GF3Z090100 and GF14Z090100

Sample dimensions: 900 mm x 1000 mm x various thickness.

5.3 CONFORMITY OF DESCRIPTION

The designations and descriptions are declared by the customer and the conformity of the samples to their designation and description is the sole responsibility of the customer.

5.4 INSTALLATION AND ASSEMBLY

The sample is positioned between Almacoustic's reverberant and semi-anechoic rooms, introduced in a window from the semi-anechoic room so that the acoustically treated side of the sample faces the emission room, as depicted in Figure 2.



Figure 2 - Installation of the sample as seen from either side.

Tightness between the sample and the surrounding wall is achieved by filling the gap between the sample and the window using repositionable mastic or plastiline (reference: Mastic TEROSON RB VII 10 mm). If applicable, an

insulating complex consisting of felt and a thick bitumen plate (thickness 2.7mm , mass per unit area 5 kg/m^2) is wrapped around the exposed lateral surfaces of the sample.

6 RESULTS

6.1 SPECIFICITY OF SCANS

Two scans are performed vertically and horizontally (Figure 3). In the following, the intensity sound reduction index presented corresponds to the average value of the intensity sound reduction indexes measured for the two scans.

The measurement surface S_m and the surface of the object to be measured S are identical and equal to $0.9 \times 1.00\text{ m}^2$. This corresponds to the surface area of the grid with its seals.

The probe is held 0.15m from the sample.

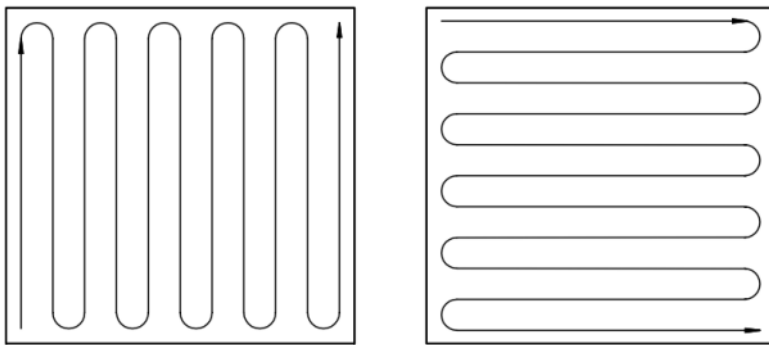


Figure 3 - Definition of scanning paths following ISO 15186-1.

6.2 SPECIFICITY OF LOW FREQUENCY MEASUREMENTS

For the purpose of low frequency measurements, the microphones in the emission room are to be placed close to the sample (at a distance $< 5\text{cm}$). Two positions of the three microphones used in this case to emulate the six microphone positions required by the standard are shown in Figure 4.

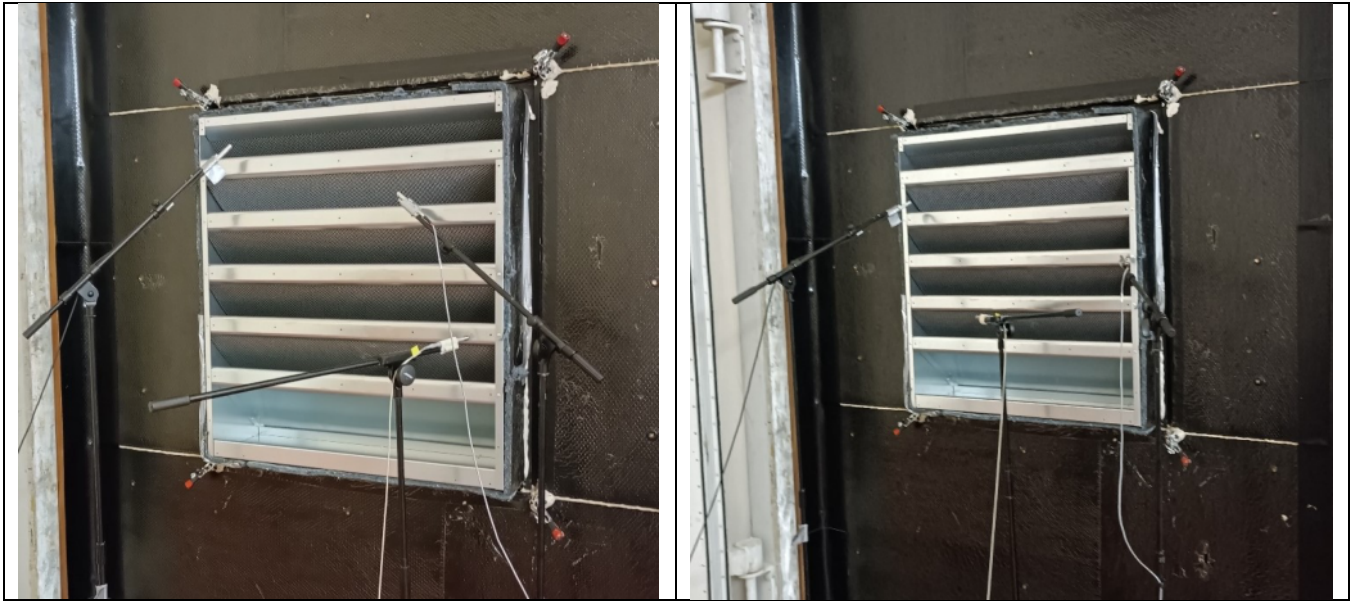


Figure 4 - Close field positions of the microphones for low frequencies measurements.

6.3 MEASUREMENT QUALITY: SURFACE PRESSURE-INTENSITY INDICATOR F_{pi}

According to paragraph 6.4.2 of the standard 15186-1, a measurement should satisfy a surface pressure-intensity indicator F_{pi} lower than 10 dB as the samples have no sound absorbing surface in the receiving room.

Figure 5 illustrates this indicator as a function of frequency for the series of measurements for sample GF14, comprising the low-frequency extension (notated LF) as well as the standard frequency band (notated HF), for both horizontal and vertical scanning paths. The requirement is satisfied for all measurements.

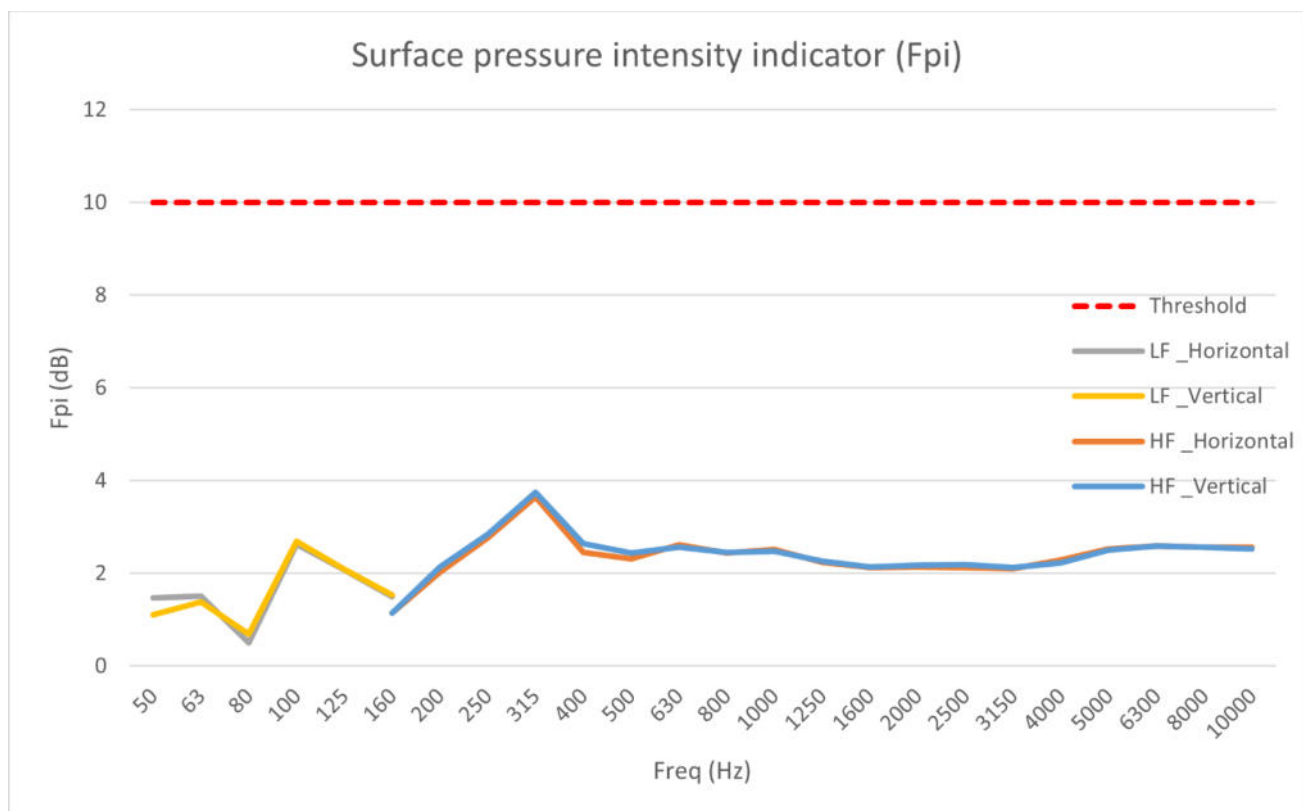


Figure 5 - Surface pressure intensity indicator for sample GF14.

6.4 INTENSITY SOUND REDUCTION INDEX R_I

Figure 6 presents the intensity sound reduction index R_I for the four samples for 3rd-octave frequency band. The same results for octave bands are presented in Figure 7.

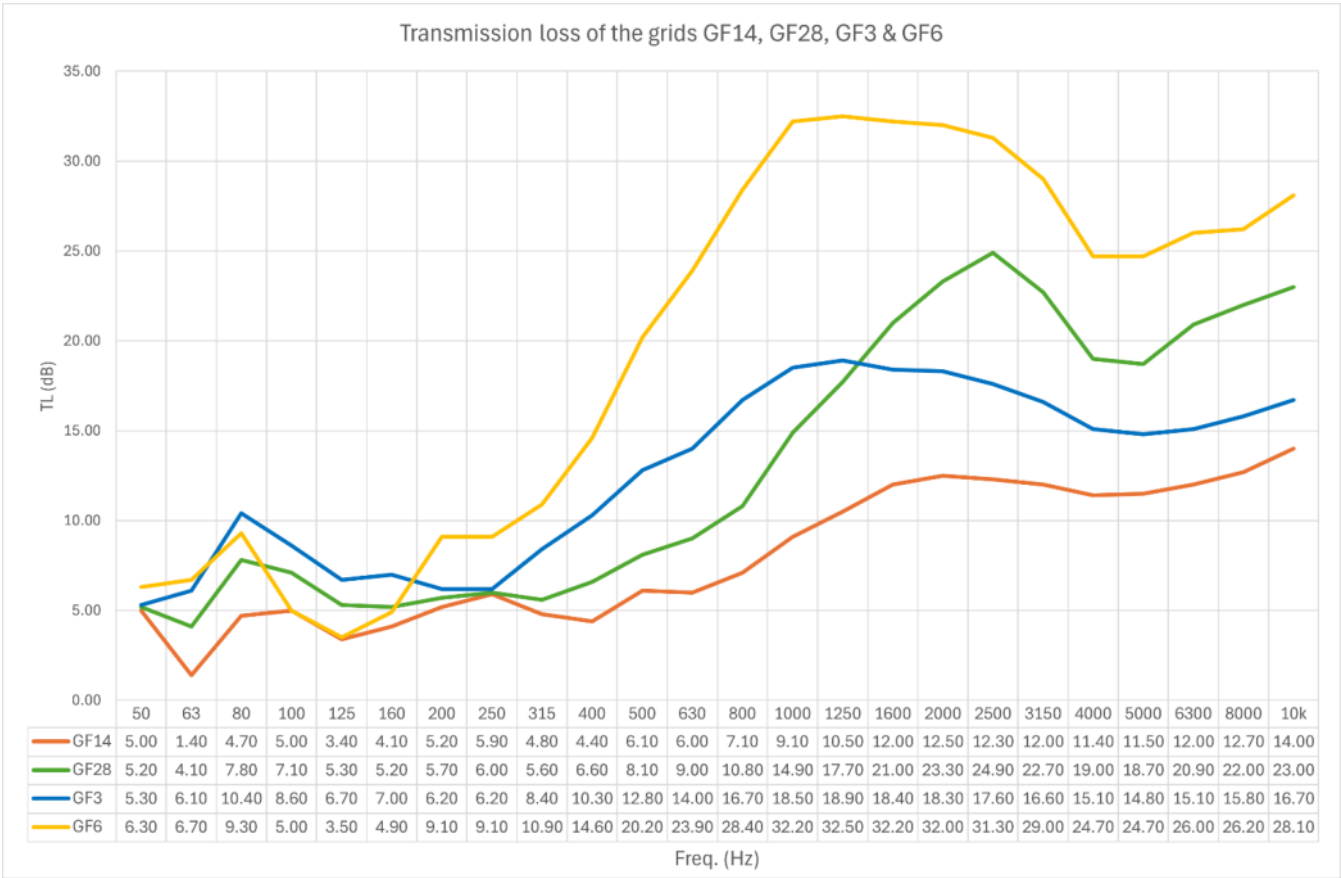


Figure 6 - Transmission loss of the samples in 3rd-octave bands.

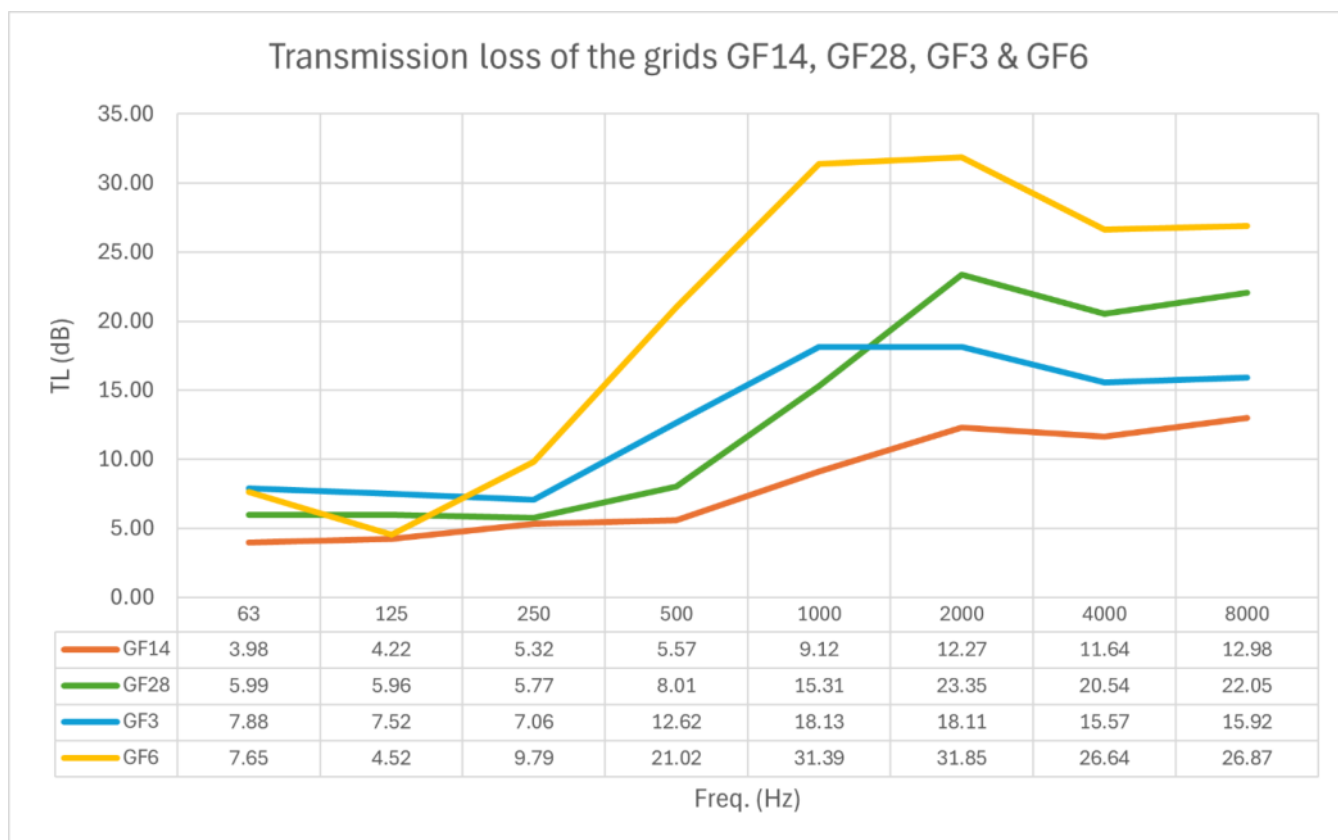


Figure 7 - Transmission loss of the samples in octave bands.

As the tests are conducted following ISO 15186-1, it is not necessary to correct the attenuation index R_l for the influence of lateral transmission.

6.5 UNIQUE WEIGHTED INTENSITY SOUND REDUCTION INDEX R_w

The weighted intensity sound reduction indices R_w are summarized in Table 5, with correction factor given for the standard frequency band ($100\text{Hz} < f < 3150\text{Hz}$), as well as for the extended frequency band ($50\text{Hz} < f < 3150\text{Hz}$).

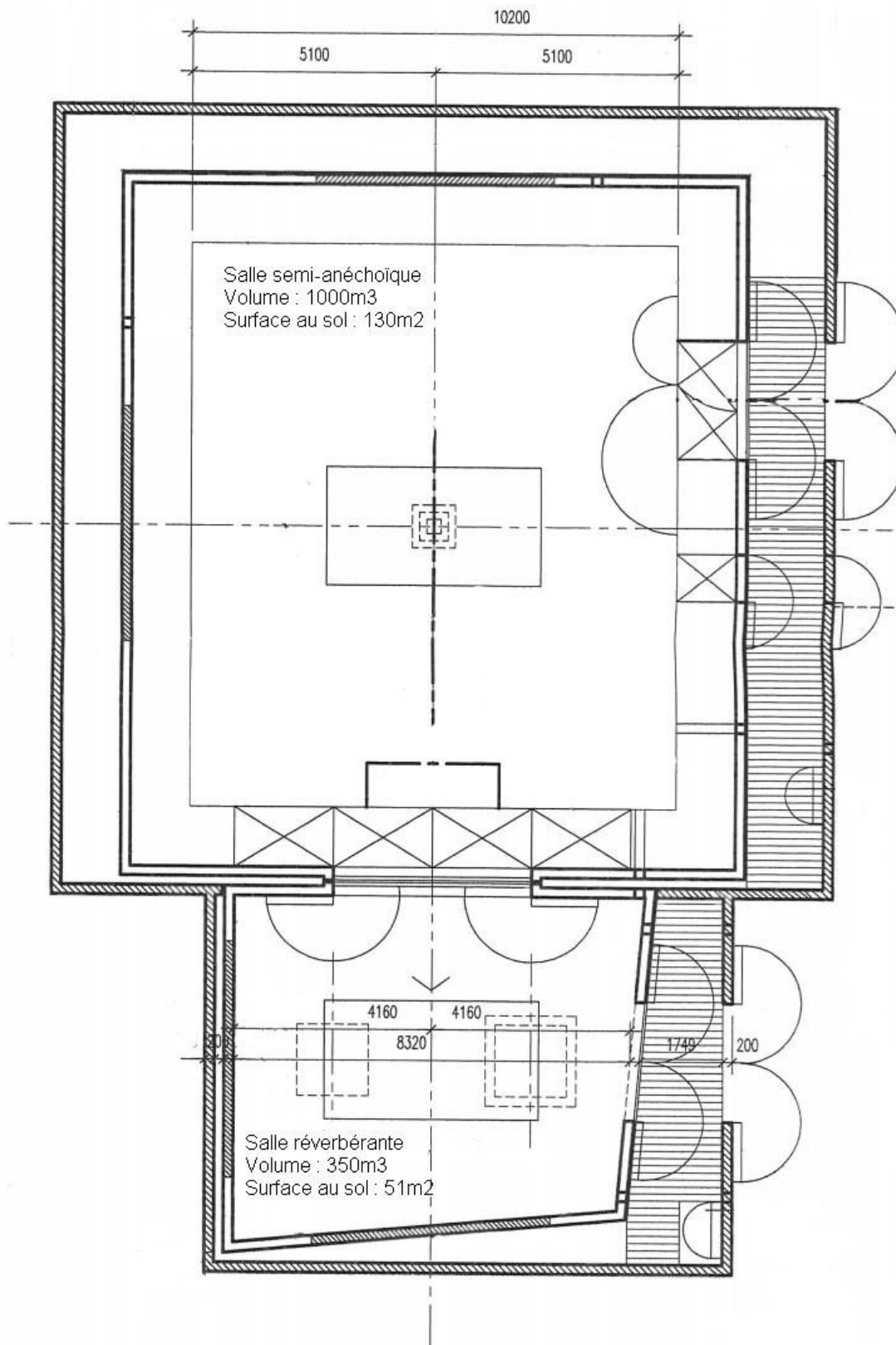
Table 5 - Weighted intensity sound reduction index R_w

Sample	Weighted intensity sound reduction index $R_w(C; C_{tr}; C_{50-3150}, C_{tr,50-3150})$ (dB)
GF3	16 (-1; -3; -1; -3)
GF6	22 (-2; -6; -2; -7)
GF14	9 (0; -1; 0; -1)
GF28	14 (-1; -3; -1; -4)

All numerical data relating to the measurements are to be found in the attached spreadsheet.

7 APPENDICES

7.1 APPENDIX A: TEST FACILITIES



 HBK HOTTINGER BRÜEL & KJÆR Hottinger Bruel & Kjaer France SAS Laboratoire d'étalonnage 2-4 rue Benjamin Franklin 94370 Sucy-en-Brie France Tél. : +33 1 69 90 71 02 Email : service.fr@hbkworld.com	 cofrac ETALONNAGE Laboratoire accrédité n°2-1119 Portée disponible sur www.cofrac.fr Scope available on www.cofrac.fr	
CERTIFICAT D'ÉTALONNAGE / CALIBRATION CERTIFICATE N° CFR2402553		
Délivré à : <i>Issued to</i>	Almacoustic 20 RUE THALES DE MILET 72000 LE MANS	
INSTRUMENT ÉTALONNÉ <i>Calibrated instrument</i>		
Désignation : <i>Designation</i>	Calibreur acoustique <i>Acoustic calibrator</i>	
Constructeur : <i>Manufacturer</i>	Brüel & Kjær	
Type : <i>Type</i>	4231	N° de série : <i>Serial number</i> 3031351
		N° d'identification ⁽¹⁾ : <i>Identification number ⁽¹⁾</i> 1E1540
Ce certificat comprend 3 pages <i>This certificate consists of 3 pages</i>		
Date d'étalonnage : <i>Date of calibration</i>	Date d'émission : <i>Date of issue</i>	
Effectué par : <i>Performed by</i>	Approuvé par : <i>Approved by</i>	
 Mathieu PAIS GOMES	 Hugo WUYTS Signataire approuvé Approved signatory	
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F04_REA_V01.01 du 11/10/2024	Page 1/3	 HBK HOTTINGER BRÜEL & KJÆR

7.3 APPENDIX C: CALIBRATION CHART OF INTENSITY PROBE MICROPHONES

Calibration Chart Type 40AK ½" Intensity Microphones

The stated sensitivities are the Open-circuit sensitivities. When used on the G.R.A.S. Type 26AA Preamplifier the sensitivities are typically 0.2dB lower. The calibrations are traceable to the National Physical Laboratory, UK.

The upper frequency responses are the free field responses when mounted in the intensity probe. The lower curves are the pressure responses recorded by electrostatic actuator.

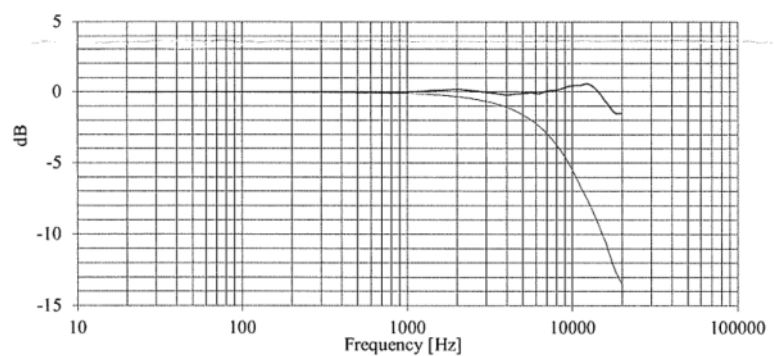
Reference conditions : Temperature 23 Celcius, Relative humidity 50%, Barometric pressure 101.3 kPa

Operator: BST
Date: 31-okt-24

QC Approval: _____

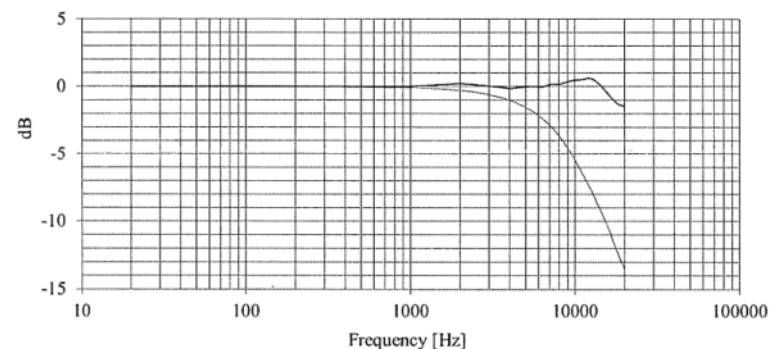
Microphone Serial No. 602823

Sensitivity : 25.54 mV/Pa
-31.86 dB re. 1V/Pa

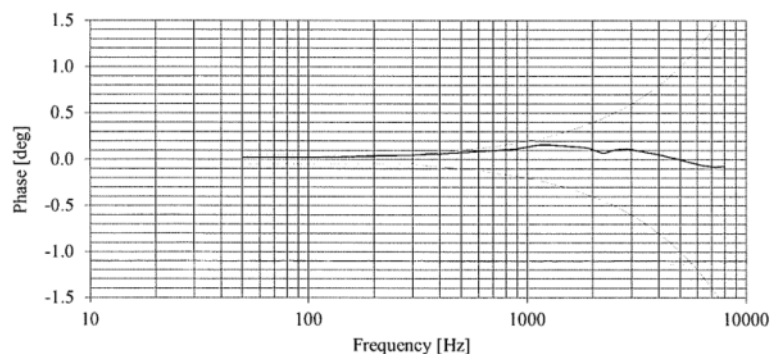


Microphone Serial No. 602829

Sensitivity : 25.19 mV/Pa
-31.97 dB re. 1V/Pa



Phase difference between the microphones, relative to the microphone with the lowest serial number, with the specified limits. The phase difference between the microphones has been measured in a G.R.A.S. Type 51AB Sound Intensity Calibrator.



ALMACOUSTIC

STUDY REPORT

ABSORPTION MEASUREMENT IN REVERBERANT ROOM

Solflex GmbH – Campus 21 – Europaring F14 202-1, 2345 Brunn am Gebirge, AUSTRIA

Quotation: DEV2025-053 V2

Almacoustic study #: A250044

Customer order: signed quotation

Identifier: A250044-02/B

STUDY MANAGED BY Côme OLIVIER - Project manager
Tel: +33 (0)6 01 36 41 79
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IN COLLABORATION WITH Laurent BOUDE, Baudoin GAULIN

	NAME - FUNCTION	SIGNATURE	DATE
AUTHOR	Côme OLIVIER Project manager		18/09/2025
AUDITOR	Baudoin GAULIN Technician		18/09/2025

ÉVOLUTION

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DIFFUSION

NAME	COMPANY	COPY NUMBER	DATE
T. BOGAERTS	Solflex GmbH	1	23/09/2025
ARCHIVING AREA	ALMACOUSTIC	1	23/09/2025

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1 INTRODUCTION

1.1 YOUR REQUEST

This report presents the results of the absorption measurements of 4 different louvered acoustic grids conducted at Almacoustic for Solflex GmbH following ISO 354.

Solflex references: GF3, GF6, GF14 & GF28

1.2 DATE AND LOCATION OF TESTS

Test conducted by: Côme OLIVIER, Baudouin GAULIN and Laurent BOUDE,
at Almacoustic, 20 rue Thalès de Milet, 72000 Le Mans, France
from Sept. 8 to Sept. 12, 2025.

2 REFERENCE DOCUMENTS

- ISO 354:2003: " *Acoustique - Mesurage de l'absorption acoustique en salle réverbérante* " (En: *Acoustics – Measurement of sound absorption in a reverberation room*)
- NF EN ISO 11654 :1997: " *Acoustique – Absorbants pour l'utilisation dans les bâtiments – Evaluation de l'absorption acoustique* " (En: *Acoustics – Sound absorbers for use in buildings – Rating of sound absorption*)
- NF ISO/IEC GUIDE 98-3: " *Guide pour l'expression de l'incertitude de mesure* ". (En: *Uncertainty of measurement - Part 3: guide to the expression of uncertainty in measurement (GUM: 1995)*)

3 TERMS AND DEFINITIONS

For the purposes of this document, the following terms and definitions apply.

3.1 REVERBERATION TIME T_{60}

Duration required for the sound level in the room to decrease by $60dB$ after the source has been shut off.
Expressed in s.

3.2 WEIGHTED SOUND ABSORPTION COEFFICIENT α_s

Ratio of the equivalent sound absorption area of a test specimen A_T to the area of the sample S . $\alpha_s = A_T/S$, where $A_T = A_2 - A_1$ is the difference between the equivalent sound absorption areas of the reverberation chamber with and without the test specimen. Unitless.

3.3 EQUIVALENT SOUND ABSORPTION AREA OF A ROOM A_n

Fictitious area with a totally absorbent surface without diffraction effects which, if it were the only absorbent element in the room, would give the same reverberation time as that room. For the empty reverberant room, this value is designated A_1 ; for the reverberant room containing a sample, it is designated A_2 . Expressed in m^2 .

3.4 WEIGHTED SOUND ABSORPTION INDEX α_w

Single value independent of frequency, equal to the value of the reference curve at 500Hz after its translation in steps of 0.05dB until the sum of the unfavorable deviations with the measured absorption is less than 0.10. The reference curve is given by the following values. Unitless.

Freq (Hz)	250	500	1000	2000	4000
Ref. value	0.80	1.00	1.00	1.00	0.90

3.5 DL_α

single index for evaluating sound absorption performance, expressed as a difference in A-weighted sound pressure levels, in dB, with a traffic-normalized noise spectrum, defined by ISO1793-1 to 1793-3. The single evaluation index DL_α is particularly suitable for characterizing absorption performance in situations where traffic noise radiation is reflected from the absorbing surface and propagates directly to the receiver without further reflection from surfaces or diffraction from noise barriers or obstacles. The bigger the value, the greater the performance. Expressed in dB.

3.6 NOISE REDUCTION COEFFICIENT (NRC)

The NRC value is determined by averaging the absorption on the frequencies of 250 Hz, 500 Hz, 1000 Hz and 2000 Hz. Unitless.

4 METHOD

4.1 METHODOLOGY

ISO 354 defines the method to determine the absorption of an absorbent sample, for each third octave, by measuring the reverberation time of the empty room and of the room comprising the sample to characterize.

Almacoustic makes use of the interrupted noise method, obtaining decay curves by directly recording the decay of the acoustic pressure level after exciting a room with broadband noise. The definition of the reverberation time with a 60 dB decrease in sound pressure level may be verified by linear extrapolation from smaller assessment ranges for some or all the frequency bands.

4.2 TEST FACILITIES

The measurement room is a 335m³ reverberant room with non-parallel walls (see Figure 1). The developed surface of its walls is 296 m². It contains 11 curved diffusers suspended from the ceiling, randomly oriented and distributed throughout the top half of the room.

Two broadband noise sources are placed in two corners of the room and directed towards the walls to excite the diffuse acoustic field.

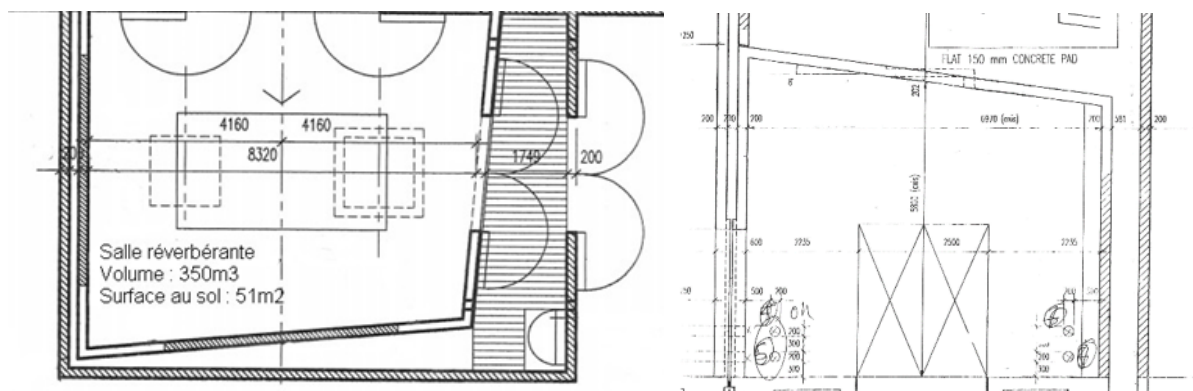


Figure 1 – Top view and vertical cross section blueprints of the reverberant room.

Figure 2 – View of the back left corner of the reverberant room.

4.3 MEASURING INSTRUMENTATION

The instrumentation consists of six B&K and GRAS ½" microphones distributed throughout the room. These microphones measure the acoustic pressure field inside the reverberation room. The sensors are connected to a National Instruments acquisition card, with signal processing performed by INTAC software (Almacoustic). Each microphone was calibrated prior to acquisition using a B&K calibrator (Almacoustic code 1E1540, date of last calibration 25/10/2024).

The references for the various elements of measurement instrumentation are given in

Table 1.

Table 1 – Characteristics of microphones in the emission room

		capsule	Pre-amp	conditioner
micro-1	designation	Brüel & Kjær 4943	Brüel & Kjær 2669	Brüel & Kjær 2690
	Serial number	2749959	2803630	3011296
	Almacoustic code	1A985	1O981	1O1442
	class	1	/	/
micro-2	designation	Brüel & Kjær 4943	Brüel & Kjær 2669	Brüel & Kjær 2690
	Serial number	2749962	2803631	3011296
	Almacoustic code	1A988	1O982	1O1442
	class	1	/	/
micro-3	designation	Brüel & Kjær 4190	Brüel & Kjær 2669	Brüel & Kjær 2690
	Serial number	2992946	2803632	3011296
	Almacoustic code	1A1211	1O983	1O1442
	class	1	/	/
micro-4	designation	GRAS 40AR	Brüel & Kjær 2669	Brüel & Kjær 2690

	Serial number	485612	2804142	3011296
	Almacoustic code	1M1538	1O984	1O1442
	class	1	/	/
micro-5	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	485602	2221277	2437911
	Almacoustic code	1M1536	1A046	1O247
	class	1	/	/
micro-6	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	3188447	2221278	2437911
	Almacoustic code	1A1354	1A047	1O247
	class	1	/	/

Acquisitions were conducted using in-house software INTAC connected to a National Instruments 9174 chassis (Almacoustic reference: 1O1197) with two 9234 acquisition cards (Almacoustic references: 1O1485 and 1O1478). The broadband random noise emission was controlled by a National Instruments 9260 card (Almacoustic reference: 1O1480) connected to an amplifier (QSC Rmx 4050a - Almacoustic reference: 1O1048).

The results are obtained by averaging the results of 12 measurements on the 6 microphones, i.e., 72 decay measurements. The confidence intervals are calculated following the Guide to the Expression of Uncertainty in Measurement. (NF ISO/IEC GUIDE 98-3).

The microphone sensitivities from the calibration measurement using a calibration cavity Bruël & Kjaer type 4231 code Almacoustic 1E1540 (Last calibration 28/10/2024). are given in Table 2 before and after the measurement.

Table 2 – Sensitivities measured before and after testing.

Designation	Sensitivities before measurements (21/07/2025) (mV/Pa)	Sensitivities after measurements (22/07/25) (mV/Pa)
Micro 1	980.0	982.25
Micro 2	983.6	983.9
Micro 3	978.5	978.2
Micro 4	964.0	967.3
Micro 5	983.5	985.7
Micro 6	840.8	842.1

4.4 SAMPLES

4.4.1 Description of the samples

The samples consist of 4 examples of louvered, acoustically treated grids. Two of these configurations consist of two of the same elements stacked in opposite directions to form a chevron configuration.



Table 1 – Description of the samples

Designation	Reference	Thickness	Configuration
GF3	GF3Z110120 (x8)	300 mm	Acoustic face up
GF6	GF3Z110120 (x16)	600 mm	Chevrons
GF14	GF14Z110120 (x8)	140 mm	Acoustic face up
GF28	GF14Z110120 (x16)	280 mm	Chevrons

4.4.2 Sample setup

The setup is of type A (the sample is mounted or placed directly against a surface in the reverberation room, i.e., the floor.). Each sample consists of 8 grids of $1085 \times 1185 \text{ mm}^2$ in a 2×4 rectangle, covering an area of 10.29 m^2 (Figure 4). Samples GF6 and GF28 consist of two layers of the same elements stacked in opposite directions to form a chevron configuration (see Figure 3).

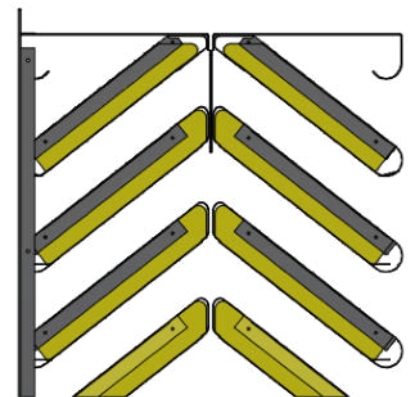


Figure 3 - Side-view of the chevron-type assembly



Figure 4 – Sample G28 set up on the reverberant room floor.

4.5 ATMOSPHERIC CONDITIONS

All tests were performed with the same atmospheric conditions summarized in the table below.

Tableau 2 – Atmospheric conditions

Test #	Temperature (°C)	Humidity (%)	Atmospheric pressure (hPa)
Empty room, GF14, GF28, GF3, GF6	19.5	63.0	995

5 RESULTS

5.1 REVERBERATION TIMES

The mean reverberation times are presented on Figure 5 for the various measured configurations.

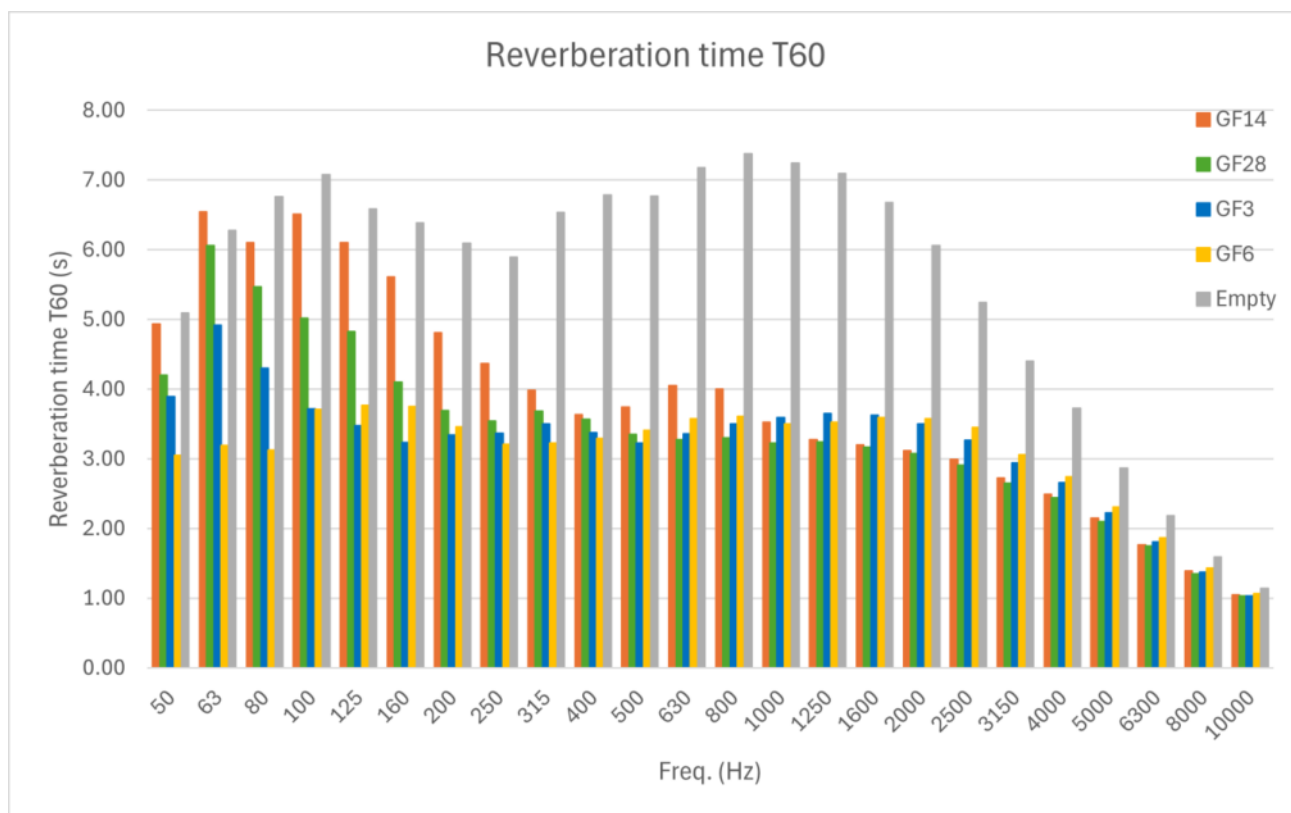


Figure 5 – Measured reverberation times of the various configurations.

5.2 WEIGHTED ABSORPTION COEFFICIENTS α_w .

The weighted absorption coefficients for each grid evaluated following ISO 11654 are summarized in Table 3.

Table 3 - Unique absorption coefficients α_w .

Sample	GF14	GF28	GF3	GF6
α_w	0.60	0.85	0.70	0.65

5.3 ABSORPTION COEFFICIENTS α_s

The absorption coefficients α_s of the samples are shown in Figure 6. for third octave frequency bands, and in Figure 7 for the same results presented in octave bands.

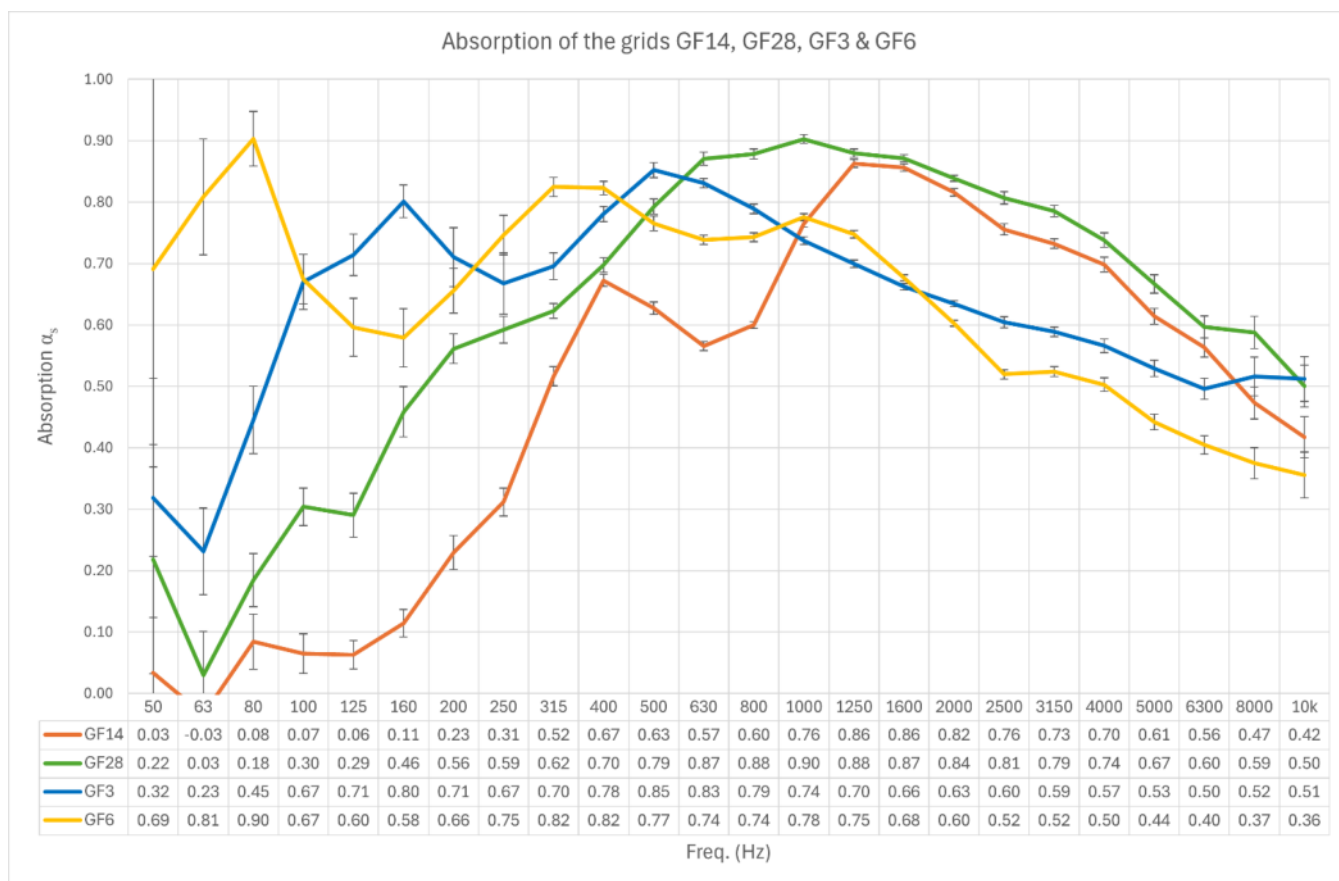


Figure 6 –Absorption coefficients α_s of the 4 samples for 3rd-octave frequency bands.

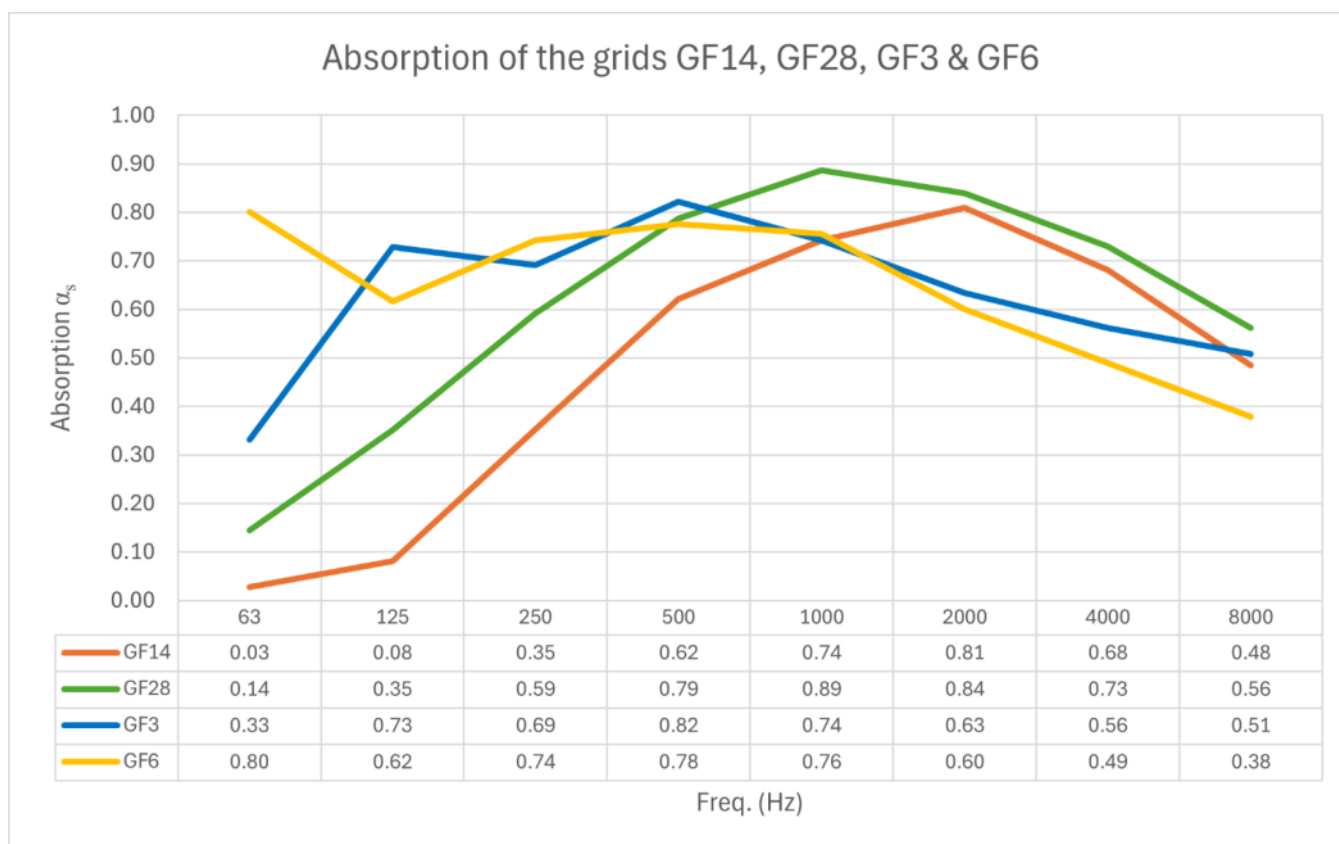


Figure 7 –Absorption coefficients α_s of the 4 samples for octave frequency bands.

Complementary results are to be found in the measurement sheets attached to this report.

RESULTS SHEET



ABSORPTION IN REVERBRANT ROOM

Standards ISO 354 ; ISO 11654 ; ISO 9613-1 ; ISO 1793-1-3

Study #: A250044
Client: Solflex GmbH
Date of the test: 10/09/2025
Place: Almacoustic
Operator(s): L. Boude

SAMPLE

Sample reference: Grids GF14
Material description: Louvered acoustic ventilation grid
Setup description: 4*2 grids on the floor, each 1085mm * 1185mm
Sample dimensions: Length: 4.35 m Width: 2.37 m Thickness: 140 mm Surface: 10.29 m²
Comment/remarks: Installation in accordance with the requirements of ISO 354

SETUP



Unique Coefficients

Alpha W	DL_alpha	NRC*
0.60	5	0.45

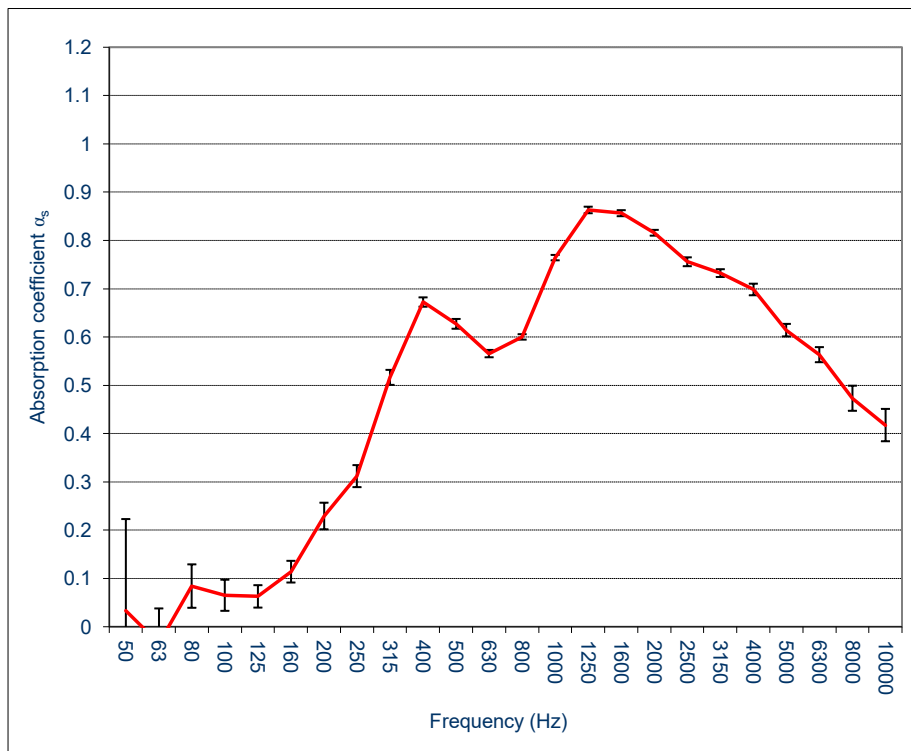
* : for information only, calculated according to ASTM C423-90a

MEASUREMENT CONDITIONS

Atmospheric conditions:

Empty room measurement: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa
Measurement with sample: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa

GRAPH



Freq (Hz)	measured alpha	Empty room T60	T60 with sample
50	0.03	5.10	4.94
63	-0.03	6.28	6.55
80	0.08	6.77	6.10
100	0.07	7.08	6.51
125	0.06	6.58	6.10
160	0.11	6.39	5.61
200	0.23	6.10	4.81
250	0.31	5.90	4.37
315	0.52	6.54	3.98
400	0.67	6.78	3.63
500	0.63	6.77	3.74
630	0.57	7.18	4.05
800	0.60	7.37	4.00
1000	0.76	7.25	3.53
1250	0.86	7.09	3.28
1600	0.86	6.68	3.20
2000	0.82	6.06	3.12
2500	0.76	5.25	2.99
3150	0.73	4.40	2.73
4000	0.70	3.72	2.49
5000	0.61	2.87	2.15
6300	0.56	2.18	1.77
8000	0.47	1.59	1.39
10000	0.42	1.15	1.05

RESULTS SHEET



ABSORPTION IN REVERBRANT ROOM

Standards ISO 354 ; ISO 11654 ; ISO 9613-1 ; ISO 1793-1-3

Study #: A250044
Client: Solflex GmbH
Date of the test: 10/09/2025
Place: Almacoustic
Operator(s): L. Boude

SAMPLE

Sample reference: Grids GF28
Material description: Louvered acoustic ventilation grid
Setup description: Chevron superposition of 2*4*2 grids on the floor, each 1085mm * 1185mm
Sample dimensions: Length: 4.35 m Width: 2.37 m Thickness: 280 mm Surface: 10.29 m²
Comment/remarks: Installation in accordance with the requirements of ISO 354

SETUP



Unique Coefficients

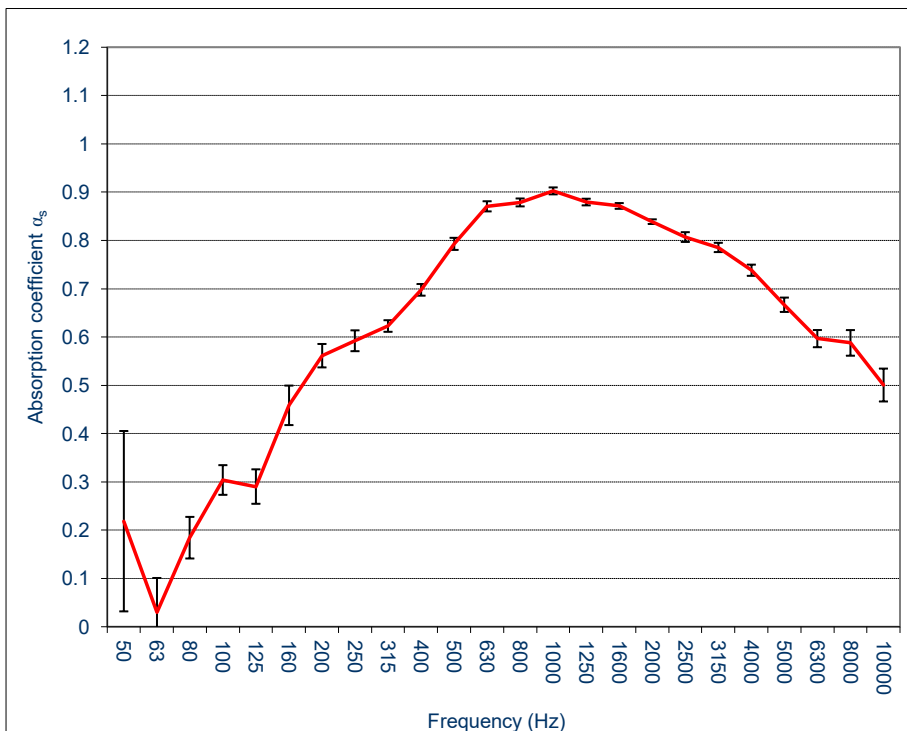
Alpha W	DL_alpha	NRC*
0.85	7	0.65

* : for information only, calculated according to ASTM C423-90a

MEASUREMENT CONDITIONS

Atmospheric conditions:
Empty room measurement: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa
Measurement with sample: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa

GRAPH



Freq (Hz)	measured alpha	Empty room T60	T60 with sample
50	0.22	5.10	4.20
63	0.03	6.28	6.06
80	0.18	6.77	5.47
100	0.30	7.08	5.02
125	0.29	6.58	4.83
160	0.46	6.39	4.10
200	0.56	6.10	3.69
250	0.59	5.90	3.54
315	0.62	6.54	3.68
400	0.70	6.78	3.57
500	0.79	6.77	3.35
630	0.87	7.18	3.28
800	0.88	7.37	3.30
1000	0.90	7.25	3.23
1250	0.88	7.09	3.24
1600	0.87	6.68	3.17
2000	0.84	6.06	3.08
2500	0.81	5.25	2.91
3150	0.79	4.40	2.65
4000	0.74	3.72	2.44
5000	0.67	2.87	2.10
6300	0.60	2.18	1.75
8000	0.59	1.59	1.35
10000	0.50	1.15	1.03

RESULTS SHEET



ABSORPTION IN REVERBRANT ROOM

Standards ISO 354 ; ISO 11654 ; ISO 9613-1 ; ISO 1793-1-3

Study #: A250044
Client: Solflex GmbH
Date of the test: 10/09/2025
Place: Almacoustic
Operator(s): L. Boude

SAMPLE

Sample reference: Grids GF3
Material description: N/C
Setup description: 4*2 grids on the floor, each 1085mm * 1185mm
Sample dimensions: Length: 4.35 m Width: 2.37 m Thickness: 300 mm Surface: 10.29 m²
Comment/remarks: Installation in accordance with the requirements of ISO 354

SETUP



Unique Coefficients

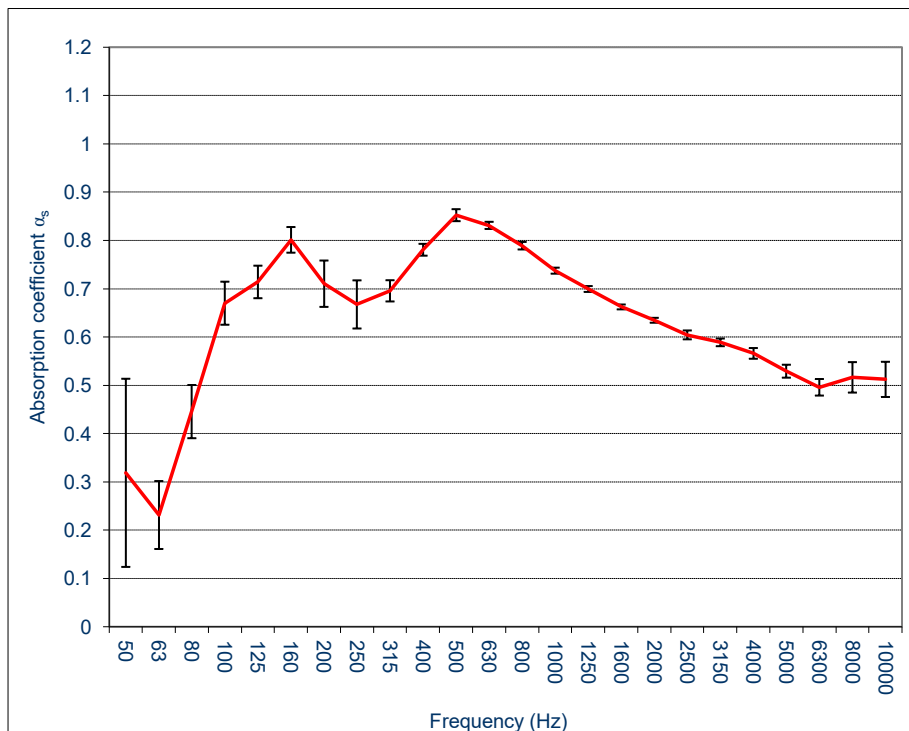
Alpha W	DL_alpha	NRC*
0.70	5	0.75

* : for information only, calculated according to ASTM C423-90a

MEASUREMENT CONDITIONS

Atmospheric conditions:
Empty room measurement: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa
Measurement with sample: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa

GRAPH



Freq (Hz)	measured alpha	Empty room T60	T60 with sample
50	0.32	5.10	3.89
63	0.23	6.28	4.92
80	0.45	6.77	4.30
100	0.67	7.08	3.72
125	0.71	6.58	3.48
160	0.80	6.39	3.24
200	0.71	6.10	3.34
250	0.67	5.90	3.37
315	0.70	6.54	3.51
400	0.78	6.78	3.38
500	0.85	6.77	3.23
630	0.83	7.18	3.36
800	0.79	7.37	3.50
1000	0.74	7.25	3.59
1250	0.70	7.09	3.65
1600	0.66	6.68	3.63
2000	0.63	6.06	3.50
2500	0.60	5.25	3.27
3150	0.59	4.40	2.95
4000	0.57	3.72	2.66
5000	0.53	2.87	2.23
6300	0.50	2.18	1.81
8000	0.52	1.59	1.38
10000	0.51	1.15	1.03

RESULTS SHEET



ABSORPTION IN REVERBRANT ROOM

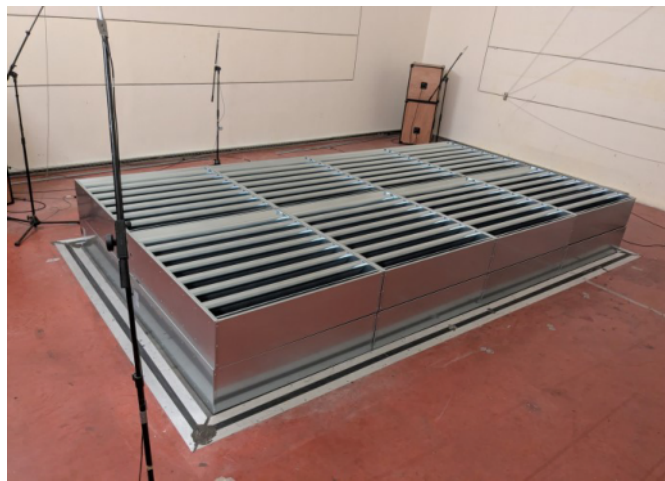
Standards ISO 354 ; ISO 11654 ; ISO 9613-1 ; ISO 1793-1-3

Study #: A250044
Client: Solflex GmbH
Date of the test: 10/09/2025
Place: Almacoustic
Operator(s): L. Boude

SAMPLE

Sample reference: Grids GF6
Material description: Louvered acoustic ventilation grid
Setup description: Chevron superposition of 2*4*2 grids on the floor, each 1085mm * 1185mm
Sample dimensions: Length: 4.35 m Width: 2.37 m Thickness: 600 mm Surface: 10.29 m²
Comment/remarks: Installation in accordance with the requirements of ISO 354

SETUP



Unique Coefficients

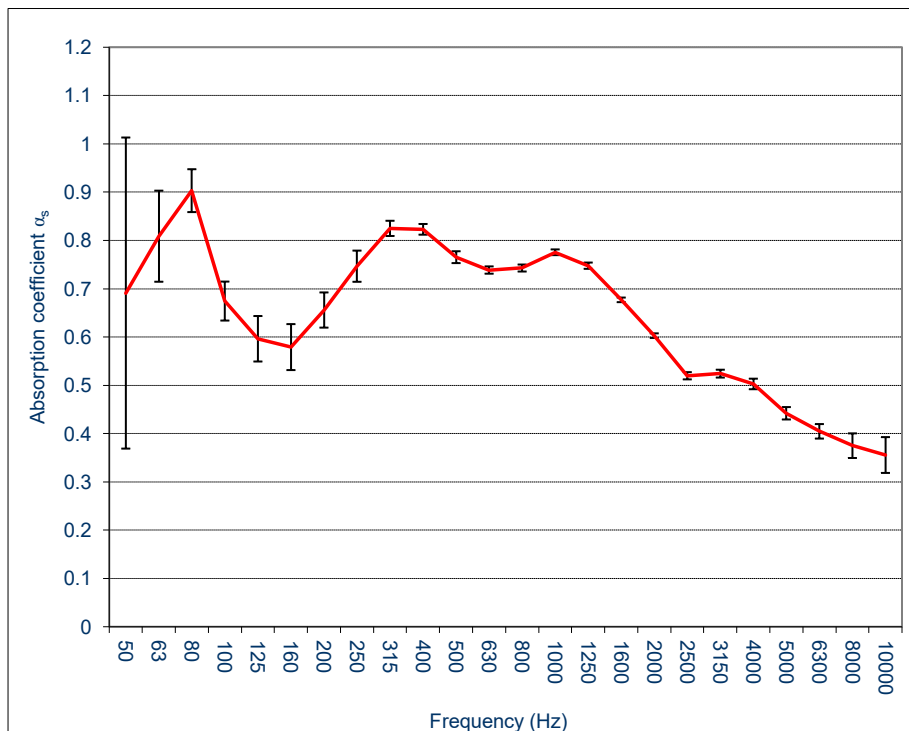
Alpha W	DL_alpha	NRC*
0.65	5	0.7

* : for information only, calculated according to ASTM C423-90a

MEASUREMENT CONDITIONS

Atmospheric conditions:
Empty room measurement: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa
Measurement with sample: T = 19.5°C , HR= 63.0 % , Patm = 995 hPa

GRAPH



Freq (Hz)	measured alpha	Empty room T60	T60 with sample
50	0.69	5.10	3.05
63	0.81	6.28	3.19
80	0.90	6.77	3.13
100	0.67	7.08	3.71
125	0.60	6.58	3.77
160	0.58	6.39	3.75
200	0.66	6.10	3.46
250	0.75	5.90	3.21
315	0.82	6.54	3.23
400	0.82	6.78	3.29
500	0.77	6.77	3.41
630	0.74	7.18	3.57
800	0.74	7.37	3.61
1000	0.78	7.25	3.50
1250	0.75	7.09	3.53
1600	0.68	6.68	3.59
2000	0.60	6.06	3.57
2500	0.52	5.25	3.45
3150	0.52	4.40	3.06
4000	0.50	3.72	2.75
5000	0.44	2.87	2.31
6300	0.40	2.18	1.87
8000	0.37	1.59	1.43
10000	0.36	1.15	1.06

ALMACOUSTIC

STUDY REPORT

REGENERATION NOISE AND PRESSURE LOSS OF FOUR ACOUSTIC VENTILATION LOUVERS

Solflex GmbH – Campus 21 – Europaring F14 202-1, 2345 Brunn am Gebirge, AUSTRIA

Quotation: DEV2025-053 V2

Almacoustic study #: A250044

Customer order: signed quotation

Identifier: A250044-03/B

STUDY MANAGED BY Côme OLIVIER - Project manager
Tel: +33 (0)6 01 36 41 79
e-mail: colivier@almacoustic.com

IN COLLABORATION WITH Laurent BOUDE, Baudoin GAULIN

	NAME - FUNCTION	SIGNATURE	DATE
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AUDITOR	Baudouin GAULIN Technician		18/09/2025

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1 INTRODUCTION

1.1 YOUR REQUEST

This report presents the results of the regeneration noise and pressure drop coefficient measurements of four different louvered acoustic grids conducted at Almacoustic for Solflex GmbH, following ISO 7235 and ISO 5135. Solflex references: GF14, GF28, GF3 & GF6

1.2 DATE AND LOCATION OF TESTS

Test conducted by: Côme OLIVIER, Baudouin GAULIN and Laurent BOUDE,
at Almacoustic, 20 rue Thalès de Milet, 72000 Le Mans, France
from Sept. 8 to Sept. 12, 2025.

2 REFERENCE DOCUMENTS

- EN ISO 7235, Août 2009, Acoustique — Modes opératoires de mesure en laboratoire pour silencieux en conduit et unités terminales — Perte d'insertion, bruit d'écoulement et perte de pression totale (*En: Acoustics – Laboratory measurement procedure for ducted silencers and air-terminal units – Insertion loss, flow noise and total pressure loss*)
- NF EN 5135, Septembre 2020, Acoustique — Détermination des niveaux de puissance acoustique du bruit émis par les bouches d'air, les unités terminales, les registres et clapets au moyen de mesurages en salle réverbérante (*En: Acoustics – Determination of sound power levels of noise from air-terminal devices, air-terminal units, dampers, and valves by measurement in a reverberation test room*)

3 METHOD

3.1 METHODOLOGY

The international standards EN ISO 5135 and EN ISO 7235 establish respectively general rules for acoustic testing of air diffusers, terminal units, dampers, and valves used in air diffusion and air distribution systems to determine the sound power levels defined in ISO 3741, and methods for determining (amongst other things) the sound power level of flow noise (or regenerated noise) generated by duct silencers, by frequency band, the total pressure loss of the silencer with air flow.

EN ISO 7235 applies to all types of silencers, including silencers for fans and air conditioning systems, smoke purification, and similar applications. It is also possible to test other passive air treatment devices, such as elbows, terminal units, or T-connectors, in accordance with this International Standard.

The acoustic power level regenerated by the grille L_W is measured for a given air flow upstream of the grid. It is defined by the following relationship:

$$L_W = \overline{L_p} + C$$

where:

$\overline{L_p}$ is the average spatial sound pressure level per third-octave band, determined in accordance with ISO 3741, without background noise correction, expressed in dB,

C is the difference in level between the sound power radiated into the reverberant room and the average sound pressure in the reverberant room, determined according to the direct or indirect method specified in ISO 3741.

The total pressure loss coefficient ζ is calculated using the average flow velocity V_0 such that (with ρ the density of air):

$$\zeta = \frac{\Delta p_t}{\frac{1}{2} \rho V_0^2}$$

It should be noted that results obtained in the laboratory in accordance with this International Standard will not necessarily be identical to those obtained in situ, since different acoustic fields and propagation fields will give different results. Pressure loss will, for example, be lower under laboratory conditions than that obtained in situ but will be comparable between different laboratories.

3.2 TEST FACILITIES

The test bench consists of two separate instrumented veins connected to a 343 m^3 reverberation chamber (Figure 1):

- a downstream section dedicated to generating air flow, comprising a Radax Var 500/2 centrifugal fan and a set of silencers to isolate it from the reverberation chamber.
- a test section equipped with instruments for measuring pressure loss and air flow.

To limit turbulence and therefore background flow noise, the fan generates air flow by aspiration in the reverberation chamber (photos 1 to 4). and the upstream section is led by a smooth profiled inlet (see Figure 2). All ducts are made of galvanized sheet metal with a thickness of 0.8 to 1.2 mm. The sections of the test duct are adapted to the dimensions of the objects to be measured. The samples to be qualified are installed in the window between the reverberant and adjacent semi-anechoic rooms (shown in red in Figure 1).

As the sample is installed on the wall, there is no downstream duct. The pressure drop is therefore measured between the pressure tap in the upstream duct and the pressure tap in the reverberation chamber.

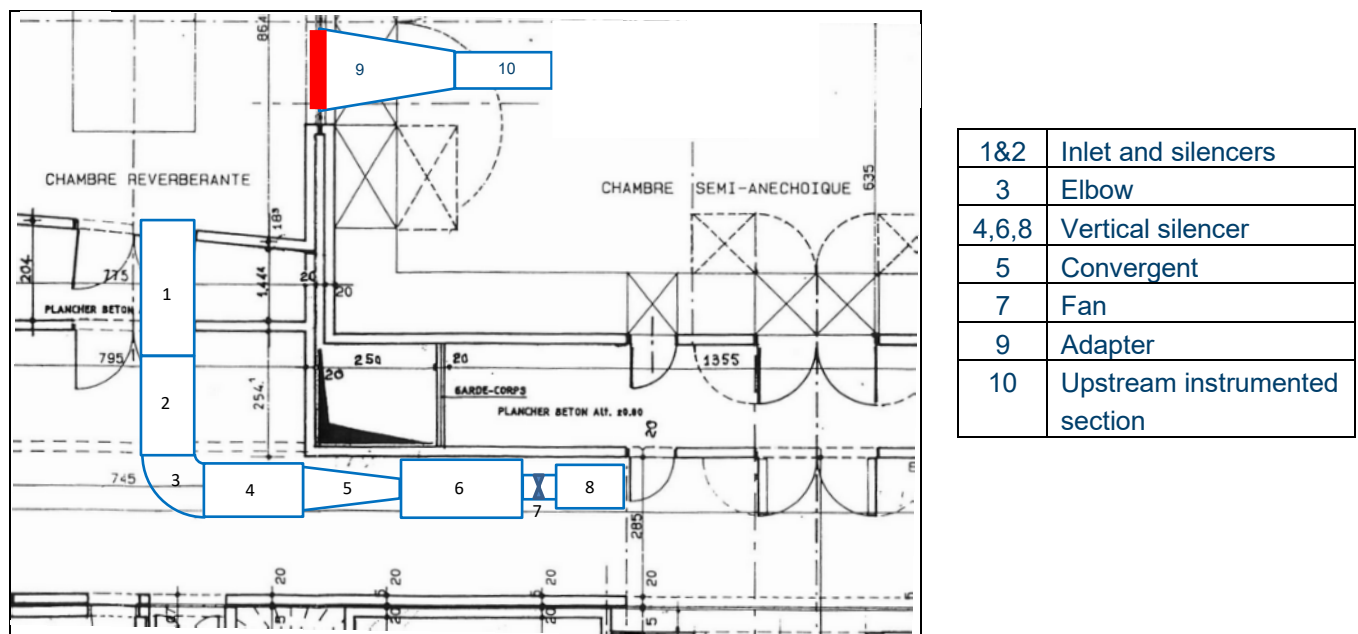


Figure 1 : General setup of the silencers testing bench.



Photo 1 : Aspiration mouth (1) in the reverberant room



Photo 2 : Aspiration section outside the reverberant room (2, 3 & 4)



Photo 3 : Convergent, fan & silencers (4 - 8)

3.3 MEASURING INSTRUMENTATION

3.3.1 Acoustic measurements

In the reverberant room, the instrumentation consists of six B&K and GRAS ½" microphones distributed throughout the room. These microphones measure the acoustic pressure field inside the room. The references for the various elements of the measurement instrumentation are given in

Table 1.

Table 1 – Characteristics of microphones in the emission room

		capsule	Pre-amp	conditioner
Micro 1	designation	Bruel & Kjaer 4943	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	2749959	2803630	3011296
	Almacoustic code	1A985	1O981	1O1442
	class	1	/	/
Micro 2	designation	Bruel & Kjaer 4943	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	2749962	2803631	3011296
	Almacoustic code	1A988	1O982	1O1442
	class	1	/	/
Micro 3	designation	Bruel & Kjaer 4190	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	2992946	2803632	3011296
	Almacoustic code	1A1211	1O983	1O1442

	class	1	/	/
Micro 4	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	485612	2804142	3011296
	Almacoustic code	1M1538	1O984	1O1442
	class	1	/	/
Micro 5	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	485602	2221277	2437911
	Almacoustic code	1M1536	1A046	1O247
	class	1	/	/
Micro 6	designation	GRAS 40AR	Bruel & Kjaer 2669	Bruel & Kjaer 2690
	Serial number	3188447	2221278	2437911
	Almacoustic code	1A1354	1A047	1O247
	class	1	/	/

3.3.2 Acquisition and control system

Acquisitions were conducted using in-house software INTAC connected to a National Instruments 9174 chassis (Almacoustic reference: 1O1436) with two NI-9234 acquisition cards (Almacoustic references: 1O1584 and 1O1353). Current signal from a Furness Control FCO432 differential pressure sensor (Almacoustic reference: 1M1313) and a Delta OHM HD403TS hot wire anemometer (Almacoustic reference: 1M1539) are acquired through a NI-9203 analog current input (Almacoustic reference: 1A1337).

The flow generating fan is controlled through a voltage output module NI-9263 card (Almacoustic reference: 1A733) via a Danfoss VLT2800 variable frequency drive.

3.3.3 Calibration, validity date

All microphones were checked before and after measurement using a calibration cavity Bruël & Kjaer type 4231 code Almacoustic 1E1540 (Last calibration 28/10/2024).

Table 2 – Sensitivities measured before and after testing.

Designation	Sensitivities before measurements (07/09/2025) (mV/Pa)	Sensitivities after measurements (12/09/25) (mV/Pa)
Micro 1	980.0	982.2
Micro 2	983.6	983.9
Micro 3	978.5	978.3
Micro 4	964.0	967.3
Micro 5	983.5	985.7
Micro 6	840.8	842.1

The Furness Control FCO432 differential pressure sensor (Almacoustic reference: 1M1313) was last checked on Aug. 11, 2025, to be within 0.5% of the value of a calibrated reference (Almacoustic reference: 1A1510, last calibration on Oct. 9, 2024).

The Delta OHM HD403TS hot wire anemometer (Almacoustic reference: 1M1539) was last calibrated on Jan. 15, 2025.

4 SAMPLES

4.1 RECEPTION - PREPARATION

Almacoustic has taken delivery of samples (6 pallets delivered by truck) on Aug. 25, 2025.

4.2 DESCRIPTION

Solflex References: GF14, GF28, GF3 & GF6 louvered acoustic grids.

Sample dimensions: 885 mm x 985 mm x various thickness.



4.3 CONFORMITY OF DESCRIPTION

The designations and descriptions are declared by the customer and the conformity of the samples to their designation and description is the sole responsibility of the customer.

4.4 INSTALLATION AND ASSEMBLY

The sample is positioned between Almacoustic's reverberant and semi-anechoic rooms, introduced in a window the size of the sample. Figure 2 shows the positioning of the grid, inserted in the upstream guide of section $0.9m \times 0.9m$ creating a smooth flow impacting the grid, and that leads to the measurement room where it is mounted flush to the wall, at a distance greater than $1m$ from any other surface.



Figure 2 - Installation of the sample as seen from the reverberant room and from the semi-anechoic room installed in the upstream section of guide.

The C coefficient links the radiated sound power to the average sound pressure, which depends on the reverberation time of the room. The latter varies with the configuration of the test section and is measured under actual experimental conditions, connected to the reverberant chamber (see Photo 5). The values of the C coefficient are given for the center frequencies of third-octave bands in Table 3.

Table 3 - C coefficients for the measurement setup.

Freq. (Hz)	50	63	80	100	125	160	200	250	315	400	500	630
C (dB)	10.63	10.58	5.10	4.42	5.20	5.55	5.28	5.13	4.87	4.67	4.56	4.19
Freq. (Hz)	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
C (dB)	4.13	4.22	4.22	4.34	4.65	5.12	5.76	6.41	7.44	8.60	10.07	11.64

5 AIR FLOW CONDITIONS

The tested air flow conditions are defined by the mean air speed in the guide with the same section (i.e., $985\text{mm} \times 885\text{mm}$) as the grid (not to be confused with the air speed in the airways).

The air flow speed is controlled via the volumetric flow established in the upstream section comprising the smooth profiled inlet of section $900\text{mm} \times 900\text{mm}$. These conditions are summarized in Table 4.

Table 4 - Test air flow conditions

Air speed V_0 (m/s)	0.5	1	1.5	2	3	4	5	6
Volumetric. flow q_v (m ³ /h)	1569	3140	4707	6280	9415	12550	15690	18830

6 RESULTS

6.1 MEASUREMENT OF THE TOTAL PRESSURE DROP

For each air flow speed, the total pressure drop Δp_t is measured and normalized by the speed to give the pressure drop coefficient. Following the simplified method from ISO 7235, the mean pressure drop coefficient ζ for each sample is then computed as the linear average of these, for configurations with a sufficient pressure drop ($\Delta p_t > 10\text{Pa}$), summarized in Table 5. Individual Pressure drops and pressure drop coefficients can be found in the attached spreadsheet.

Table 5 - Pressure drop coefficients of the samples.

Sample		GF14	GF28	GF3	GF6	empty
Pressure drop Δp_t (Pa) at given frontal air speed V_0	@ 0.5 m/s	0.50	0.75	0.68	1.35	0.00
	@ 1 m/s	2.09	3.25	4.70	6.60	0.00
	@ 1.5 m/s	4.85	7.25	10.70	14.50	0.50
	@ 2 m/s	8.85	12.80	19.00	24.50	1.35
	@ 3 m/s	21.35	30.90	44.80	56.80	3.90
	@ 4 m/s	40.10	56.00	79.30	106.00	8.55
	@ 5 m/s	70.50	94.00	108.00	168.00	12.60
	@ 6 m/s	101.60	136.00	140.00	236.00	17.80
Press. drop coeff. ζ		4.3	5.8	7.6	10.7	0.8

6.2 MEASUREMENT OF THE REGENERATED NOISE

Regenerated noise measurements results are given for each grid and each air speed in Figure 3, Figure 4, Figure 5 and Figure 6, compared to that of the setup without the grid. Octave values are summarized in Table 6 and Table 7.

Numerical results are available in the attached spreadsheet.

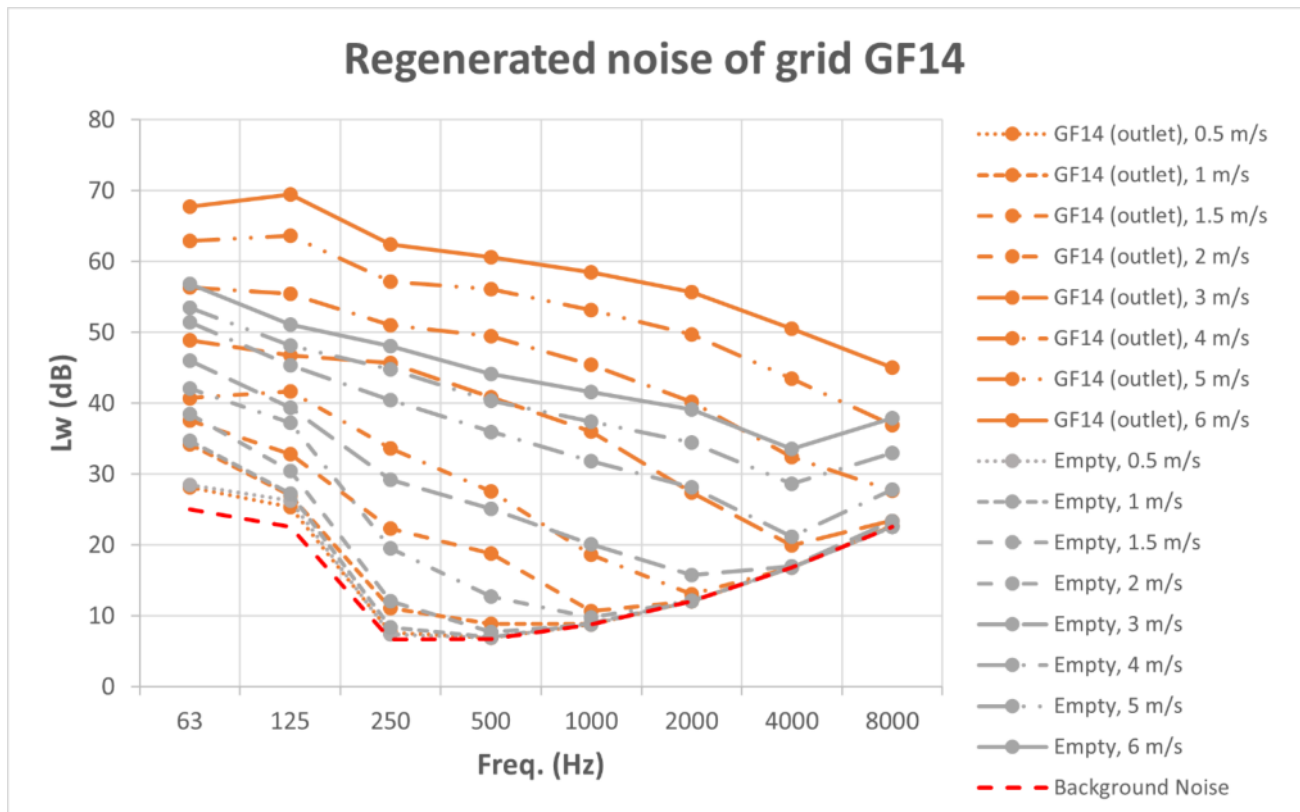


Figure 3 - Regenerated noise of GF14.

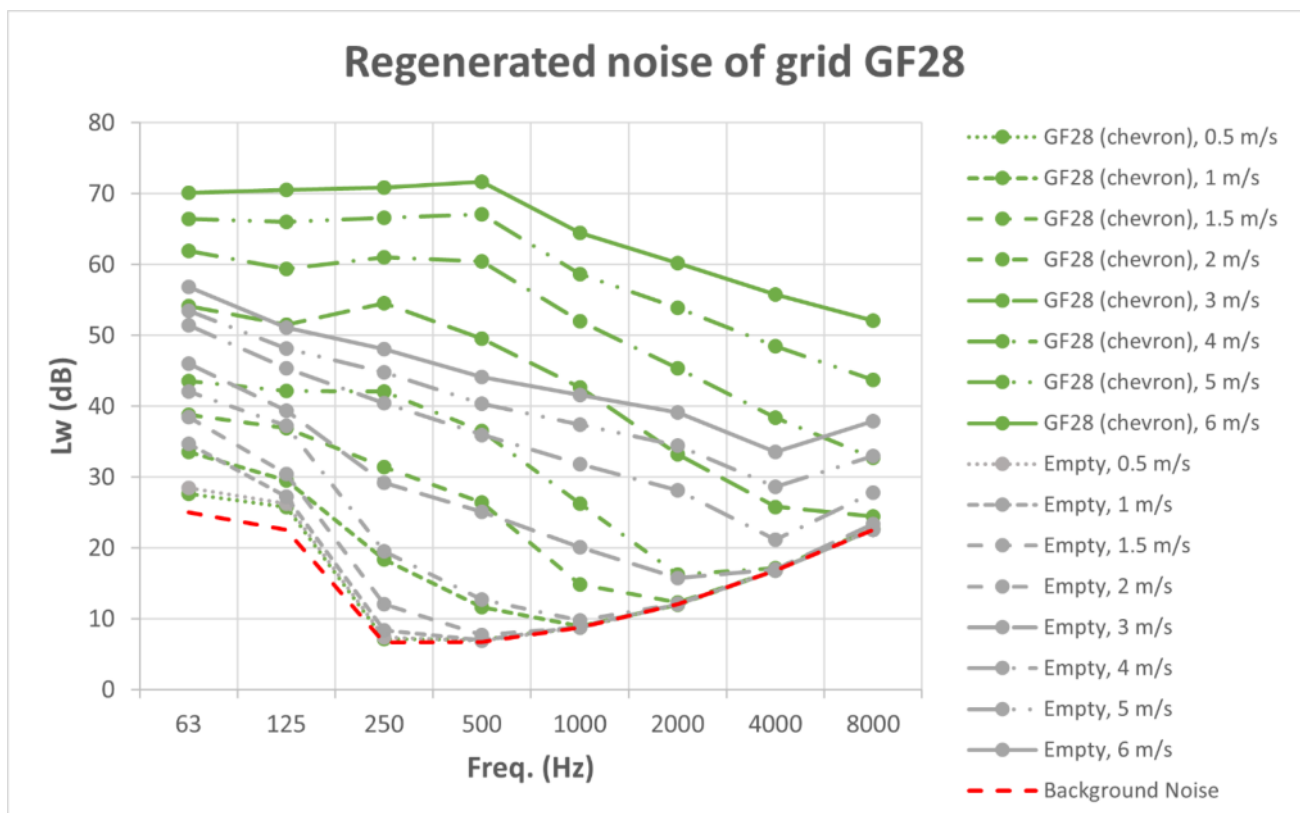


Figure 4 - Regenerated noise of GF28.

Table 6 - Regenerated noise levels for samples GF14 and GF28.

Grid sample	V ₀ (m/s)	Freq (Hz)								Global
		63	125	250	500	1000	2000	4000	8000	
GF14	0.5	28.1	25.4	7.6	6.9	8.8	12.0	16.8	22.7	31.0
	1.0	34.2	26.9	11.1	8.8	8.8	12.0	16.8	22.6	35.3
	1.5	37.5	32.8	22.3	18.7	10.6	12.1	16.8	22.6	39.1
	2.0	40.7	41.7	33.6	27.5	18.6	13.0	16.8	22.7	44.7
	3.0	48.8	46.8	45.7	40.8	36.0	27.4	19.9	23.4	52.5
	4.0	56.3	55.4	51.0	49.5	45.4	40.2	32.4	27.6	60.2
	5.0	62.9	63.6	57.1	56.1	53.2	49.7	43.5	36.9	67.4
	6.0	67.7	69.4	62.4	60.6	58.5	55.7	50.5	45.0	72.7
GF28	0.5	27.6	25.7	7.1	7.0	8.7	12.0	16.8	22.7	30.9
	1.0	33.6	29.5	18.4	11.7	8.9	12.0	16.8	22.6	35.4
	1.5	38.8	36.9	31.4	26.4	14.8	12.3	16.8	22.6	41.6
	2.0	43.5	42.1	42.0	36.5	26.3	16.3	17.1	22.7	47.8
	3.0	54.2	51.5	54.6	49.5	42.7	33.2	25.8	24.4	59.0
	4.0	61.9	59.3	61.0	60.4	52.0	45.3	38.3	32.7	67.0
	5.0	66.4	66.0	66.6	67.1	58.6	53.8	48.4	43.7	72.8
	6.0	70.1	70.5	70.9	71.7	64.5	60.2	55.7	52.1	77.2
Empty	0.5	28.5	26.3	7.4	6.9	8.8	12.0	16.8	22.6	31.4
	1.0	34.7	27.2	8.4	7.0	8.9	12.0	16.8	22.5	35.7
	1.5	38.5	30.4	12.0	7.7	8.8	12.0	16.8	22.6	39.2
	2.0	42.1	37.2	19.5	12.7	9.8	12.1	16.8	22.6	43.4
	3.0	46.0	39.3	29.2	25.1	20.1	15.8	17.0	23.4	47.0
	4.0	51.4	45.4	40.4	36.0	31.8	28.1	21.2	27.8	52.8
	5.0	53.5	48.2	44.8	40.3	37.4	34.5	28.6	33.0	55.3
	6.0	56.9	51.1	48.0	44.1	41.6	39.1	33.5	37.8	58.7
Background Noise	N/A	25.0	22.6	6.6	6.7	8.7	12.0	16.8	22.5	28.8

* For all values highlighted in yellow, the criterion of a 3 dB emergence of regenerated noise—compared to the “empty duct” configuration or background noise—has not been met. These values should therefore be considered ceiling values, meaning the actual noise levels are likely lower but cannot be accurately assessed under the current installation conditions.

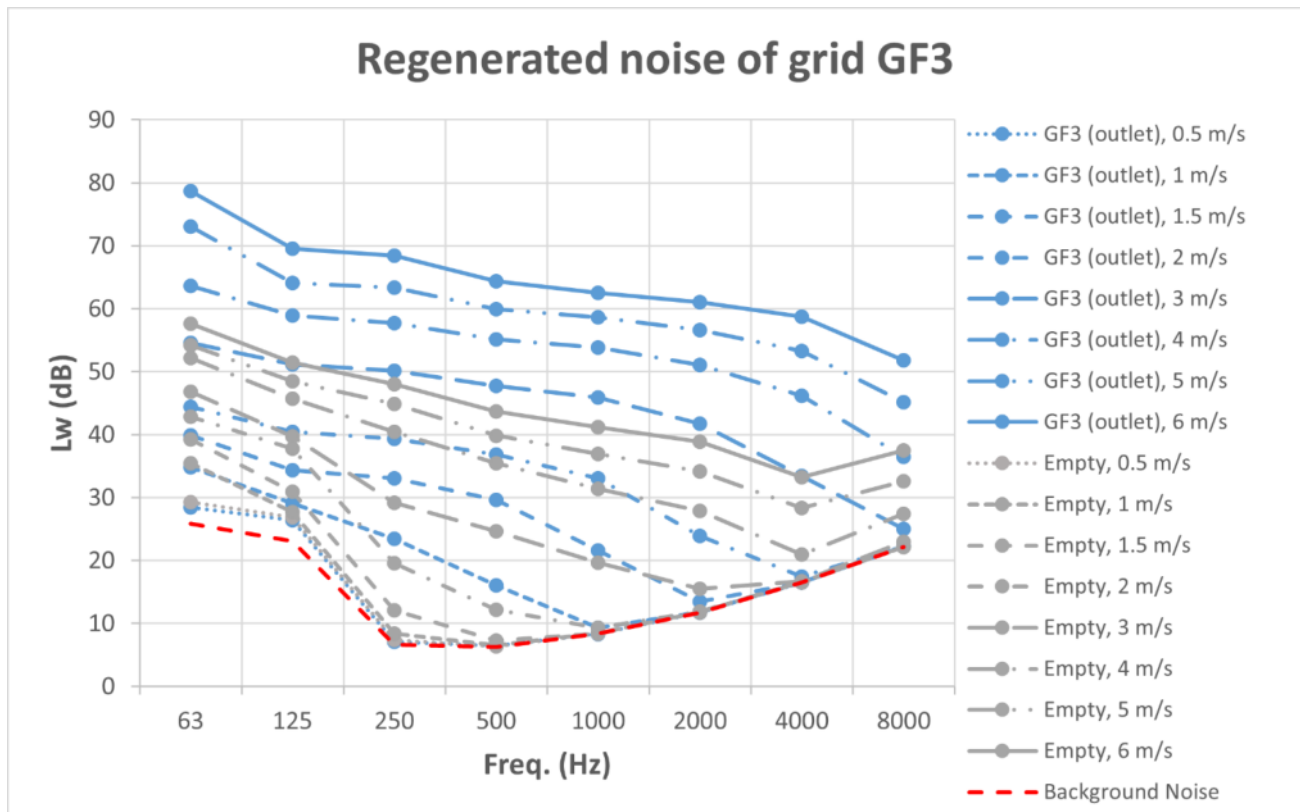


Figure 5 - Regenerated noise of GF3.

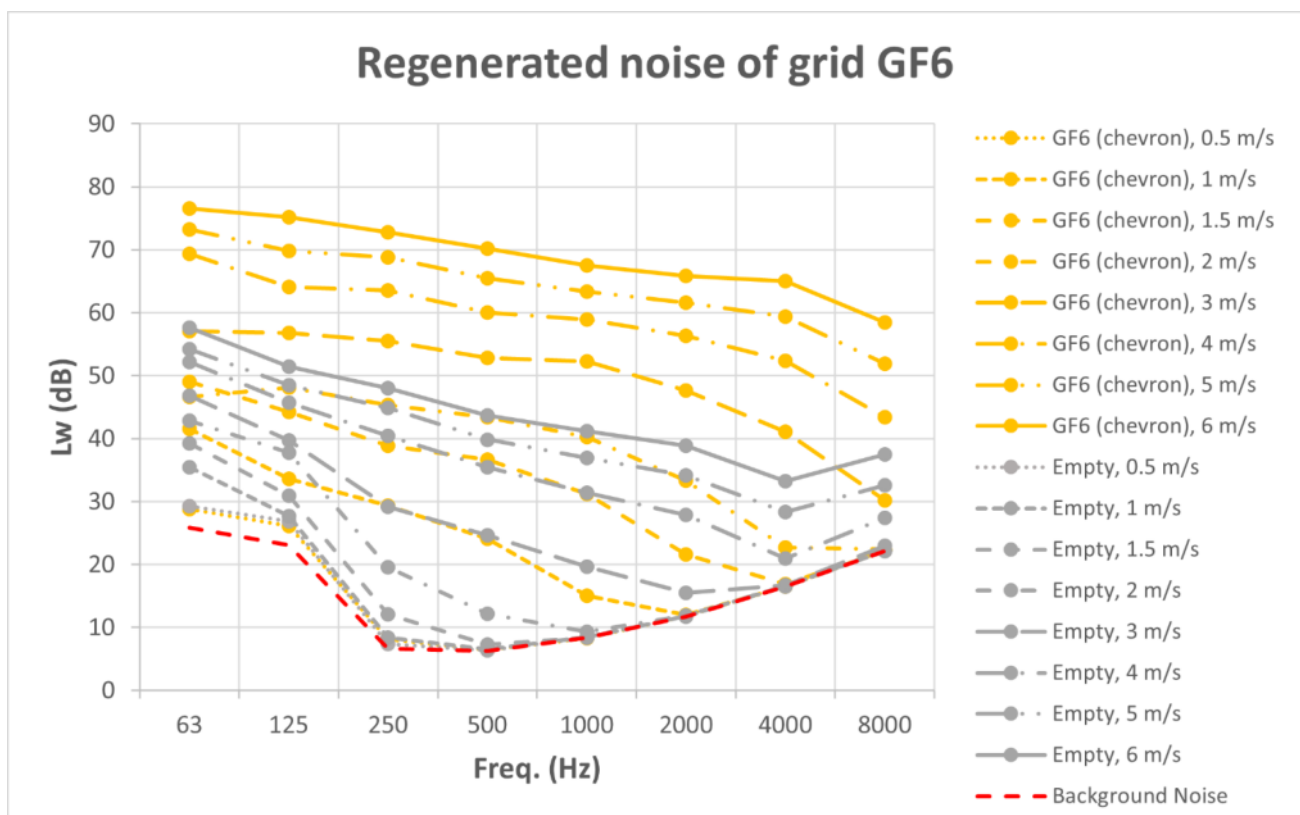


Figure 6 - Regenerated noise of GF6.

Table 7 - Regenerated noise levels for samples GF3 and GF6

Grid sample	V ₀ (m/s)	Freq (Hz)								Global
		63	125	250	500	1000	2000	4000	8000	
GF3	0.5	28.5	26.4	7.0	6.5	8.3	11.7	16.5	22.3	31.4
	1.0	34.8	29.0	23.4	16.1	9.3	11.8	16.5	22.3	36.4
	1.5	39.9	34.3	33.0	29.6	21.6	13.4	16.5	22.3	42.0
	2.0	44.4	40.5	39.3	36.8	33.0	23.9	17.4	22.3	47.4
	3.0	54.6	51.1	50.1	47.7	45.9	41.7	33.4	25.0	58.0
	4.0	63.6	58.9	57.7	55.1	53.8	51.0	46.2	36.5	66.4
	5.0	73.0	64.1	63.4	59.9	58.6	56.6	53.2	45.2	74.3
	6.0	78.7	69.5	68.4	64.4	62.5	61.0	58.7	51.8	79.8
GF6	0.5	28.8	26.1	8.1	6.4	8.3	11.8	16.5	22.3	31.5
	1.0	41.6	33.6	29.3	24.1	15.1	12.0	16.5	22.3	42.6
	1.5	49.1	44.2	38.9	36.6	31.2	21.6	16.9	22.3	50.8
	2.0	46.7	48.1	45.3	43.4	40.2	33.3	22.7	22.4	52.5
	3.0	57.1	56.8	55.5	52.8	52.2	47.6	41.1	30.2	62.5
	4.0	69.3	64.0	63.5	60.0	58.9	56.3	52.4	43.4	72.0
	5.0	73.2	69.8	68.8	65.5	63.4	61.6	59.3	51.9	76.7
	6.0	76.6	75.1	72.8	70.1	67.5	65.8	65.0	58.5	80.8
Empty	0.5	29.3	26.8	7.4	6.4	8.3	11.8	16.5	22.2	32.0
	1.0	35.5	27.7	8.4	6.5	8.5	11.8	16.6	22.1	36.4
	1.5	39.3	30.9	12.0	7.2	8.4	11.7	16.5	22.2	40.0
	2.0	42.8	37.7	19.5	12.2	9.3	11.9	16.6	22.2	44.0
	3.0	46.8	39.7	29.2	24.6	19.6	15.5	16.7	23.0	47.7
	4.0	52.1	45.7	40.4	35.5	31.4	27.8	20.9	27.4	53.4
	5.0	54.2	48.5	44.8	39.8	36.9	34.2	28.3	32.6	55.9
	6.0	57.6	51.4	48.0	43.7	41.1	38.8	33.3	37.4	59.2
Background Noise	N/A	25.8	23.1	6.6	6.2	8.3	11.7	16.5	22.1	29.2

* For all values highlighted in yellow, the criterion of a 3 dB emergence of regenerated noise—compared to the “empty duct” configuration or background noise—has not been met. These values should therefore be considered ceiling values, meaning the actual noise levels are likely lower but cannot be accurately assessed under the current installation conditions.