# REPORT

Issued by an Accredited Testing Laboratory

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Date: 2022-06-28

Reference: O100282-1107551 C

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Volution Sweden AB
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# Measurement of the airborne sound insulation of small technical element according to ISO 10140-2

(3 appendices)

## Client

Volution Sweden AB

## Test object

Different designs of supply air vent for wall mounting have been tested in a wall with a total thickness of 200 mm.

The test objects consisted of wall pipes in polyether / PE foam. The internal part of the wall vent and the external grill were mounted in each end.

The test objects are more in detail described in table 1 and in the appendices. Pictures of the test objects can be seen in the report. All information of the test objects is provided by the client.

The objects were mounted in the wall with three different openings for the wall pipes with diameter Ø150 mm. The centre of the openings was located 0.5 m above the floor.

The wall was made of 4 x 12.5 mm plasterboard on each side of mineral wool filling with thickness 100 mm. The sound absorption of the wall's mineral wool was intended to contribute to the sound insulation of the test objects.

## Date of testing

June 9, 2022

## Results

A summary of the test results is given in table 1. Complete results can be seen in the appendices.

The results are valid for the tested objects only.

Higher values for $D_{n,e}$ and $D_{n,e,w}$ means less noise through the test object.



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*Table 1 – Results.*

| **Test objects: Supply air vent for wall mounting.** | $D_{n,e,w}$ (dB) | Appendix |
|---|---|---|
| Ø150 mm - TL80C dBR with Ø98/81/148 x 200 mm wall pipe and external grille #150 with cover plate #175mm.<br>*The wall pipe was made of polyether foam surrounded by PE foam.* | 45 | 1 |
| Ø150 mm - TL80C dBR with Ø81/81/148 x 200 mm wall pipe and external grille #150 with cover plate #175mm.<br>*The wall pipe was made of polyether foam surrounded by PE foam.* | 48 | 2 |
| Ø150 mm - TL80C dBR with Ø98/81/148 x 200 mm wall pipe and external grille #150 with cover plate #175mm.<br>Unperforated filter cassette.<br>*The wall pipe was made of polyether foam surrounded by PE foam.* | 42 | 3 |

## Measurement method

The measurements have been conducted according to ISO 10140-1:2021 and SS-EN ISO 10140-2:2021. RISE is accredited for the Swedish standard.

The element-normalized level difference has been determined according to:

$D_{n,e} = L_1 - L_2 + 10 \lg (A_0/A)$

where:

$L_1$ is the average sound pressure level in the source room (dB),
$L_2$ is the average sound pressure level in the receiving room (dB),
$A_0$ is the reference area of the test specimen (10 m²) and
$A$ is the equivalent absorption area of the receiving room (m²).

The average sound pressure levels have been determined using a rotating microphone boom (radius >1,1 m) and a digital frequency analyzer. A continuously moving loudspeaker has been used in the source room. During the measurement time of 128 s, the loudspeaker has moved up and down along a line across the room.

In those cases where the difference between the measured sound reduction index of the test object and the sound reduction index of the flanking transmission is less than 10 dB, the measurement value has been corrected. In those cases where the margin of the test object to the flanking transmission is ≤ 6 dB, the measurement value has been corrected with 1,3 dB.

In the table 2, the element-normalized maximum level difference for the test wall (without test object) $D_{n,e,F}$ calculated on a partition area of 10 m² is given.



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Remark, that the maximum level difference of the test wall has an upper limitation and has affected the test results in the upper frequency range. However, these frequencies have not affected the weighted normalised level difference of the tested objects.

*Table 2 – Sound insulation of flanking construction.*

| Frequency (Hz) | $D_{n,e,F}$ (dB) |
|---|---|
| 50 | 33,4 |
| 63 | 38,1 |
| 80 | 48,0 |
| 100 | 45,3 |
| 125 | 43,6 |
| 160 | 51,9 |
| 200 | 57,4 |
| 250 | 57,3 |
| 315 | 56,8 |
| 400 | 59,8 |
| 500 | 63,8 |
| 630 | 65,6 |
| 800 | 67,0 |
| 1000 | 69,2 |
| 1250 | 72,1 |
| 1600 | 72,6 |
| 2000 | 71,1 |
| 2500 | 70,1 |
| 3150 | 65,0 |
| 4000 | 57,9 |
| 5000 | 56,4 |
| $D_{n,e,F,w}$ | 66 |



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## Evaluation

The results have been evaluated according to the Swedish and international standard SS-EN ISO 717-1:2020. The spectrum adaptation terms ($C$; $C_{tr}$), ($C_{50\text{-}3150}$;$C_{tr\ 50\text{-}3150}$) and ($C_{50\text{-}5000}$;$C_{tr\ 50\text{-}5000}$) are calculated for the 1/3 octave-bands 100-3150, 50-3150 and 50-5000 Hz respectively and shall be added to the $D_{n,e,w}$ values to obtain a single number value based on other noise spectra. $C$ is relevant for spectrum of A-weighted pink noise and $C_{tr}$ is relevant for spectrum of A-weighted urban traffic noise.

## Measurement uncertainty

The measurement uncertainty $\sigma_{R95}$, according to ISO 12999-1:2020 and SS-EN ISO 12999-1:2020, with respect to the reproducibility of the reduction index is shown in Table 3. RISE is accredited for the Swedish standard.

The reproducibility corresponds to the spread in measurement data in comparison tests between different laboratories with different test rooms, equipment, personnel, etc. The repeatability of measurements in the same laboratory is normally considerably better.

The table shows the upper limit of the expanded double-sided measurement uncertainty at the coverage factor $k = 2$ (corresponding to 95% confidence level).

*Table 3 - Measurement uncertainty*

| 1/3-octave band (Hz) | Uncertainty, $\sigma_{R95}$ (dB) |
|---|---|
| 50 | 13,6 |
| 63 | 9,2 |
| 80 | 7,6 |
| 100 | 6 |
| 125 | 5,4 |
| 160 | 4,8 |
| 200 | 4,2 |
| 250 | 3,6 |
| 315 | 3,6 |
| 400 | 3,6 |
| 500 | 3,6 |
| 630 | 3,6 |
| 800 | 3,6 |
| 1000 | 3,6 |
| 1250 | 3,6 |
| 1600 | 3,6 |
| 2000 | 3,6 |
| 2500 | 3,8 |
| 3150 | 4 |
| 4000 | 4,8 |
| 5000 | 5,6 |
| **$R_w$** | **2,4** |



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## Measurement room

The airborne sound reduction laboratory for doors and windows, where the volumes of the source and receiving rooms are 106 m³ and 129 m³ respectively, was used as test room.

## Mounting

The penetration seals were mounted into a test wall with a total thickness of 200 mm, made out of 4 x 12,5 mm plasterboard on each side of a mineral wool filling.

## Climate

Temperature: 22 ± 3 ˚C
Air pressure 99 ± 1 kPa
Relative humidity RH 48 ± 5 %

## Pictures of the test objects

The pictures below were taken in connection with testing with 400 mm wall, reported in O100282-1107551 A. The difference is the length of the pipe, which is shortened when measuring on a 200 mm wall.

*Picture 1 – The test object seen from the receiving room.*


*Picture 2 – The test object seen from the source room.*



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## Pictures to appendix 1

*Picture 3 – TL80C dBR with Ø98/81/148 x 200 mm pipe made of polyether foam rings surrounded by PE foam.*

*Picture 4 – The inner foam ring started 15 cm into the wall measured from the internal side.*

*Picture 5 – The polyether foam rings seen from the exterior side.*



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*Picture 6 – The indoor part of the unit with dust and insect filter.*

*Picture 7 – The indoor part of the unit front side before assembly.*

*Picture 8 – The indoor unit mounted on the wall.*

*Picture 9 – External grille #150 with cover plate #175.*



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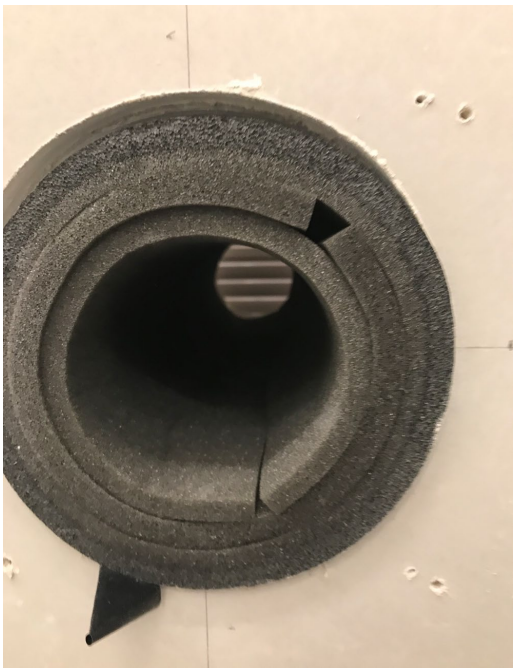
## Pictures to appendix 2



*Picture 10 – TL80C dBR with Ø81/148 x 200 mm wall pipe. The polyether foam rings seen from the interior side.*

*Picture 11 – The interior unit during assembly.*

*Picture 12 – The standard filter mounted.*

*Picture 13 – The wall vent mounted.*



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## Pictures to appendix 3

*Picture 14 – The inner polyether foam ring was removed and replaced with an un-perforated filter cassette.*

*Picture 15 – The filter cassette during assembly.*

## Equipment

The measurement equipment is listed in *Table 4*. Current calibration dates are reported in RISE quality system.

*Table 4 - Measurement equipment*

| Instrument | Manufacturer | Type | Serial / ID nr. |
|---|---|---|---|
| Microphones | Brüel & Kjær | 4166 | 1011605 |
| | " | 4166 | 1072010 |
| Pre amplifiers | Brüel & Kjær | 2619 | 970951 |
| | " | 2619 | 726782 |
| Power supplies | Brüel & Kjær | 2801 | 618956 |
| | " | 2804 | 815268 |
| Rotating booms | Brüel & Kjær | 3923 | 912304 |
| | " | 3923 | 761963 |
| Analyser | Norsonic | 850 | BX41345 |
| Calibrator | Brüel & Kjær | 4230 | 1410946 |
| Software | Norsonic | Nor850 | Ver 3.0 |
| Climate sensor | Vaisala | PTU303 | KWP01123 |



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## Appendices



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Appendix 1

# Level difference according to ISO 10140-2

Laboratory measurement of sound insulation of building elements

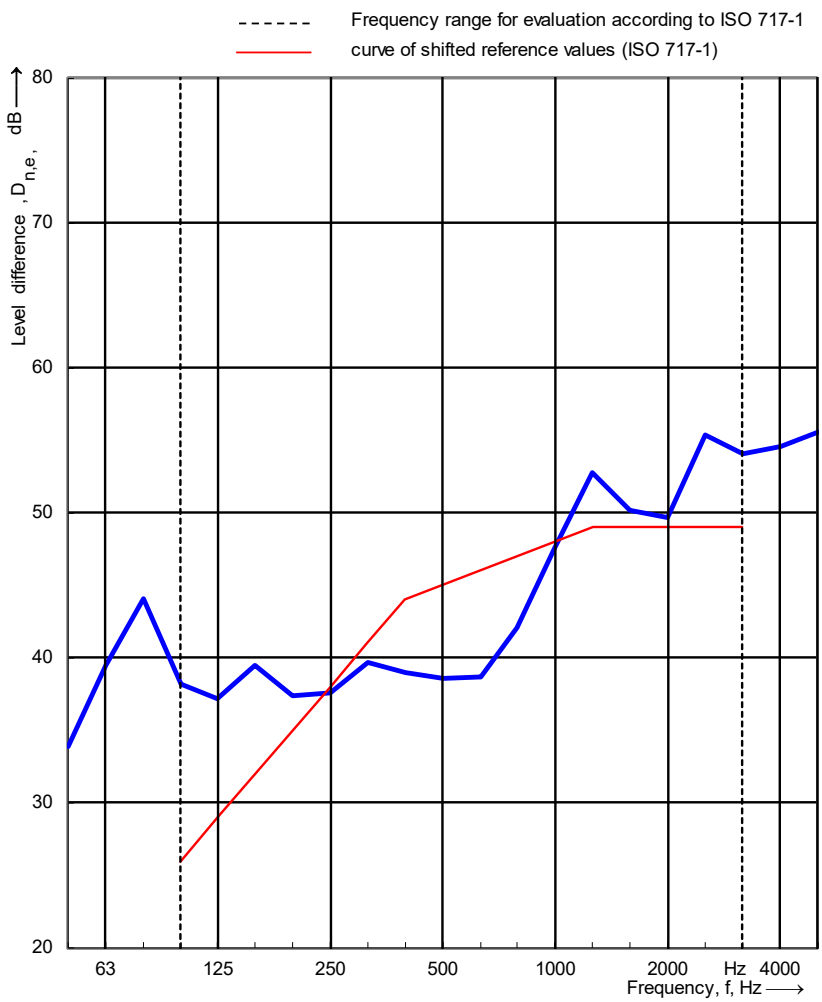
Client: Volution Sweden AB Date of test: 2022-06-09
Manufacturer:
Test room identification:
Test specimen mounted by: Client
Product identification: Wall 200 mm

Description of the specimen: Supply air vent for wall mounting: Ø150 mm - TL80C dBR with Ø98/81/148 x 200 wall pipe and external grille #150 with cover plate #175mm.

| | | | |
|---|---|---|---|
| Area, S, of test element: | 10,00 m² | Static pressure: | 99,0 kPa |
| Source room volume: | 100,6 m³ | Air temperature: | 22,5 °C |
| Receiving room volume: | 128,3 m³ | Relative air humidity: | 44,9 % |
| Mass per unit area: | | | |

| Frequency f [Hz] | $D_{n,e}$ 1/3 octave [dB] |
|---|---|
| 50 | 33,9 |
| 63 | 39,5 |
| 80 | 44,1 |
| 100 | 38,2 |
| 125 | 37,2 |
| 160 | 39,5 |
| 200 | 37,4 |
| 250 | 37,6 |
| 315 | 39,7 |
| 400 | 39,0 |
| 500 | 38,6 |
| 630 | 38,7 |
| 800 | 42,1 |
| 1000 | 47,6 |
| 1250 | 52,8 |
| 1600 | 50,2 |
| 2000 | 49,7 |
| 2500 | 55,4 |
| 3150 | 54,1 |
| 4000 | 54,6 |
| 5000 | 55,6 |

[1] Too high background
[2] Minimum values ≥




Rating according to ISO 717-1
$D_{n,e,w}$ ($C;C_{tr}$) = 45 ( -1 ; -3 ) dB
Evaluation based on laboratory measurements in third octave bands by an engineering method.

Sum of unfavourable deviations : 25,7 dB
Max. unfavourable deviation : 7,3 dB at 630 Hz
$C_{50\text{-}3150}$ = -1 dB $C_{50\text{-}5000}$ = 0 dB $C_{100\text{-}5000}$ = 0 dB
$C_{tr,50\text{-}3150}$ = -3 dB $C_{tr,50\text{-}5000}$ = -3 dB $C_{tr,100\text{-}5000}$ = -3 dB



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Appendix 2

# Level difference according to ISO 10140-2

Laboratory measurement of sound insulation of building elements

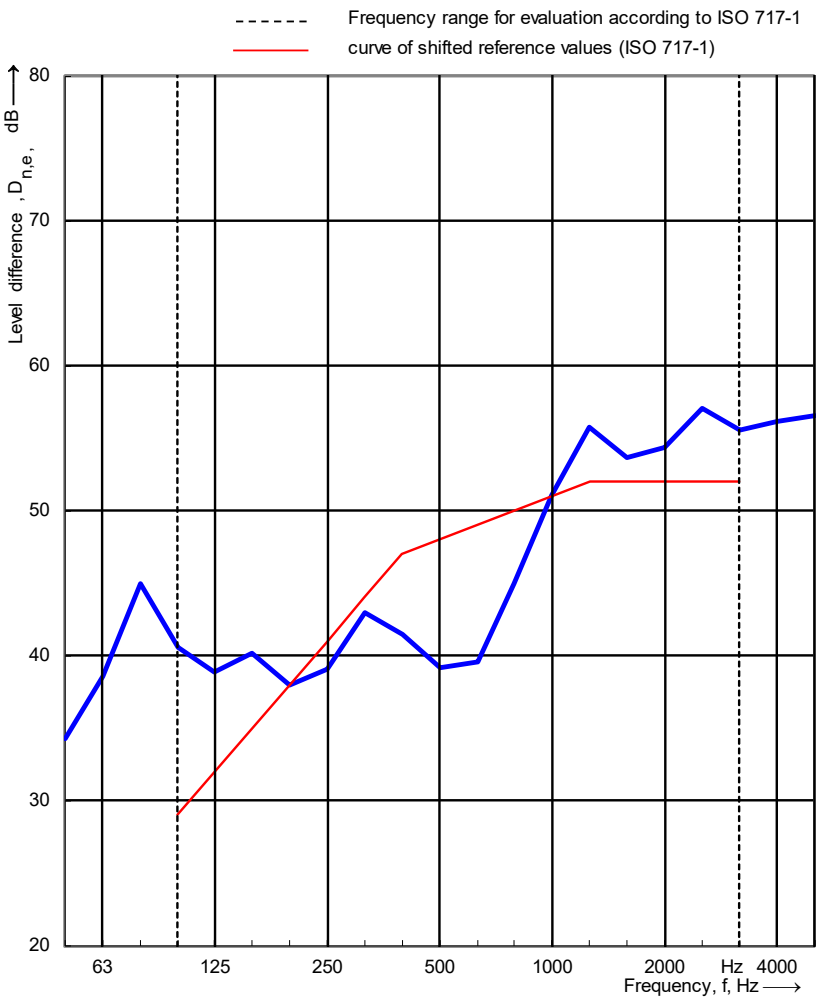
Client: Volution Sweden AB Date of test: 2022-06-09
Manufacturer:
Test room identification:
Test specimen mounted by: Client
Product identification: Wall 200 mm

Description of the specimen: Supply air vent for wall mounting: Ø150 mm - TL80C dBR with Ø81/81/148 x 200 wall pipe and external grille #150 with cover plate #175mm.

| | | | |
|---|---|---|---|
| Area, S, of test element: | 10,00 m² | Static pressure: | 99,0 kPa |
| Source room volume: | 100,6 m³ | Air temperature: | 22,5 °C |
| Receiving room volume: | 128,3 m³ | Relative air humidity: | 45,1 % |
| Mass per unit area: | | | |

| Frequency f [Hz] | $D_{n,e}$ 1/3 octave [dB] |
|---|---|
| 50 | 34,3 |
| 63 | 38,6 |
| 80 | 45,0 |
| 100 | 40,6 |
| 125 | 38,9 |
| 160 | 40,2 |
| 200 | 38,0 |
| 250 | 39,1 |
| 315 | 43,0 |
| 400 | 41,5 |
| 500 | 39,2 |
| 630 | 39,6 |
| 800 | 45,0 |
| 1000 | 51,1 |
| 1250 | 55,8 |
| 1600 | 53,7 |
| 2000 | 54,4 |
| 2500 | 57,1 |
| 3150 | 55,6 |
| 4000 | 56,2 |
| 5000 | 56,6 |

[1] Too high background
[2] Minimum values ≥




Rating according to ISO 717-1
$D_{n,e,w}$ ($C;C_{tr}$) = 48 ( -2 ; -4 ) dB
Evaluation based on laboratory measurements in third octave bands by an engineering method.

Sum of unfavourable deviations : 31,6 dB
Max. unfavourable deviation : 9,4 dB at 630 Hz
$C_{50\text{-}3150}$ = -2 dB $C_{50\text{-}5000}$ = -1 dB $C_{100\text{-}5000}$ = -1 dB
$C_{tr,50\text{-}3150}$ = -4 dB $C_{tr,50\text{-}5000}$ = -4 dB $C_{tr,100\text{-}5000}$ = -4 dB



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Appendix 3

## Level difference according to ISO 10140-2

Laboratory measurement of sound insulation of building elements

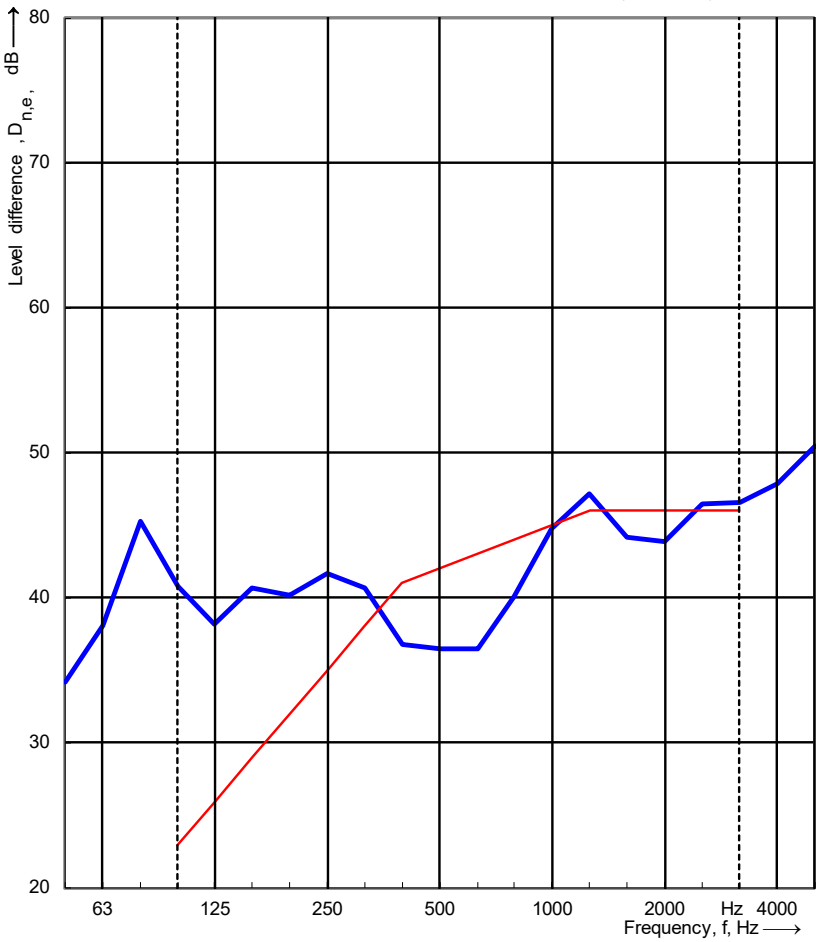
Client: Volution Sweden AB Date of test: 2022-06-09
Manufacturer:
Test room identification:
Test specimen mounted by: Client
Product identification: Wall 200 mm

Description of the specimen: Supply air vent for wall mounting: Ø150 mm - TL80C dBR with Ø98/81/148 x 200 wall pipe and external grille #150 with cover plate #175mm. Unperforated filter cassette.

| | | | |
|---|---|---|---|
| Area, S, of test element: | 10,00 m² | Static pressure: | 99,0 kPa |
| Source room volume: | 100,6 m³ | Air temperature: | 22,5 °C |
| Receiving room volume: | 128,3 m³ | Relative air humidity: | 45,3 % |
| Mass per unit area: | | | |

| Frequency f [Hz] | $D_{n,e}$ 1/3 octave [dB] |
|---|---|
| 50 | 34,2 |
| 63 | 38,1 |
| 80 | 45,3 |
| 100 | 40,8 |
| 125 | 38,2 |
| 160 | 40,7 |
| 200 | 40,2 |
| 250 | 41,7 |
| 315 | 40,7 |
| 400 | 36,8 |
| 500 | 36,5 |
| 630 | 36,5 |
| 800 | 40,1 |
| 1000 | 44,8 |
| 1250 | 47,2 |
| 1600 | 44,2 |
| 2000 | 43,9 |
| 2500 | 46,5 |
| 3150 | 46,6 |
| 4000 | 47,9 |
| 5000 | 50,5 |

[1] Too high background
[2] Minimum values ≥




Rating according to ISO 717-1
$D_{n,e,w}$ ($C;C_{tr}$) = 42 ( 0 ; -1 ) dB
Evaluation based on laboratory measurements in third octave bands by an engineering method.

Sum of unfavourable deviations : 24,2 dB
Max. unfavourable deviation : 6,5 dB at 630 Hz
$C_{50\text{-}3150}$ = 0 dB $C_{50\text{-}5000}$ = 1 dB $C_{100\text{-}5000}$ = 1 dB
$C_{tr,50\text{-}3150}$ = -1 dB $C_{tr,50\text{-}5000}$ = -1 dB $C_{tr,100\text{-}5000}$ = -1 dB



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# Verifikat

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## Dokument

O100282-1107551 C Report
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13 sidor
*Startades 2022-06-29 13:59:05 CEST (+0200) av Geir Andresen (GA)*
*Färdigställt 2022-06-29 14:50:23 CEST (+0200)*

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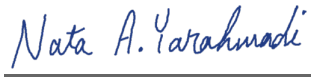

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