

IMPACT SOUND IMPROVEMENT FOR VIBRATEC CEILING SYSTEMS VT-SFC AND VT-CBC

ABSTRACT

The impact sound level and the impact sound improvement have been measured in a laboratory for two different suspended ceiling systems; VT-SFC and VT-CBC from Vibratec Akustikprodukter AB. Both ceiling systems have been mounted below a reference heavyweight floor made of 160 mm concrete. Both systems were mounted with 250 mm suspension and 95 mm mineral wool, and with 2, 3 and 4 layers of normal gypsum boards (12.5 mm thickness) respectively.

All measurements have been performed according to SS-EN ISO 10140-3:2010 and evaluated according to SS-EN ISO 717-2:2013. Single number values for all measurements can be found in the table below.

Test sample	$L_{n,w}$ (dB)	$C_{1,50-2500}$	ΔL_w (dB)	$C_{1,\Delta}$
1. Vibratec VT-SFC, 250 mm suspension with 95 mm mineral wool, 2 layers of 12.5 mm normal gypsum board	53	-6	25	-7
2. Vibratec VT-SFC, 250 mm suspension with 95 mm mineral wool, 3 layers of 12.5 mm normal gypsum board	51	-6	28	-7
3. Vibratec VT-SFC, 250 mm suspension with 95 mm mineral wool, 4 layers of 12.5 mm normal gypsum board	49	-7	30	-7
4. Vibratec VT-CBC-RF50, 250 mm suspension with 95 mm mineral wool, 2 layers of 12.5 mm normal gypsum board	46	2	32	-15
5. Vibratec VT-CBC-RF50, 250 mm suspension with 95 mm mineral wool, 3 layers of 12.5 mm normal gypsum board	45	0	34	-14
6. Vibratec VT-CBC-RF50, 250 mm suspension with 95 mm mineral wool, 4 layers of 12.5 mm normal gypsum board	43	0	35	-13

1. CLIENT

Vibratec Akustikprodukter AB, Fagernäsvägen 1, 760 17 Blidö, Sweden
Contact: Svante Hågerstrand, 0176 – 20 78 84, svante.hagerstrand@vibratec.se

2. ASSIGNMENT

To measure the impact sound level and the impact sound improvement of two suspended ceiling systems sold by Vibratec. The measurements shall be made according to SS-EN ISO 10140-3:2010 and evaluated according to SS-EN ISO 717-2:2013.

3. TEST SAMPLES

The constructions of the test samples are described in Table 1. The test samples were mounted below Akustikverkstan's 160 mm heavyweight reference concrete floor. The whole surface was covered, and elastic strips were mounted between test sample and surrounding laboratory structure.



Figure 1: The VT-SFC system contains only primary profiles. Tested with 25 mm elastic pads. In the tests the hangers were mounted with c/c 900 mm and the profiles were mounted with c/c 450 mm.

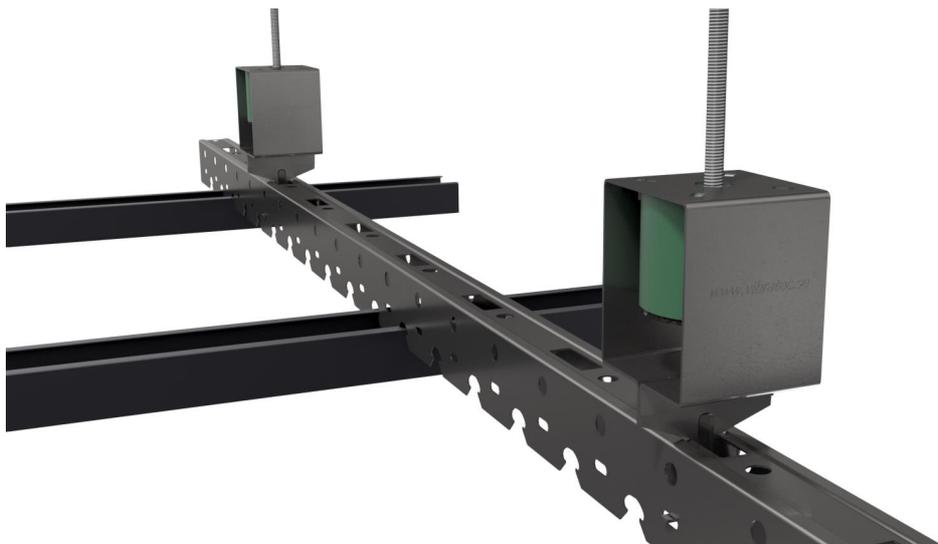


Figure 2: The VT-CBC system contains both primary and a secondary profiles. Tested with 50 mm elastic pads. In the tests the hangers were mounted with c/c 600 mm, the primary profiles were mounted with c/c 750 mm, and the secondary profiles were mounted with c/c 400 mm.

Sample	Sample description
1	VT-SFC with 2 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads
2	VT-SFC with 3 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads
3	VT-SFC with 4 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads
4	VT-CBC-RF50 with 2 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads
5	VT-CBC-RF50 with 3 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads
6	VT-CBC-RF50 with 4 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads

Table 1: Description of test samples. P describes the c/c distance between primary profiles, S the c/c distance between secondary profiles, and G the c/c distance between hangers.

4. MEASUREMENT PROCEDURE

The impact sound level measurements were performed according to SS-EN ISO10140-3:2010 with the tapping machine in 5 positions on the concrete floor. The microphone was placed on a rotating boom and the measurement period was 60 seconds, which corresponds to two full revolutions of the rotating boom. The reverberation time in the receiving room were measured using the rotating boom, 16 measurements in total. The measurements were then evaluated according to SS-EN ISO 717-2:2013.

The measurements were performed by Carl Nyqvist in Akustikverkstan's laboratory in Skultorp, Sweden, 2019-01-30 and 2019-02-11.

5. MEASUREMENT EQUIPMENT

Table 2 presents the equipment that was used during the measurements. The equipment fulfils the requirements of Class 1 according to SS-EN 61672-1, 60942 and 61260. Date for last calibration is kept in Akustikverkstan's instrument journal. The equipment was control calibrated before and after the measurements.

Equipment	Brand and type	Serial number
Analyzer	Norsonic 140	1404198
Speaker	IMA Kub 1	9
Microphone cartridge	Norsonic 1225	215330
Microphone preamplifier	Norsonic 1209	13604
Calibrator	Norsonic 1251	31964
Tapping machine	Norsonic 277	2775763
Equalizer	Monacor MEQ-2152	-
Amplifier	Denon POA-2200	-

Table 2: Equipment that was used in the measurements.

6. MEASUREMENT RESULTS

The measurement results have been evaluated according to SS-EN ISO 717-2:2013. The weighted impact sound level and the weighted impact sound improvement, together with selected correction terms are presented in Table 3. The measurement results are presented in detail in the attached measurement protocols 18-718-M1 to M12. The impact sound level of the reference floor is presented in measurement protocol 18-718-M19.

The measurement results are only valid for the tested samples.

Provnr / beskrivning	$L_{n,w}$ (dB)	$C_{1,50-2500}$	ΔL_w (dB)	$C_{1,\Delta}$	Measurement- protocol
1. VT-SFC with 2 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads	53	-6	25	-7	M1, M2
2. VT-SFC with 3 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads	51	-6	28	-7	M3, M4
3. VT-SFC with 4 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads	49	-7	30	-7	M5, M6
4. VT-CBC-RF50 with 2 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads	46	2	32	-15	M7, M8
5. VT-CBC-RF50 with 3 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads	45	0	34	-14	M9, M10
6. VT-CBC-RF50 with 4 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads	43	0	35	-13	M11, M12

Table 3: Selected one-figure measurement results and corresponding measurement protocols.

7. MEASUREMENT PRECISION

The precision of the weighted one-figure numbers is normally within $\pm 2,2$ dB. Typical precisions for each one-third octave band is shown in Table 4. These values corresponds to the repeatability of one standard deviation for this laboratory, based on ten measurements on the heavyweight reference floor during 2004 to 2015.

50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz
$\pm 3,8$ dB	$\pm 3,2$ dB	$\pm 3,1$ dB	$\pm 2,2$ dB	$\pm 2,1$ dB	$\pm 1,5$ dB	$\pm 1,5$ dB
250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz
$\pm 1,1$ dB	$\pm 1,4$ dB	$\pm 0,8$ dB	$\pm 1,1$ dB	$\pm 1,1$ dB	$\pm 1,2$ dB	$\pm 1,3$ dB
1,25 kHz	1,6 kHz	2,0 kHz	2,5 kHz	3,15 kHz	4,0 kHz	5,0 kHz
$\pm 1,5$ dB	$\pm 1,9$ dB	$\pm 1,8$ dB	$\pm 2,3$ dB	$\pm 2,3$ dB	$\pm 2,5$ dB	$\pm 2,8$ dB

Table 4: One standard deviation for impact sound level measurements performed on the 160 mm heavyweight reference floor.

The measurement uncertainties for meteorological parameters are shown in Table 5.

Parameter	Uncertainty
Temperature	$\pm 0,5^{\circ} \text{C}$
Relative humidity	± 3 percent
Air pressure	$\pm 0,5 \text{ kPa}$

Table 5: Measurement uncertainty.

8. DEVIATIONS FROM STANDARDS

No deviations from the applicable standards were made during these measurements.

This report shall only be reprinted in its entirety. The measurement protocols may however be used separately.

Pontus Thorsson
PhD in acoustics

Reviewed by Johan Jernstedt, 2019-05-13

APPENDIX 1: INFORMATION ABOUT THE LABORATORY

Test room 3 (Impact sound room) on the laboratory's first floor has a rectangular shape with the dimensions $L \times B \times H = 4,96 \times 6,25 \times 3,38$ m. The room's volume is 105 m^3 and the total surface for walls, floor and ceiling is 138 m^2 .

Test room 2 (used as receiving room in impact sound measurements) has a rectangular shape with the dimensions $L \times B \times H = 5,0 \times 6,25 \times 3,93$ m. The room's volume is 123 m^3 and the total surface for walls, floor and ceiling is 151 m^2 .

The reference floor's size is $4,0 \times 2,5$ m.

A section for the two rooms together with the location of the reference floor is shown in Figure B1.1.

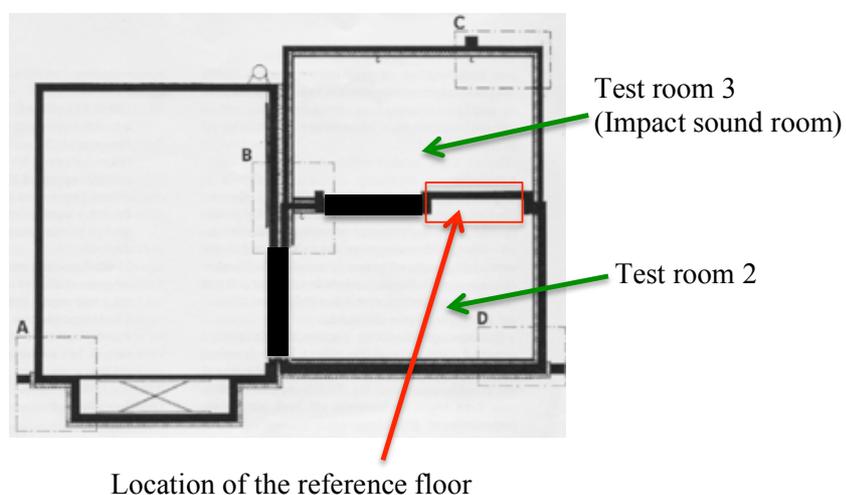


Figure B1.1: Section for Test room 2 and Test room 3 together with the location of the reference floor.

The Laboratory's address is Vallmovägen 11, 541 55 Skövde, Sweden.

APPENDIX 2: PHOTOS FROM THE MEASUREMENTS



Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M1
Date of report: 2019-05-13
Date of test: 2019-01-30
Name: Carl Nyqvist

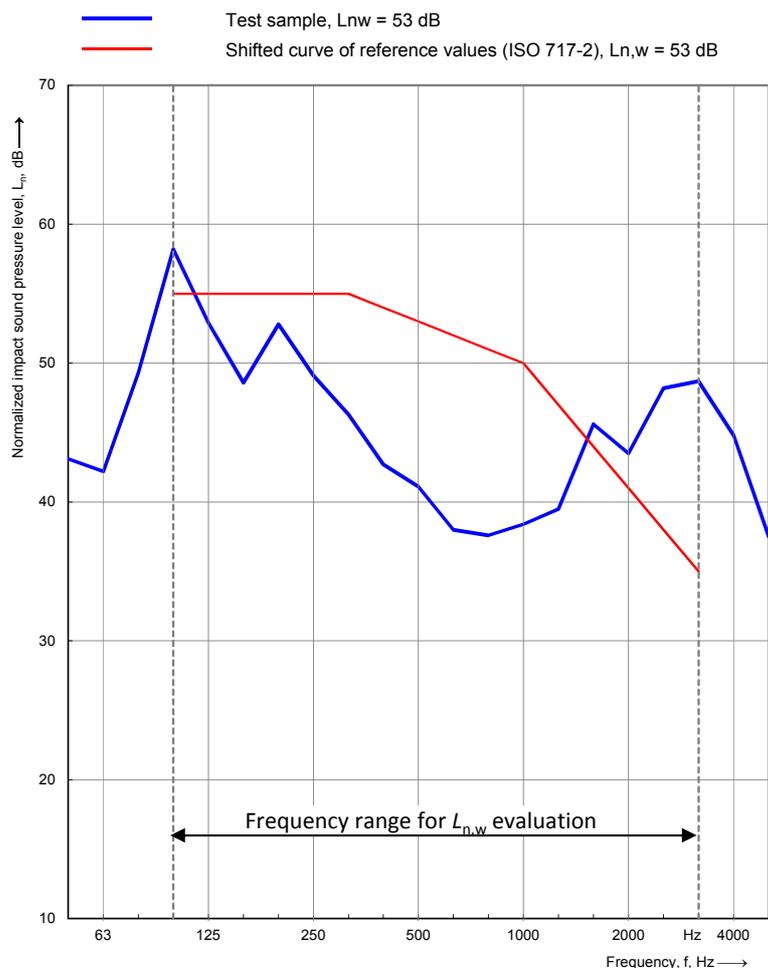
Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
VT-SFC with 2 layers of normal gypsum boards

Description of the specimen:
VT-SFC with 2 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 384 kg/m²
Curing time: 1 days
Barometric pressure: 98,1 kPa
Temperature - source room: 16,5 °C
- receiving room: 16,5 °C
Air humidity - source room: 32,8 %
- receiving room: 32,8 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	43,1
63	42,2
80	49,3
100	58,2
125	52,9
160	48,6
200	52,8
250	49,1
315	46,3
400	42,7
500	41,1
630	38,0
800	37,6
1000	38,4
1250	39,5
1600	45,6
2000	43,5
2500	48,2
3150	48,7
4000	44,8
5000	37,5



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 53 \text{ (} -6 \text{) dB}$$

$$C_{1,50-2500} = -6 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M2
 Date of report: 2019-05-13
 Date of test: 2019-01-30
 Name: Carl Nyqvist

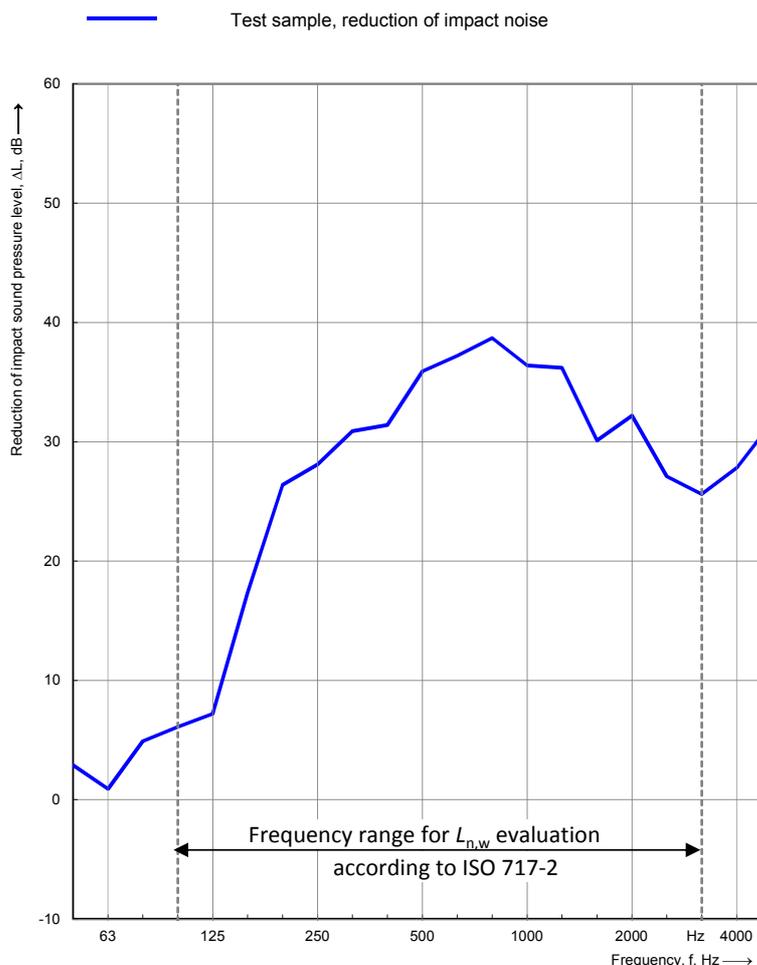
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-SFC with 2 layers of normal gypsum boards

Description of the specimen:
 VT-SFC with 2 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 19 kg/m²
Curing time: 86400 s
Barometric pressure: 98,1 kPa
Temperature - source room: 16,5 °C
 - receiving room: 16,5 °C
Air humidity - source room: 32,8 %
 - receiving room: 32,8 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	2,9
63	43,1	0,9
80	54,2	4,9
100	64,3	6,1
125	60,1	7,2
160	65,9	17,3
200	79,2	26,4
250	77,2	28,1
315	77,2	30,9
400	74,1	31,4
500	77,0	35,9
630	75,2	37,2
800	76,3	38,7
1000	74,8	36,4
1250	75,7	36,2
1600	75,7	30,1
2000	75,7	32,2
2500	75,3	27,1
3150	74,3	25,6
4000	72,6	27,8
5000	69,1	31,6



Rating according to ISO 717-2

ΔL_w = 25 dB

C_{l,A} = -7 dB

C_{l,r} = -4 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M3
Date of report: 2019-05-13
Date of test: 2019-01-30
Name: Carl Nyqvist

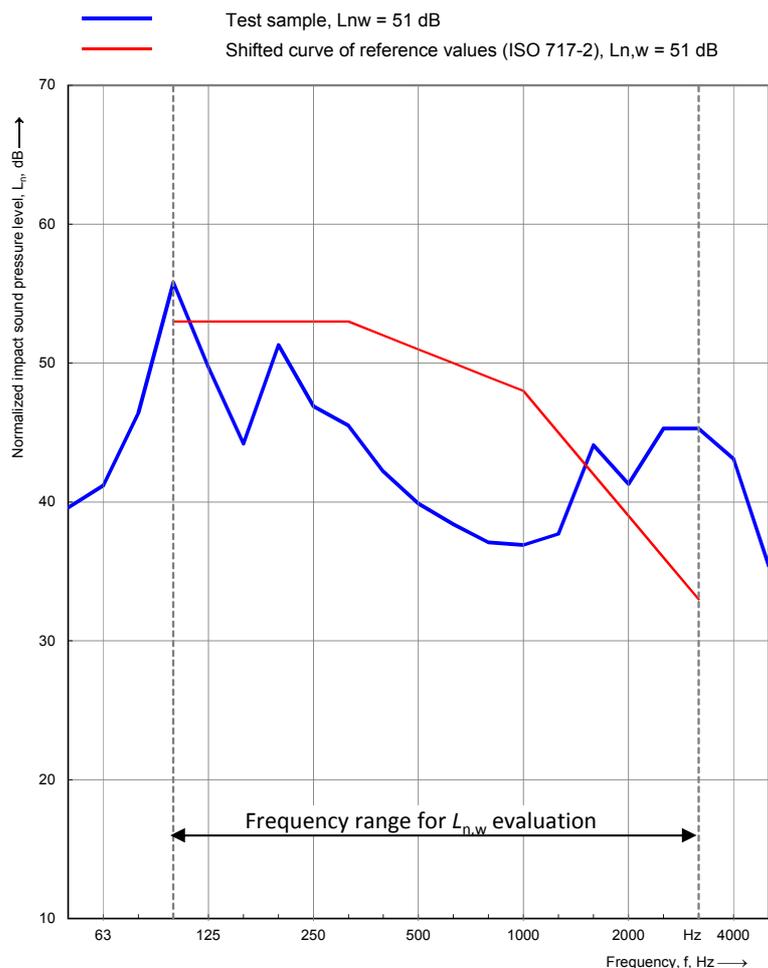
Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
VT-SFC with 3 layers of normal gypsum boards

Description of the specimen:
VT-SFC with 3 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 393 kg/m²
Curing time: 1 days
Barometric pressure: 98,1 kPa
Temperature - source room: 16,5 °C
- receiving room: 16,5 °C
Air humidity - source room: 32,8 %
- receiving room: 32,8 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	39,6
63	41,2
80	46,4
100	55,8
125	49,7
160	44,2
200	51,3
250	46,9
315	45,5
400	42,2
500	39,9
630	38,4
800	37,1
1000	36,9
1250	37,7
1600	44,1
2000	41,3
2500	45,3
3150	45,3
4000	43,1
5000	35,4



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 51 \text{ (-7) dB}$$

$$C_{1,50-2500} = -6 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M4
Date of report: 2019-05-13
Date of test: 2019-01-30
Name: Carl Nyqvist

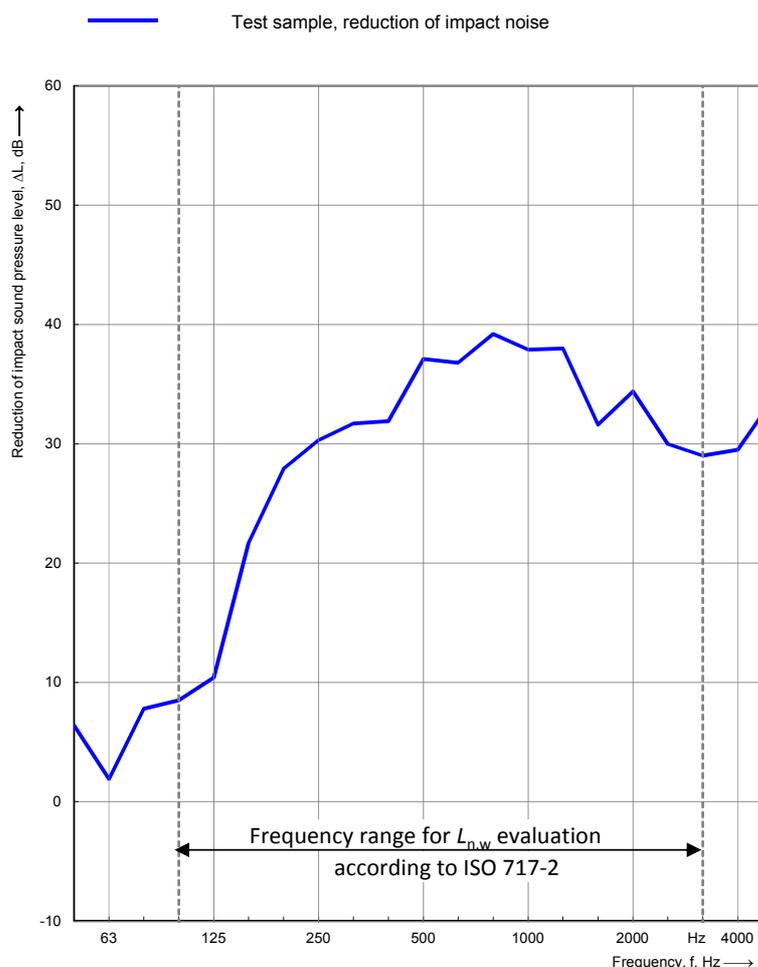
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification: Test room 3 (sending room) to Test room 2 (receiving room)
Product identification: VT-SFC with 3 layers of normal gypsum boards

Description of the specimen: VT-SFC with 3 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 28 kg/m²
Curing time: 86400 s
Barometric pressure: 98,1 kPa
Temperature - source room: 16,5 °C
- receiving room: 16,5 °C
Air humidity - source room: 32,8 %
- receiving room: 32,8 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	6,4
63	43,1	1,9
80	54,2	7,8
100	64,3	8,5
125	60,1	10,4
160	65,9	21,7
200	79,2	27,9
250	77,2	30,3
315	77,2	31,7
400	74,1	31,9
500	77,0	37,1
630	75,2	36,8
800	76,3	39,2
1000	74,8	37,9
1250	75,7	38,0
1600	75,7	31,6
2000	75,7	34,4
2500	75,3	30,0
3150	74,3	29,0
4000	72,6	29,5
5000	69,1	33,7



Rating according to ISO 717-2

ΔL_w = 28 dB

C_{l,A} = -7 dB

C_{l,r} = -4 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M5
Date of report: 2019-05-13
Date of test: 2019-01-30
Name: Carl Nyqvist

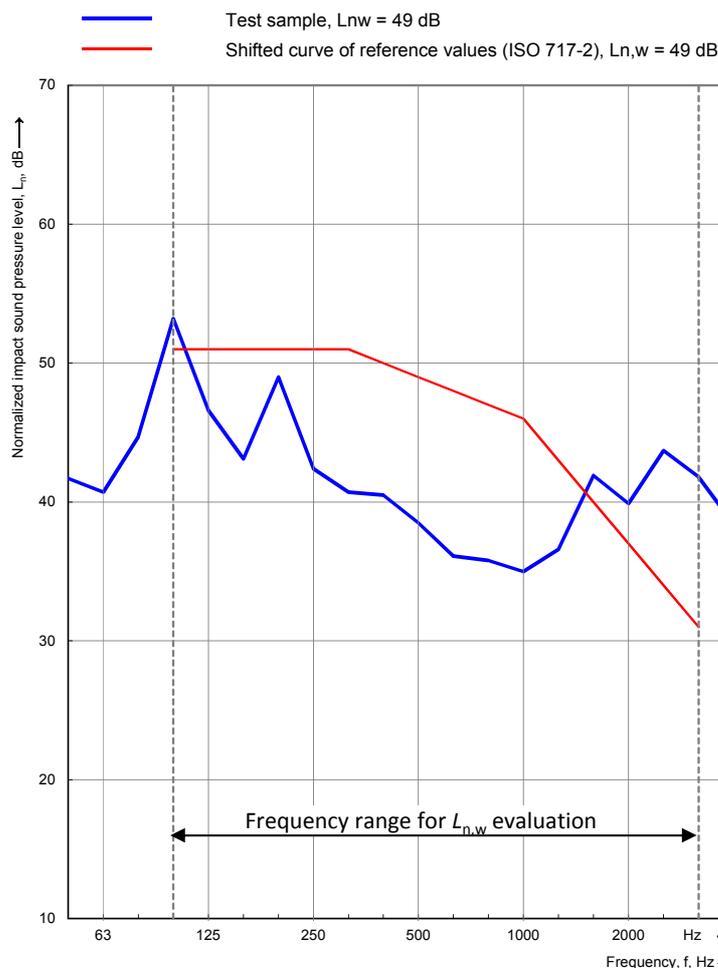
Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
VT-SFC with 4 layers of normal gypsum boards

Description of the specimen:
VT-SFC with 4 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 402 kg/m²
Curing time: 1 days
Barometric pressure: 98,1 kPa
Temperature - source room: 16,5 °C
- receiving room: 16,5 °C
Air humidity - source room: 32,8 %
- receiving room: 32,8 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	41,7
63	40,7
80	44,7
100	53,2
125	46,6
160	43,1
200	49,0
250	42,4
315	40,7
400	40,5
500	38,5
630	36,1
800	35,8
1000	35,0
1250	36,6
1600	41,9
2000	39,9
2500	43,7
3150	41,8
4000	38,4
5000	31,0



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 49 \text{ (-7) dB}$$

$$C_{1,50-2500} = -7 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M6
Date of report: 2019-06-27
Date of test: 2019-01-30
Name: Carl Nyqvist

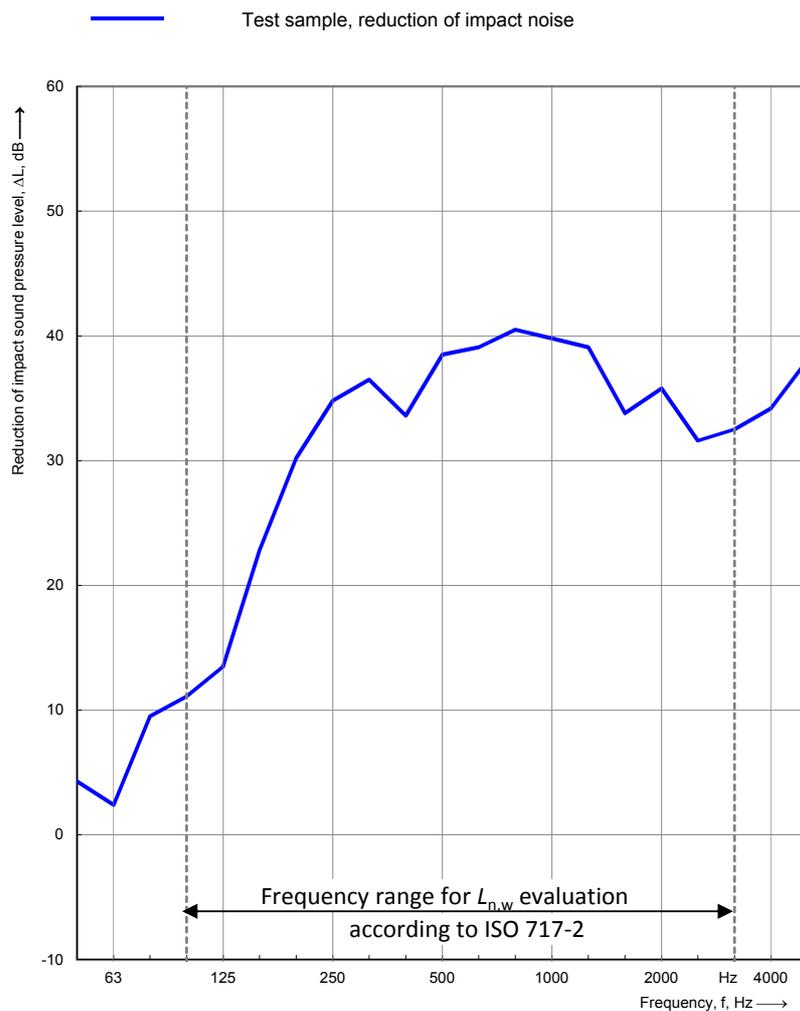
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-SFC with 4 layers of normal gypsum boards

Description of the specimen:
 VT-SFC with 4 layers of 12.5 mm normal gypsum boards. P: 450 mm, G: 900 mm. 250 mm suspension with 95 mm mineral wool. 25 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 37 kg/m²
Curing time: 86400 s
Barometric pressure: 98,1 kPa
Temperature - source room: 16,5 °C
 - receiving room: 16,5 °C
Air humidity - source room: 32,8 %
 - receiving room: 32,8 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	4,3
63	43,1	2,4
80	54,2	9,5
100	64,3	11,1
125	60,1	13,5
160	65,9	22,8
200	79,2	30,2
250	77,2	34,8
315	77,2	36,5
400	74,1	33,6
500	77,0	38,5
630	75,2	39,1
800	76,3	40,5
1000	74,8	39,8
1250	75,7	39,1
1600	75,7	33,8
2000	75,7	35,8
2500	75,3	31,6
3150	74,3	32,5
4000	72,6	34,2
5000	69,1	38,1



Rating according to ISO 717-2

ΔL_w = 30 dB

C_{l,Δ} = -7 dB

C_{l,r} = -4 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M7
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

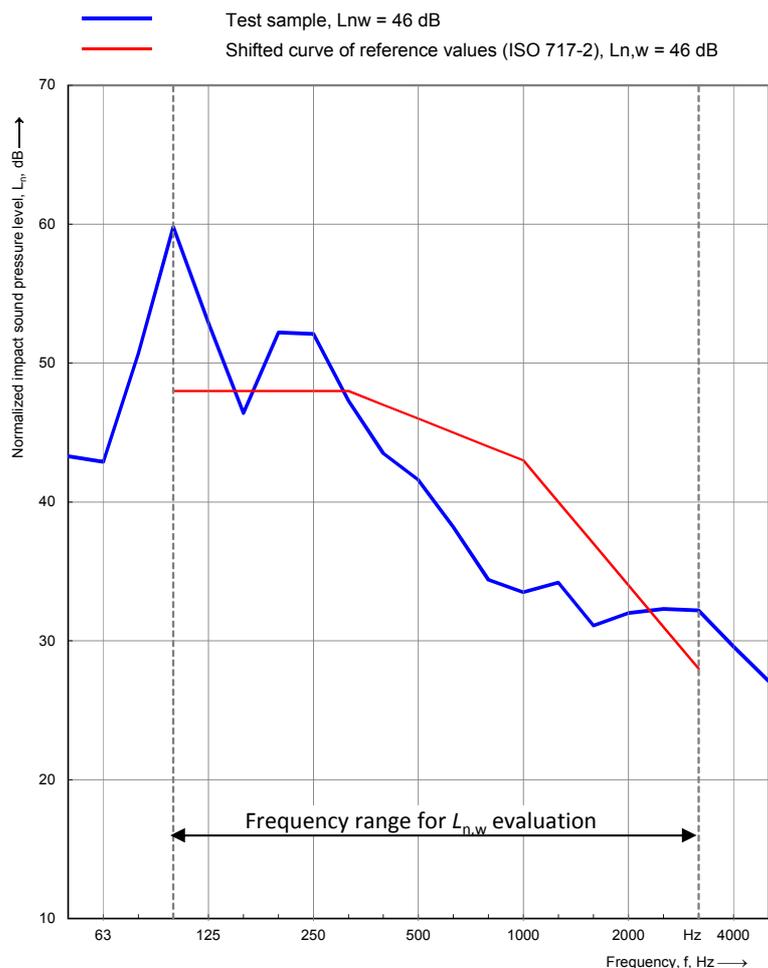
Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
VT-CBC-RF50 with 2 layers of normal gypsum boards

Description of the specimen:
VT-CBC-RF50 with 2 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 385 kg/m²
Curing time: 1 days
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
- receiving room: 17,7 °C
Air humidity - source room: 34,2 %
- receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	43,3
63	42,9
80	50,7
100	59,8
125	52,9
160	46,4
200	52,2
250	52,1
315	47,3
400	43,5
500	41,6
630	38,2
800	34,4
1000	33,5
1250	34,2
1600	31,1
2000	32,0
2500	32,3
3150	32,2
4000	29,6
5000	27,1



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 46 (1) \text{ dB}$$

$$C_{1,50-2500} = 2 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M8
 Date of report: 2019-05-13
 Date of test: 2019-02-11
 Name: Carl Nyqvist

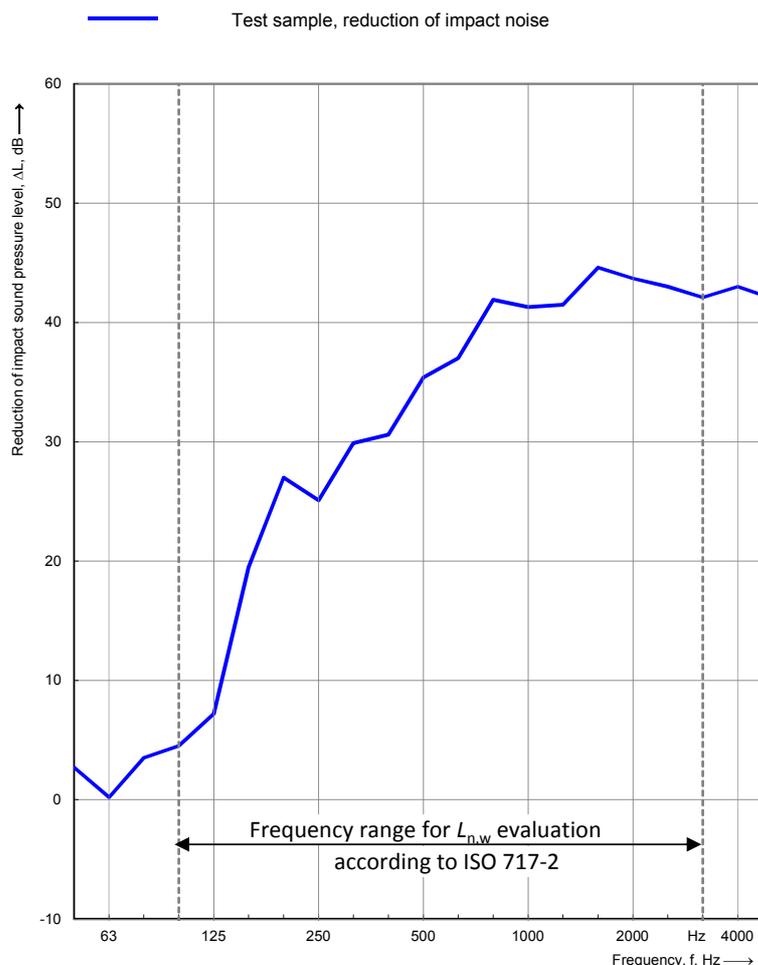
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-CBC-RF50 with 2 layers of normal gypsum boards

Description of the specimen:
 VT-CBC-RF50 with 2 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 20 kg/m²
Curing time: 86400 s
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
 - receiving room: 17,7 °C
Air humidity - source room: 34,2 %
 - receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	2,7
63	43,1	0,2
80	54,2	3,5
100	64,3	4,5
125	60,1	7,2
160	65,9	19,5
200	79,2	27,0
250	77,2	25,1
315	77,2	29,9
400	74,1	30,6
500	77,0	35,4
630	75,2	37,0
800	76,3	41,9
1000	74,8	41,3
1250	75,7	41,5
1600	75,7	44,6
2000	75,7	43,7
2500	75,3	43,0
3150	74,3	42,1
4000	72,6	43,0
5000	69,1	42,0



Rating according to ISO 717-2

ΔL_w = 32 dB

C_{l,A} = -15 dB

C_{l,r} = 4 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M9
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan

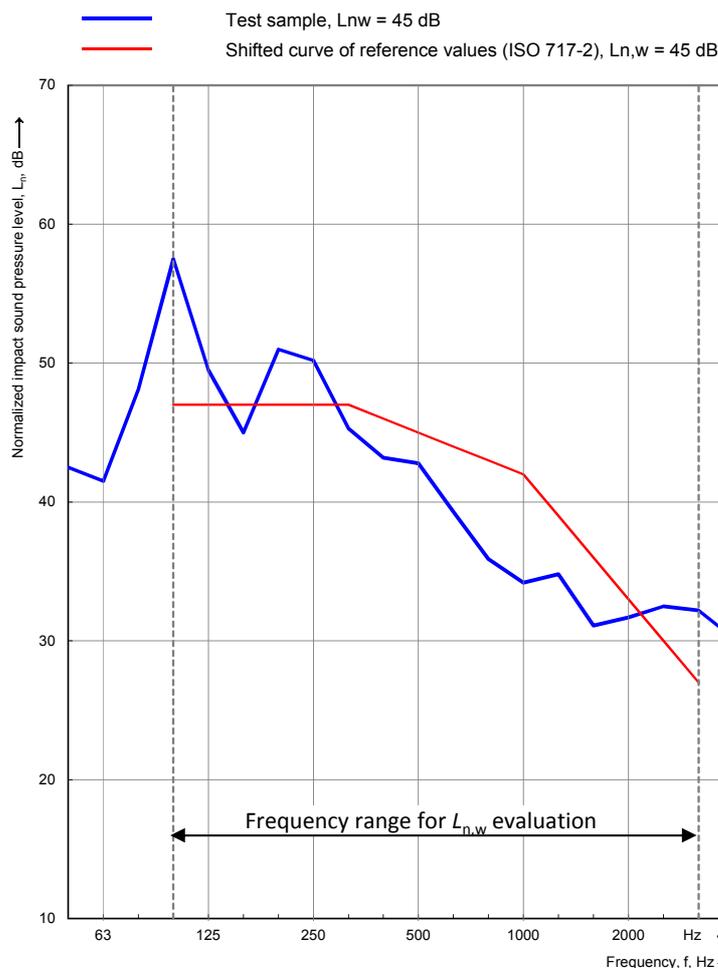
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)

Product identification:
VT-CBC-RF50 with 3 layers of normal gypsum boards

Description of the specimen:
VT-CBC-RF50 with 3 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 394 kg/m²
Curing time: 1 days
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
- receiving room: 17,7 °C
Air humidity - source room: 34,2 %
- receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	42,5
63	41,5
80	48,1
100	57,5
125	49,5
160	45,0
200	51,0
250	50,2
315	45,3
400	43,2
500	42,8
630	39,3
800	35,9
1000	34,2
1250	34,8
1600	31,1
2000	31,7
2500	32,5
3150	32,2
4000	30,2
5000	27,8



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 45 (0) \text{ dB}$$

$$C_{1,50-2500} = 0 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M10
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

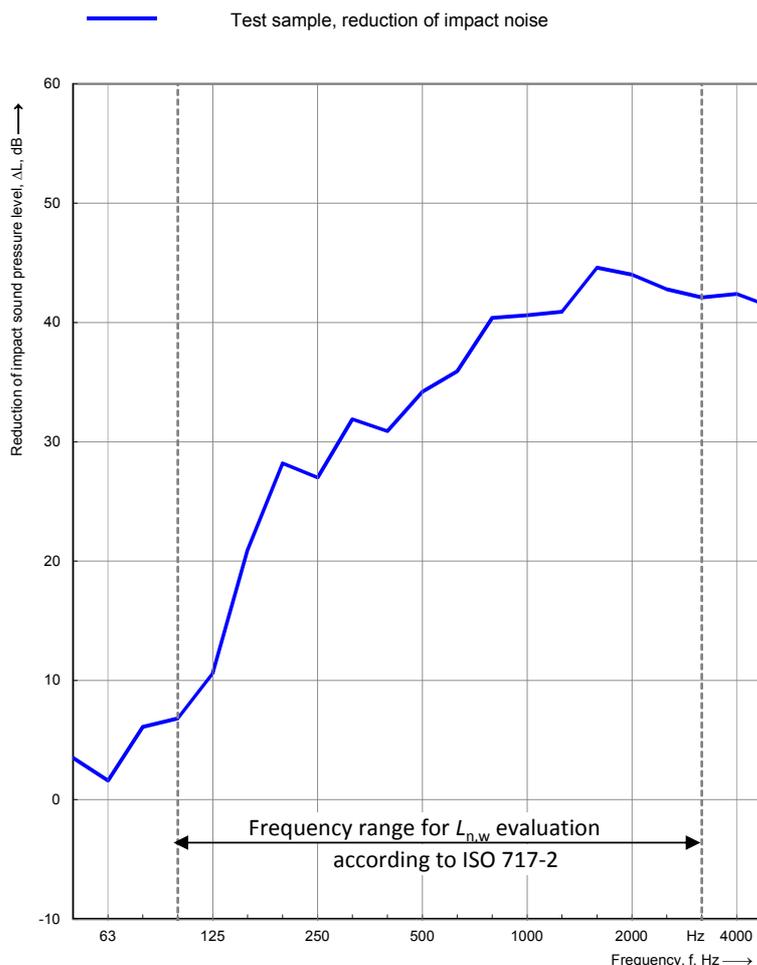
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-CBC-RF50 with 3 layers of normal gypsum boards

Description of the specimen:
 VT-CBC-RF50 with 3 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 29 kg/m²
Curing time: 86400 s
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
 - receiving room: 17,7 °C
Air humidity - source room: 34,2 %
 - receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	3,5
63	43,1	1,6
80	54,2	6,1
100	64,3	6,8
125	60,1	10,6
160	65,9	20,9
200	79,2	28,2
250	77,2	27,0
315	77,2	31,9
400	74,1	30,9
500	77,0	34,2
630	75,2	35,9
800	76,3	40,4
1000	74,8	40,6
1250	75,7	40,9
1600	75,7	44,6
2000	75,7	44,0
2500	75,3	42,8
3150	74,3	42,1
4000	72,6	42,4
5000	69,1	41,3



Rating according to ISO 717-2

ΔL_w = 34 dB

C_{l,A} = -14 dB

C_{l,r} = 3 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

No. of test report: 18-718-M11
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

Laboratory measurements of impact sound insulation of floors

Client: Vibratex Akustikprodukter AB
Manufacturer: Vibratex Akustikprodukter AB
Test specimen mounted by: Akustikverkstan

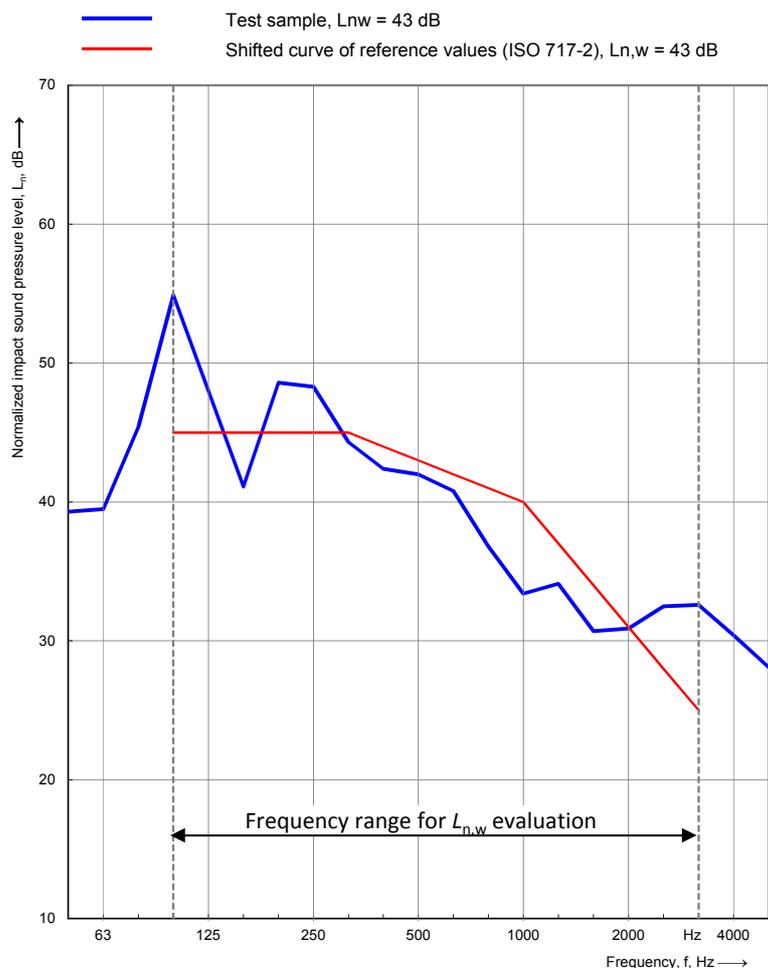
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)

Product identification:
VT-CBC-RF50 with 4 layers of normal gypsum boards

Description of the specimen:
VT-CBC-RF50 with 4 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 403 kg/m²
Curing time: 1 days
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
- receiving room: 17,7 °C
Air humidity - source room: 34,2 %
- receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	39,3
63	39,5
80	45,4
100	54,9
125	48,0
160	41,1
200	48,6
250	48,3
315	44,3
400	42,4
500	42,0
630	40,8
800	36,8
1000	33,4
1250	34,1
1600	30,7
2000	30,9
2500	32,5
3150	32,6
4000	30,4
5000	28,1



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 43 (0) \text{ dB}$$

$$C_{1,50-2500} = 0 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

Reduction of impact sound pressure level according to ISO 10140

No. of test report: 18-718-M12
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

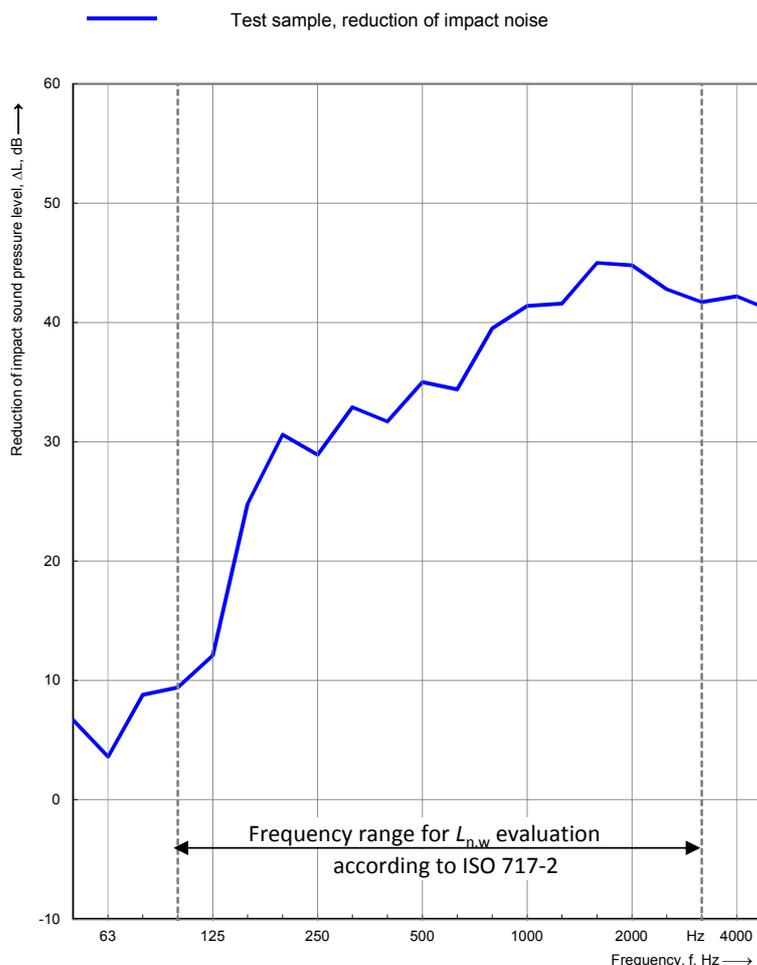
Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: Akustikverkstan
Test room identification:
 Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
 VT-CBC-RF50 with 4 layers of normal gypsum boards

Description of the specimen:
 VT-CBC-RF50 with 4 layers of 12.5 mm normal gypsum boards. P: 750 mm, S: 400 mm, G: 600 mm. 250 mm suspension with 95 mm mineral wool. 50 mm elastic pads. Mounted under 160 mm heavyweight reference concrete floor.

Mass per unit area: 38 kg/m²
Curing time: 86400 s
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
 - receiving room: 17,7 °C
Air humidity - source room: 34,2 %
 - receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _{n,0} 1/3 octave [dB]	ΔL 1/3 octave [dB]
50	46,0	6,7
63	43,1	3,6
80	54,2	8,8
100	64,3	9,4
125	60,1	12,1
160	65,9	24,8
200	79,2	30,6
250	77,2	28,9
315	77,2	32,9
400	74,1	31,7
500	77,0	35,0
630	75,2	34,4
800	76,3	39,5
1000	74,8	41,4
1250	75,7	41,6
1600	75,7	45,0
2000	75,7	44,8
2500	75,3	42,8
3150	74,3	41,7
4000	72,6	42,2
5000	69,1	41,0



Rating according to ISO 717-2

ΔL_w = 35 dB

C_{l,A} = -13 dB

C_{l,r} = 2 dB

These results are based on test made with an artificial source under laboratory conditions obtained in one-third-octave bands by an engineering method.

Normalized impact sound pressure levels according to ISO 10140-3

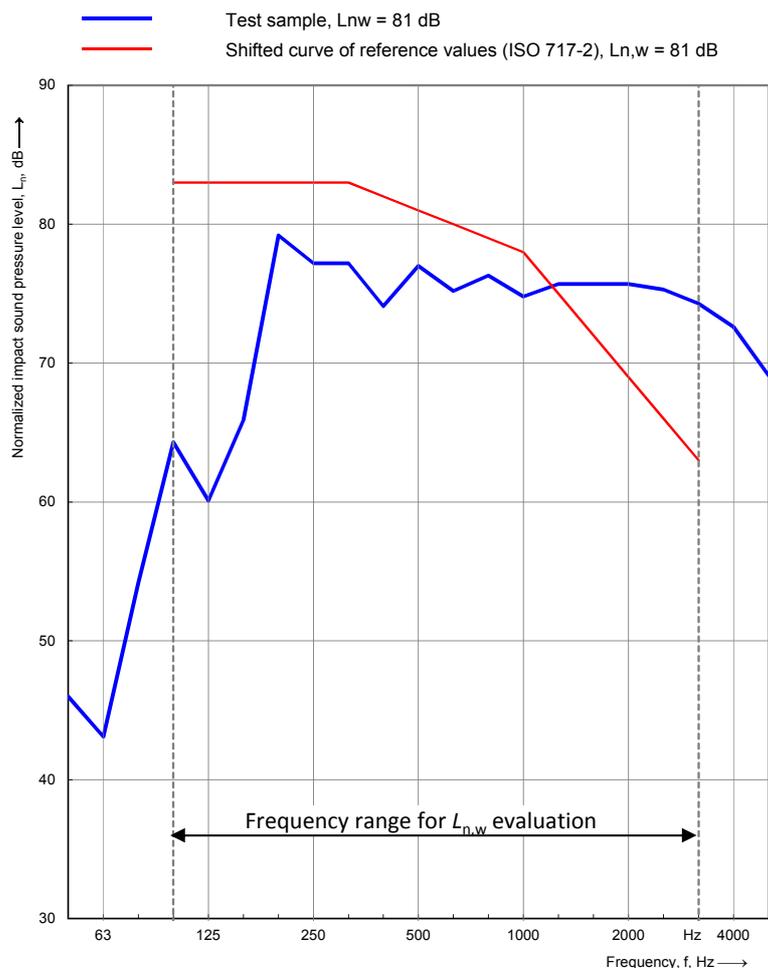
No. of test report: 18-718-M19
Date of report: 2019-05-13
Date of test: 2019-02-11
Name: Carl Nyqvist

Laboratory measurements of impact sound insulation of floors

Client: Vibratec Akustikprodukter AB
Manufacturer: Vibratec Akustikprodukter AB
Test specimen mounted by: -
Test room identification:
Test room 3 (sending room) to Test room 2 (receiving room)
Product identification:
Heavyweight reference floor, 160 mm concrete
Description of the specimen:
Heavyweight type 2

Mass per unit area: 365 kg/m²
Curing time: 0 days
Barometric pressure: 99,2 kPa
Temperature - source room: 17,7 °C
- receiving room: 17,7 °C
Air humidity - source room: 34,2 %
- receiving room: 34,2 %
Source room volume: 105 m³
Receiving room volume: 123,0 m³

Frequency f [Hz]	L _n 1/3 octave [dB]
50	46,0
63	43,1
80	54,2
100	64,3
125	60,1
160	65,9
200	79,2
250	77,2
315	77,2
400	74,1
500	77,0
630	75,2
800	76,3
1000	74,8
1250	75,7
1600	75,7
2000	75,7
2500	75,3
3150	74,3
4000	72,6
5000	69,1



Rating according to ISO 717-2

$$L_{n,w}(C_1) = 81 \text{ (-9) dB}$$

$$C_{1,50-2500} = -9 \text{ dB}$$

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.