REPORT

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Ecophon AB
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Determination of airborne sound reduction improvement index of suspended ceilings below a bare concrete floor

(17 enclosures)

Client

Ecophon AB

Test object

Suspended ceilings listed in table 1.

Date of arrival of test objects

December 2005

Date of test

December 12, 2005 until April 4, 2006.

Results

The airborne direct difference of the weighted sound reduction improvement index ($\Delta Rw,direct$) is given in table 1 and airborne sound reduction improvement index (ΔR) for each frequency band is given in enclosure 1-17.

The results at and above 2000 Hz may be affected by flanking transmission. In that case the result of the improvement might be too low. The airborne direct difference of weighted sound reduction index is however not affected.

The test results are valid for the tested objects only.

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Table 1

Suspended ceiling:	ΔR_W (dB)	Enclosure
Combison Duo A Mounting depth: 200 mm	7	1
Combison Duo A + Combison XR 50 mm Mounting depth: 200 mm	12	2
Combison Duo A + 2 layers Combison XR 50 mm Mounting depth: 200 mm	15	3
Combison Duo E Mounting depth: 200 mm	7	4
Master A Mounting depth: 200 mm	6	5
Combison Uno A Mounting depth: 200 mm	7	6
Master C/D Mounting depth: 200 mm	9	7
Master C/D with splines Mounting depth: 200 mm	9	8
Combison Uno D Mounting depth: 200 mm	7	9
Master C/D Mounting depth: 440 mm	9	10
Master A + Combison XR 50 mm Mounting depth: 440 mm	10	11
Master A Mounting depth: 440 mm	7	12
Combison Uno A Mounting depth: 440 mm	10	13
Combison Duo A Mounting depth: 440 mm	11	14
Combison Duo A + Combison XR 50 mm Mounting depth: 440 mm	16	15
Combison Duo A + 2 layers Combison XR 50 mm Mounting depth: 440 mm	18	16
Master C Mounting depth: 55 mm	4	17

Test method

The test on the bare concrete floor and on the concrete floor with a suspended ceiling under has been made according to the international standard EN ISO 140-3:1995.

The sound insulation improvement of the suspended ceilings was determined by comparing the sound insulation in each third octave band with the bare concrete floor with and without the suspended ceilings.

Airborne sound reduction improvement index:

$$\Delta R = R_{with} - R_{without}$$

ΔR = Airborne sound reduction improvement index.
R_{with} = The sound reduction of the bare concrete floor with suspended ceiling below.
$R_{without}$ = The sound reduction of the bare concrete floor without test object.

Airborne direct difference of the weighted sound reduction improvement index:

$$\Delta R_{w,direct} = R_{w,with} - R_{w,without}$$

$\Delta R_{w,direct}$ = Airborne direct difference of the weighted sound reduction improvement index.
$R_{w,with}$ = The weighted sound reduction of the bare concrete floor with suspended ceiling below.
$R_{w,without}$ = The weighted sound reduction of the bare concrete floor without test object.

The test and the vocabulary are in line with the draft international standard ISO/DIS 140-16.

Mounting of test object

The mounting was made by Borås Akustik AB, Tommy Petersson.

Equipment

Instrument	Manufacturer	Type	Serial / SP no.
Frequency analyser	Norsonic	830	10765
Calibrator	Brüel & Kjaer	4230	1410946
Microphone source room	Brüel & Kjær	4166	1011605
Microphone receiving room	Brüel & Kjær	4166	1011722
Mic. preamplifier source room	Brüel & Kjaer	2619	970951
Mic. preamplifier rec. room	Brüel & Kjaer	2619	971003
Rotating stand source room	Brüel & Kjaer	3923	612159
Rotating stand rec. room	Brüel & Kjaer	3923	681300
Mic. power supply source room	Brüel & Kjaer	2804	815268
Mic. power supply rec. room	Brüel & Kjaer	2804	455245

SP Swedish National Testing and Research Institute
Energy Technology - Acoustics

Håkan Andersson
Technical Manager

Joachim Stadig
Technical Officer

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Acoustics

Enclosure 1

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

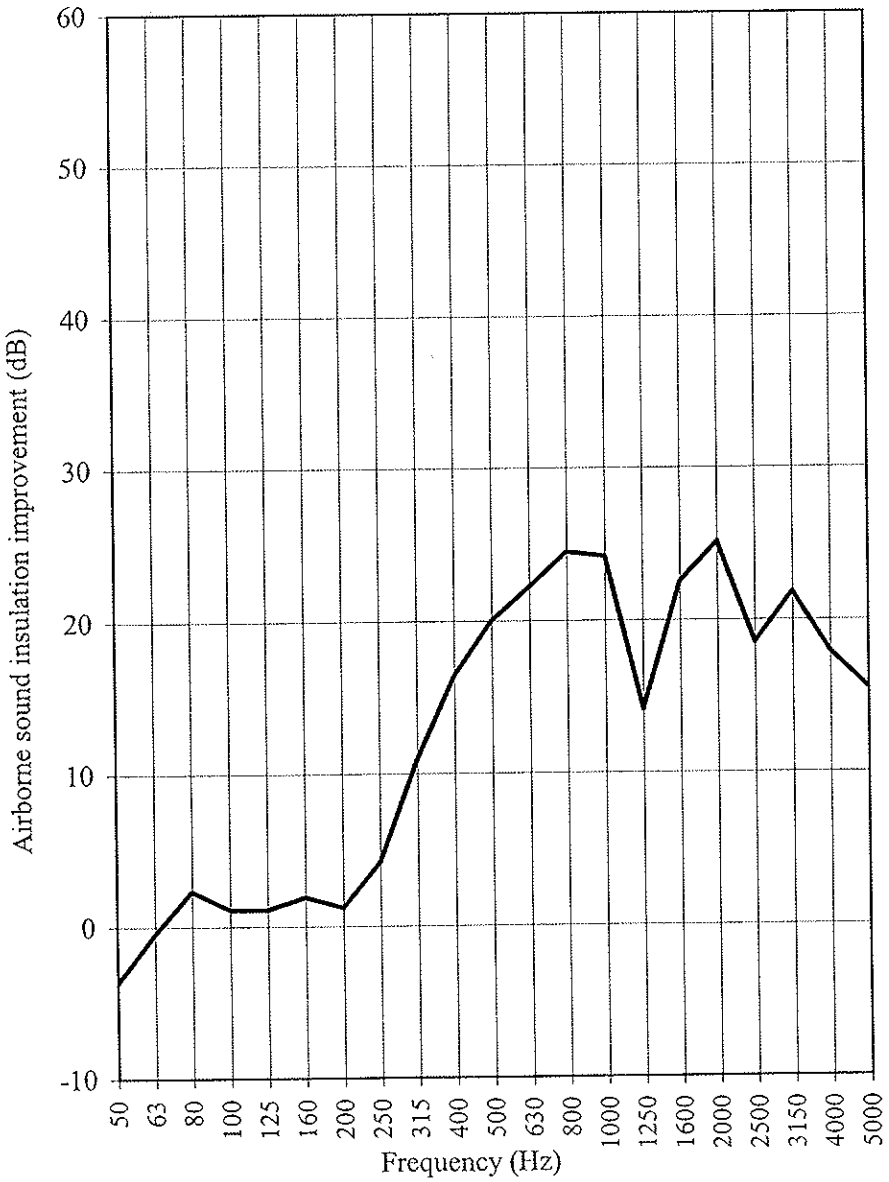
Client: Ecophon AB

Test object: Combison Duo A, mounting depth 200 mm

Test date: 2005-12-12

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-3,7
63	-0,5
80	2,3
100	1,1
125	1,1
160	1,9
200	1,2
250	4,2
315	10,9
400	16,4
500	20,0
630	22,2
800	24,5
1000	24,2
1250	14,1
1600	22,5
2000	25,1
2500	18,5
3150	21,8
4000	17,9
5000	15,5

$\Delta R_w = 7$

Acoustics

Enclosure 2

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

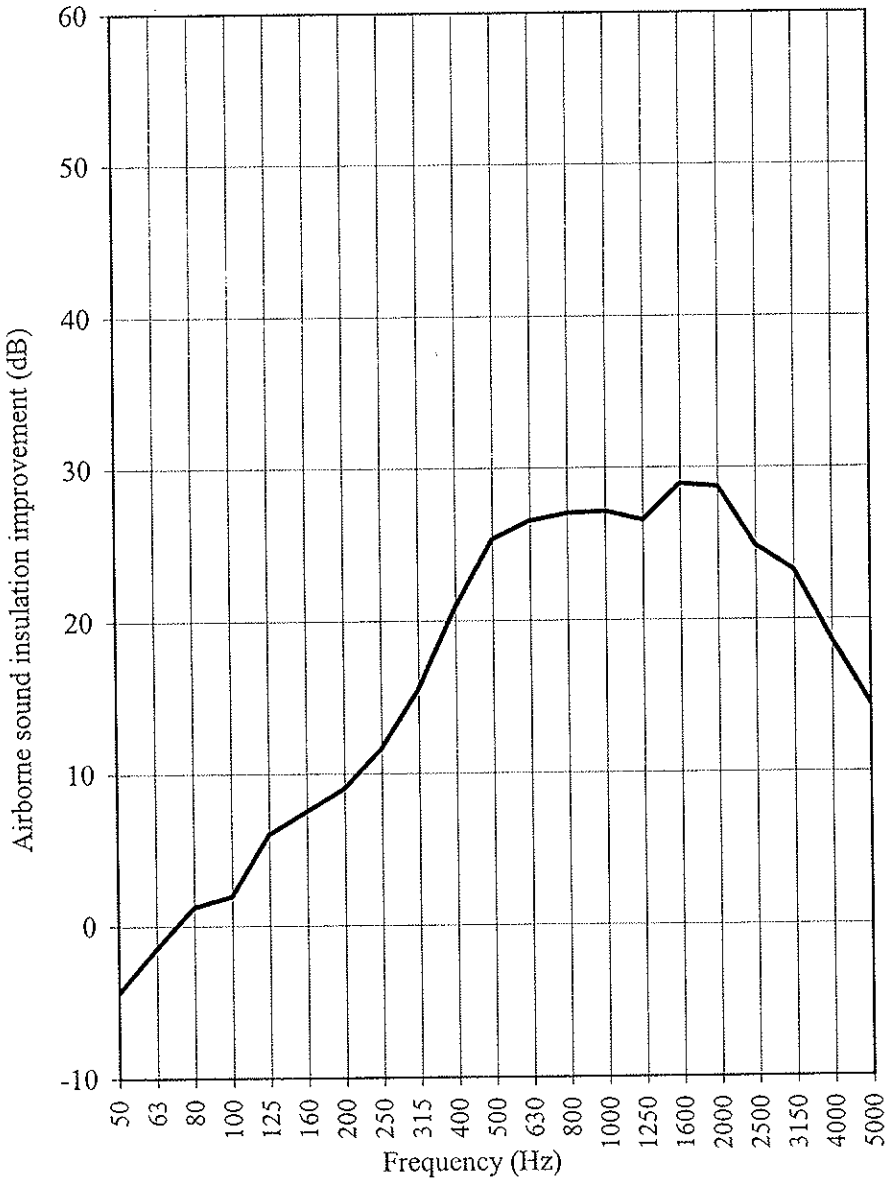
Client: Ecophon AB

Test object: Combison Duo A + Combison XR 50 mm, mounting depth 200 mm

Test date: 2006-01-04

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Result: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-4,4
63	-1,5
80	1,2
100	1,9
125	6,0
160	7,5
200	9,0
250	11,6
315	15,5
400	20,9
500	25,3
630	26,5
800	27,0
1000	27,1
1250	26,5
1600	28,9
2000	28,7
2500	24,8
3150	23,2
4000	18,6
5000	14,4

$\Delta R_w = 12$

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Enclosure 3

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

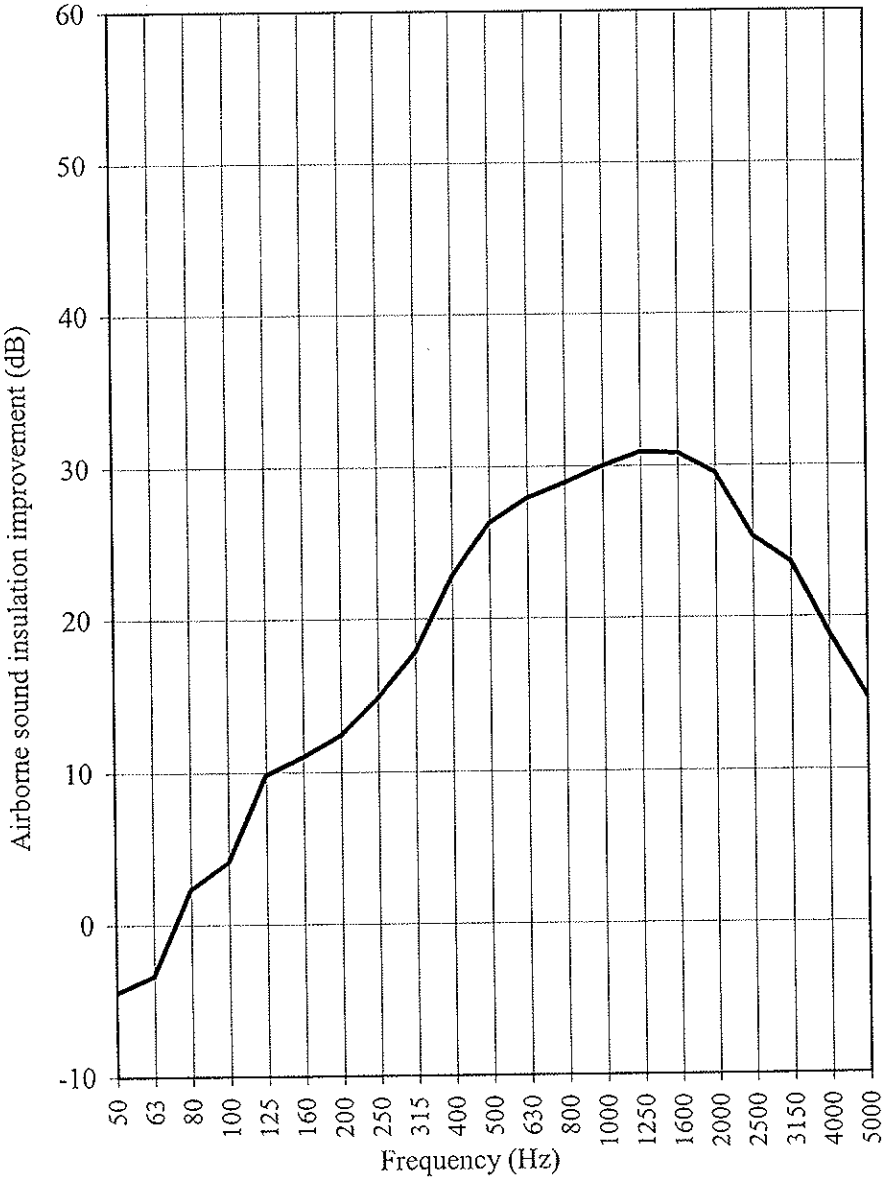
Client: Ecophon AB

Test object: Combison Duo A + 2 layers of Combison XR 50 mm, mounting depth 200 mm

Test date: 2006-01-09

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-4,5
63	-3,4
80	2,3
100	4,1
125	9,8
160	11,0
200	12,4
250	14,8
315	17,8
400	22,8
500	26,3
630	27,9
800	28,9
1000	30,0
1250	30,9
1600	30,8
2000	29,5
2500	25,3
3150	23,6
4000	18,9
5000	14,7

$\Delta R_w = 15$

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Enclosure 4

Determination of improvement of airborne sound insulation of suspended ceilings on bare concrete floors

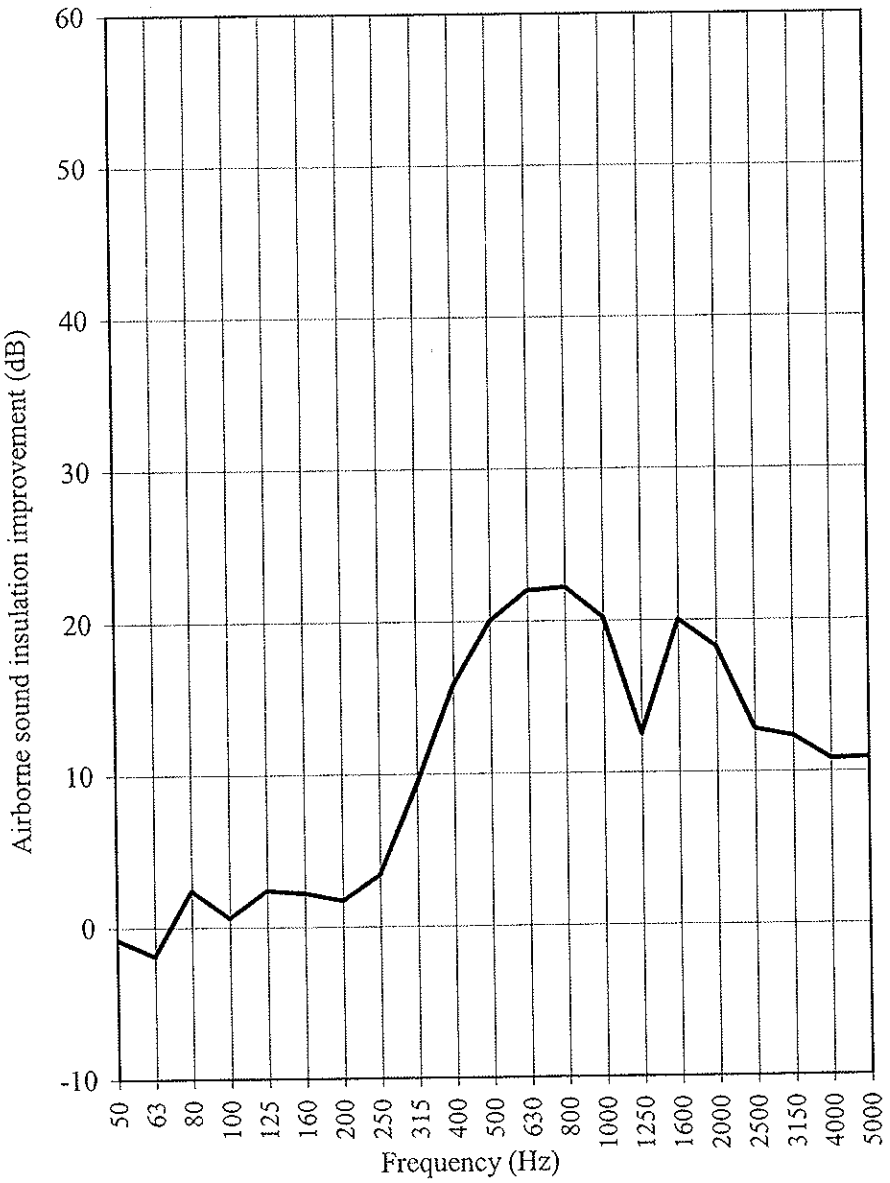
Client: Ecophon AB

Test object: Combison Duo E, mounting depth 200 mm

Test date: 2006-01-02

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-0,8
63	-1,9
80	2,4
100	0,6
125	2,4
160	2,2
200	1,7
250	3,4
315	9,3
400	15,8
500	20,0
630	22,0
800	22,2
1000	20,2
1250	12,5
1600	20,0
2000	18,2
2500	12,8
3150	12,3
4000	10,8
5000	10,9

$\Delta R_w = 7$

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Enclosure 5

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

Client: Ecophon AB

Test object: Master A, mounting depth 200 mm

Test date: 2006-01-10

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w

Frequency (Hz)	ΔR (dB)
50	-2,4
63	-2,8
80	-1,2
100	0,8
125	2,5
160	2,4
200	2,7
250	4,0
315	7,2
400	9,7
500	11,3
630	12,3
800	11,2
1000	8,6
1250	11,7
1600	15,1
2000	14,6
2500	15,3
3150	16,0
4000	15,9
5000	13,9

$\Delta R_w = 6$

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Enclosure 6

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

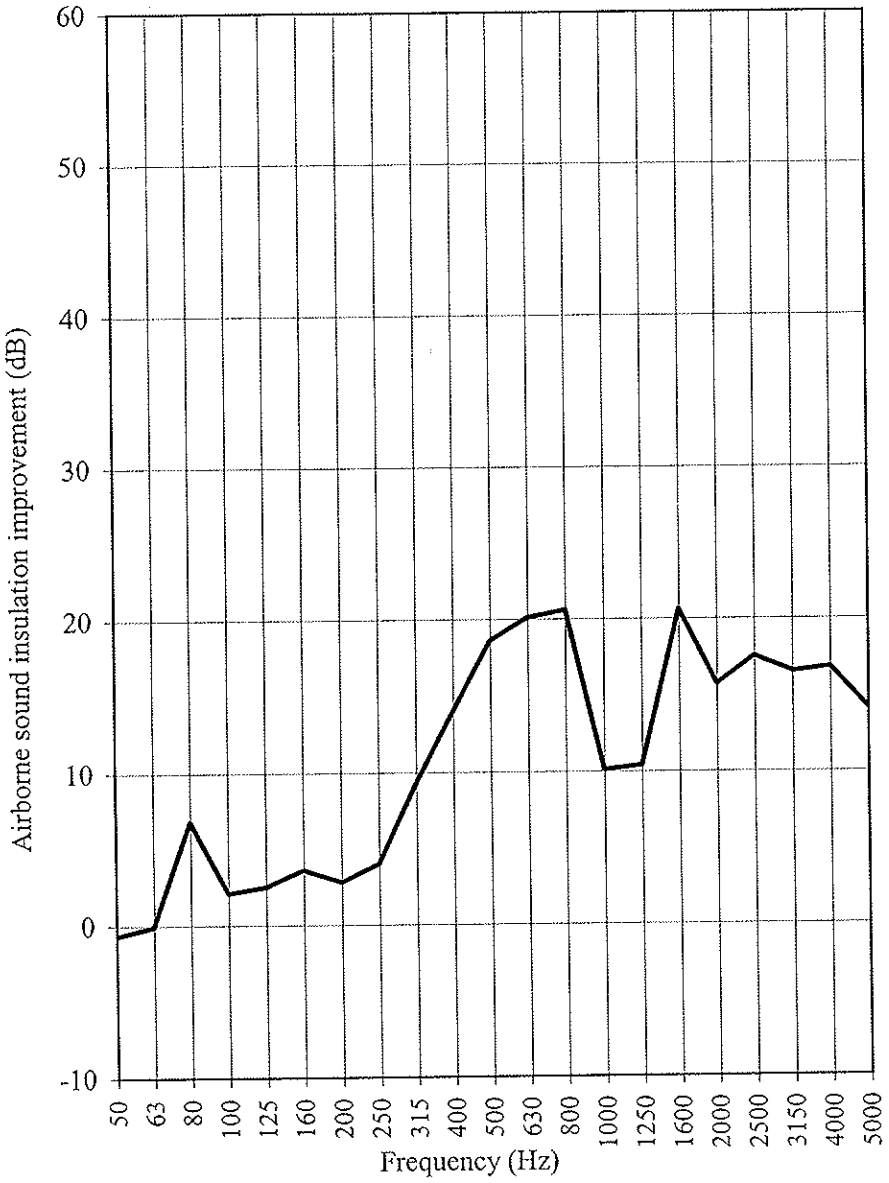
Client: Ecophon AB

Test object: Combison Uno A, mounting depth 200 mm

Test date: 2006-01-17

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-0,7
63	-0,1
80	6,8
100	2,1
125	2,5
160	3,6
200	2,8
250	4,0
315	9,3
400	14,0
500	18,6
630	20,1
800	20,6
1000	10,1
1250	10,4
1600	20,6
2000	15,7
2500	17,5
3150	16,5
4000	16,8
5000	14,1

$\Delta R_w = 7$

Acoustics

Enclosure 7

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

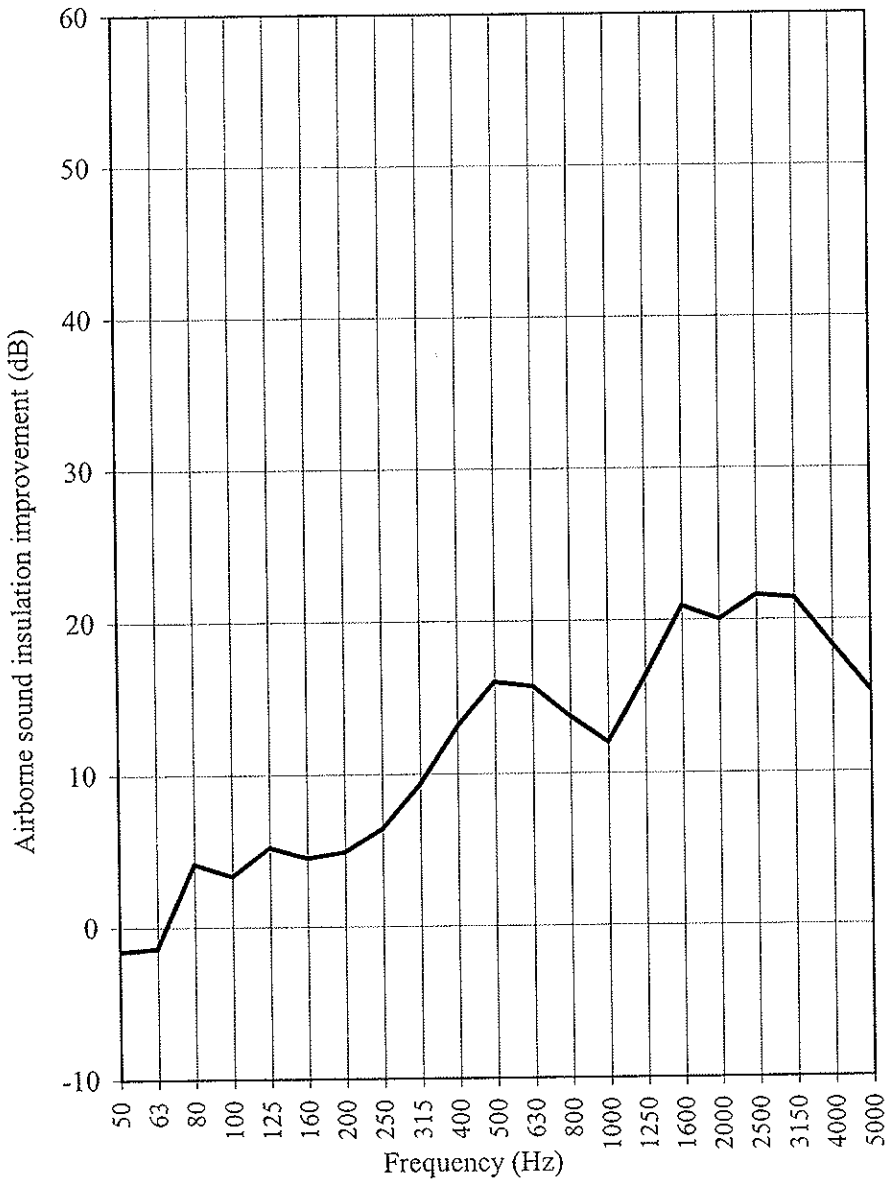
Client: Ecophon AB

Test object: Master C/D, mounting depth 200 mm

Test date: 2006-02-09

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-1,6
63	-1,4
80	4,1
100	3,3
125	5,2
160	4,5
200	4,9
250	6,4
315	9,3
400	13,1
500	16,0
630	15,7
800	13,7
1000	12,0
1250	16,3
1600	20,9
2000	20,0
2500	21,6
3150	21,4
4000	18,3
5000	15,3

$\Delta R_w = 9$

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Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

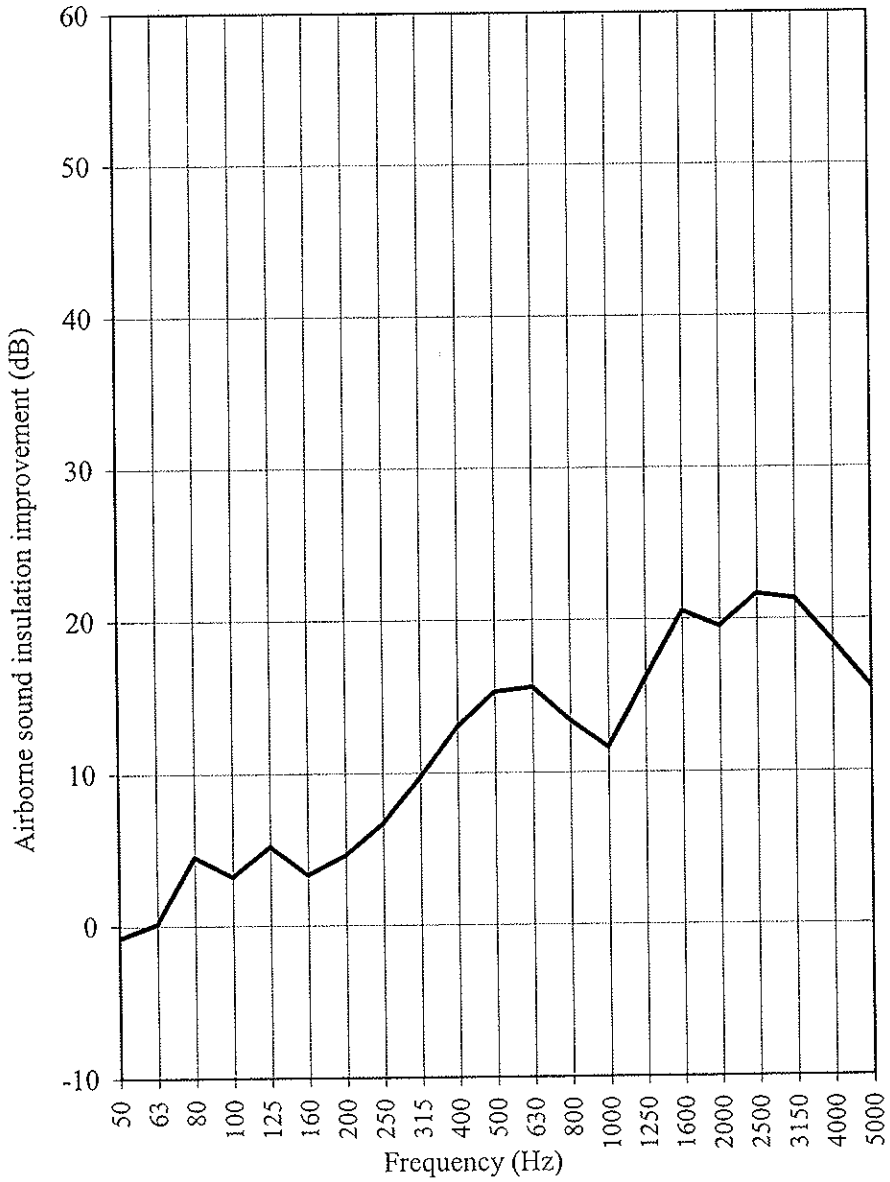
Client: Ecophon AB

Test object: Master C/D with splines, mounting depth 200 mm

Test date: 2006-02-20

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-0,8
63	0,1
80	4,5
100	3,2
125	5,2
160	3,3
200	4,6
250	6,7
315	9,7
400	13,0
500	15,3
630	15,6
800	13,4
1000	11,6
1250	16,1
1600	20,5
2000	19,5
2500	21,6
3150	21,3
4000	18,5
5000	15,5

$\Delta R_w = 9$

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Enclosure 9

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

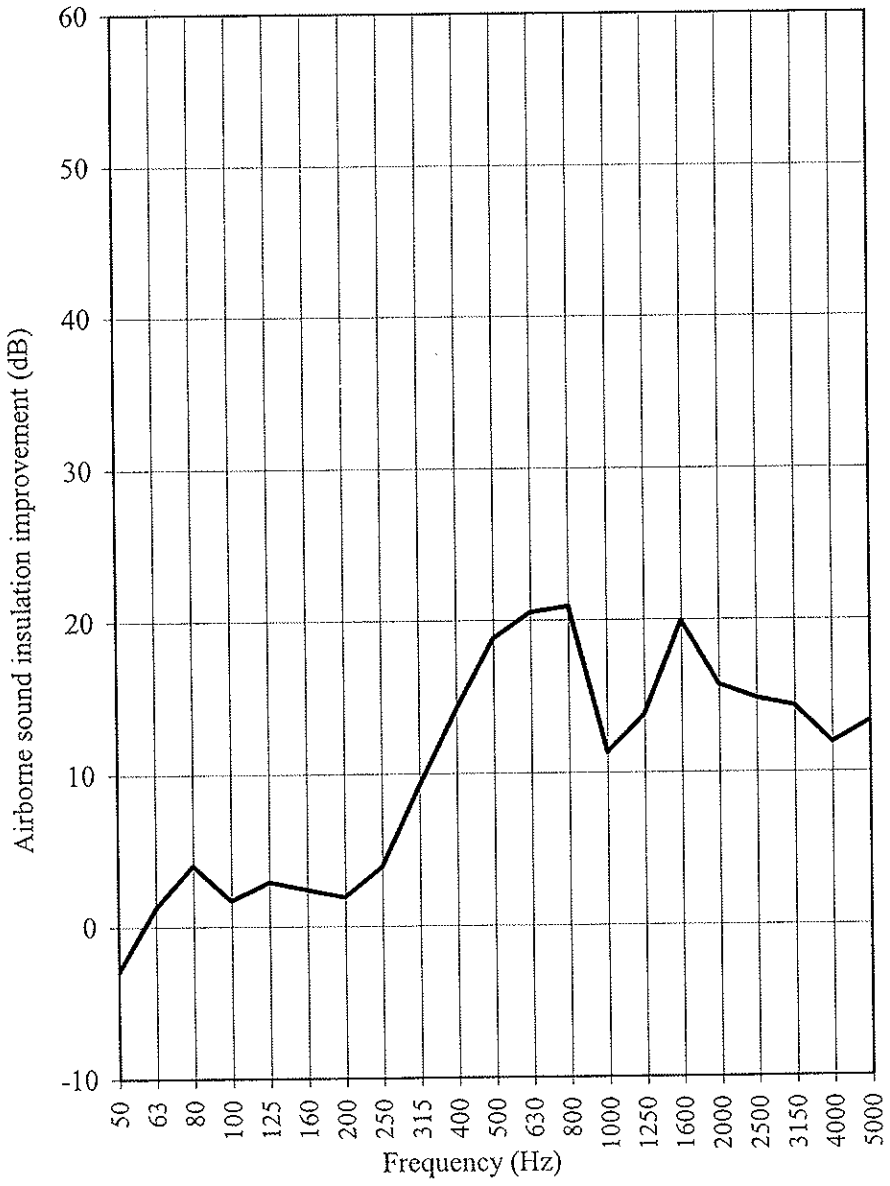
Client: Ecophon AB

Test object: Combison Uno D, mounting depth 200 mm

Test date: 2006-02-23

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-3,0
63	1,2
80	4,0
100	1,7
125	2,9
160	2,4
200	1,9
250	3,9
315	9,2
400	14,2
500	18,8
630	20,5
800	20,9
1000	11,3
1250	13,8
1600	19,9
2000	15,7
2500	14,8
3150	14,3
4000	11,9
5000	13,3

$\Delta R_w = 7$

Date	Reference	Page
2006-06-28	P505126-C	1 (1)

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Enclosure 10

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

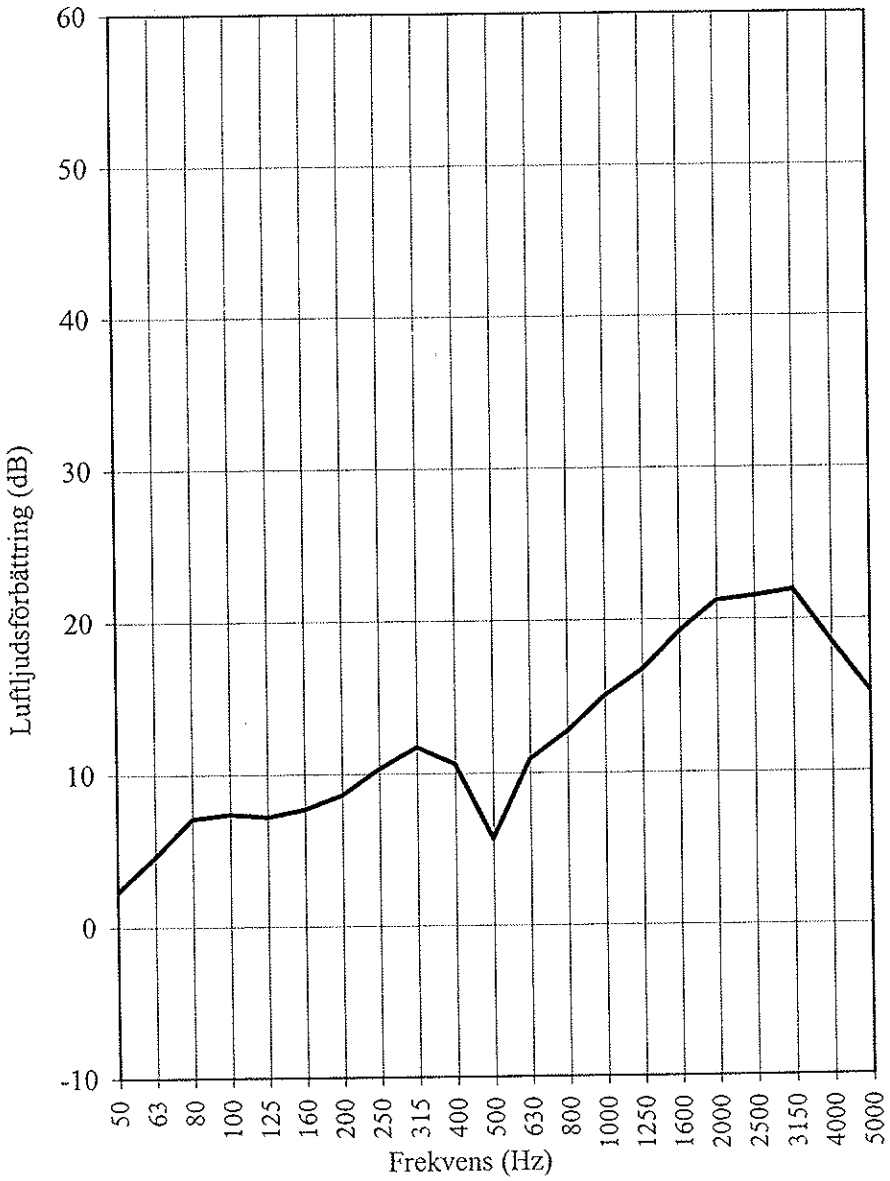
Client: Ecophon AB

Test object: Master C/D, mounting depth 440 mm

Test date: 2006-03-10

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frekvens (Hz)	ΔR (dB)
50	2,3
63	4,6
80	7,1
100	7,4
125	7,2
160	7,7
200	8,6
250	10,3
315	11,7
400	10,6
500	5,7
630	10,9
800	12,7
1000	15,0
1250	16,7
1600	19,2
2000	21,2
2500	21,5
3150	21,9
4000	18,5
5000	15,2

$\Delta R_w = 9$

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Enclosure 11

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

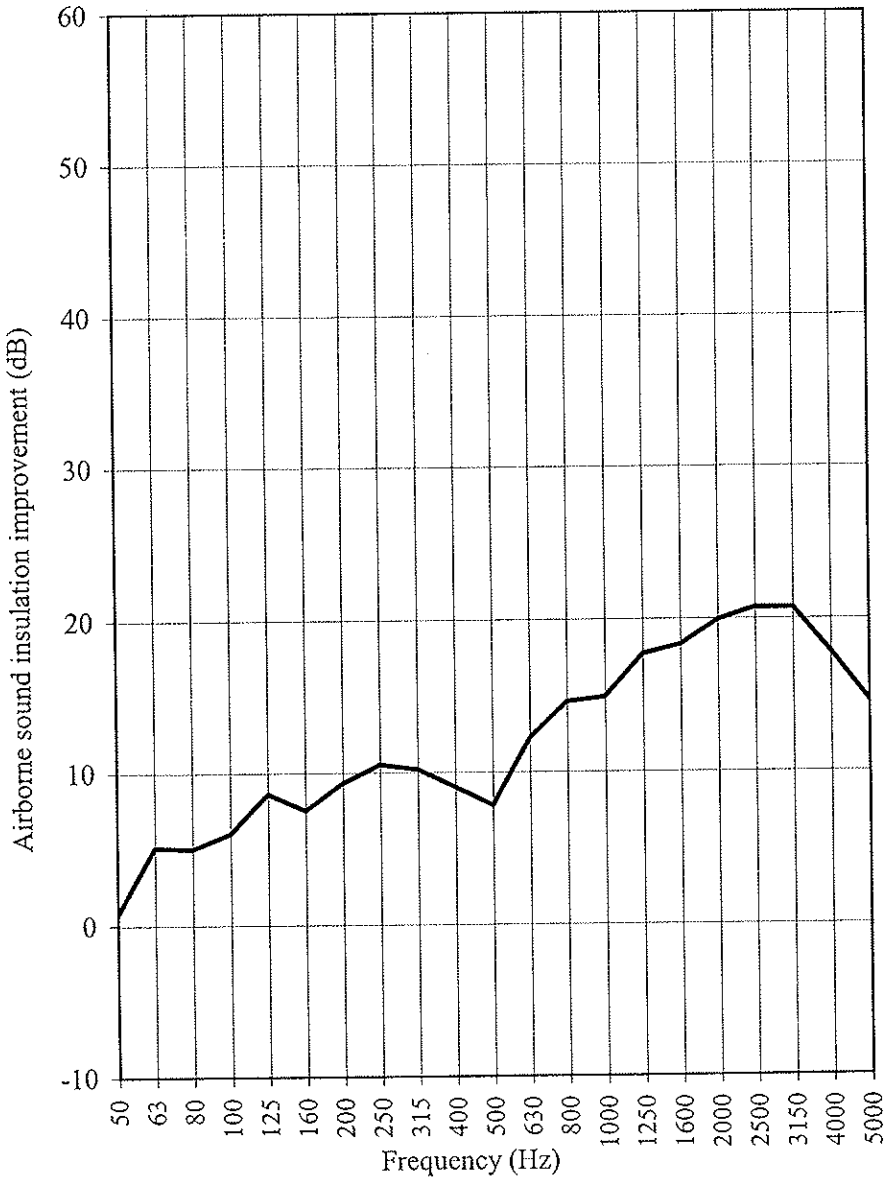
Client: Ecophon AB

Test object: Master A + Combison XR 50 mm, mounting depth 440 mm

Test date: 2006-03-13

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	0,7
63	5,1
80	5,0
100	6,0
125	8,6
160	7,5
200	9,3
250	10,5
315	10,2
400	9,0
500	7,8
630	12,2
800	14,6
1000	14,9
1250	17,7
1600	18,3
2000	19,9
2500	20,7
3150	20,7
4000	17,8
5000	14,6

ΔR_w = **10**

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Enclosure 12

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

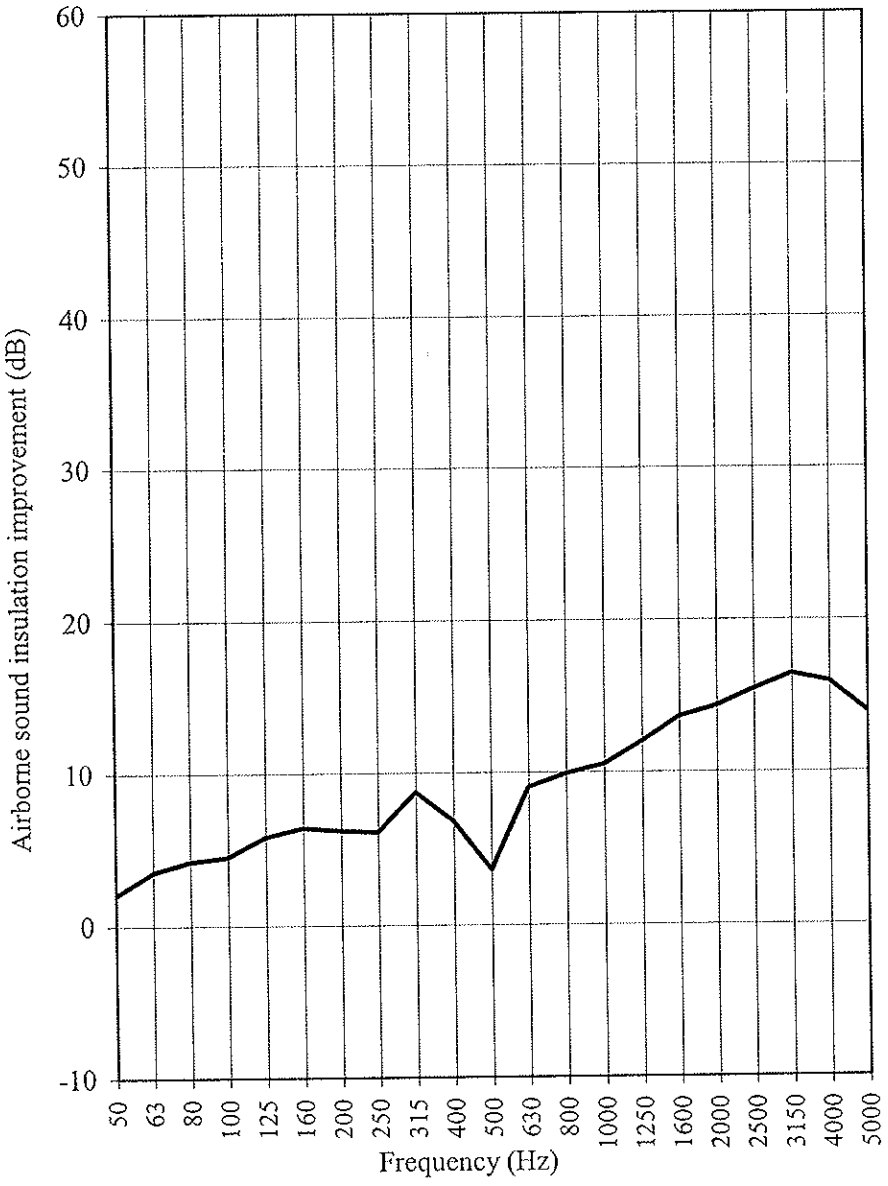
Client: Ecophon AB

Test object: Master A, mounting depth 440 mm

Test date: 2006-03-14

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	2,0
63	3,5
80	4,2
100	4,5
125	5,8
160	6,4
200	6,2
250	6,1
315	8,7
400	6,8
500	3,6
630	9,0
800	9,9
1000	10,5
1250	12,0
1600	13,6
2000	14,3
2500	15,4
3150	16,4
4000	15,9
5000	13,9

$\Delta R_w = 7$

Acoustics

Enclosure 13

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

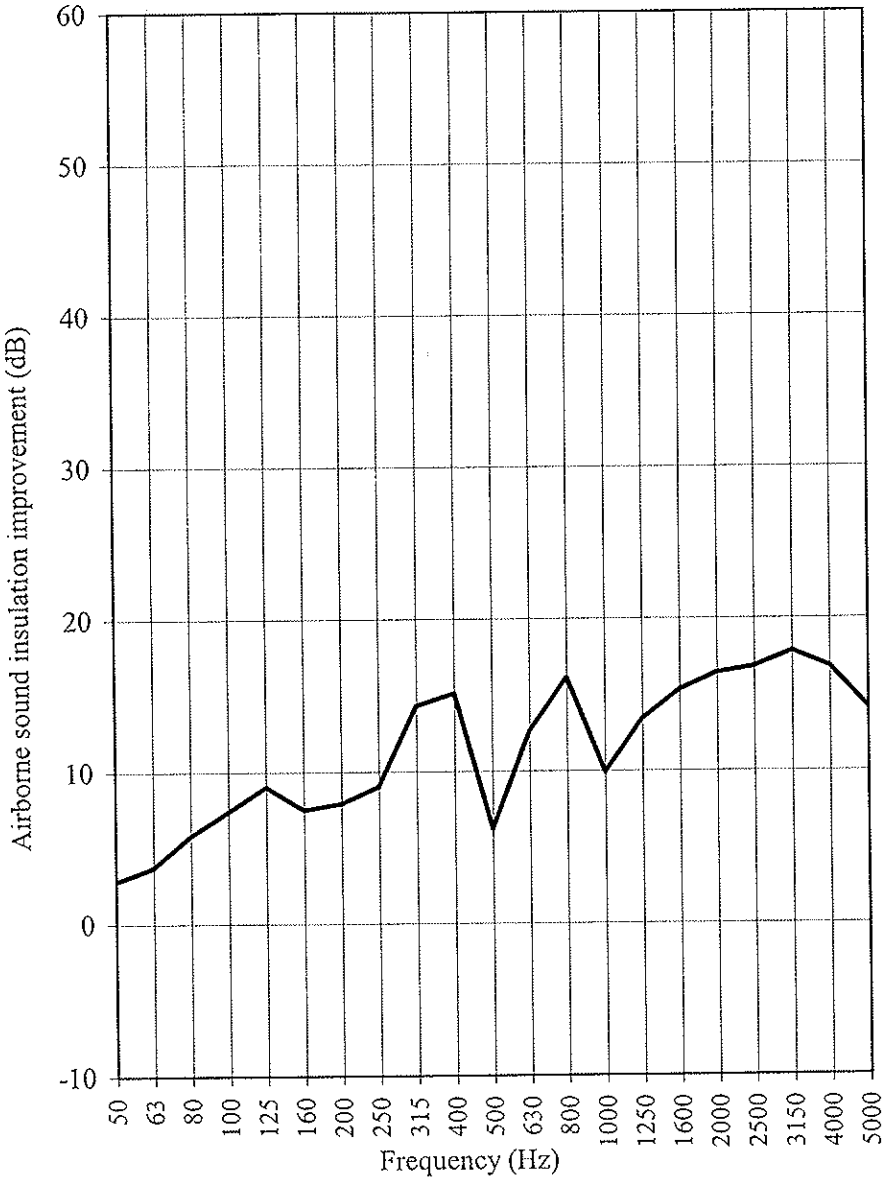
Client: Ecophon AB

Test object: Combison Uno A, mounting depth 440 mm

Test date: 2006-03-16

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frekvens (Hz)	ΔR (dB)
50	2,8
63	3,7
80	5,8
100	7,4
125	9,0
160	7,5
200	7,9
250	9,0
315	14,3
400	15,1
500	6,2
630	12,6
800	16,1
1000	9,9
1250	13,4
1600	15,3
2000	16,4
2500	16,8
3150	17,8
4000	16,8
5000	14,1

ΔR_w = **10**

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Enclosure 14

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

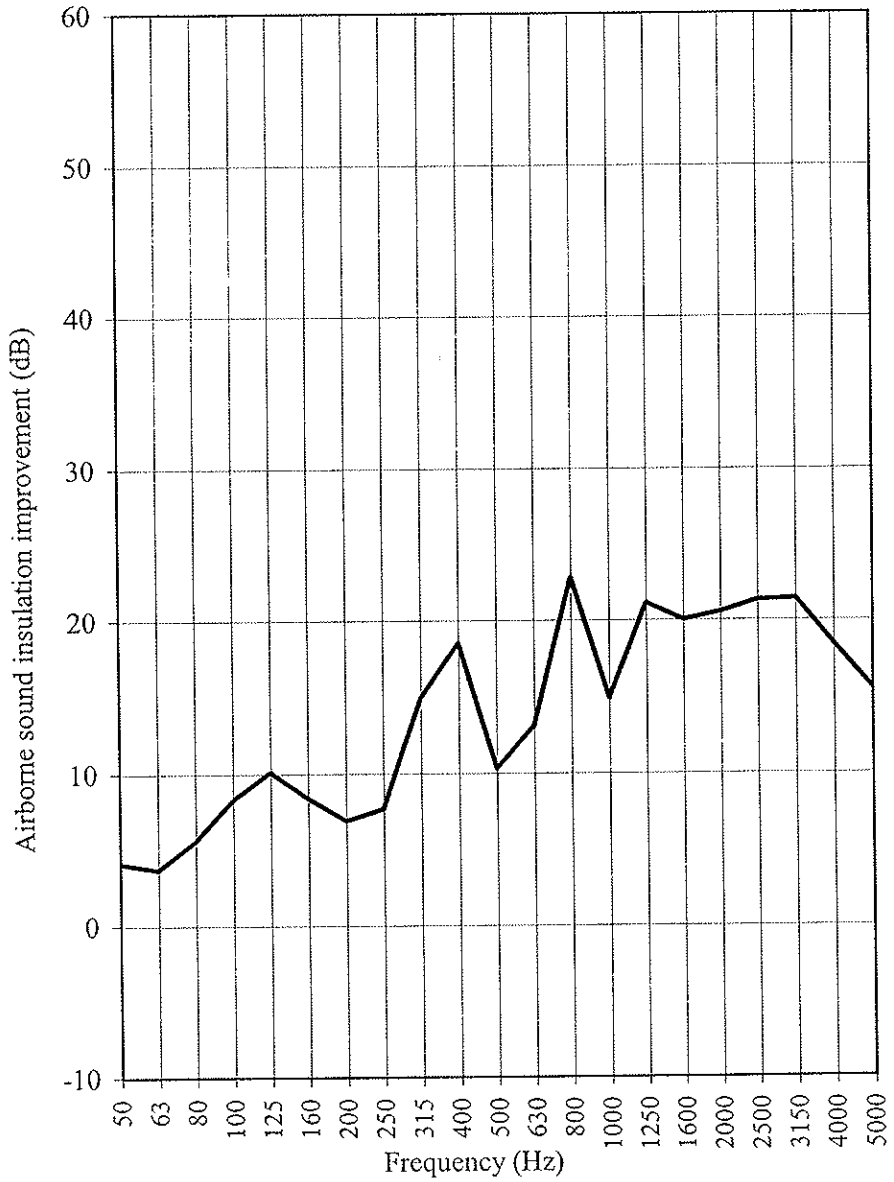
Client: Ecophon AB

Test object: Combison Duo A, mounting depth 440 mm

Test date: 2006-03-27

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	4,1
63	3,7
80	5,6
100	8,3
125	10,1
160	8,4
200	6,9
250	7,7
315	14,9
400	18,5
500	10,3
630	13,1
800	22,8
1000	14,9
1250	21,1
1600	20,0
2000	20,5
2500	21,3
3150	21,4
4000	18,4
5000	15,5

$\Delta R_w = 11$

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Enclosure 15

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

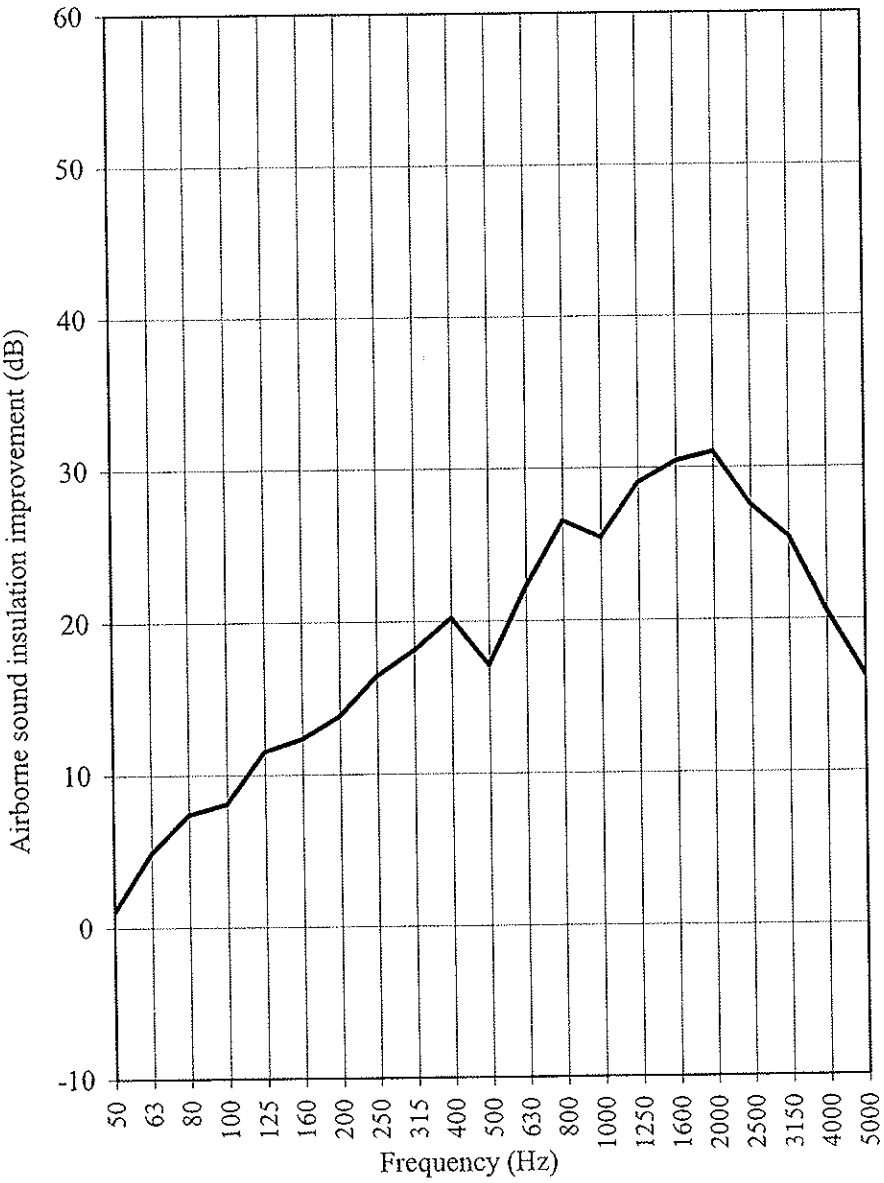
Client: Ecophon AB

Test object: Combison Duo A + Combison XR 50 mm, mounting depth 440 mm

Test date: 2006-03-29

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	1,0
63	4,9
80	7,4
100	8,1
125	11,5
160	12,3
200	13,8
250	16,4
315	18,1
400	20,2
500	17,1
630	22,2
800	26,5
1000	25,4
1250	29,0
1600	30,4
2000	31,0
2500	27,5
3150	25,4
4000	20,5
5000	16,3

ΔR_w = **16**

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Enclosure 16

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

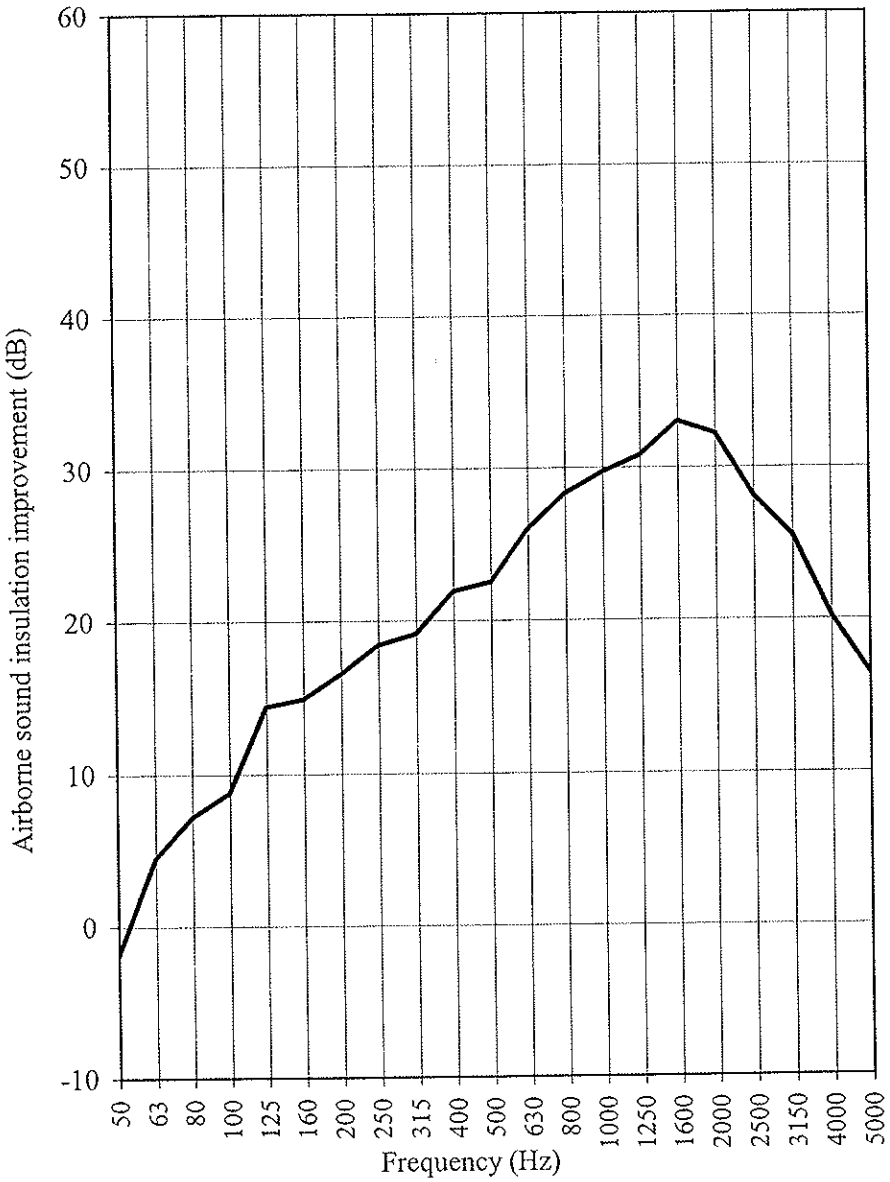
Client: Ecophon AB

Test object: Combison Duo A + 2 layers of Combison XR 50 mm, mounting depth 440 mm

Test date: 2006-04-04

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	-1,9
63	4,5
80	7,2
100	8,8
125	14,4
160	14,9
200	16,5
250	18,4
315	19,1
400	21,9
500	22,5
630	26,0
800	28,3
1000	29,7
1250	30,8
1600	33,0
2000	32,2
2500	28,1
3150	25,5
4000	20,2
5000	16,4

ΔR_w = **18**

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Enclosure 17

Determination of of airborne sound reduction improvement index of suspended ceilings below bare concrete floors

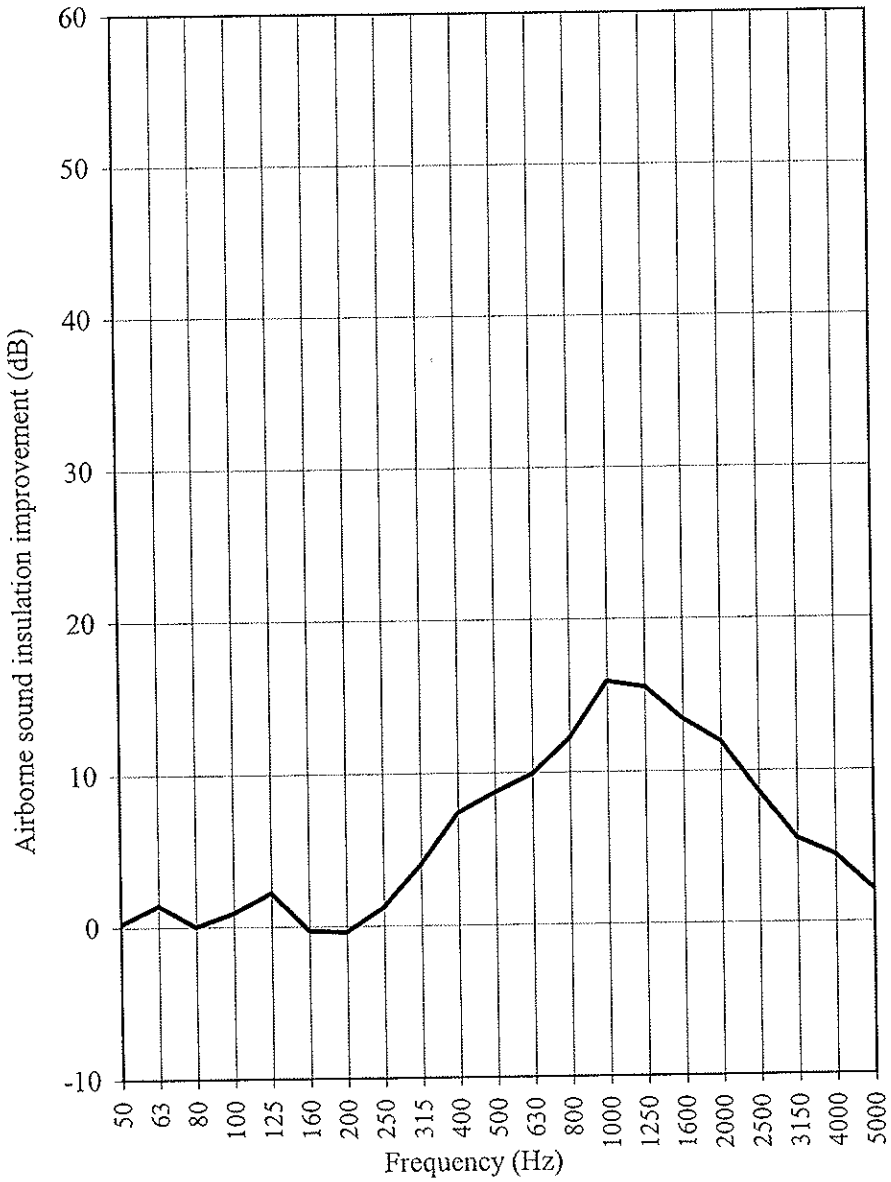
Client: Ecophon AB

Test object: Master C, mounting depth 55 mm

Test date: 2006-04-06

Concrete floor: 150 mm homogeneous concrete (4,2 m x 3,2 m)

Results: Airborne sound insulation improvement, ΔR and weighted value, ΔR_w



Frequency (Hz)	ΔR (dB)
50	0,2
63	1,4
80	0,0
100	0,9
125	2,2
160	-0,3
200	-0,4
250	1,2
315	4,0
400	7,4
500	8,7
630	9,9
800	12,2
1000	15,9
1250	15,5
1600	13,4
2000	11,9
2500	8,6
3150	5,5
4000	4,4
5000	2,1

$\Delta R_w = 4$