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- Acoustics
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Legioblock construction system

Sound insulation test report

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1. Introduction

With the concrete stacking blocks of the Legioblock construction system, walls are realised. The walls can be built up to a height of 8.80 m and remain movable and reusable. They are used in many different situations. In some situations, reducing sound transmission to the environment is relevant. Therefore, a study has been conducted into the sound insulation value of the Legioblock wall system. This study was conducted on the basis of sound insulation measurements.

2. Sound insulation measurements

The measurements were performed on Monday, 20 March 2017 on walls at the transshipment company Zietzschmann GmbH in Neuss-Düsseldorfer Hafen (Germany). The walls measured were of the maximum height of 8.80 m, so that sound transmission over the top of the wall was minimized.

2.1 Measuring method

The noise measurements were performed with an integrating Class I sound level meter with real-time 1/3 octave band filters, a boom pole and a 5 m extension lead. The accompanying omnidirectional ½" microphone is fitted with a windscreen. The measurement system was checked with an acoustic calibrator before and after the measurements (93.8 dB at 1000 Hz).

The measurements were performed using a loud noise source set up at a distance of at least 10 m from the wall. The transmit level was measured at a distance of 1 m in front of the wall. The receive level was measured at a distance of 0.5–1.0 m behind the wall. Both the transmit level and the receive level were determined by scanning a wall surface of about 10 m² with the microphone (swaying the microphone parallel to the wall).

In this way, four randomly chosen wall surface areas were measured. The relevant wall surfaces were representative of the average execution quality of the Legioblock walls. There are horizontal and vertical open joints between the blocks.

2.2 Measurement results

The measurement results for the relevant frequency domain are presented in the graphs of Appendices 1.1 to 1.7. The average sound insulation value is summarised in Table 1.

Table 1 Sound insulation value R of the Legioblock wall system per octave band

Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz
Sound insulation R	21.0 dB	21.2 dB	23.5 dB	23.4 dB	27.2 dB



The weighted sound insulation value $R_w(C;C_{tr})$ amounts to 25(-1;-2) dB, with the weighting in accordance with the EN ISO 717-1 standard. The A-weighted sound insulation value R_A is 23.1 dB(A). This value is based on the standard spectrum for outdoor noise and road traffic noise.

The reported insulation values of the Legioblock construction system can be used for noise transmission calculations in practical situations. For most open air situations, the Legioblock wall can be regarded as a perfect sound insulating noise barrier, where only the noise transmission over the top of the wall and around the wall is relevant.

Mr. C.A.E. (Kees) Rijk

Appendices: 1.1 – 1.7: sound insulation measurement results



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Neuss-Düsseldorf harbour

Sound source 10m from wall 1, measurement directly behind the wall

Ratings:

Weighted level difference

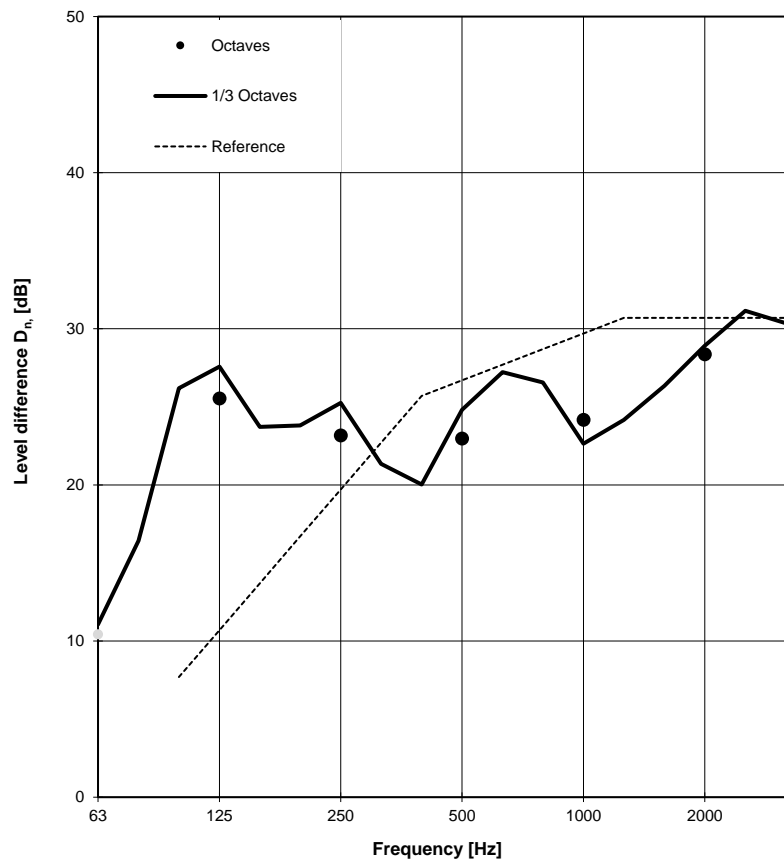
$D_{n,A}$: 24,7 dB

$D_{n,w}(C;C_{tr})$: 27(-1;-2) dB

Sound reduction index

R_A : 21,7 dB

$R_w(C;C_{tr})$: 24(-1;-2) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	93,1	84,0	79,6	74,8	80,6	
Sound level behind wall	67,6	60,9	56,6	50,6	52,2	
Difference level D_n	25,5	23,2	23,0	24,2	28,4	
Sound reduction R	22,5	20,2	20,0	21,2	25,4	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Neuss-Düsseldorf harbour
Sound source at wall 2, measurement directly behind the wall

Ratings:

Weighted level difference

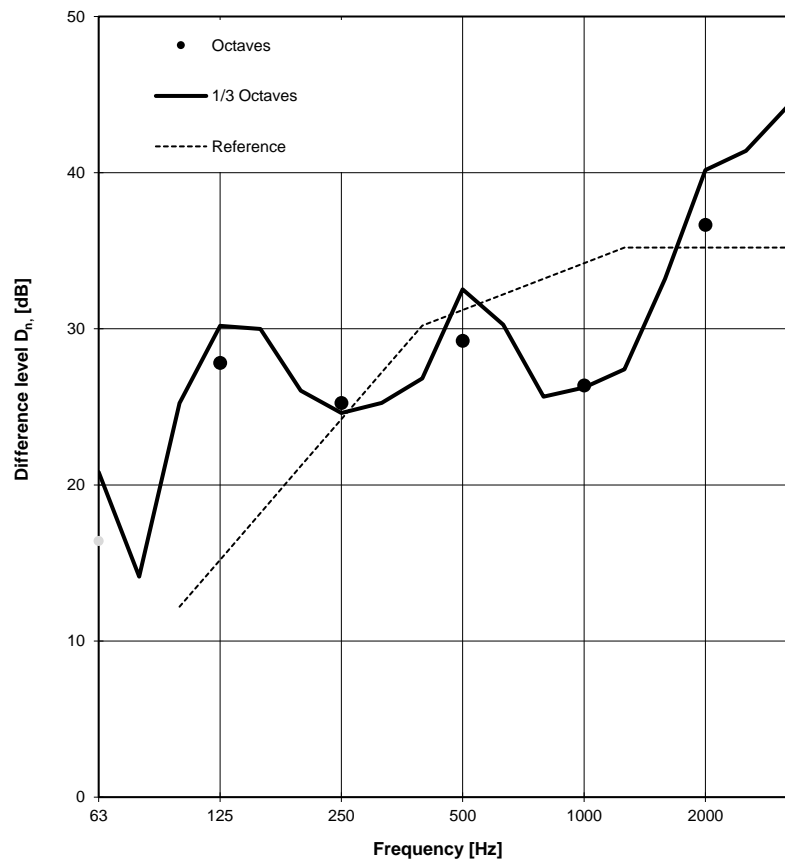
$D_{n,A}$: 28,4 dB

$D_{n,w}(C;C_{tr})$: 31(-2;-3) dB

Sound reduction index

R_A : 25,4 dB

$R_w(C;C_{tr})$: 28(-2;-3) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	93,8	83,5	82,7	75,8	81,8	
Sound level behind wall	65,9	58,2	53,5	49,4	45,1	
Difference level D_n	27,8	25,3	29,2	26,4	36,7	
Sound reduction R	24,8	22,3	26,2	23,4	33,7	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Hafen Neuss-Düsseldorf
Sound source at wall 3, measurement 1 directly behind the wall

Ratings:

Weighted level difference

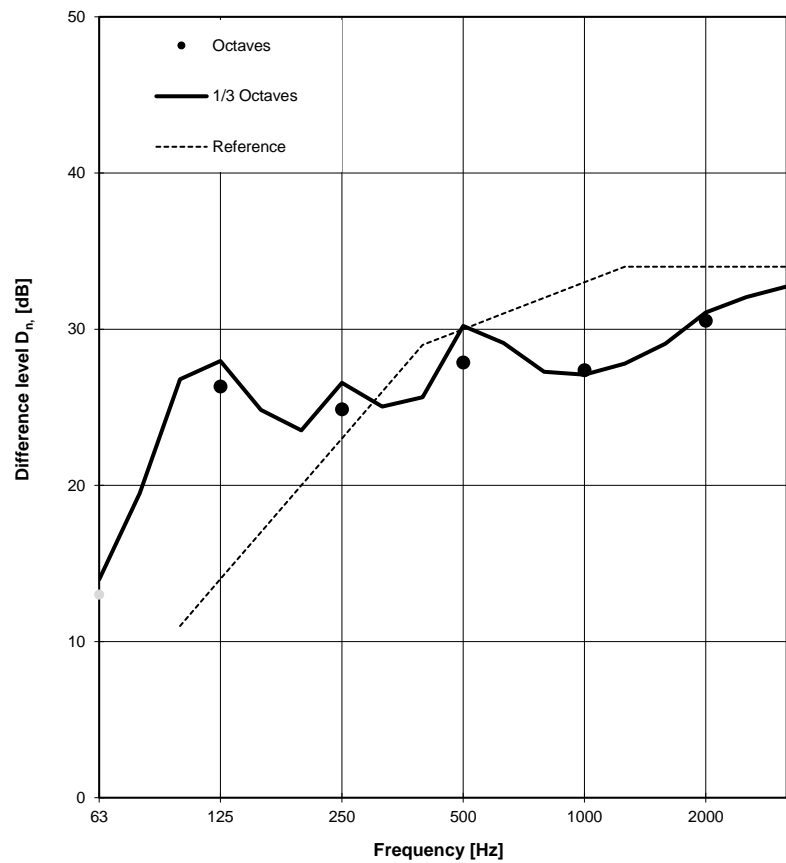
$D_{n,A}$: 28,0 dB

$D_{n,w}(C;C_{tr})$: 30(-1;-2) dB

Sound reduction index

R_A : 25,0 dB

$R_w(C;C_{tr})$: 27(-1;-2) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	93,4	84,7	83,3	75,3	81,4	
Sound level behind wall	67,1	59,9	55,4	48,0	50,9	
Difference level D_n	26,3	24,9	27,9	27,4	30,5	
Sound reduction R	23,3	21,9	24,9	24,4	27,5	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Neuss-Düsseldorf harbour
Sound source at wall 3, measurement 2 directly behind the wall

Ratings:

Weighted level difference

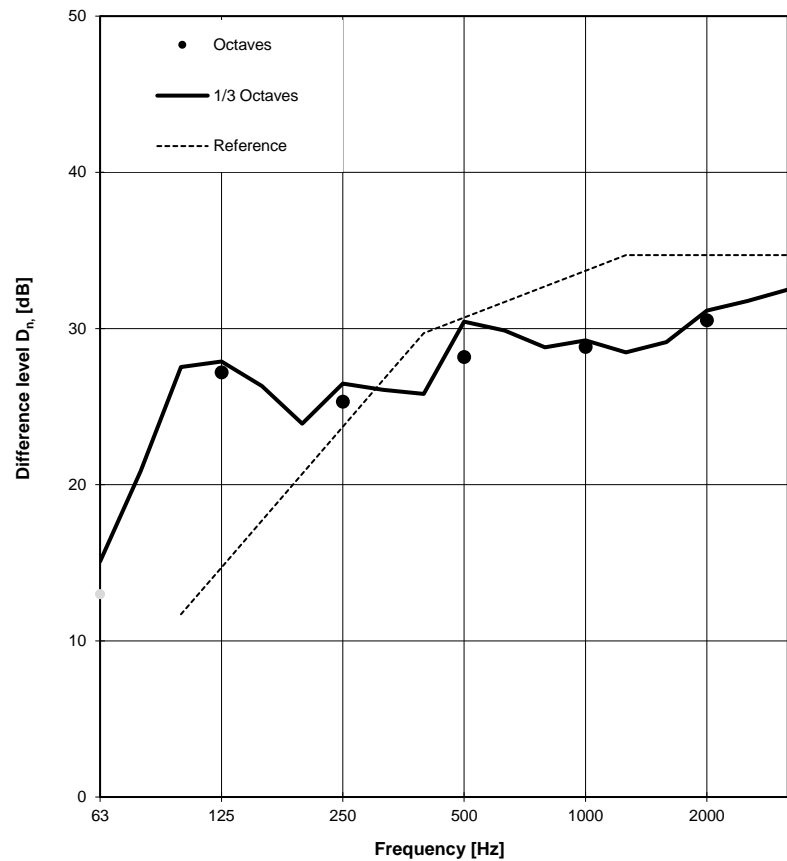
$D_{n,A}$: 28,7 dB

$D_{n,w}(C;C_{tr})$: 31(-1;-2) dB

Sound reduction index

R_A : 25,7 dB

$R_w(C;C_{tr})$: 28(-1;-2) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	93,4	84,7	83,3	75,3	81,4	
Sound level behind wall	66,3	59,4	55,1	46,5	50,9	
Difference level D_n	27,2	25,3	28,2	28,8	30,5	
Sound reduction R	24,2	22,3	25,2	25,8	27,5	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Neuss-Düsseldorf harbour
Sound source at wall 4, measurement 1 directly behind the wall

Ratings:

Weighted level difference

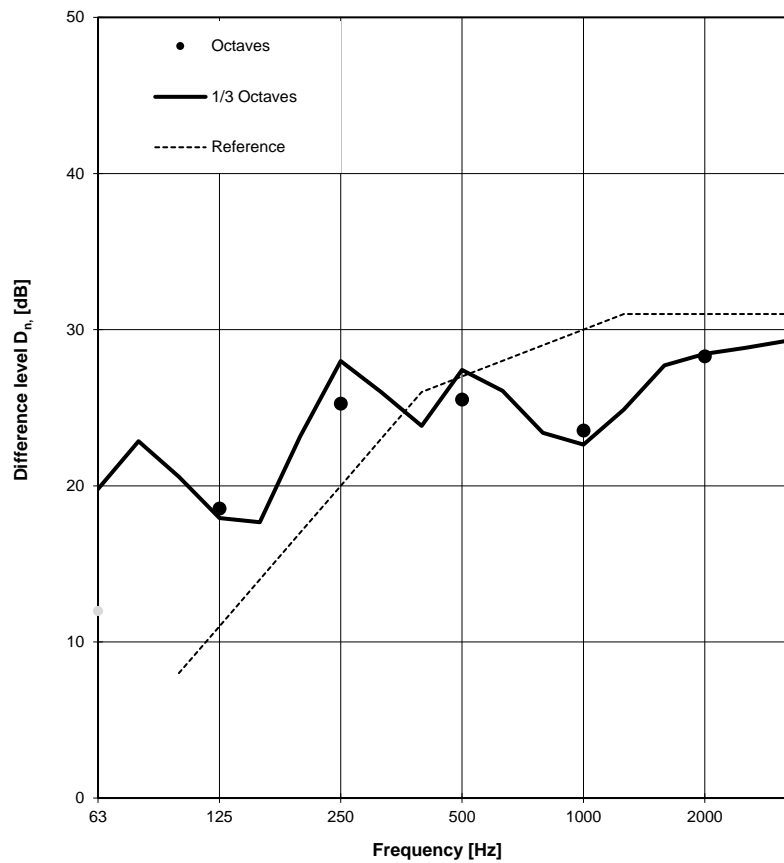
$D_{n,A}$: 24,9 dB

$D_{n,w}(C;C_{tr})$: 27(-1;-2) dB

Sound reduction index

R_A : 21,9 dB

$R_w(C;C_{tr})$: 24(-1;-2) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	84,7	84,8	79,5	72,6	77,9	
Sound level behind wall	66,1	59,5	54,0	49,1	49,6	
Difference level D_n	18,5	25,3	25,5	23,5	28,3	
Sound reduction R	15,5	22,3	22,5	20,5	25,3	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Neuss-Düsseldorf harbour
Sound source at wall 4, measurement 2 directly behind the wall

Ratings:

Weighted level difference

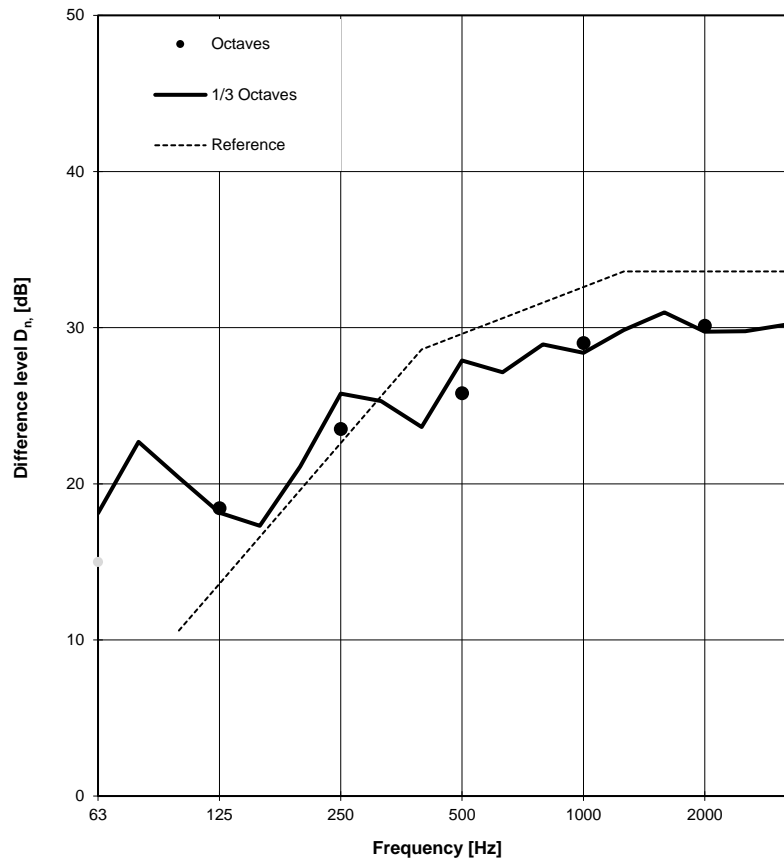
$D_{n,A}$: 26,4 dB

$D_{n,w}(C;C_{tr})$: 30(-1;-3) dB

Sound reduction index

R_A : 23,4 dB

$R_w(C;C_{tr})$: 27(-1;-3) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	84,7	84,8	79,5	72,6	77,9	
Sound level behind wall	66,2	61,3	53,7	43,6	47,7	
Difference level D_n	18,4	23,5	25,8	29,0	30,1	
Sound reduction R	15,4	20,5	22,8	26,0	27,1	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise



Sound insulation measurement EN ISO 140

Legioblock wall system

Measurement: March 20th, 2017

Object: Neuss-Düsseldorf harbour
Sound source at wall 4, measurement 3 directly behind the wall

Ratings:

Weighted level difference

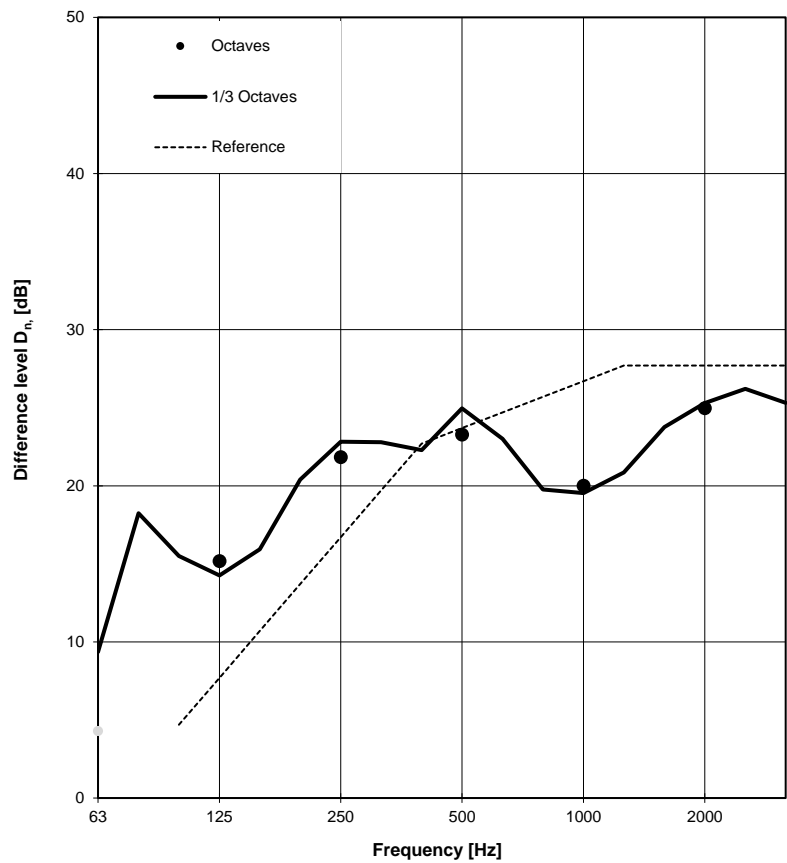
$D_{n,A}$: 21,7 dB

$D_{n,w}(C;C_{tr})$: 24(-1;-2) dB

Sound reduction index

R_A : 18,7 dB

$R_w(C;C_{tr})$: 21(-1;-2) dB



Frequency	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	
Sound level at wall	84,7	84,8	79,5	72,6	77,9	
Sound level behind wall	69,5	62,9	56,3	52,6	52,9	
Difference level D_n	15,2	21,8	23,3	20,0	25,0	
Sound reduction R	12,2	18,8	20,3	17,0	22,0	R = D - 3dB wall reflection
Spectrum for $D_{nT,A}/R_A$	-14	-10	-6	-5	-7	standard spectrum outdoor+traffic noise