

Report

Nord2000. Validation of the Propagation Model

Client: Danish Road Directorate

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Summary

The present report contains a large number of cases (544) with point-to-point validation of the Nord2000 propagation model based on measurements and reference calculation results and 9 cases with calculation of the yearly average L_{den} from a road.

The point-to-point validation consists of four groups of cases. Group 1 contains 61 measurements covering propagation distances up to 200 m. Group 2 contains 64 reference results covering distances up to 200 m. Most of the results in Group 2 come from the Harmonoise benchmark calculations. Group 3 contains 281 reference results for downwind (1-5 m/s), flat grass-covered ground, and distances in the range 50-1000 m. Group 4 contains 138 reference results for downwind (3 m/s), thin screens on flat ground, and distances in the range 25-400 m.

The point-to-point validation cases show on the average small differences in A-weighted levels between the Nord2000 predictions and the measurement or reference results. The largest differences are observed for thin screens on flat ground where Nord2000 predicts in the order of 1 dB higher noise levels than the reference method.

The standard uncertainty of individual results has been found to be in the order of 1 dB for all groups for propagation distances up to 400 m. Above 400 m reference results have only been available for flat ground (range of distances 600-1000 m) where the standard uncertainty has been estimated to be in the order of 2 dB.

The 9 cases with calculation of the yearly average L_{den} from a road covering propagation distances up to 300 m show an average difference less than 0.5 dB and a standard uncertainty less than 1 dB.

DELTA, 31 March 2006



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1. Introduction

In the present report the Nord2000 propagation model has been validated by comparing with results of outdoor sound propagation measurements and with reference results (results obtained by accurate calculation methods).

The results used for validation are divided into five groups:

1. Validation by measurements, 61 cases
2. Validation by reference calculations, 64 cases
3. Validation for flat ground by PE (Parabolic Equation method), 281 cases
4. Validation for a screen on flat ground by PE, 138 cases
5. Validation of the yearly average L_{den} by reference calculations, 9 cases

In Groups 1-4 the validation is for point-to-point propagation with fixed meteorological conditions. In Group 5 the validation is for a line source (a road), and the predicted noise level is the yearly average L_{den} taking into account varying meteorological conditions during the year.

2. Method

In validation Groups 1 and 2 the ground effect predicted by Nord2000 is in each case compared to the measured or calculated ground effect on the basis of both 1/3-octave band spectra and A-weighted levels.

In validation Groups 3 and 4 the comparisons include A-weighted ground effects only, due to the large number of validation cases.

The ground effect is defined as the difference between sound pressure level and the free-field sound pressure level. In this report the A-weighted ground effect is defined as the difference between the A-weighted sound pressure level and the free-field A-weighted sound pressure level assuming a pink noise source spectrum. When calculating the A-weighted ground effect, only frequency bands with a measured or calculated value of the noise level are included.

A positive difference between the Nord2000 result and the reference result indicates that higher noise levels are predicted by Nord2000.

In validation Group 5 the yearly average L_{den} is calculated as described in Section 7.

3. Validation by Measurements

The measurements used for the validation are:

- Cases 11-36: 26 measurements described in [1]. Very short propagation distances (3.5-4.5 m) including cases with flat ground, thin and thick screens and one case with double screens and one case with mixed impedances.
- Cases 41-54: 14 measurements described in [2]. Short propagation distances (6-20 m). Propagation over complex terrain including screening effects.
- Cases 1-2: 2 measurements described in [3]. Long propagation distances (approx. 200 m). Propagation over non-flat terrain.
- Cases 39-40: 2 measurements described in [4]. Medium propagation distances (40 and 120 m). Propagation over an embankment.
- Cases 61-64: 4 scale model measurements described in [5]. Short propagation distances (full scale equivalent distances of 15 and 30 m). Propagation over non-flat terrain.
- Cases 71-77: 6 measurements described in [6]. Short and medium propagation distances (14-100 m). Propagation over non-flat terrain.
- Cases 81-84: 4 measurements described in [7]. Medium propagation distances (31-44 m). Propagation over non-flat terrain.
- Cases 91-93: 3 scale model measurements described in [8]. Medium propagation distances (full scale equivalent distances of 50 m). Propagation over a barrier on flat ground.

Only validation cases 83, 84, and 93 contain effects of refraction.

The results are shown in Appendix A. The appendix contains one page for each validation case showing the ground effect spectrum calculated by Nord2000 and the measured spectrum. The page also includes the A-weighted ground effect calculated by Nord2000 and the difference between this value and the A-weighted ground effect determined from the measurement result and all input values necessary for doing the calculations by Nord2000 (terrain profile and calculation parameters).

The difference in the A-weighted ground effect can be used to analyze the accuracy of predictions by Nord2000 compared to the “true” results. The mean and the standard deviation of ground effect differences for the 61 cases are shown in Table 1. The table shows that the average difference is 0 dB, and the standard deviation is 1.2 dB. A part of the standard deviation is due to measurement uncertainties. It is therefore likely that part of the standard uncertainty due to the Nord2000 predictions is less than 1 dB.

	Difference in A-weighted ground effect (dB)
Mean	0.0
Standard deviation	1.2

Table 1
Mean and standard deviation of differences in A-weighted ground effect predicted by Nord2000 and measured in 61 validation cases.

It has been analyzed whether the accuracy of Nord2000 estimated on the basis of the measurements depends on the propagation distance or on the magnitude of the propagation effect as shown in Figure 1 and Figure 2. In the range of distances covered by the measurements there is no clear indication that the mean or the standard deviation depends on the propagation distance or on the magnitude of the ground effect.

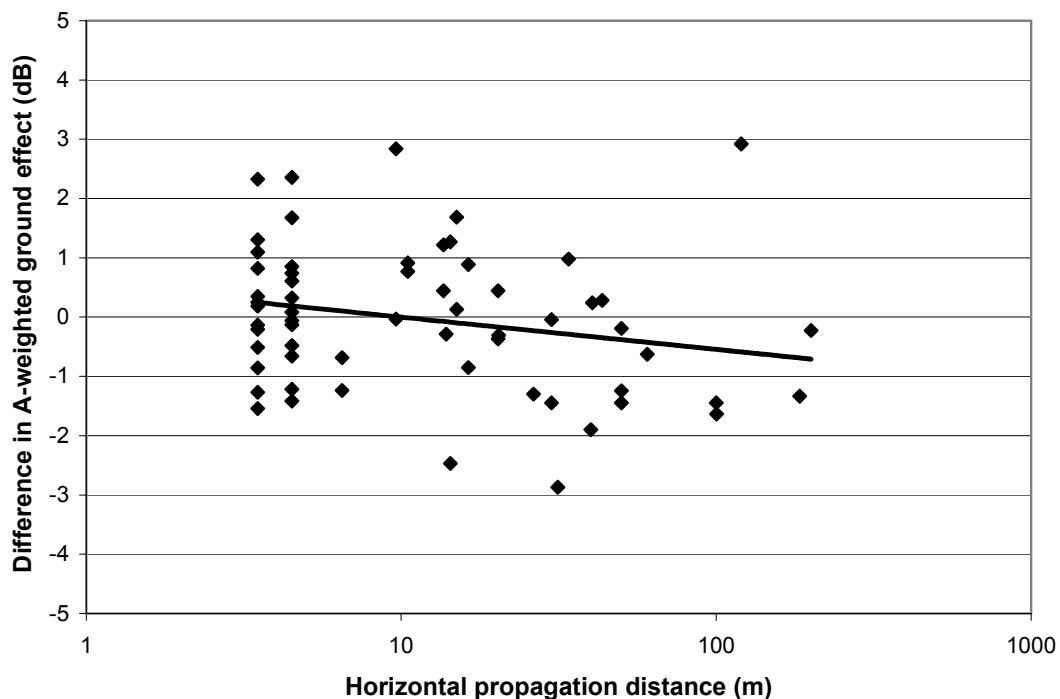


Figure 1
Difference in A-weighted ground effect between predictions by Nord2000 and measurements as a function of the horizontal propagation distance in each individual case (points) and trend line (solid line).

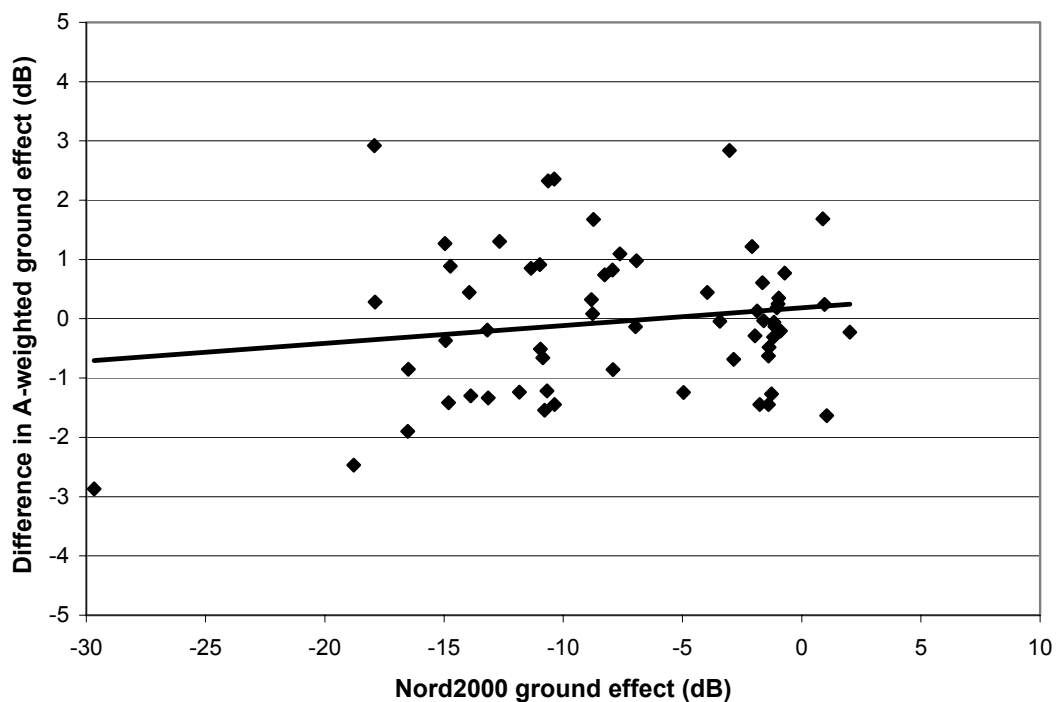


Figure 2
Difference in A-weighted ground effect between predictions by Nord2000 and measurements as a function of the A-weighted ground effect by Nord2000 in each individual case (points) and trend line (solid line).

4. Validation by Reference Calculations

The reference calculations (obtained by accurate calculation methods) used for the validation are:

- Cases 111-118: 8 calculations for a thick screen (two edges). Calculations by the Boundary Element Method (BEM) [9]. Propagation distance of 10 m.
- Cases 121-127: 7 calculations for a wedge-shaped screen with a valley-shaped terrain before the screen. Calculations by the Boundary Element Method (BEM) [9], [10]. Propagation distance of 10 m.
- Cases 1001-1082: 49 calculations selected from the Harmonoise benchmark cases [11]. Cases 1001-1053 are calculations made by TNO (the Netherlands) using the Crank-Nicholson Parabolic Equation method. Cases 1061-1072 are calculations made by CSTB (France) using the Green's Function Parabolic Equation method. Cases 1081-1082 are calculations made by CSTB using the Boundary Element method. Propagation distances of 20 or 200 m.

The results are shown in Appendix B. The appendix contains one page for each validation case showing the ground effect spectrum calculated by Nord2000 and by the reference calculation method. The page also includes the A-weighted ground effect calculated by Nord2000 and the difference between this value and the A-weighted ground effect determined from the reference result and all input values for the calculations by Nord2000 (terrain profile and calculation parameters).

In most cases the results in Appendix B show a good agreement between Nord2000 and the reference results. The cases where Nord2000 fails are long distance propagation over hard ground in the presence of a strong wind component. Particularly in the cases with hard ground where strong upwind causes shadow zones, Nord2000 predicts too high noise levels. This is a well-known weakness which is considered to be of little practical importance, and the effect of shadow zones is adequately modelled in case of “soft” ground. In case of strong downwind where multiple ground reflections occur, the method is also found to be inaccurate.

The difference in the A-weighted ground effect can be used to analyze the accuracy of predictions by Nord2000 compared to the “true” results. The mean and the standard deviation of ground effect differences are shown in Table 2. The 12 results (cases 1006-1008, 1016-1018, 1026-1028, and 1046-1048) for hard surfaces and refraction effects have been omitted from the statistics. The table shows that the average difference is 0.7 dB, and the standard deviation is 1.4 dB. If only the three very deviating results with a strong shadow zone effect are omitted, the standard deviation will increase to 1.6 dB. Some of the standard deviation is due to uncertainties in the reference results. It is difficult to quantify the contribution from the reference results, but it can be concluded that the standard uncertainty of A-weighted results predicted by Nord2000 compared to “true” results will be in the order of 1 dB.

	Difference in A-weighted ground effect (dB)
Mean	0.7
Standard deviation	1.4

Table 2

Mean and standard deviation of differences in A-weighted ground effect predicted by Nord2000 and predicted by reference methods in 52 validation cases.

It has been analyzed whether the accuracy of Nord2000 estimated on the basis of the reference results depends on the propagation distance or on the magnitude of the propagation effect as shown in Figure 3 and Figure 4. In the range of distances covered by the refer-

ence results the mean difference and the standard deviation both are increasing slightly with the propagation distance and with ground attenuation.

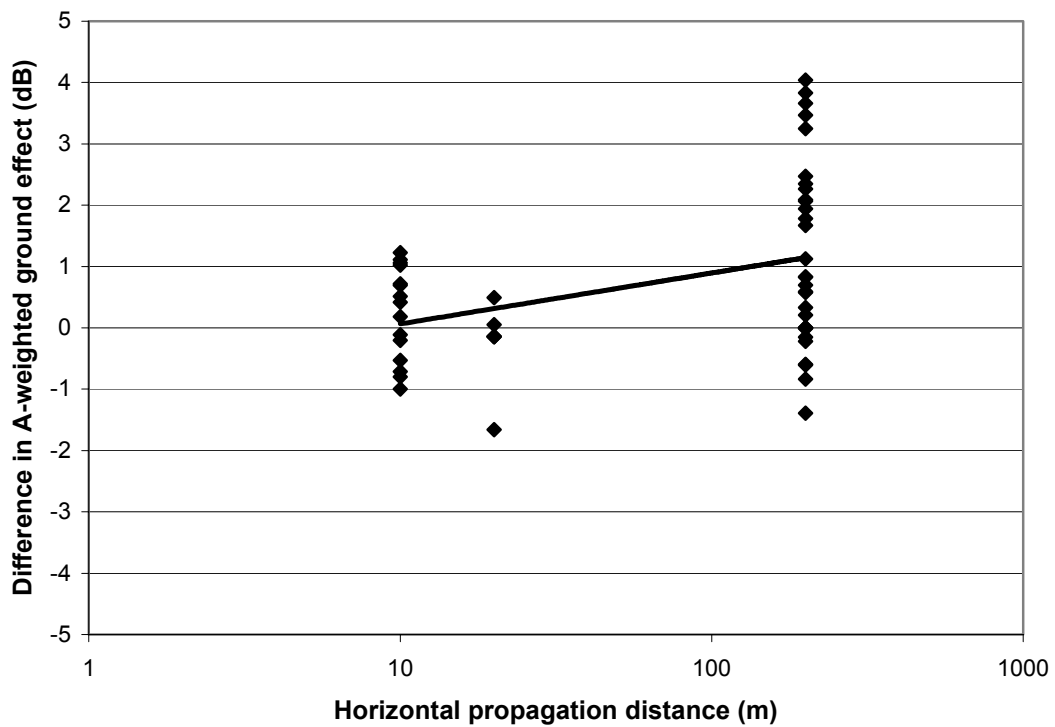


Figure 3
Difference in A-weighted ground effect between predictions by Nord2000 and 52 reference results as a function of the horizontal propagation distance in each individual case (points) and trend line (solid line).

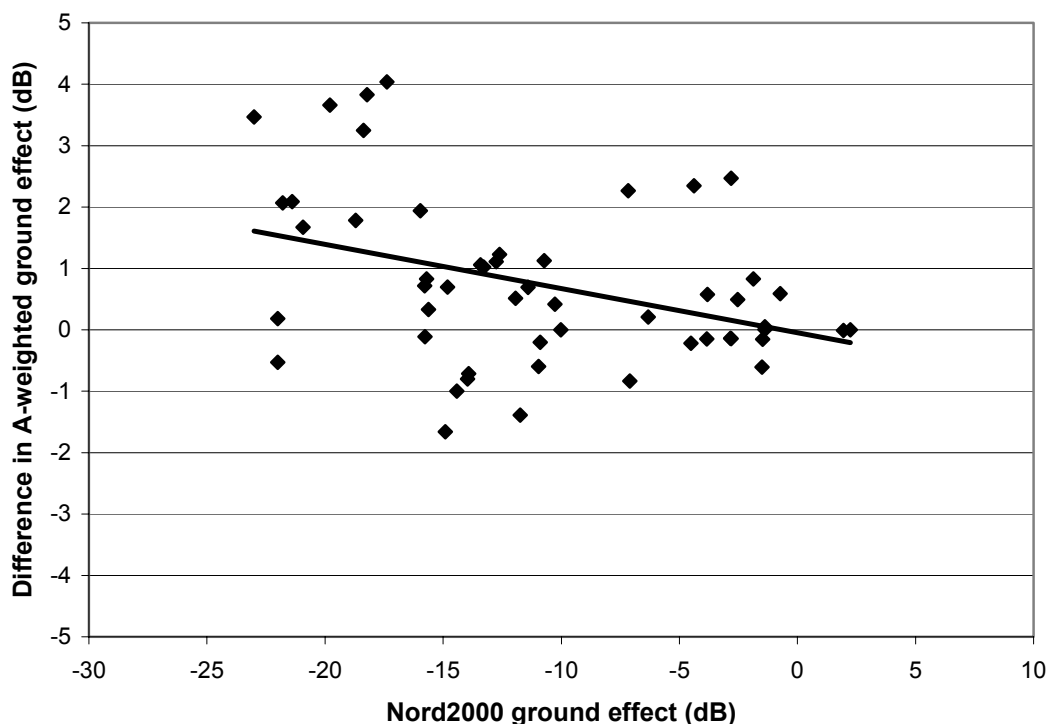


Figure 4
Difference in A-weighted ground effect between predictions by Nord2000 and 52 reference results as a function of the A-weighted ground effect by Nord2000 in each individual case (points) and trend line (solid line)

5. Validation for Flat Ground by PE

To validate the Nord2000 propagation model for flat grass-covered ground, 281 reference results have been made by DELTA using the Parabolic Equation method (PE) described in [12]. Calculations have been carried out for downwind wind propagation with wind speeds of 1, 3, and 5 m/s, a roughness length z_0 of 0.05 m, and no temperature gradients. The ground was characterized by a flow resistivity of 200 kPasm^{-2} . Calculations have been carried out for horizontal propagation distances of 50, 100, 200, 400, 600, 800, and 1000 m and source heights of 0.5, 1, 2, 4, and 10 m. For wind speeds of 1 and 5 m/s receiver heights were 0.5, 1.5, 3, and 10 m (0.5 m is only included when the source height is not 0.5 m as well). For a wind speed of 3 m/s only the receiver height 1.5 m was included.

Due to the large number of results, spectral comparisons for individual results have not been included in the present report. Only differences in A-weighted ground effects are analyzed.

The mean and the standard deviation of ground effect differences for the 281 cases are shown in Table 3 for the whole range of propagation distances (50-1000 m) and for the ranges 50-400 m and 600-1000 m, respectively. The table shows that the average difference in the range of distances up to 400 m is 0.7 dB, and the standard deviation is 1.1 dB. For the high range of distances (600-1000 m) the standard deviation is twice the standard deviation in the low range of distances. Some of the standard deviation is due to uncertainties in the PE-results. It is difficult to quantify the contribution of uncertainty from the PE-results, but it can be concluded that the standard uncertainty of A-weighted results predicted by Nord2000 compared to “true” results will be in the order of 1 dB for distances up to 400 m and twice of that in the range of distances above this and up to 1000 m.

	A-weighted ground effect (dB)		
	50-1000 m	50-400 m	600-1000 m
Mean	0.9	0.7	1.1
Standard deviation	1.8	1.1	2.3

Table 3

Mean and standard deviation of differences in A-weighted ground effect predicted by Nord2000 and predicted by PE for flat grass-covered ground and downwind propagation in 281 validation cases.

In Figure 5 the differences in A-weighted ground effects are shown as a function of the horizontal propagation distance and in Figure 6 also as a function of the ratio between the propagation distance and the sum of source and receiver heights. In both figures it is demonstrated that the accuracy of the Nord2000 results decreases with distance.

Figure 7 shows that there is no clear connection between the accuracy and the size of the ground effect.

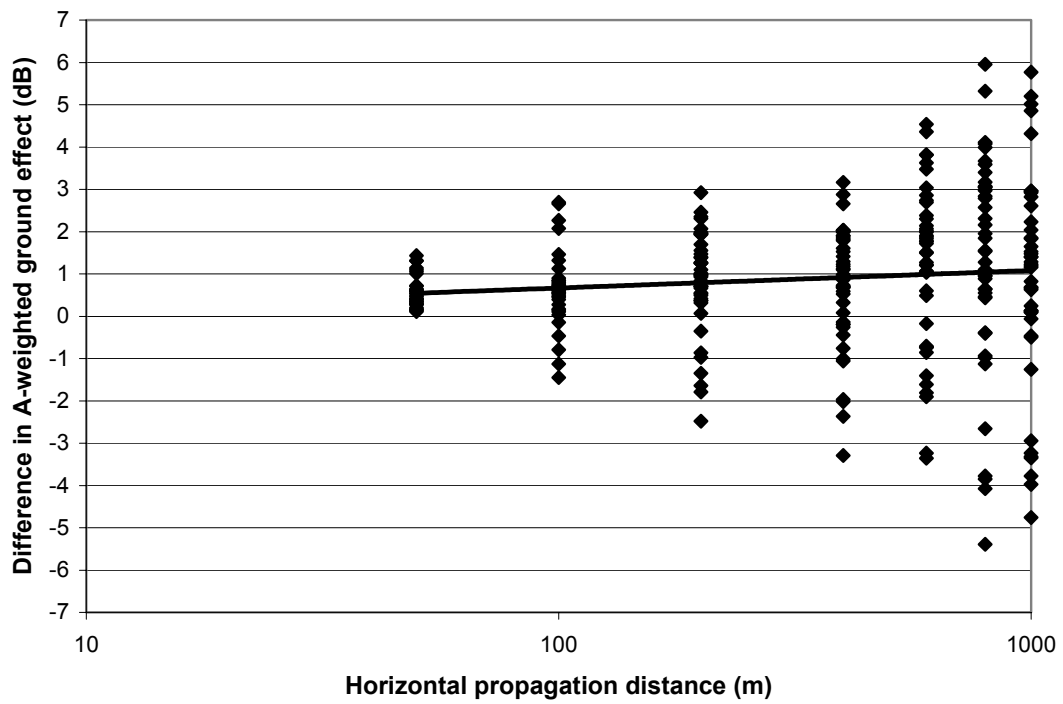


Figure 5
Difference in A-weighted ground effect between predictions by Nord2000 and 281 PE-results for flat grass-covered ground and downwind propagation as a function of the horizontal propagation distance in each individual case (points) and trend line (solid line).

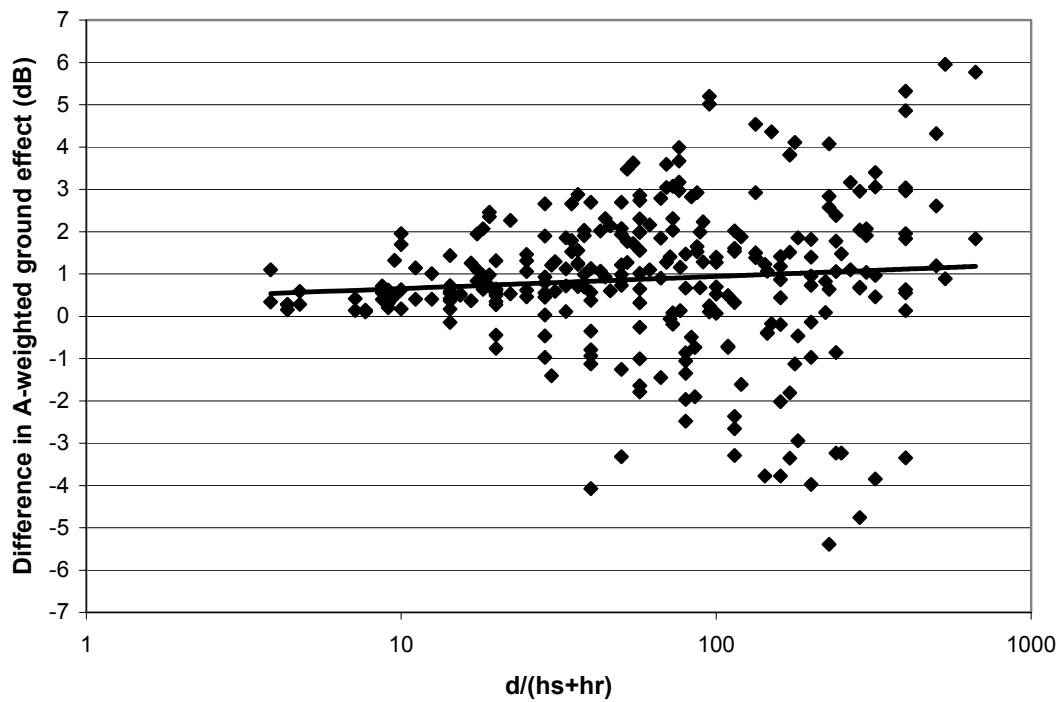


Figure 6
Difference in A-weighted ground effect between predictions by Nord2000 and 281 PE-results for flat grass-covered ground and downwind propagation as a function of the horizontal propagation distance d divided by the sum of the source and receiver heights (h_s+h_r) in each individual case (points) and trend line (solid line).

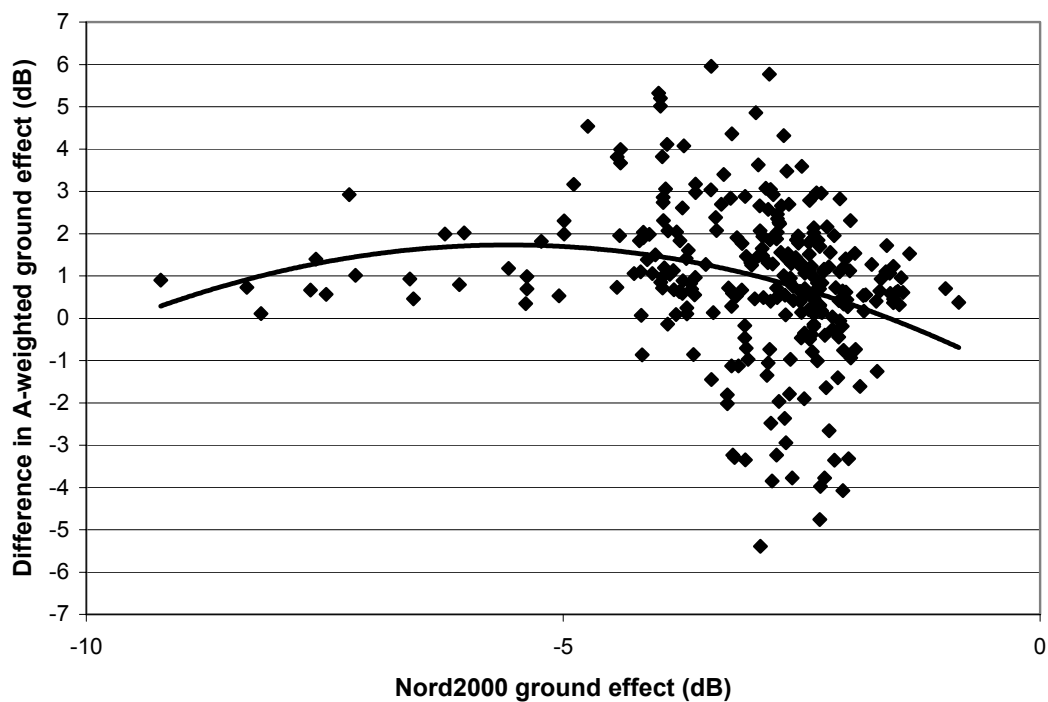


Figure 7
Difference in A-weighted ground effect between predictions by Nord2000 and 281 PE-results for flat grass-covered ground and downwind propagation as a function of the A-weighted ground effect by Nord2000 in each individual case (points) and trend line (solid line).

6. Validation for a Screen on Flat Ground by PE

To validate the Nord2000 propagation model for screens placed on a flat ground, 138 reference results have been made by DELTA using the Parabolic Equation method (PE) described in [12]. Calculations have been carried out for downwind propagation with a wind speed of 3 m/s, a roughness length z_0 of 0.05 m, and no temperature gradients. Soft ground was characterized by flow resistivity 200 kPasm^{-2} and hard ground and the screen faces by flow resistivity $20,000 \text{ kPasm}^{-2}$. Calculations have been carried out for horizontal propagation distances of 25, 50, 100, 150, 200, 300, and 400 m. The source height was 0.5 m, and the receiver heights were 2, 4, and 10 m. For all propagation distances and receiver heights calculations have been carried out for the seven combinations of screen height h_{SCR} , source-screen distances d_{SCR} , and ground impedance shown in Table 4. For Groups 6 and 7 the propagation distance was omitted if the receiver was at the screen position or between source and screen.

No.	d_{SCR} (m)	h_{SCR} (m)	Ground surface
1	10	2	Soft
2	10	2	Hard
3	10	4	Soft
4	6	2	Soft
5	16	2	Soft
6	25	2	Soft
7	50	4	Soft

Table 4
Groups of screen and surface configurations in the 138 PE-results.

Due to the large number of results, spectral comparisons for individual results are not included in the present report. Only differences found in A-weighted ground effects have been analyzed.

The mean and the standard deviation of ground effect differences for the 138 cases are shown in Table 5 for the whole range of propagation distances (25-400 m). The table shows that the average difference is 1.4 dB, and the standard deviation is 1.3 dB. The standard deviation was also analyzed by dividing the propagation distances into a low and high range, but no significant difference was found. The average difference between the Nord2000 results and the reference results is somewhat higher than seen in the results described previously in this report. This difference is the result of a deliberate strategy when elaborating the method for determining the ray curvature in case of refraction. In the PE-calculations described in this section the effect on the attenuation of the change in air flow caused by the screen has not been included. This effect may reduce the attenuation of a screen if source or receiver is close to the screen. One of the measurement results in Validation Group 1 and some of the reference results from the Harmonoise benchmark cases in Validation Group 2 include this effect. Therefore, a conservative approach has been applied when elaborating the ray curvature method to account for this effect and not to disagree with the results where the effect has been included.

Some of the standard deviation is due to uncertainties in the PE-results. It is difficult to quantify the contribution of uncertainty from the PE-results, but it can be concluded that the standard uncertainty of A-weighted results predicted by Nord2000 compared to “true” results will be in the order of 1 dB for distances up to 400 m.

	Difference in A-weighted ground effect (dB)
Mean	1.4
Standard deviation	1.3

Table 5
Mean and standard deviation of differences in A-weighted ground effect predicted by Nord2000 and predicted by PE in 138 validation cases.

In Figure 8 the differences in A-weighted ground effects are shown as a function of the horizontal propagation distance and in Figure 9 also as a function of the ratio between the propagation distance and the sum of source and receiver heights. In both figures it is demonstrated that the accuracy of the Nord2000 results does not depend significantly on the propagation distance up to 400 m. One of the points at the distance 50 m in Figure 8 shows a considerable deviation (6.5 dB) between the Nord2000 prediction and the reference result. This validation case has a 2 m high screen placed halfway between the source and receiver on grass-covered ground. Therefore, the case corresponds to Validation Case 93 in Validation Group 1. In [8] it is reported that this particular measurement is a case with a very dominant effect of changes in the air flow caused by the screen. Therefore the deviation can be interpreted as mentioned earlier as an insufficiency of the reference results where the effect of the changed airflow is not taken into account rather than an increased inaccuracy in the Nord2000 method.

Figure 10 shows no connection between the accuracy and the size of the ground effect.

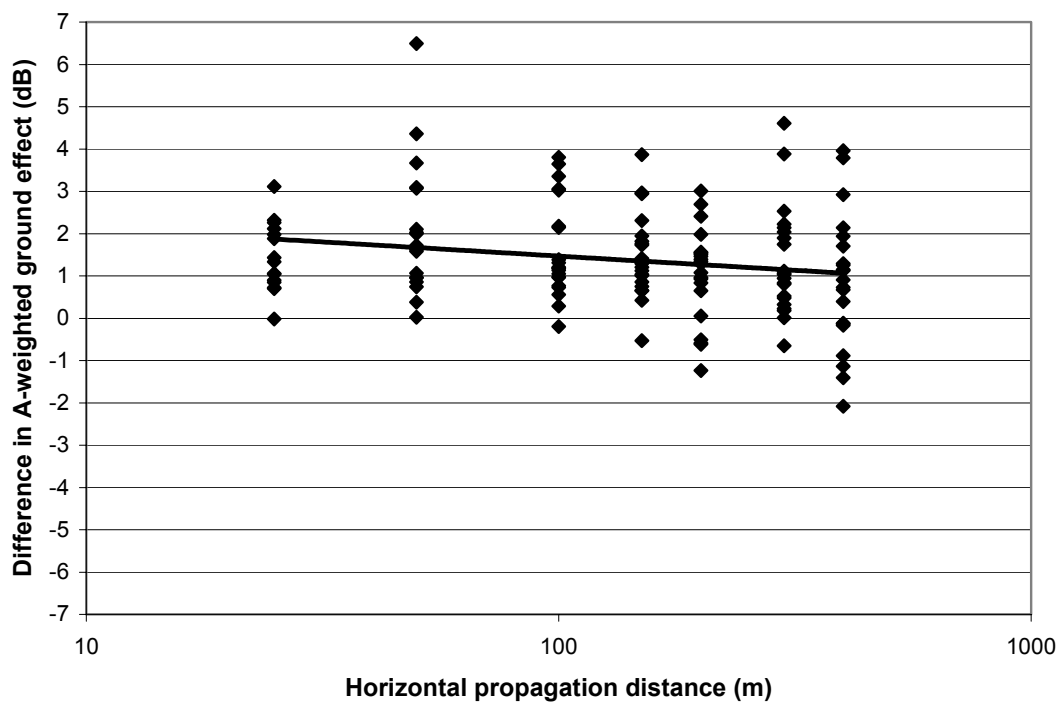


Figure 8
Difference in A-weighted ground effect between predictions by Nord2000 and 138 PE-results for a screen on flat ground and downwind propagation as a function of the horizontal propagation distance in each individual case (points) and trend line (solid line).

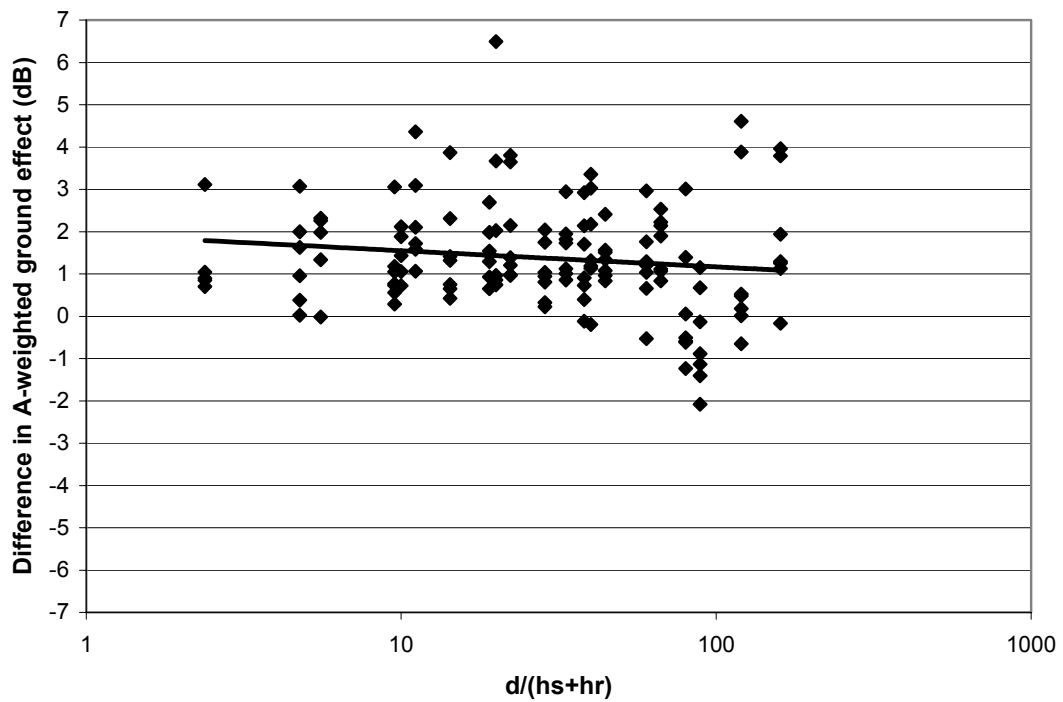


Figure 9
Difference in A-weighted ground effect between predictions by Nord2000 and 138 PE-results for a screen on flat ground and downwind propagation as a function of the horizontal propagation distance d divided by the sum of the source and receiver heights ($h_s + h_r$) in each individual case (points) and trend line (solid line).

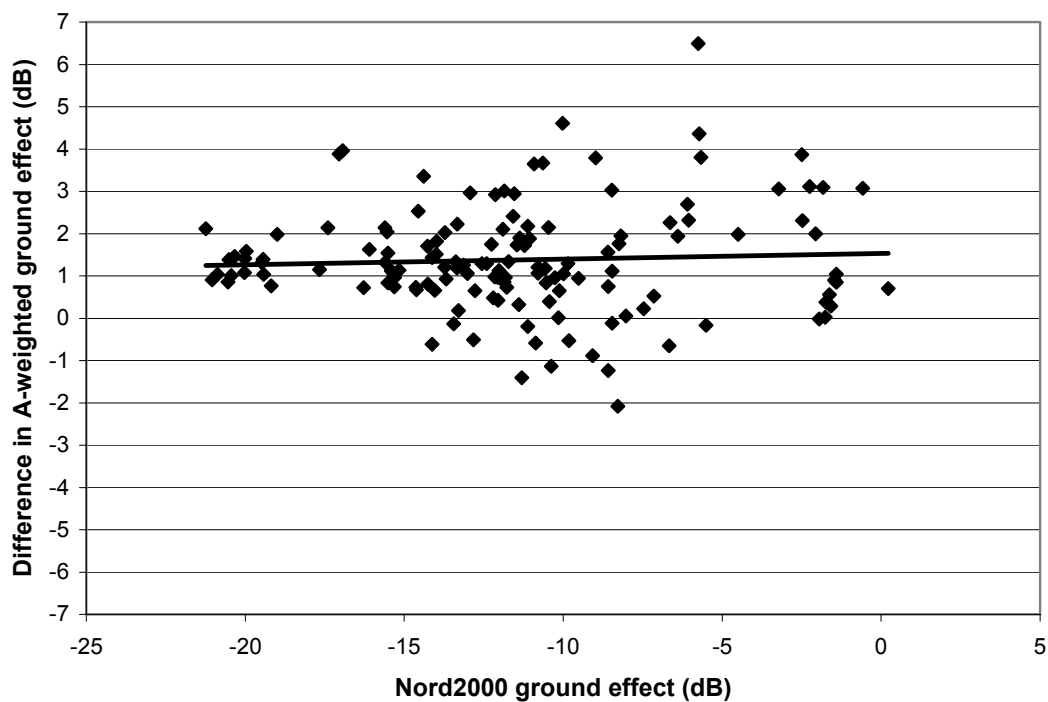


Figure 10
Difference in A-weighted ground effect between predictions by Nord2000 and 138 PE-results for a screen on flat ground and downwind propagation as a function of the A-weighted ground effect by Nord2000 in each individual case (points) and trend line (solid line).

7. Validation of the Yearly Average of the Noise Levels from Roads

The validation described in this section concerns the accuracy of the Nord2000 model when used to predict the yearly average of the day-evening-night level L_{den} taking into account the varying meteorological conditions during the year. A number of calculations of L_{den} from a road have been carried in the European Harmonoise project [13] with the purpose of testing the suitability of different reference calculation models. The results from this exercise can be used to test the accuracy of the Nord2000 model.

Four groups of test cases numbered 1-4 are illustrated schematically in Figure 11. Test Case 1 is propagation over flat grass-covered ground, Test Case 2 is propagation over a single 6 m high rigid thin screen placed at the roadside, and Test Case 3 has screens on both sides of the road. The test cases also included a T-top barrier (Test Case 4) where the top is covered with glass wool. This case is not covered by the Nord2000 model and has been omitted from the analysis in the present report, but a comment concerning the case is included below. The two columns of dots to the left in the figure illustrate that there are two lanes, and the vehicles on each lane are represented by three source heights placed

vertically above each other. The three horizontally placed dots to the right illustrate three propagation distances (50, 100, and 300 m). The receiver height is 4 m as recommended by the European Union for L_{den} -calculations. The road surface is porous asphalt modelled by the Hamet impedance model. The Hamet model is not included in Nord2000 where only the Delany and Bazley model is used. Therefore, it was necessary to modify the Nord2000 code to include the Hamet model. A detailed description of the calculation setup including traffic information, source description, and meteorological statistics can be found in [13].

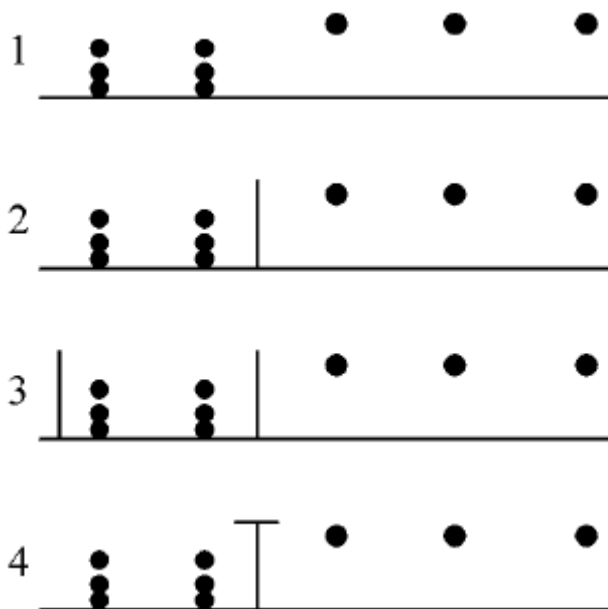


Figure 11
Schematic illustration of four Harmonoise L_{den} test cases.

The results of the L_{den} calculations by Nord2000 are shown in Table 6. The table contains the result of predictions by Nord2000 compared to reference results calculated by TNO (the Netherlands) using the Crank-Nicholson Parabolic Equation method. The results of calculations made by CSTB (France) is also included in [13], but as the results of CSTB are missing for Test Case 3 and the difference between the TNO and CSTB results are small in the other cases, the TNO-results were selected as reference results.

Test case	Distance	TNO	Nord2000	Difference
1	50 m	71.8	71.6	-0.2
	100 m	65.5	65.5	0.0
	300 m	58.5	59.0	0.5
2	50 m	57.9	57.3	-0.6
	100 m	55.7	54.9	-0.8
	300 m	49.0	47.9	-1.1
3	50 m	62.1	61.3	-0.8
	100 m	61.9	60.4	-1.5
	300 m	56.7	57.8	1.1

Table 6
Yearly average L_{den} calculated by Nord2000 compared to reference results (Crank-Nicholson PE made by TNO) for Harmonoise L_{den} Test Cases 1-3.

Table 6 shows that the agreement between Nord2000 results and the reference results are very good in all three test cases. The average difference is less than 0.5 dB, and the standard uncertainty is less than 1 dB.

As mentioned above the Nord2000 method does not include T-top barriers covered with absorbing material, and Test Case 4 has been omitted from the analyses in the present report. However, calculations by Nord2000 were performed for Test Case 4 by including the barrier top correction described in [13] in the Nord2000 code. These calculations showed differences in the same order as observed for Test Case 3. Therefore, it will be possible to include the effect of T-top barriers in the Nord2000 methodology, if necessary.

1/3-octave band spectra of L_{den} predicted by Nord2000 and the Harmonoise reference model corresponding to the 9 results in Table 6 are shown in Figure 12 to Figure 20. Also the spectra show good agreement.

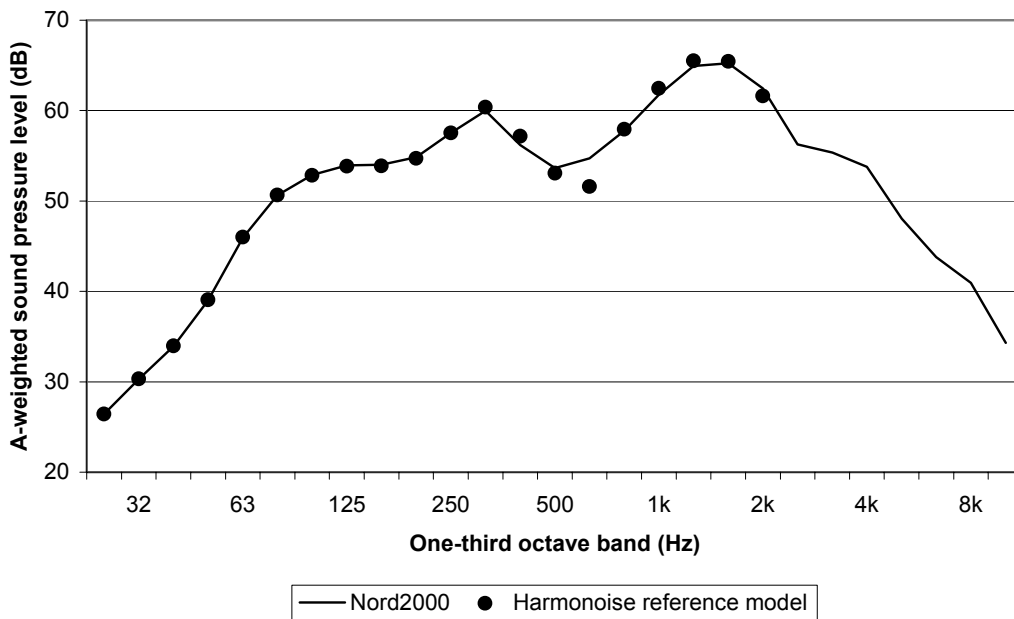


Figure 12
Harmonoise L_{den} Test Case 1. Propagation distance 50 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

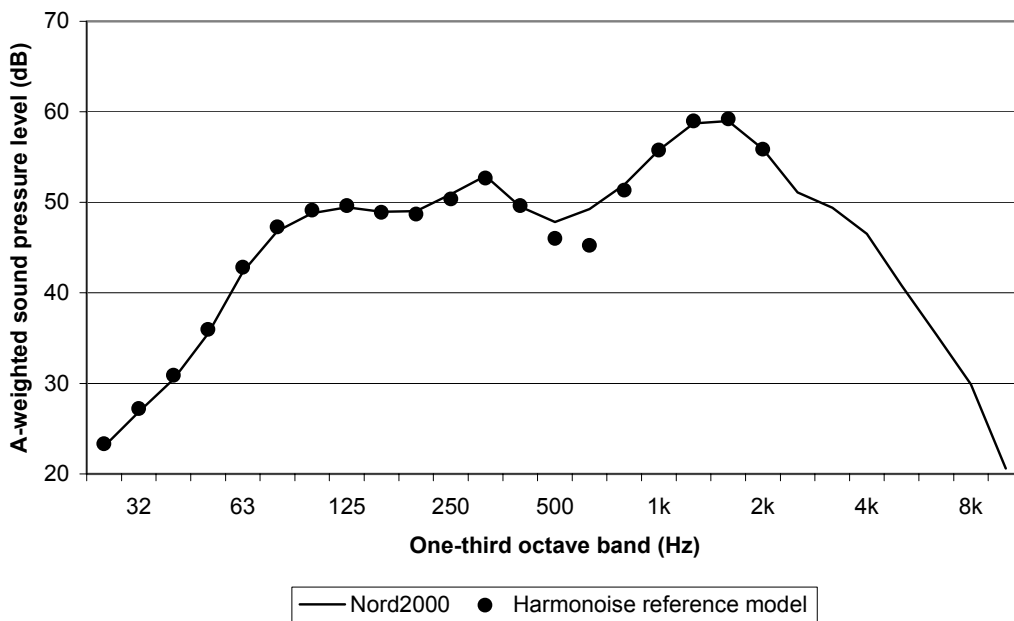


Figure 13
Harmonoise L_{den} Test Case 1. Propagation distance 100 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

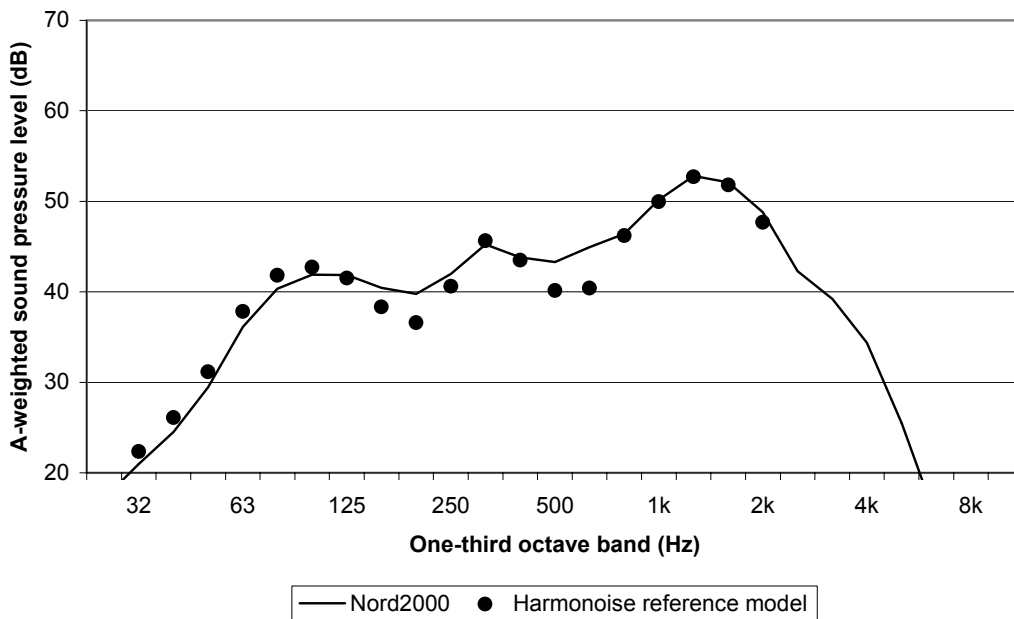


Figure 14
Harmonoise L_{den} Test Case 1. Propagation distance 300 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

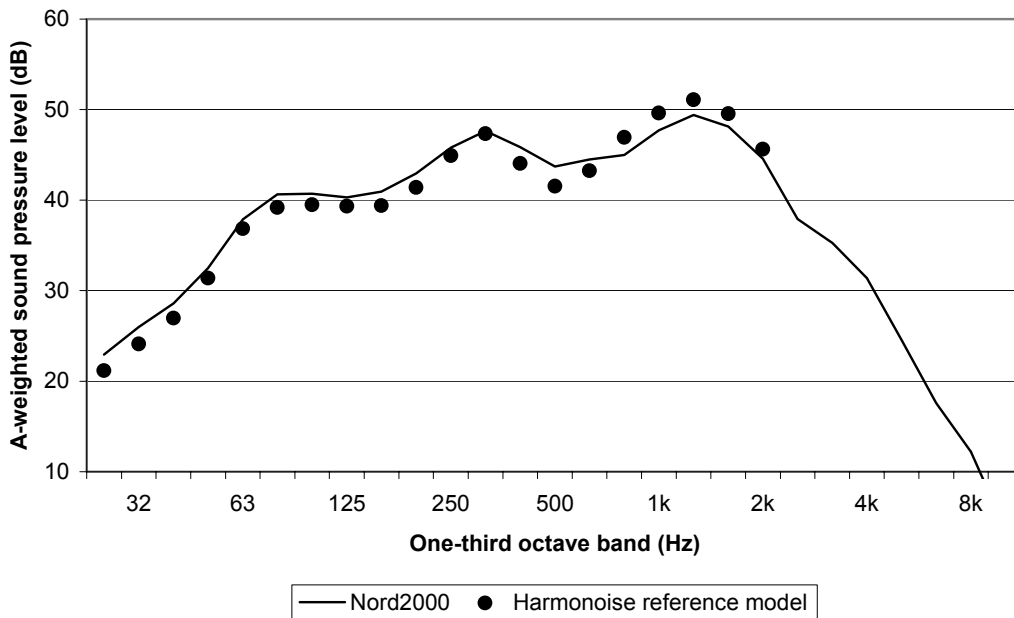


Figure 15
Harmonoise L_{den} Test Case 2. Propagation distance 50 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

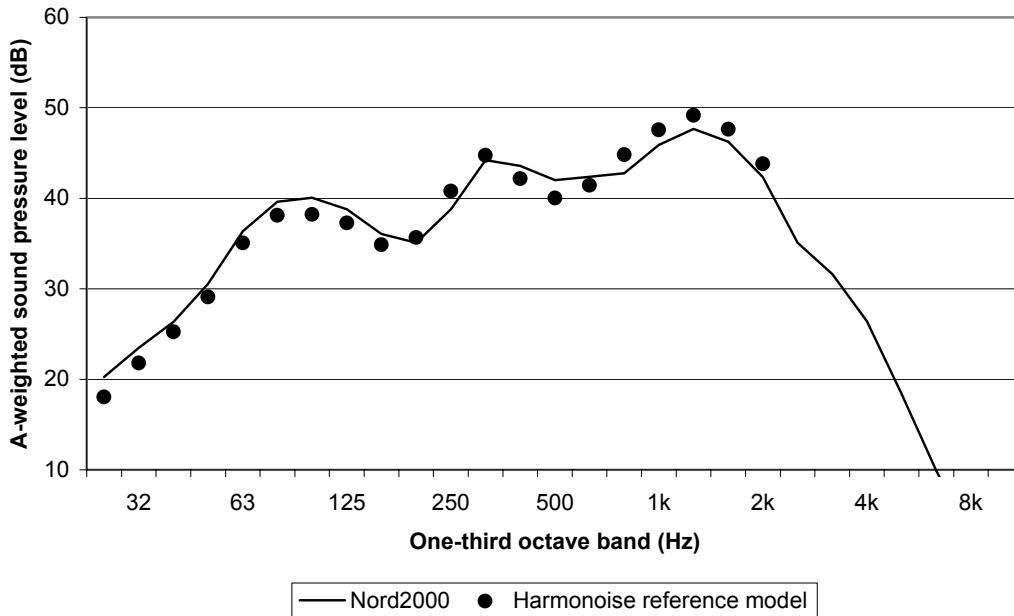


Figure 16
Harmonoise L_{den} Test Case 2. Propagation distance 100 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

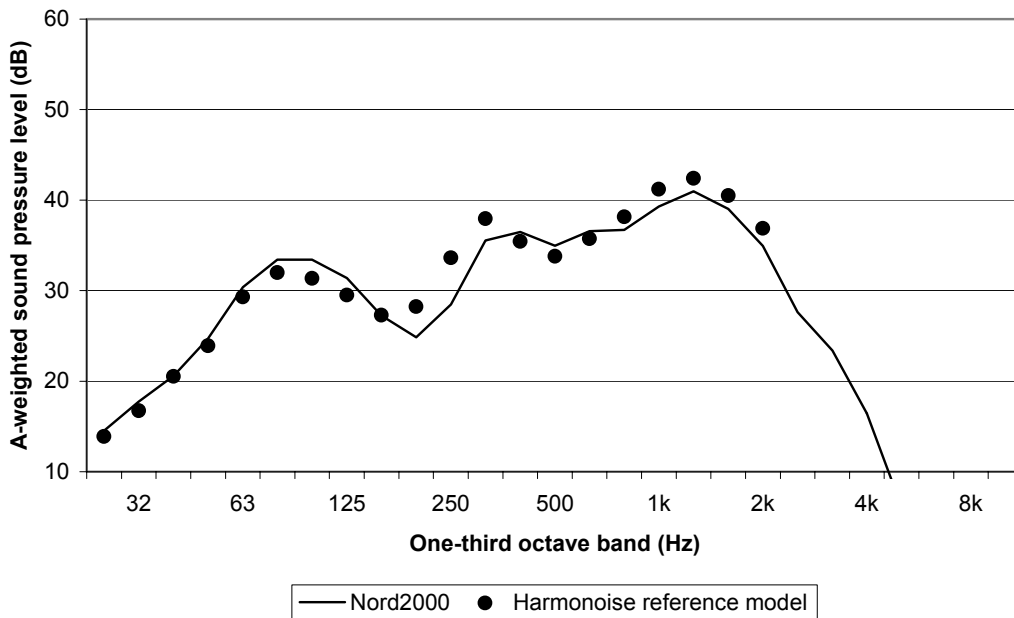


Figure 17
Harmonoise L_{den} Test Case 2. Propagation distance 300 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

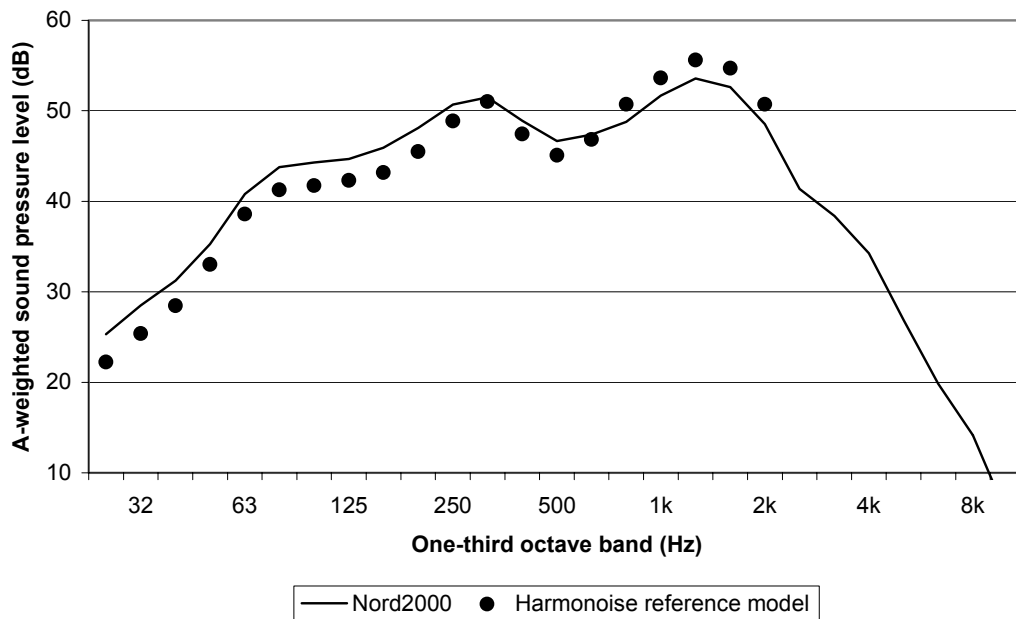


Figure 18
Harmonoise L_{den} Test Case 3. Propagation distance 300 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

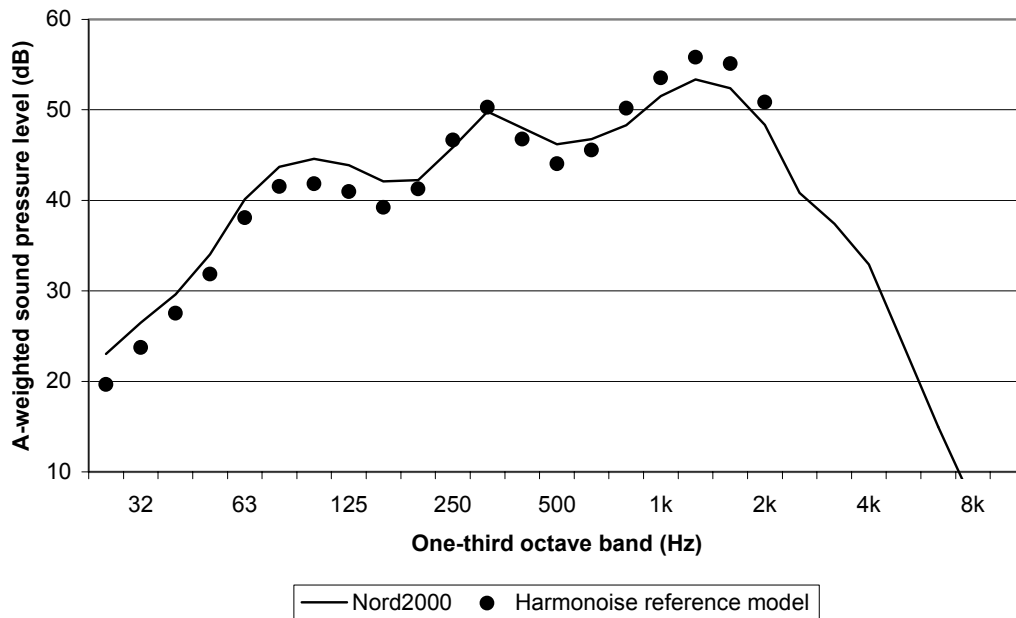


Figure 19
Harmonoise L_{den} Test Case 3. Propagation distance 100 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

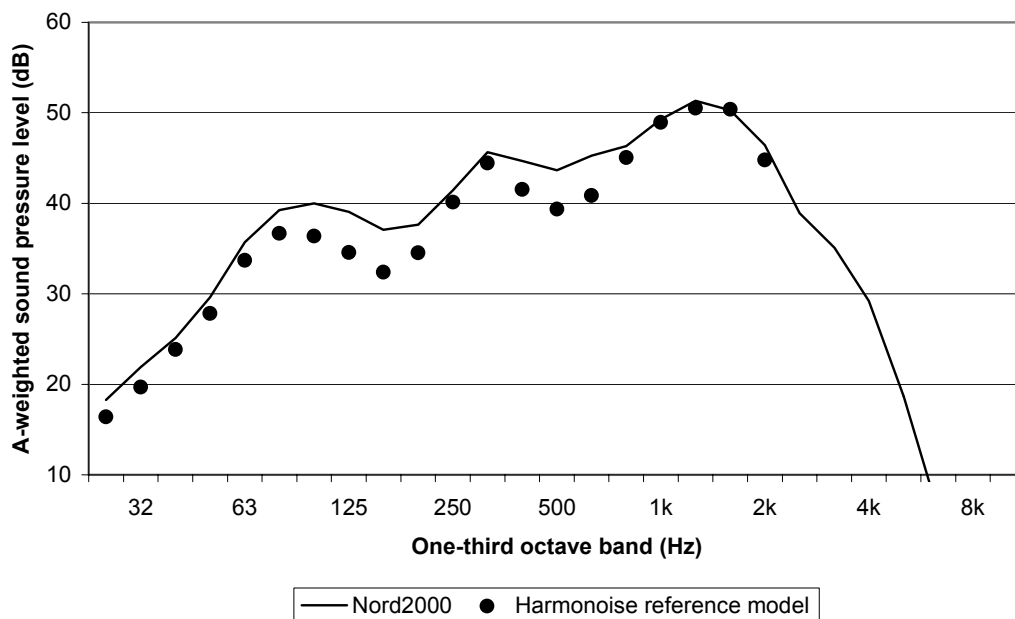


Figure 20
Harmonoise L_{den} Test Case 3. Propagation distance 300 m. A-weighted 1/3-octave band spectrum of L_{den} predicted by Nord2000 and by a Harmonoise reference model.

8. Conclusion

The present report contains a large number of cases (544) with point-to-point validation of the Nord2000 propagation model based on measurements and reference calculation results and 9 cases with calculation of the yearly average L_{den} from a road.

The point-to-point validation consists of four groups of cases:

- 61 measurements covering propagation distances up to 200 m with a majority of small distances and only few cases including meteorological effects.
- 64 reference results covering distances up to 200 m with half of them including meteorological effects. Most of the reference results come from the Harmonoise benchmark calculations.
- 281 reference results for downwind (1-5 m/s) and flat grass-covered ground (made by DELTA using the Parabolic Equation method) and covering propagation distances between 50 and 1000 m.
- 138 reference results for downwind (3 m/s) and a thin screen on flat ground (made by DELTA using the Parabolic Equation method) and covering propagation distances between 25 and 400 m

The point-to-point validation cases show on the average small differences between the Nord2000 predictions and the measurement or reference results. The largest average difference is observed in the results for a thin screen on flat ground where Nord2000 produces A-weighted noise levels which are in the order of 1 dB higher than the reference results.

The standard uncertainty of individual results has been found to be in the order of 1 dB for all four groups for propagation distances up to 400 m. Above 400 m reference results have only been available for flat ground (range of distances 600-1000 m) where the standard uncertainty is in the order of 2 dB.

The 9 cases with calculation of the yearly average L_{den} from a road covering propagation distances up to 300 m show an average deviation from the reference results less than 0.5 dB and a standard uncertainty less than 1 dB.

The validation cases cover moderate complex terrain such as terrain with screens and non-flat terrain and moderate wind speeds (5 m/s). It must be expected that the calculation uncertainty will increase compared to the mentioned values in case of a very complex propagation environment and in case of very strong wind speeds.

9. References

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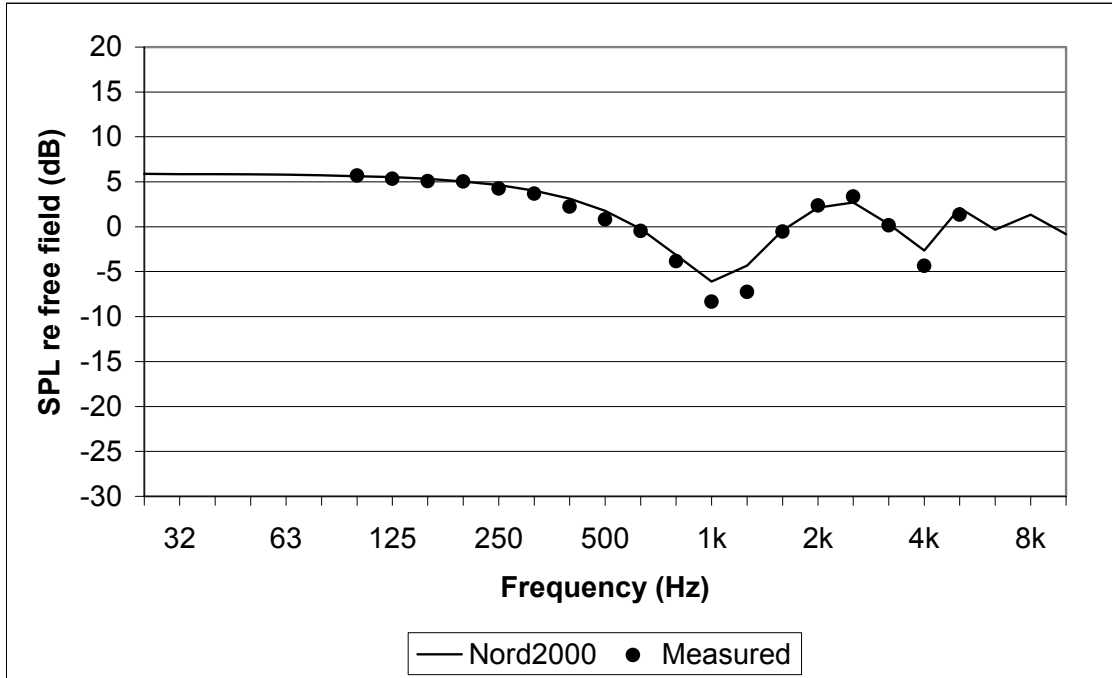
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Appendix A

Results from Validation Group 1 Based on Measurement Results

In some of the cases (61-64) shown in this appendix a flow resistivity value of 5 can be found in the terrain profile table. This value indicates that the exponential-porosity impedance model has been used instead of the Delany and Bazley model with an effective flow resistivity σ of 16 kPasm⁻² and rate of porosity decrease with depth α of 38.6 m⁻¹.

Nord2000 Validation. Measurements. Case No. 11



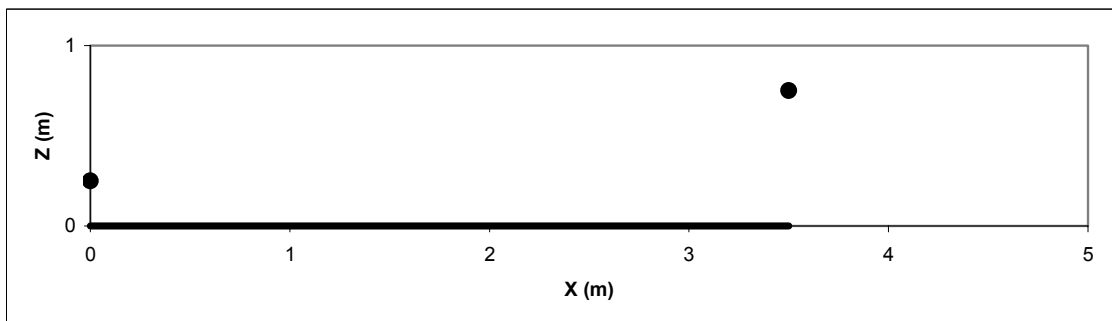
Nord2000 A-weighted ground effect (dB)	-1.0
A-weighted difference re. measured (dB)	0.2

Terrain profile

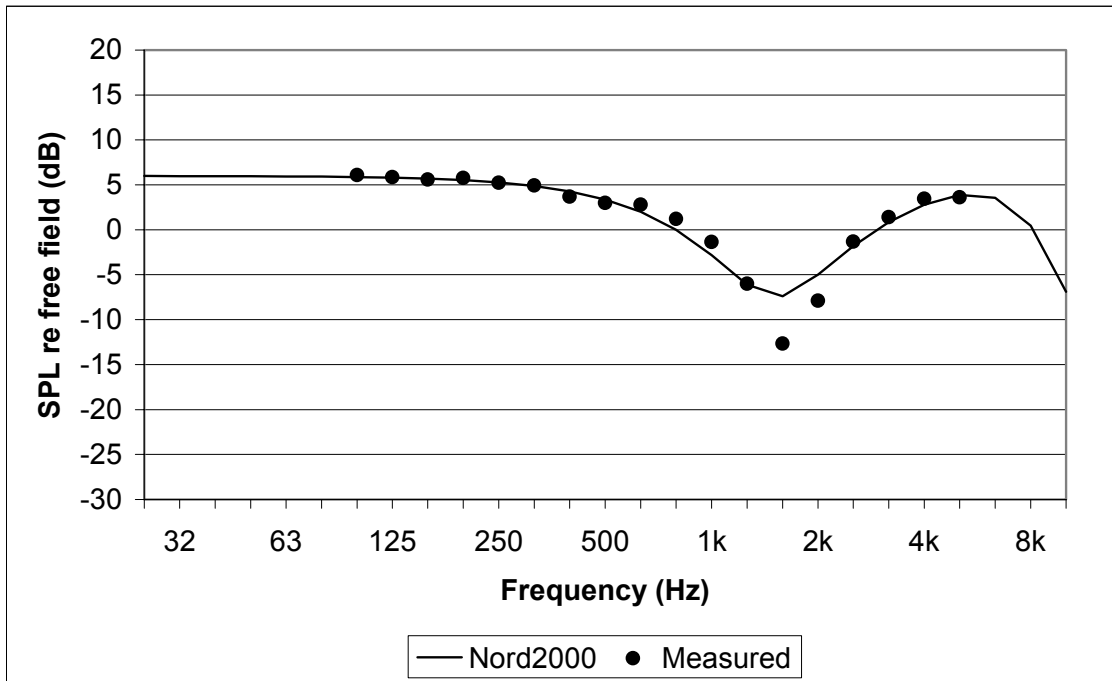
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 12



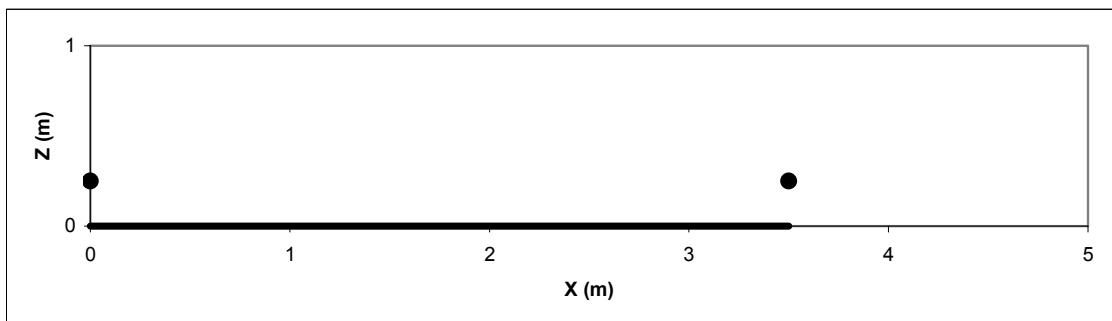
Nord2000 A-weighted ground effect (dB)	-0.9
A-weighted difference re. measured (dB)	-0.2

Terrain profile

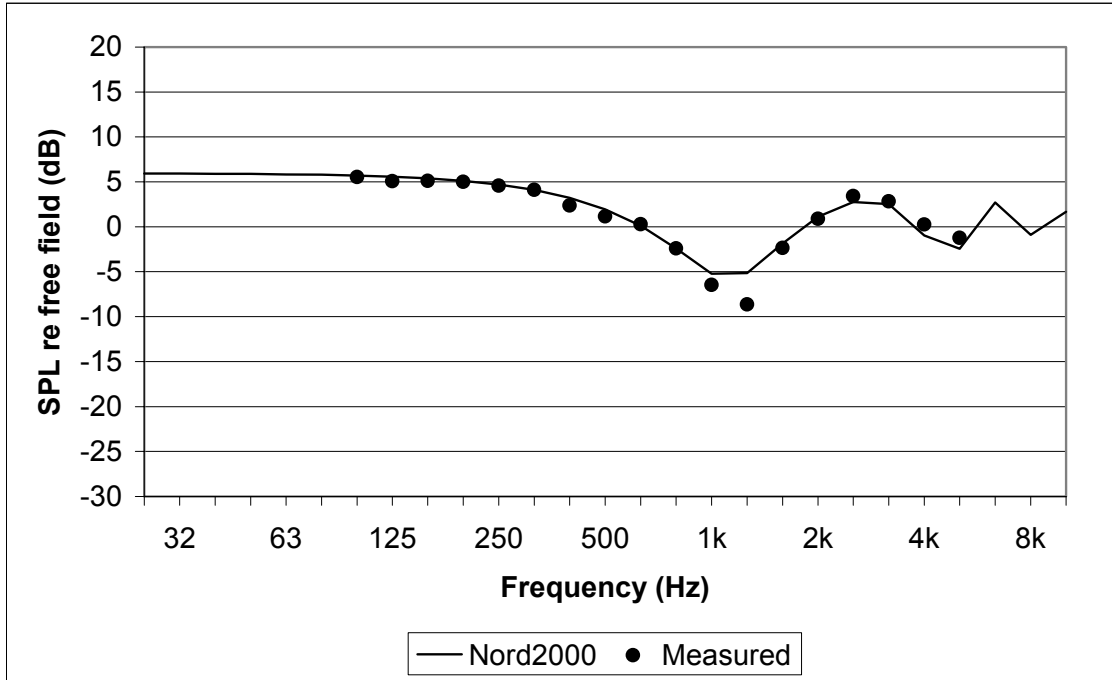
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 13



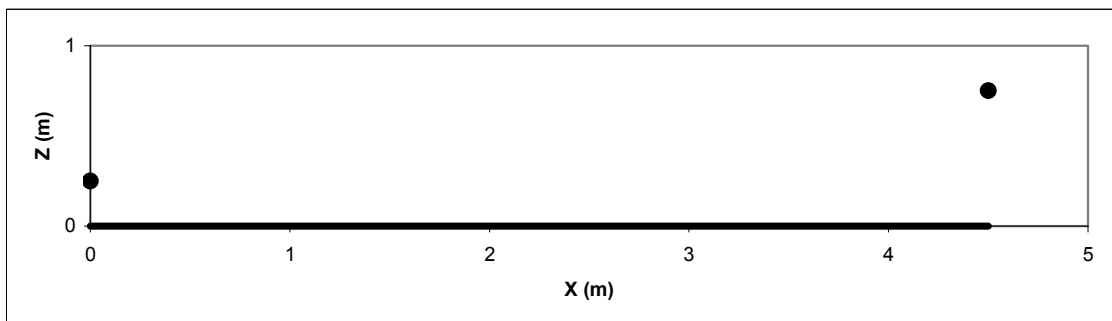
Nord2000 A-weighted ground effect (dB)	-1.1
A-weighted difference re. measured (dB)	-0.1

Terrain profile

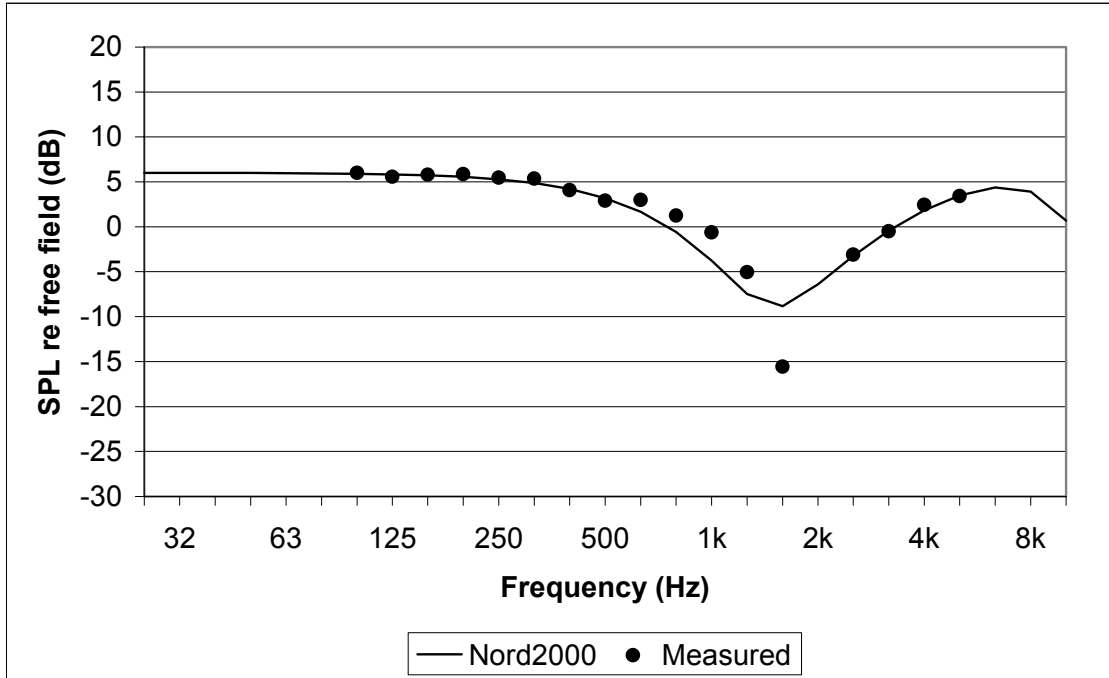
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 14



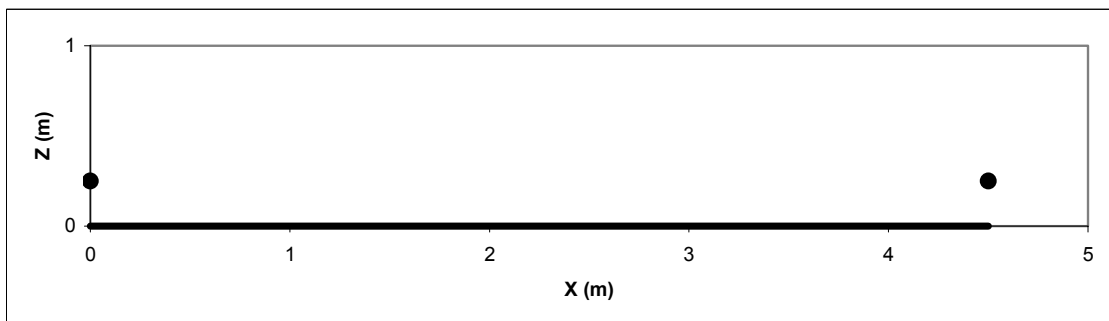
Nord2000 A-weighted ground effect (dB)	-1.4
A-weighted difference re. measured (dB)	-0.5

Terrain profile

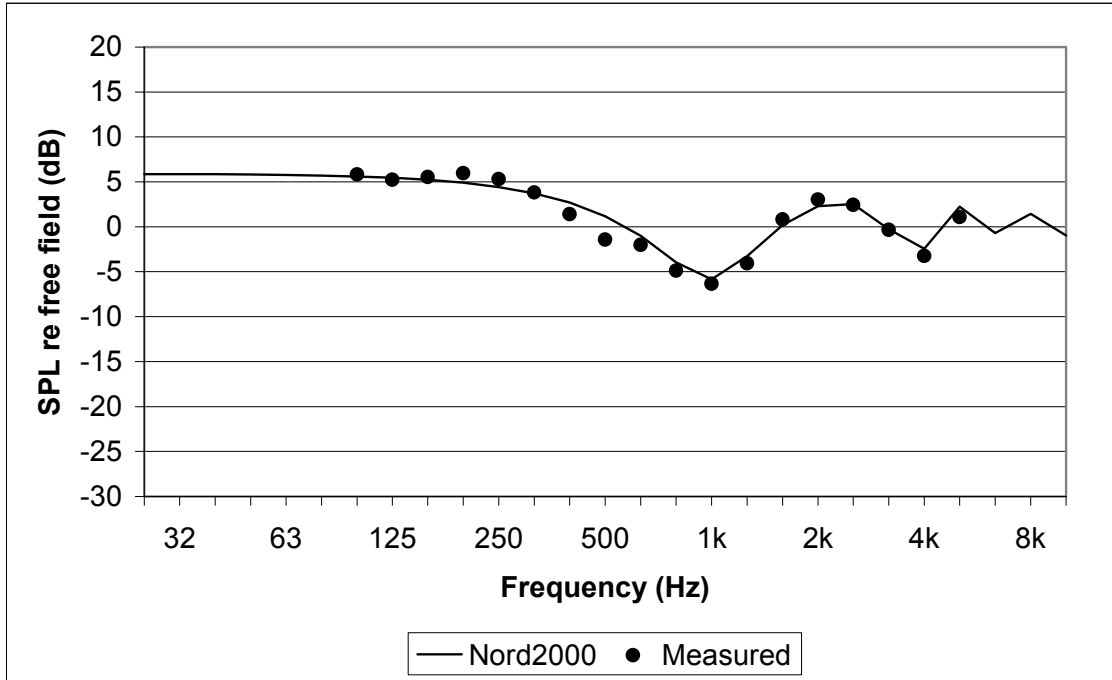
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 23



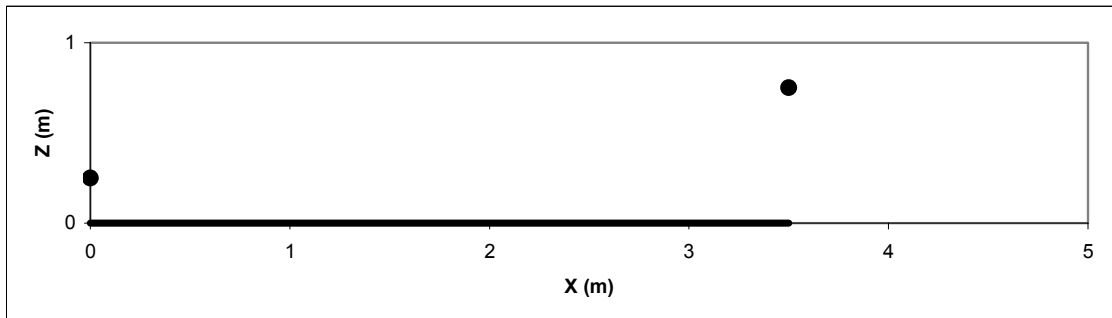
Nord2000 A-weighted ground effect (dB)	-1.0
A-weighted difference re. measured (dB)	0.2

Terrain profile

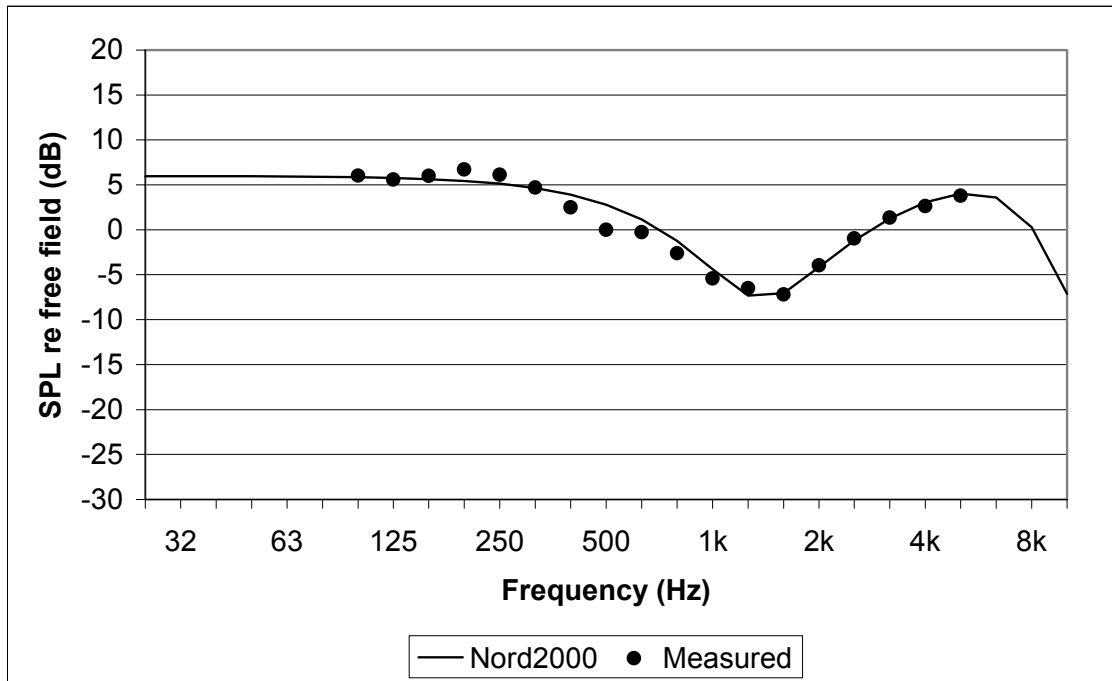
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 24



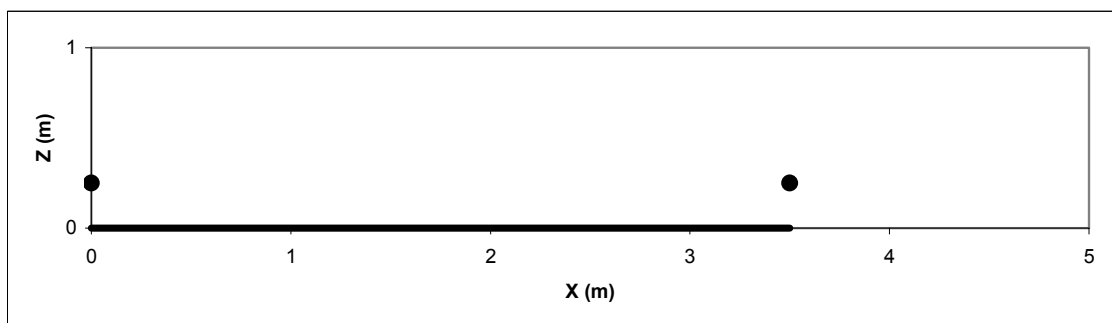
Nord2000 A-weighted ground effect (dB)	-1.0
A-weighted difference re. measured (dB)	0.3

Terrain profile

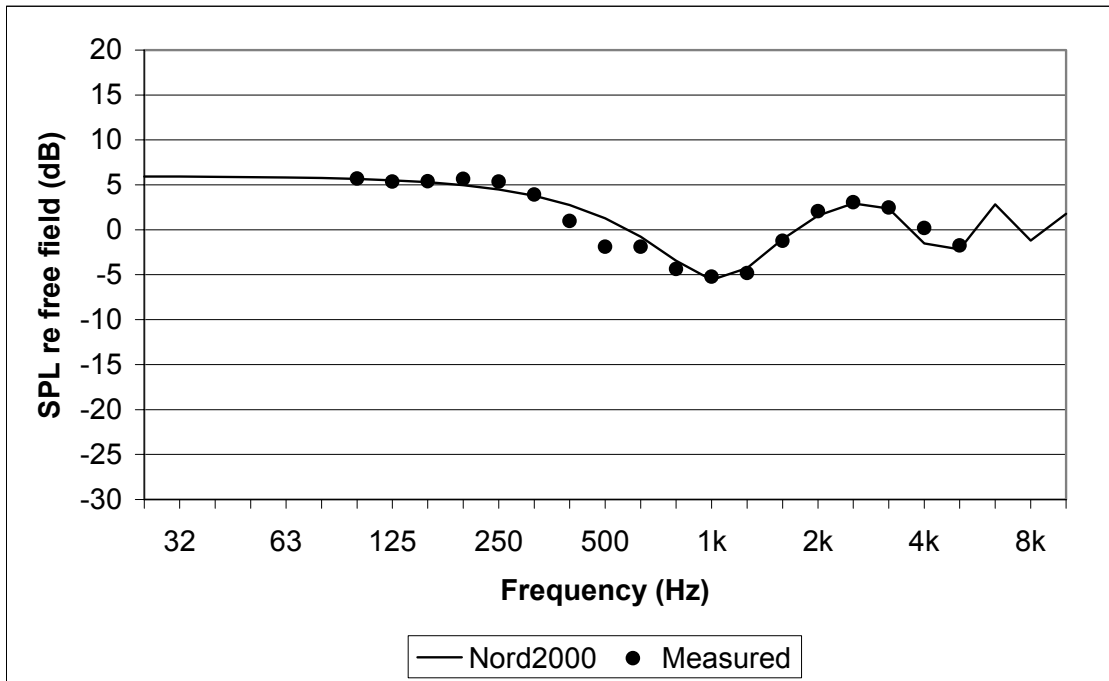
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 25



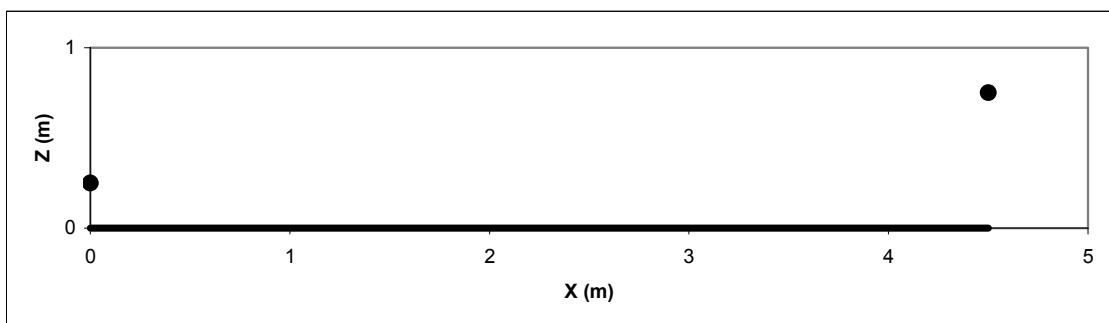
Nord2000 A-weighted ground effect (dB)	-1.2
A-weighted difference re. measured (dB)	-0.1

Terrain profile

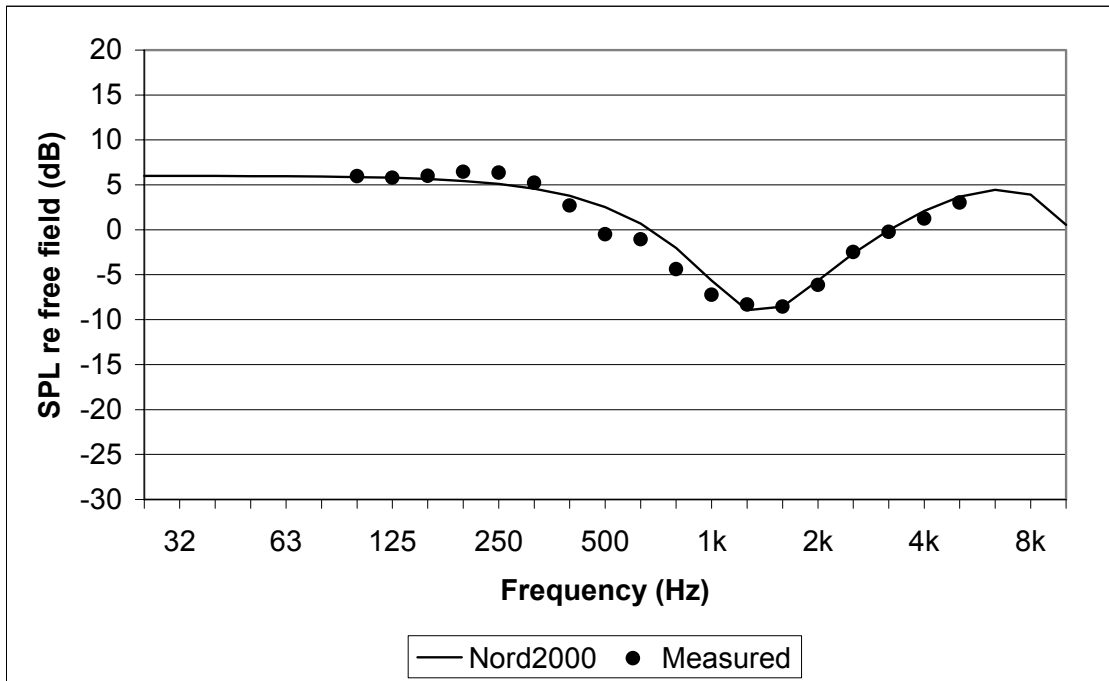
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dt dz	0.0000	K/m
sd t dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 26



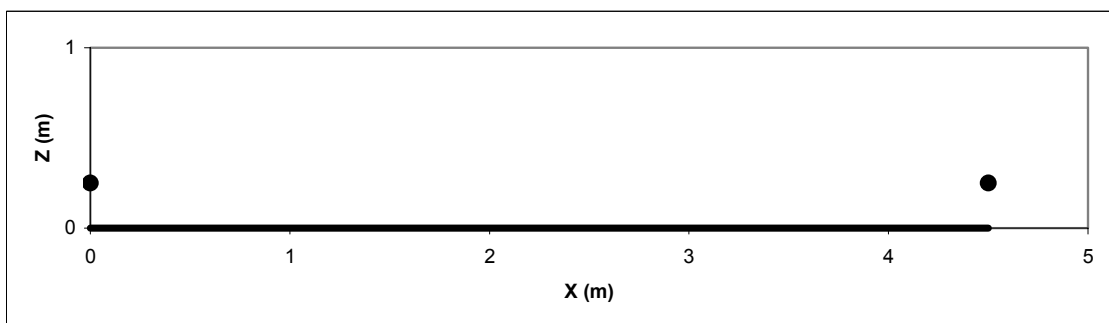
Nord2000 A-weighted ground effect (dB)	-1.6
A-weighted difference re. measured (dB)	0.6

Terrain profile

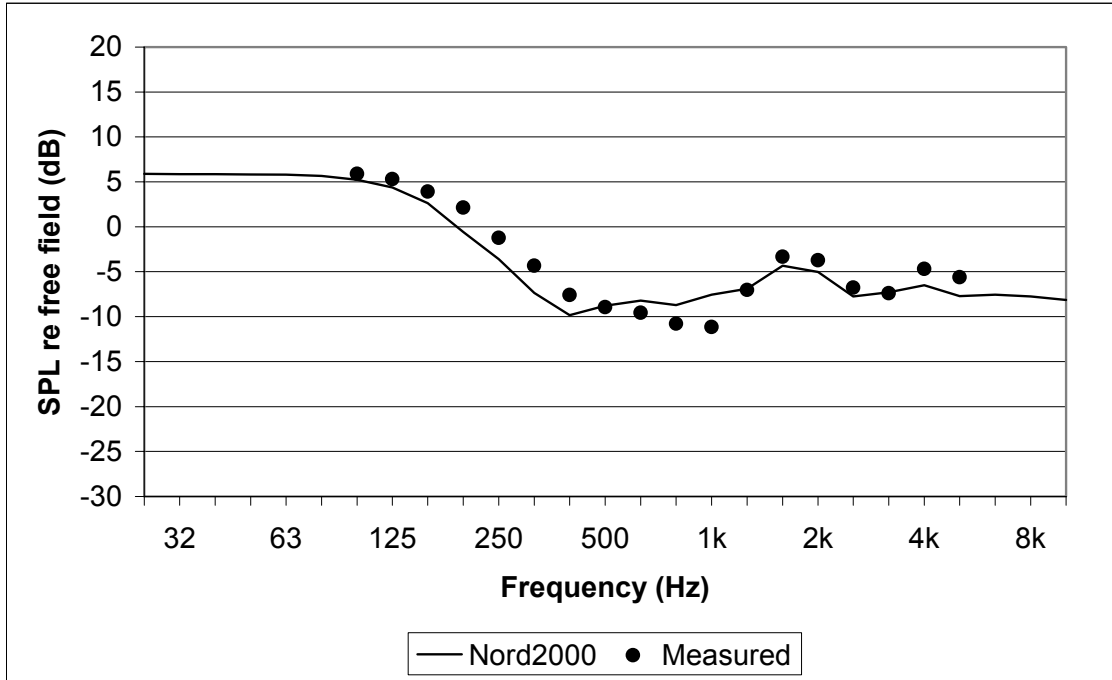
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 15



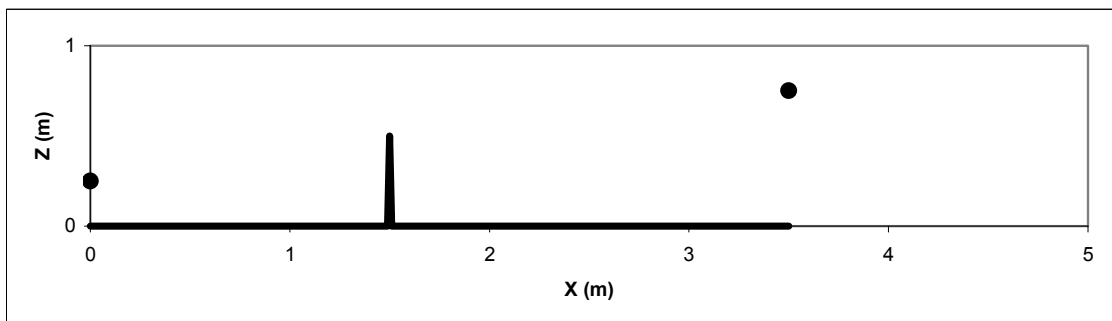
Nord2000 A-weighted ground effect (dB)	-7.9
A-weighted difference re. measured (dB)	-0.9

Terrain profile

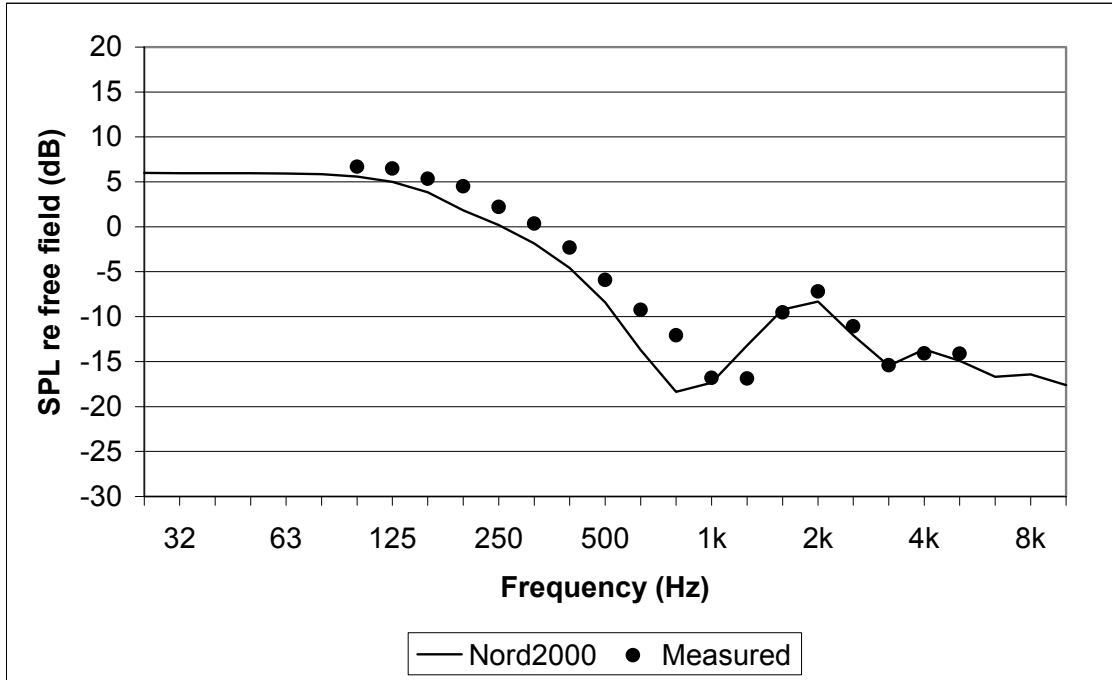
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	250000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 16



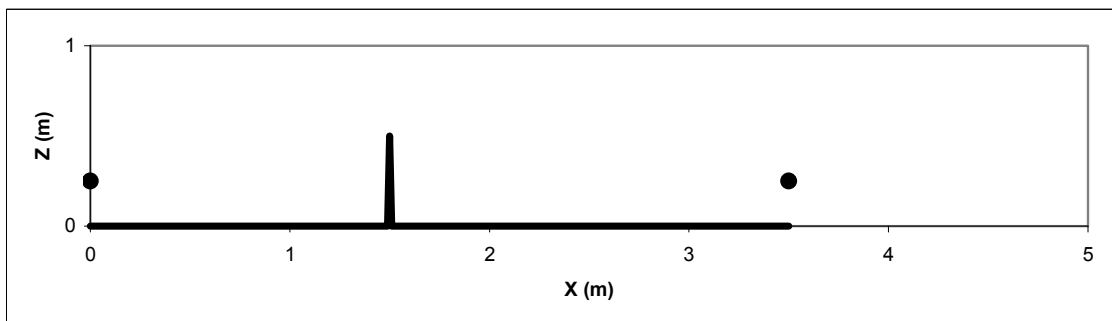
Nord2000 A-weighted ground effect (dB)	-10.8
A-weighted difference re. measured (dB)	-1.5

Terrain profile

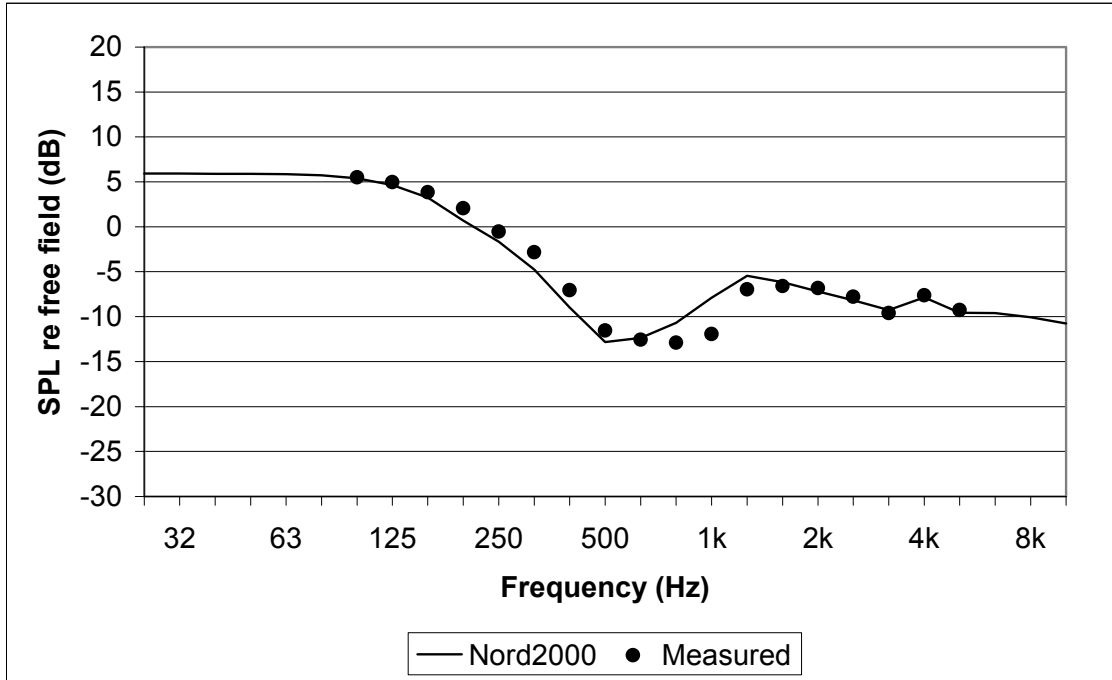
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	250000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 17



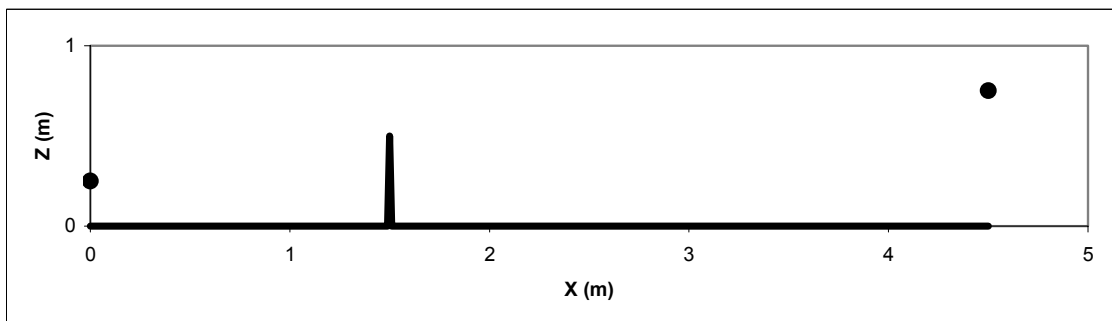
Nord2000 A-weighted ground effect (dB)	-8.8
A-weighted difference re. measured (dB)	0.1

Terrain profile

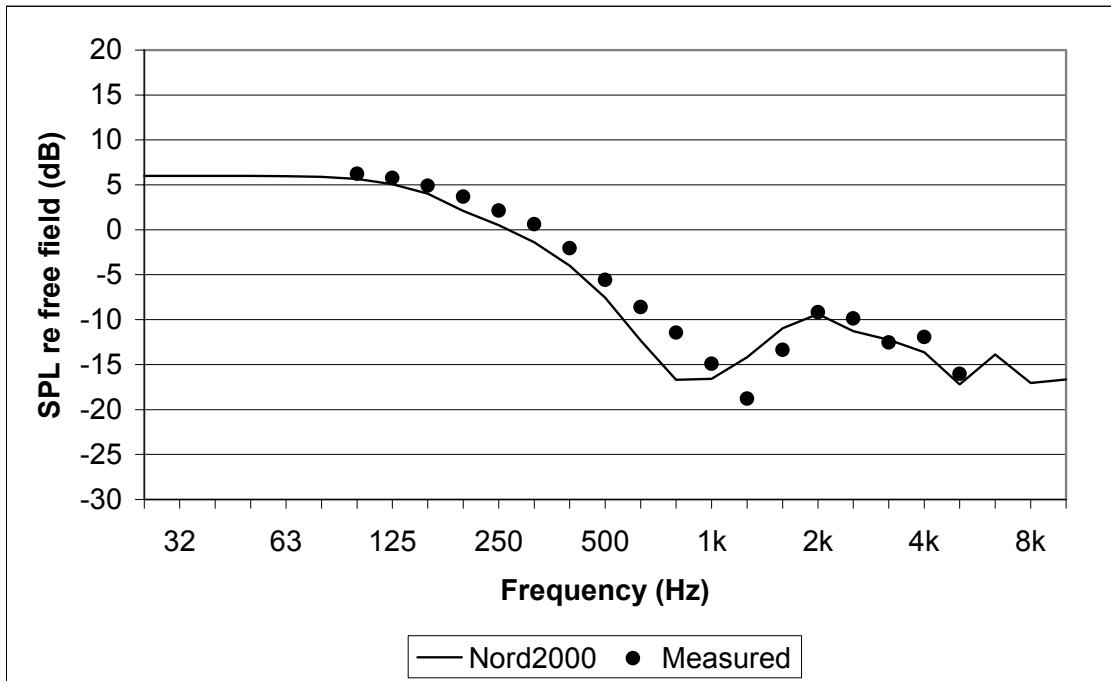
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	250000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 18



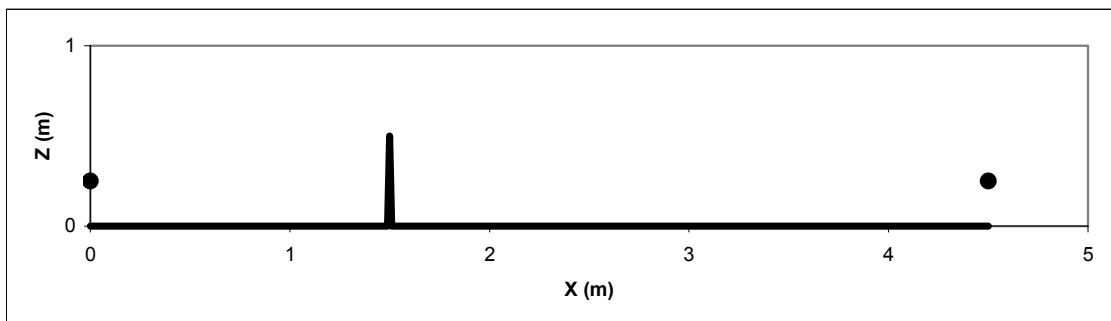
Nord2000 A-weighted ground effect (dB)	-10.7
A-weighted difference re. measured (dB)	-1.2

Terrain profile

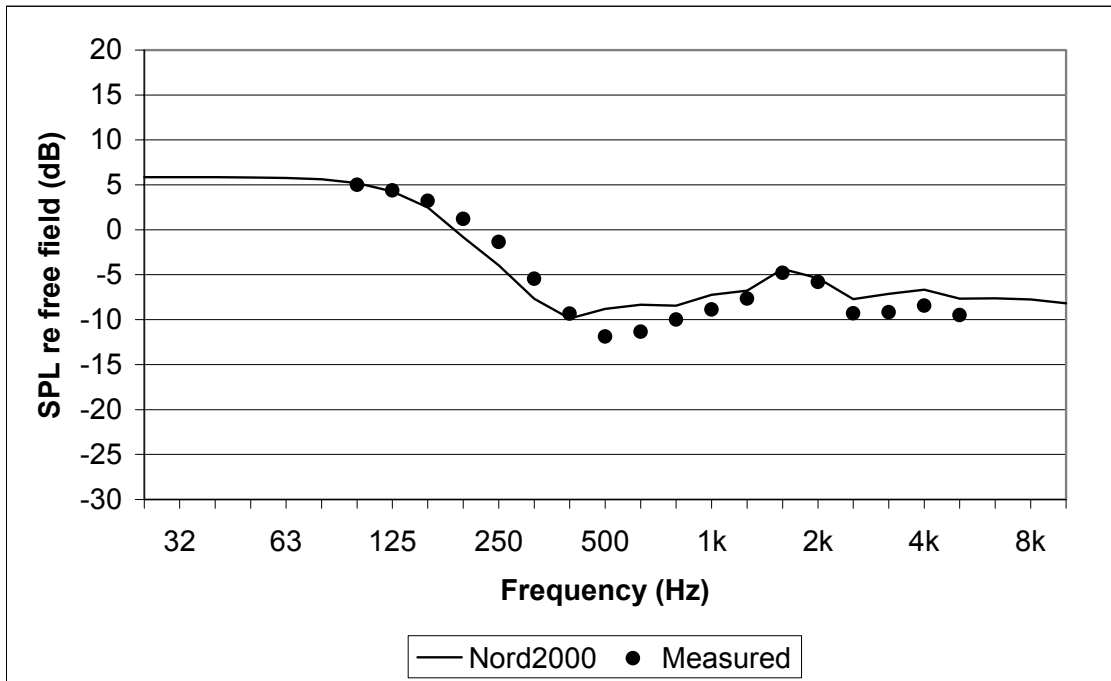
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	250000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 27



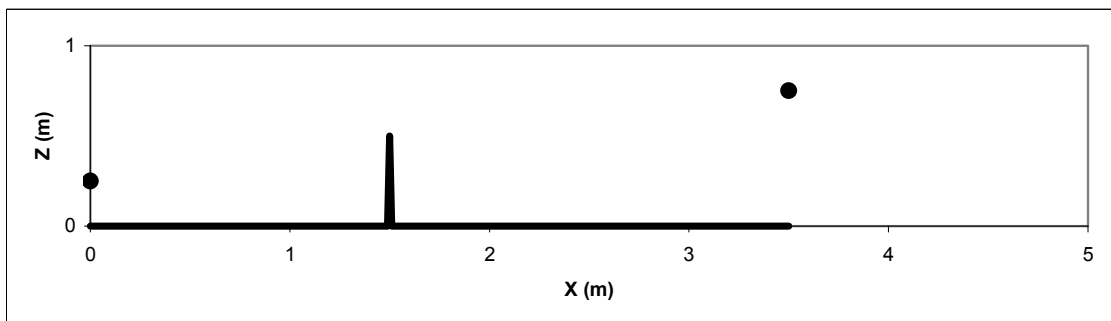
Nord2000 A-weighted ground effect (dB)	-7.9
A-weighted difference re. measured (dB)	0.8

Terrain profile

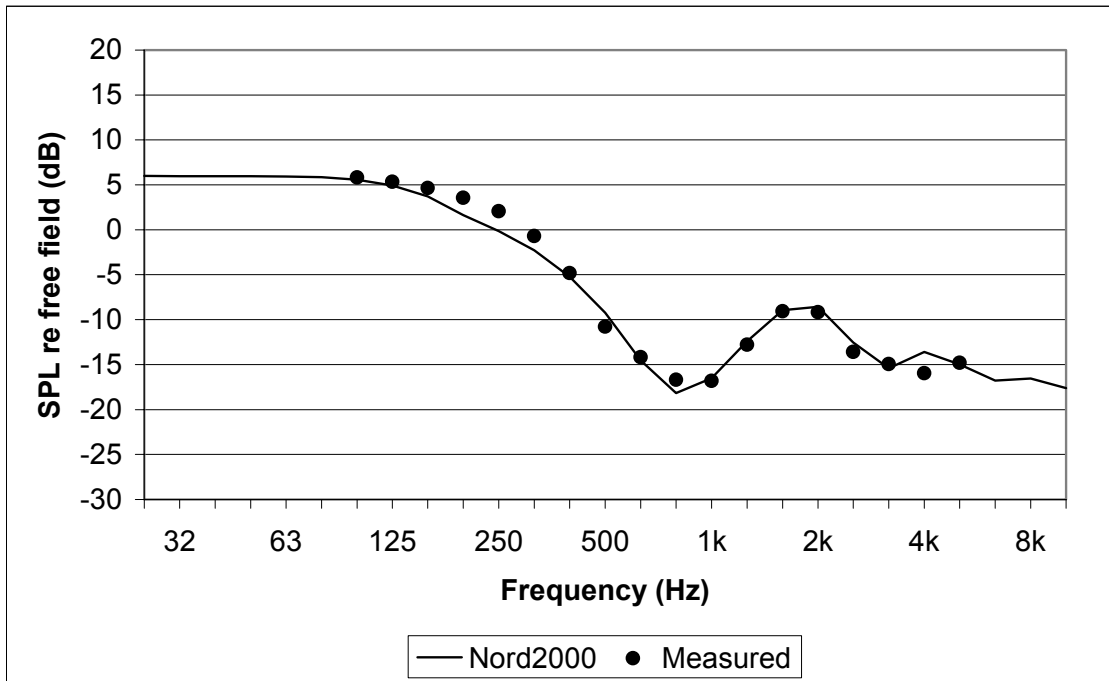
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 28



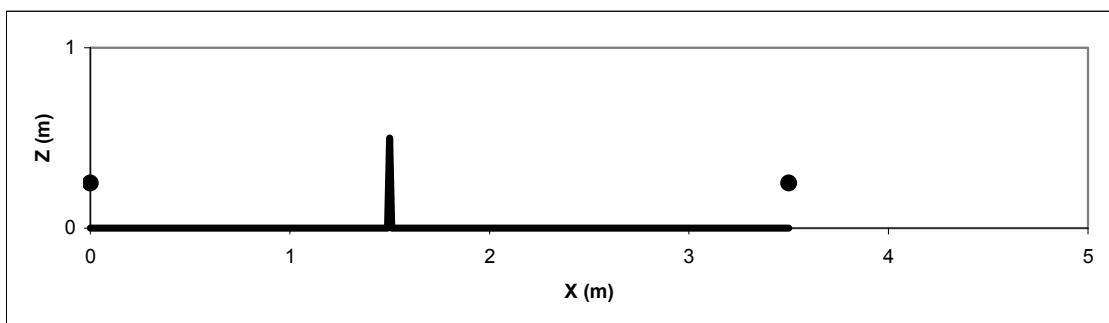
Nord2000 A-weighted ground effect (dB)	-11.0
A-weighted difference re. measured (dB)	-0.5

Terrain profile

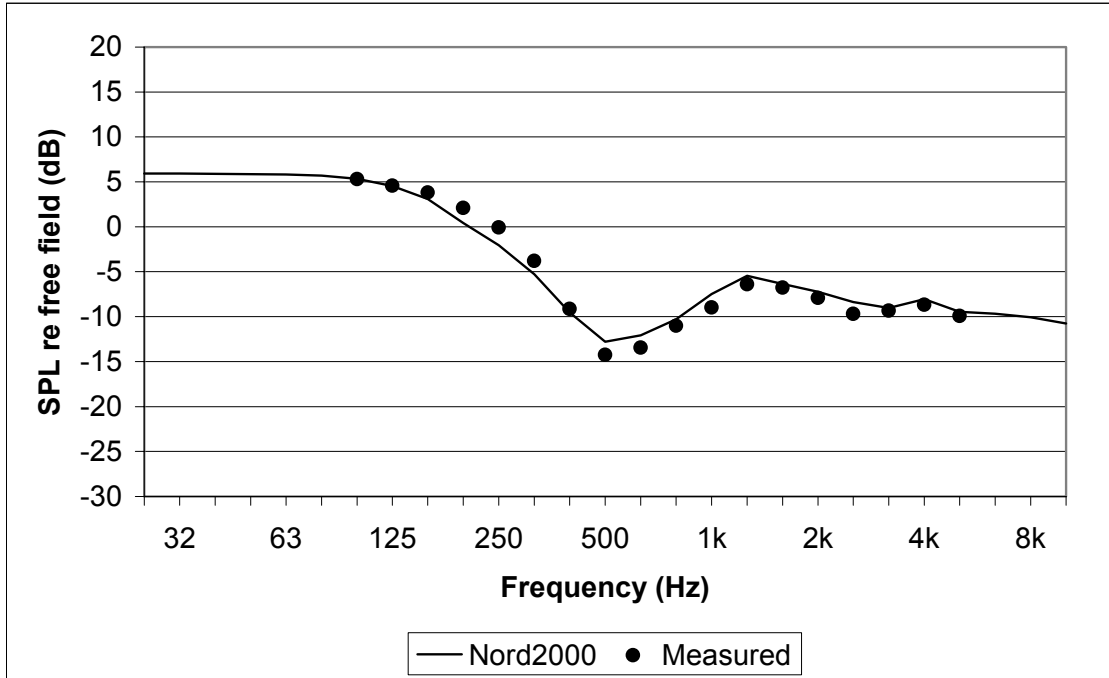
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 29



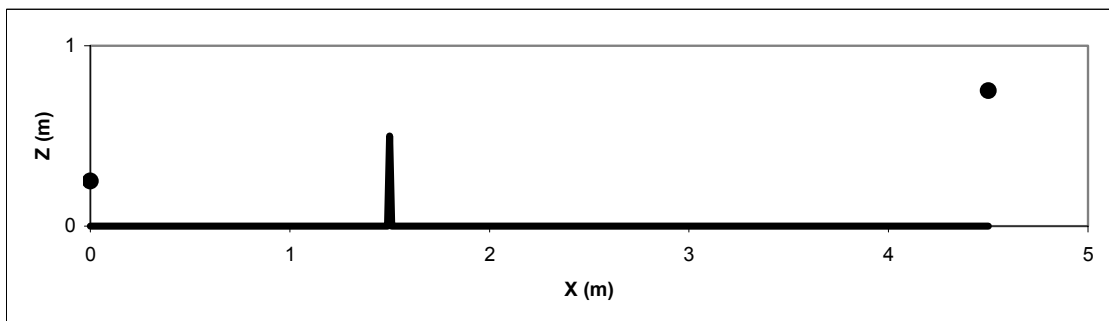
Nord2000 A-weighted ground effect (dB)	-8.8
A-weighted difference re. measured (dB)	0.3

Terrain profile

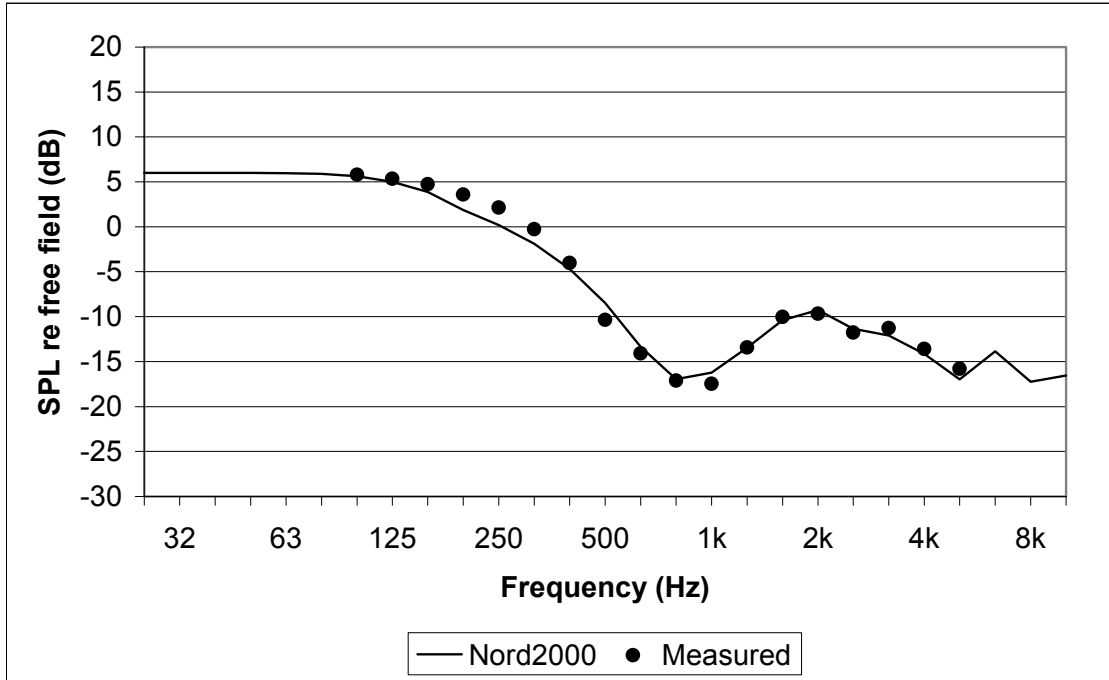
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	200000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 30



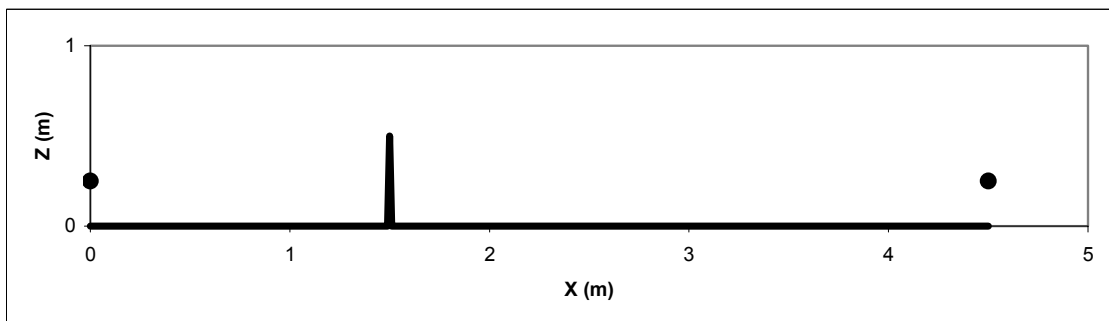
Nord2000 A-weighted ground effect (dB)	-10.9
A-weighted difference re. measured (dB)	-0.7

Terrain profile

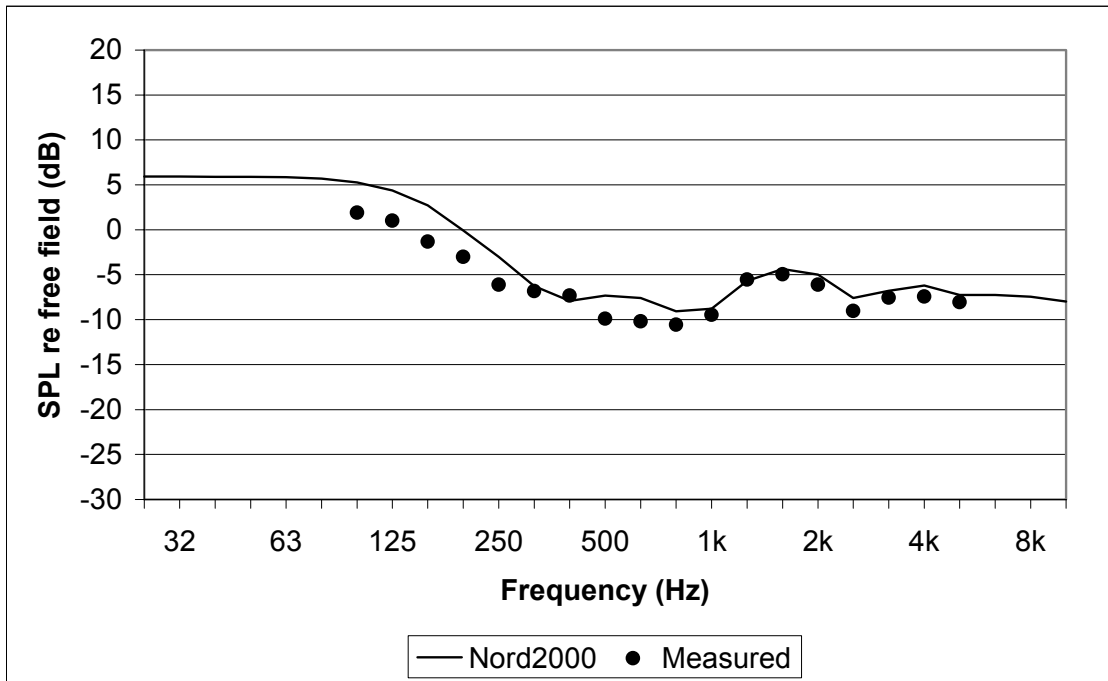
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	200000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 31



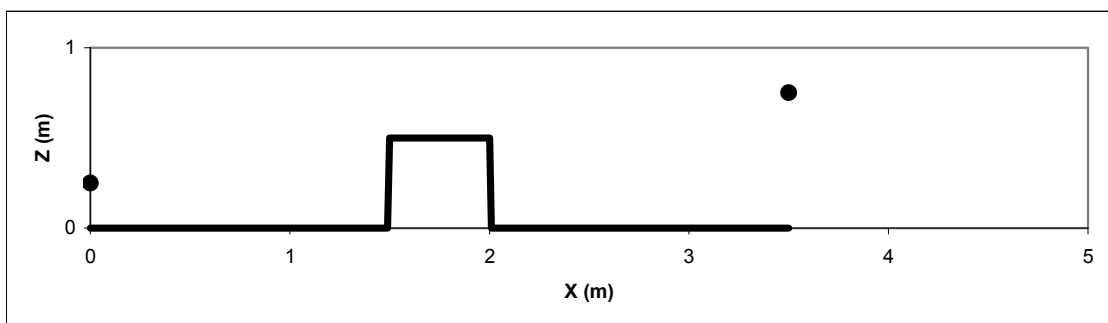
Nord2000 A-weighted ground effect (dB)	-7.6
A-weighted difference re. measured (dB)	1.1

Terrain profile

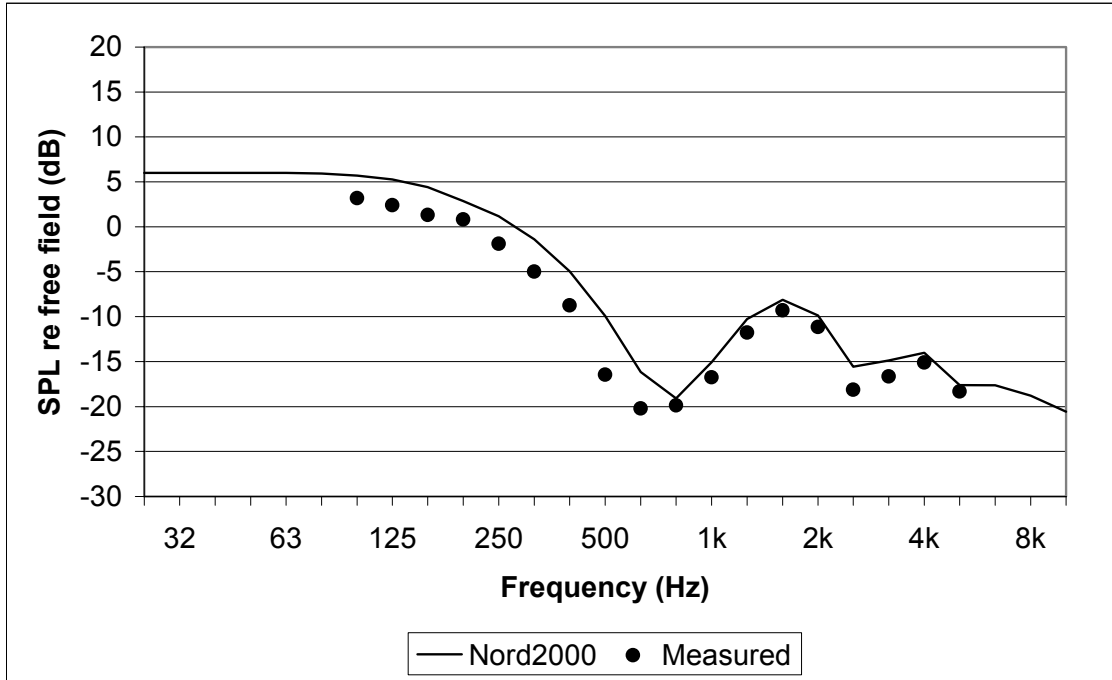
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
2.00	0.50	100000000	0
2.01	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 32



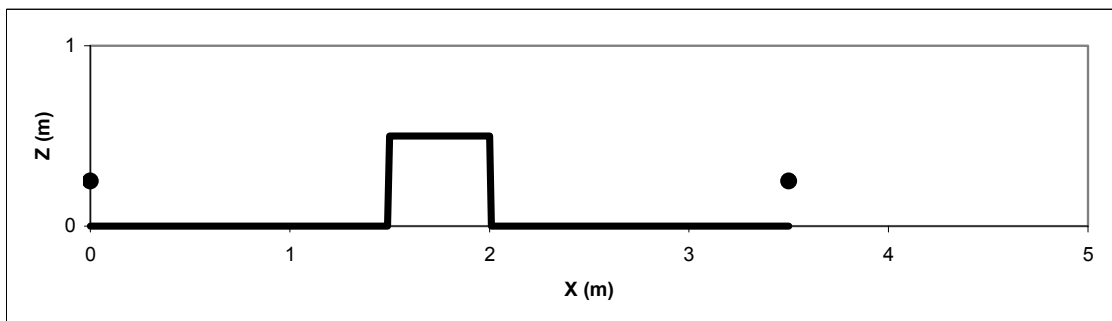
Nord2000 A-weighted ground effect (dB)	-10.6
A-weighted difference re. measured (dB)	2.3

Terrain profile

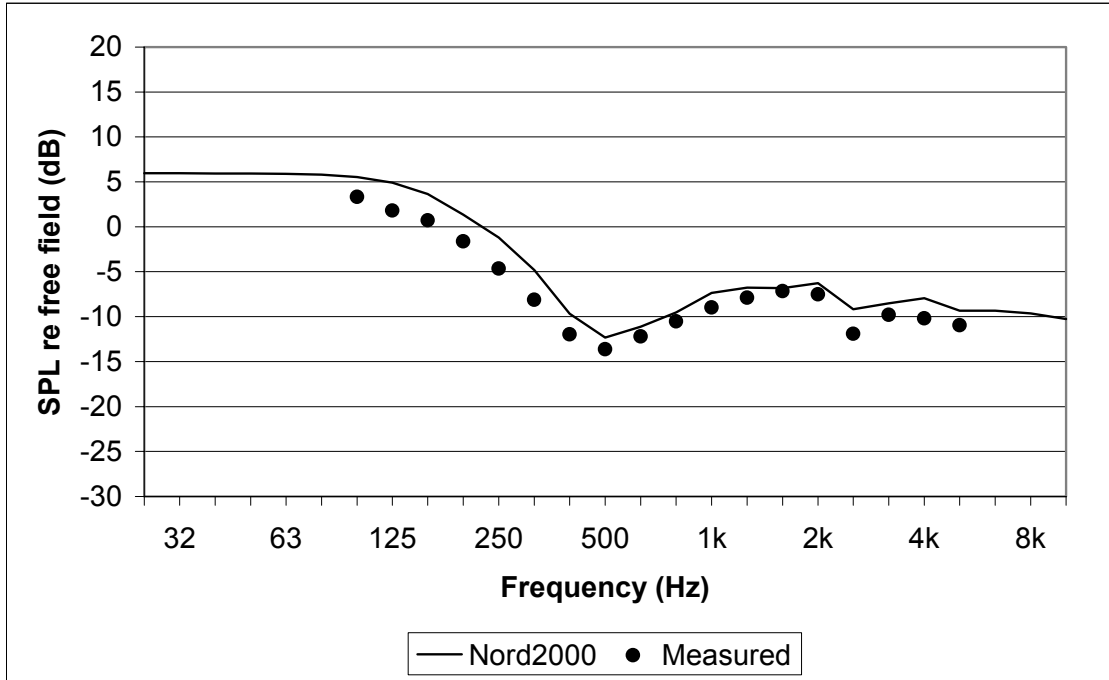
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
2.00	0.50	100000000	0
2.01	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 33



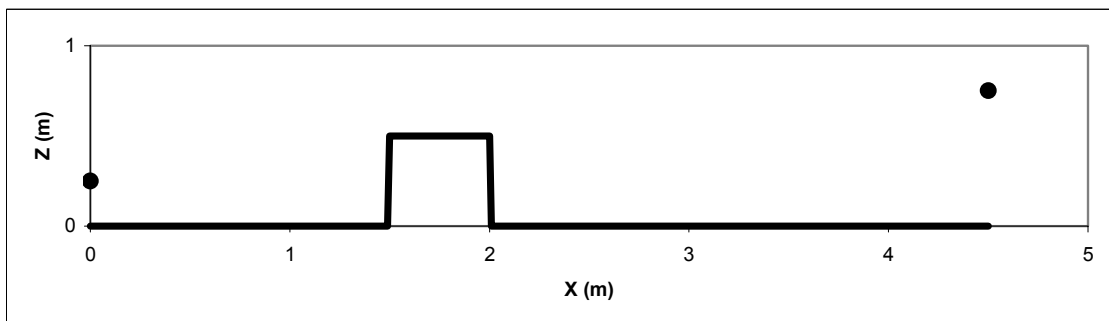
Nord2000 A-weighted ground effect (dB)	-8.7
A-weighted difference re. measured (dB)	1.7

Terrain profile

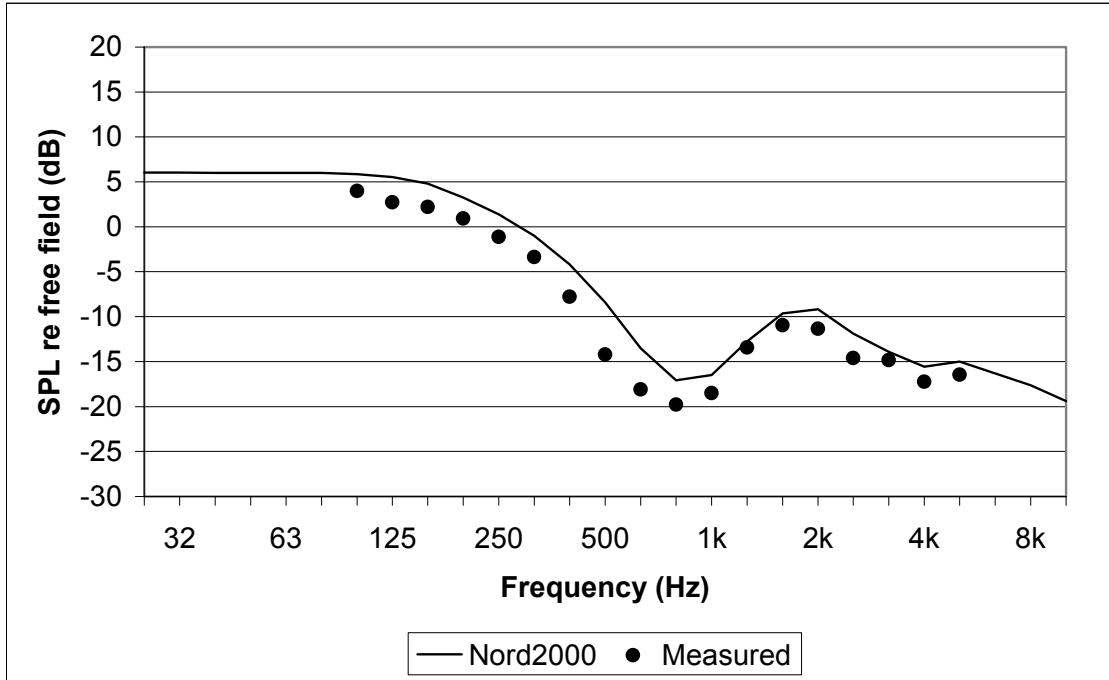
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
2.00	0.50	100000000	0
2.01	0.00	200000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.75	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 34



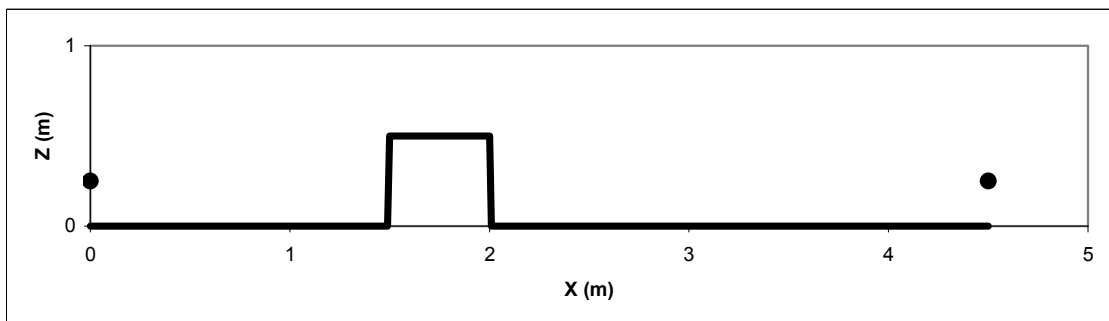
Nord2000 A-weighted ground effect (dB)	-10.4
A-weighted difference re. measured (dB)	2.4

Terrain profile

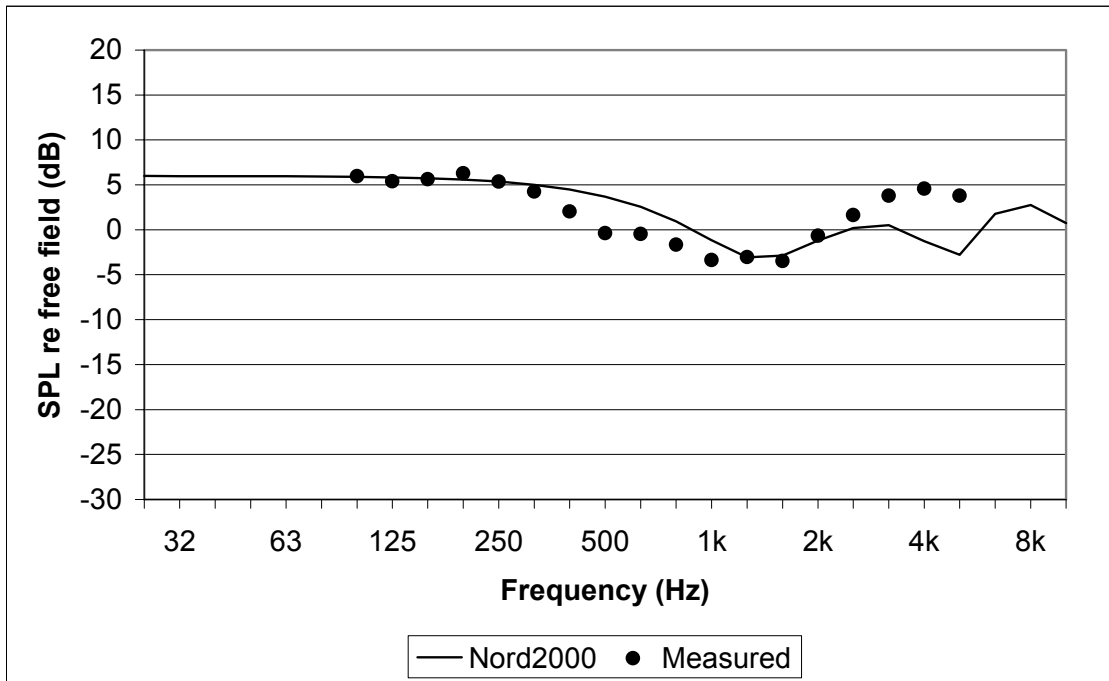
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
2.00	0.50	100000000	0
2.01	0.00	200000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 35



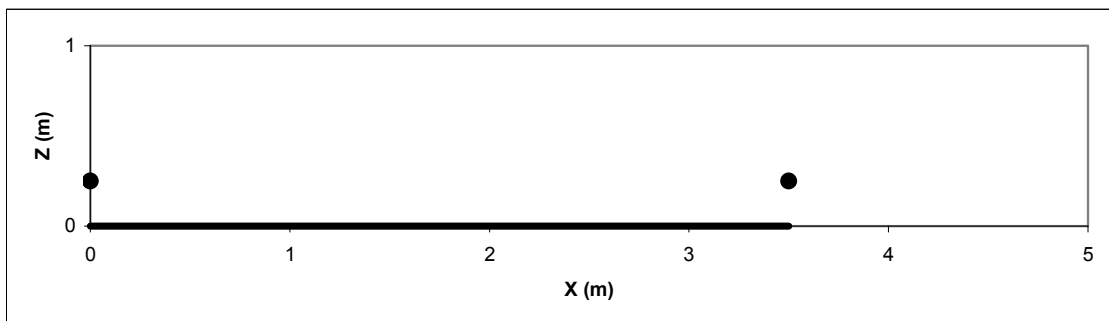
Nord2000 A-weighted ground effect (dB)	-1.3
A-weighted difference re. measured (dB)	-1.3

Terrain profile

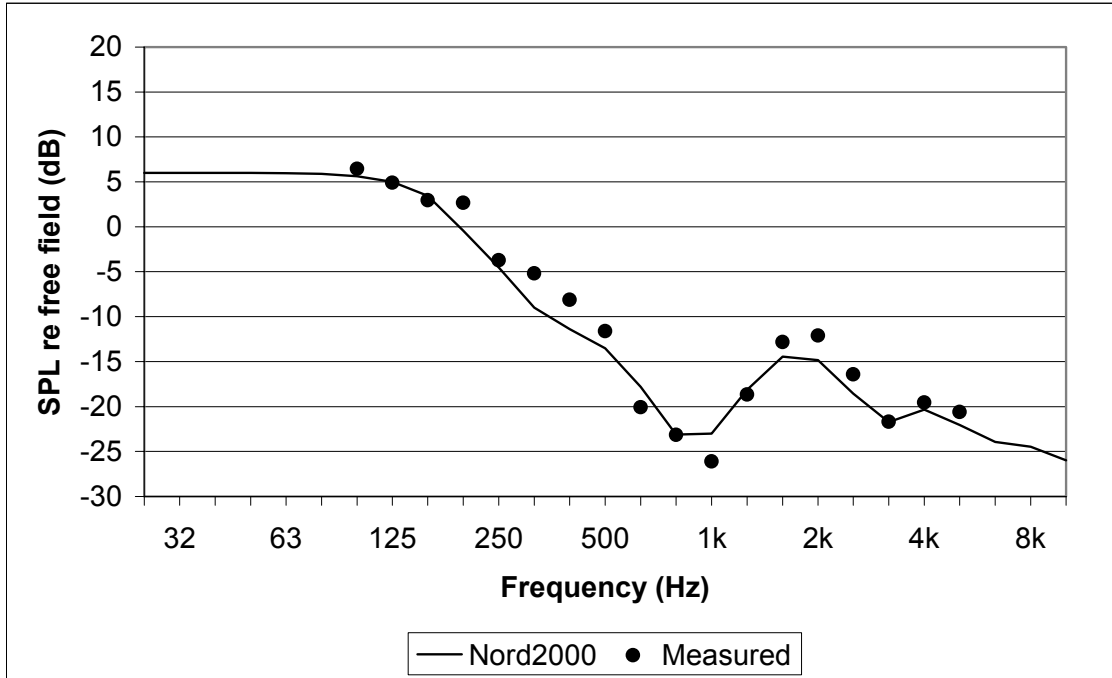
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
1.50	0.00	100000000	0
2.50	0.00	200000	0
3.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 36



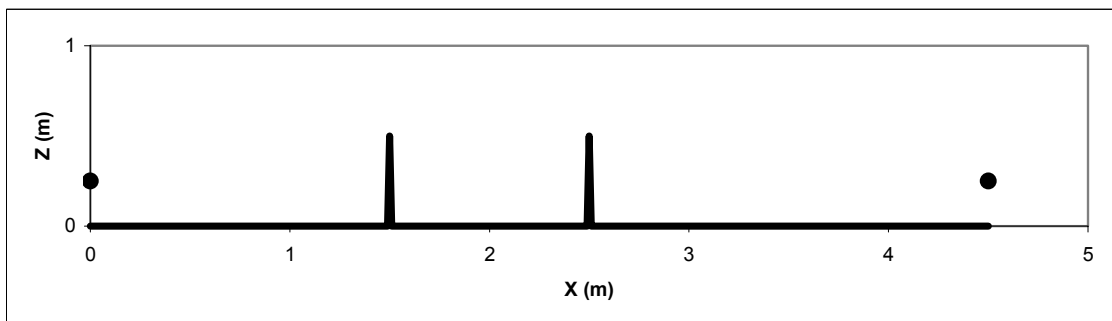
Nord2000 A-weighted ground effect (dB)	-14.8
A-weighted difference re. measured (dB)	-1.4

Terrain profile

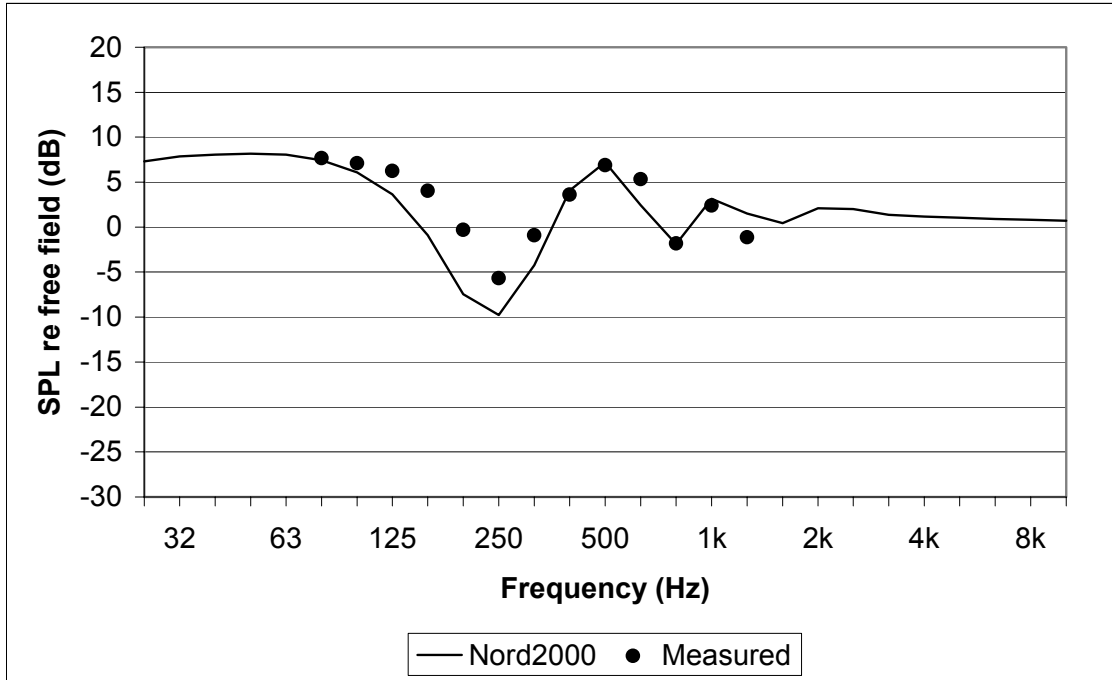
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
1.49	0.00	100000000	0
1.50	0.50	100000000	0
1.51	0.00	250000	0
2.49	0.00	100000000	0
2.50	0.50	100000000	0
2.51	0.00	250000	0
4.50	0.00	0	0

Calculation parameters

hs	0.25	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 41



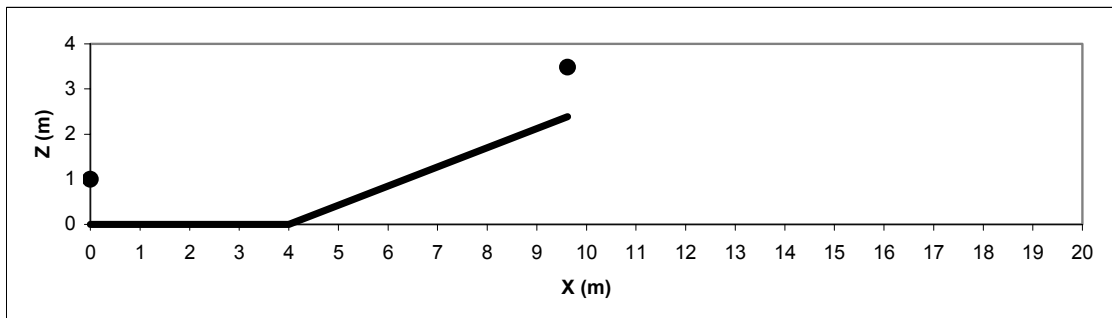
Nord2000 A-weighted ground effect (dB)	-1.6
A-weighted difference re. measured (dB)	0.0

Terrain profile

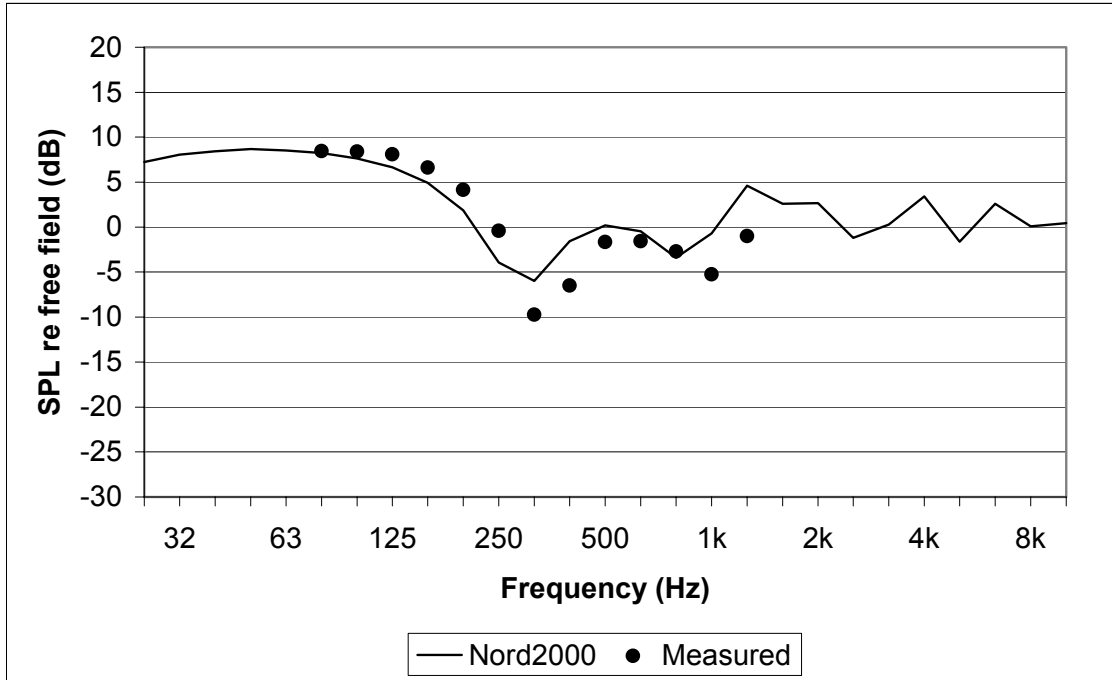
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
4.00	0.00	80000	0
9.62	2.39	0	0

Calculation parameters

hs	1.00	m
hr	1.10	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 42



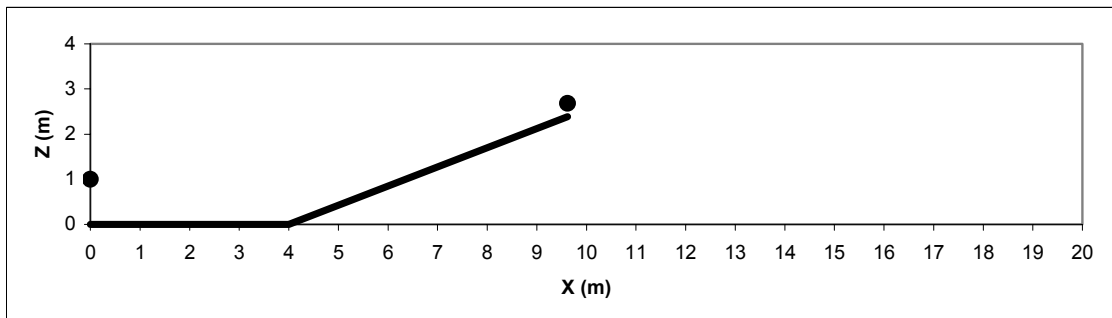
Nord2000 A-weighted ground effect (dB)	-3.0
A-weighted difference re. measured (dB)	2.8

Terrain profile

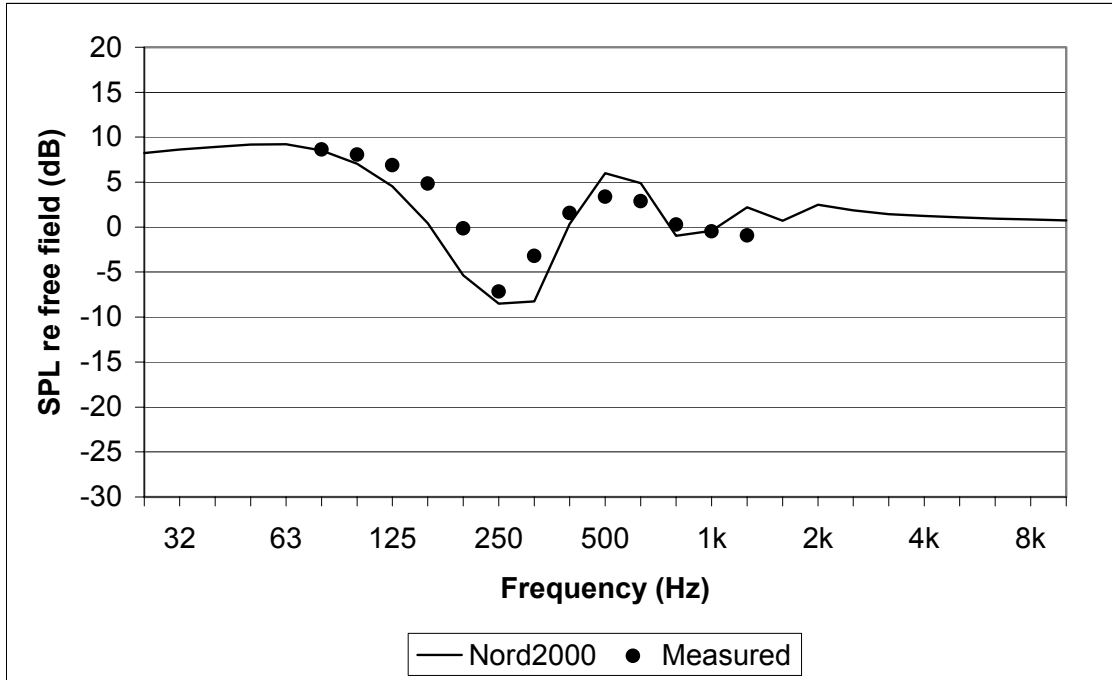
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
4.00	0.00	80000	0
9.62	2.39	0	0

Calculation parameters

hs	1.00	m
hr	0.29	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 43



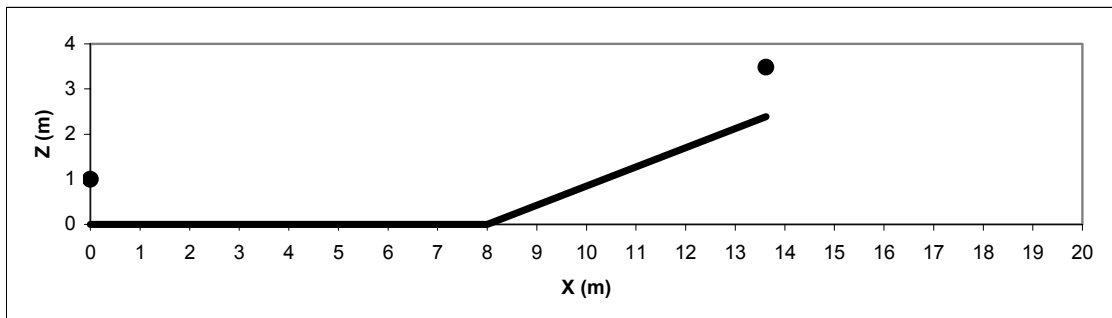
Nord2000 A-weighted ground effect (dB)	-2.1
A-weighted difference re. measured (dB)	1.2

Terrain profile

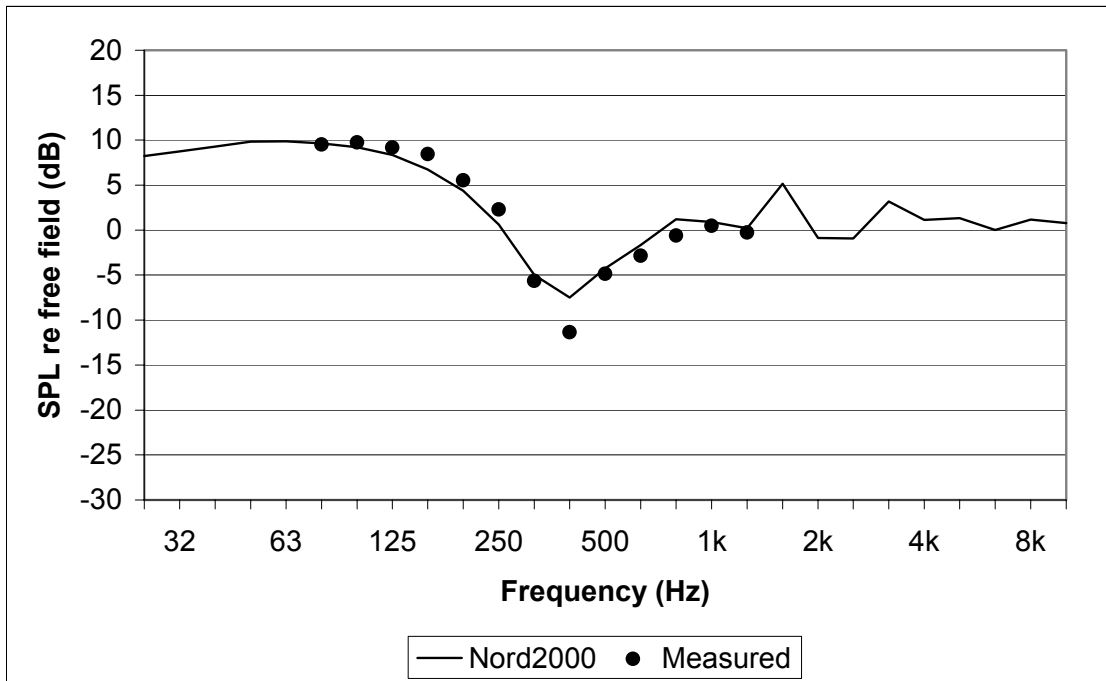
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
8.00	0.00	80000	0
13.62	2.39	0	0

Calculation parameters

hs	1.00	m
hr	1.10	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 44



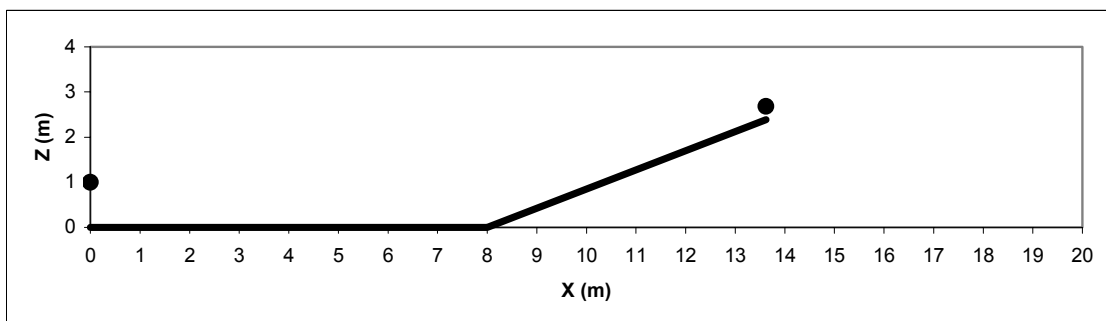
Nord2000 A-weighted ground effect (dB)	-4.0
A-weighted difference re. measured (dB)	0.4

Terrain profile

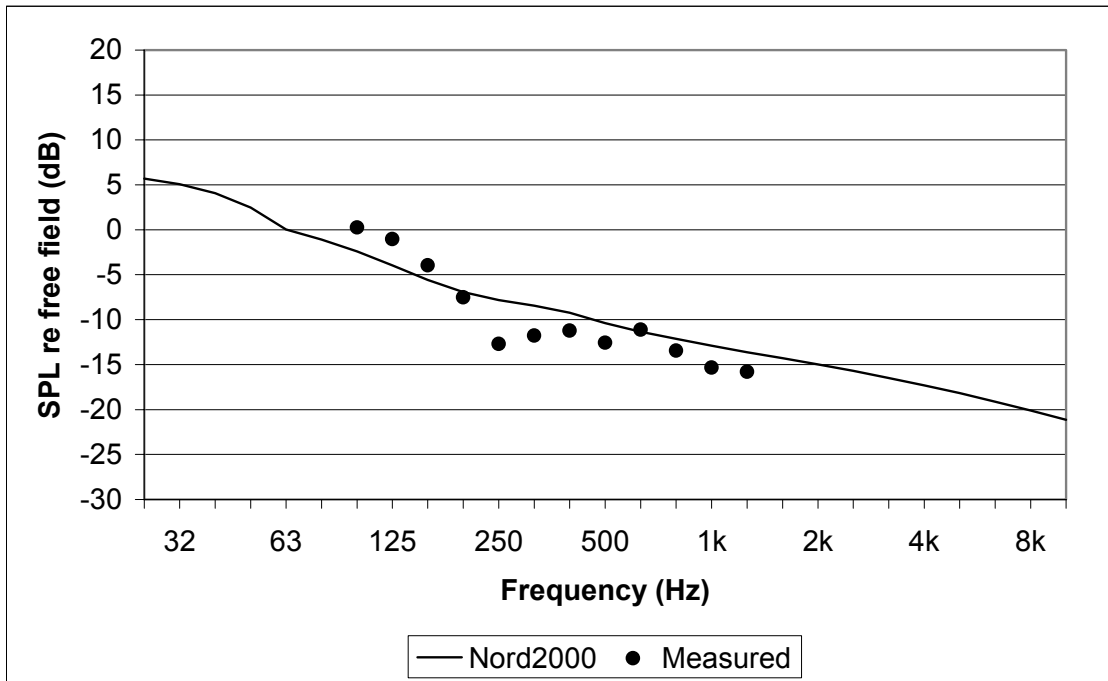
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
8.00	0.00	80000	0
13.62	2.39	0	0

Calculation parameters

hs	1.00	m
hr	0.29	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 45



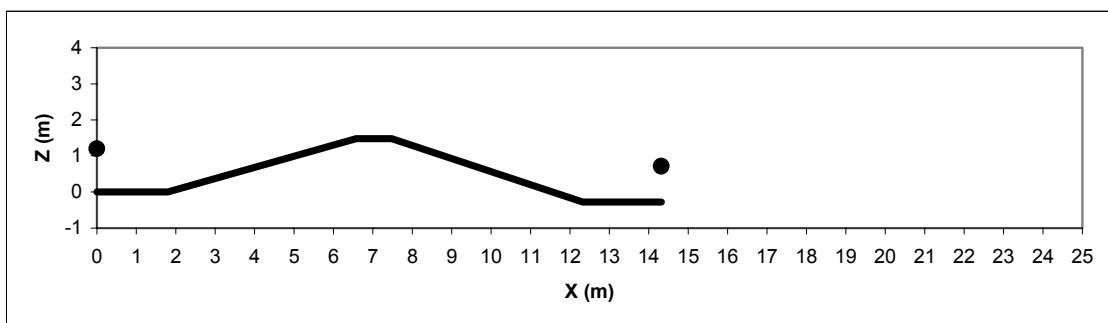
Nord2000 A-weighted ground effect (dB)	-15.0
A-weighted difference re. measured (dB)	1.3

Terrain profile

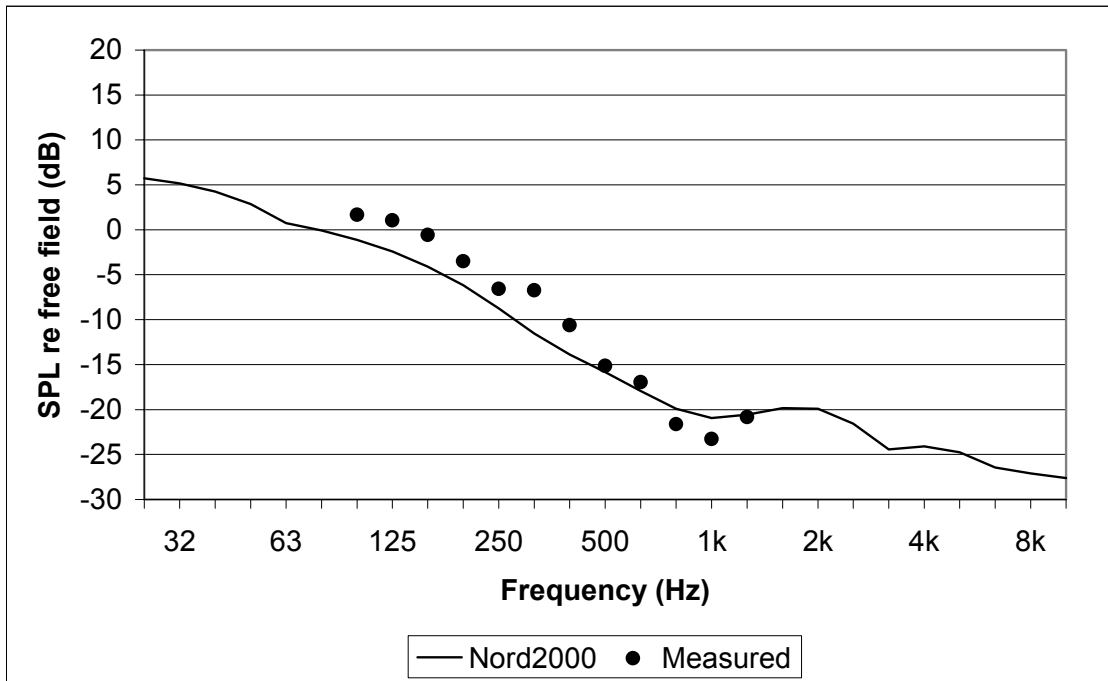
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
1.80	0.00	80000	0
6.58	1.48	80000	0
7.48	1.48	80000	0
12.32	-0.28	300000	0
14.32	-0.28	0	0

Calculation parameters

hs	1.20	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 46



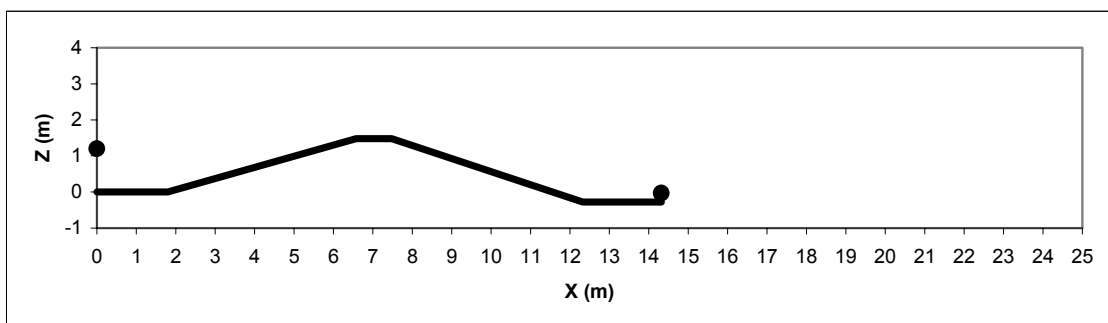
Nord2000 A-weighted ground effect (dB)	-18.8
A-weighted difference re. measured (dB)	-2.5

Terrain profile

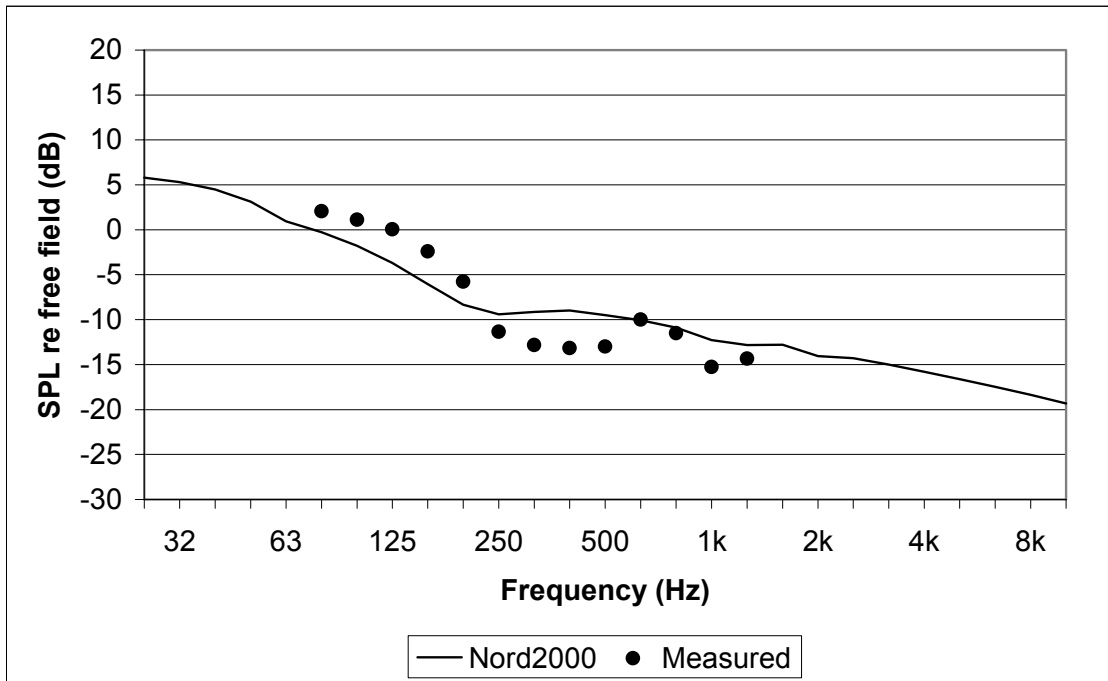
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
1.80	0.00	80000	0
6.58	1.48	80000	0
7.48	1.48	80000	0
12.32	-0.28	300000	0
14.32	-0.28	0	0

Calculation parameters

hs	1.20	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 47



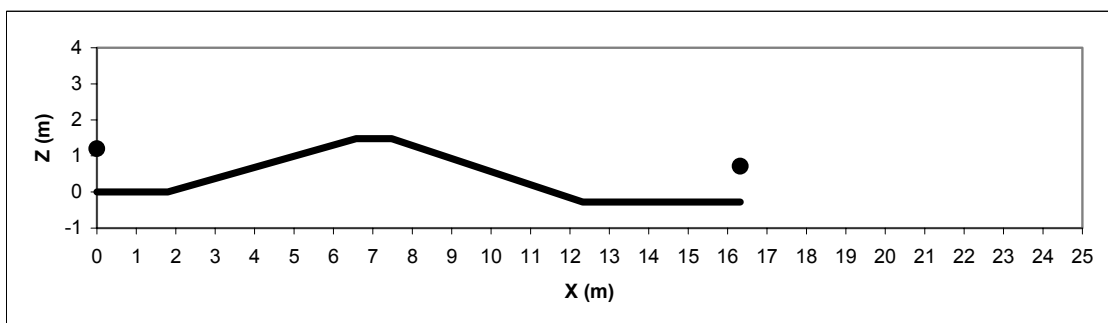
Nord2000 A-weighted ground effect (dB)	-14.7
A-weighted difference re. measured (dB)	0.9

Terrain profile

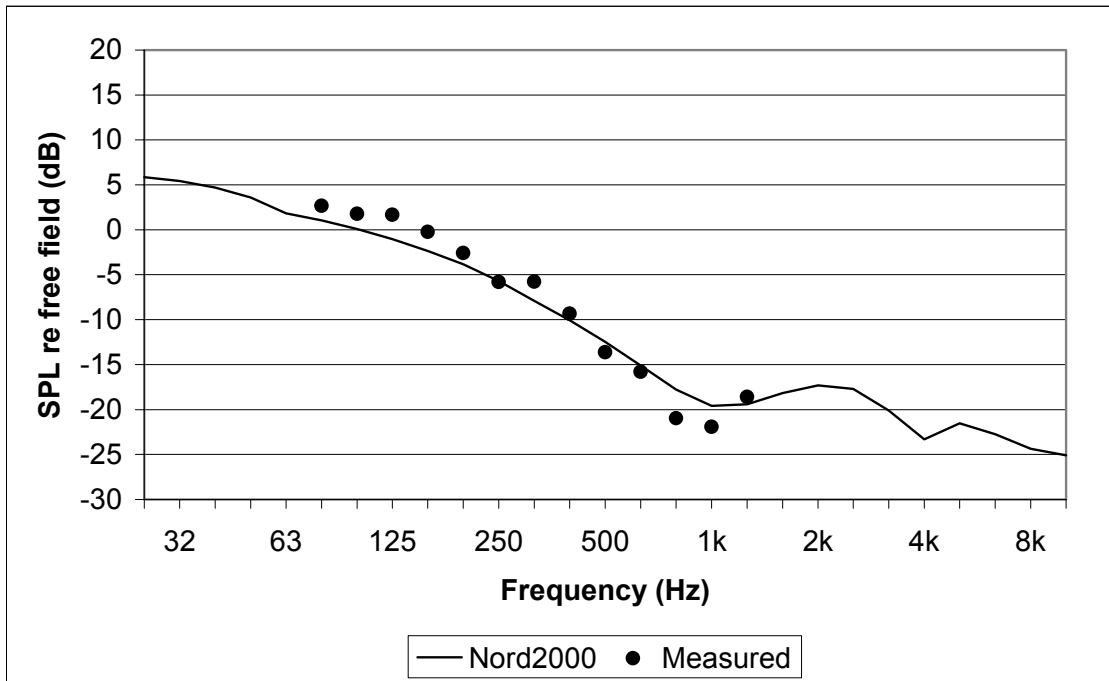
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
1.80	0.00	80000	0
6.58	1.48	80000	0
7.48	1.48	80000	0
12.32	-0.28	300000	0
16.32	-0.28	0	0

Calculation parameters

hs	1.20	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 48



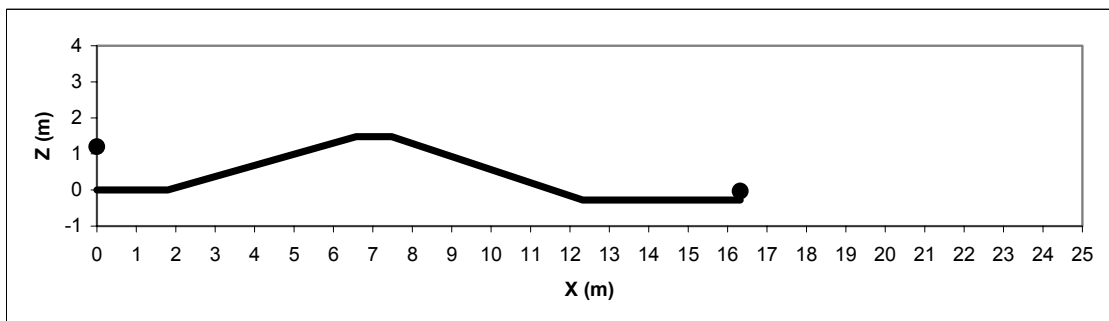
Nord2000 A-weighted ground effect (dB)	-16.5
A-weighted difference re. measured (dB)	-0.9

Terrain profile

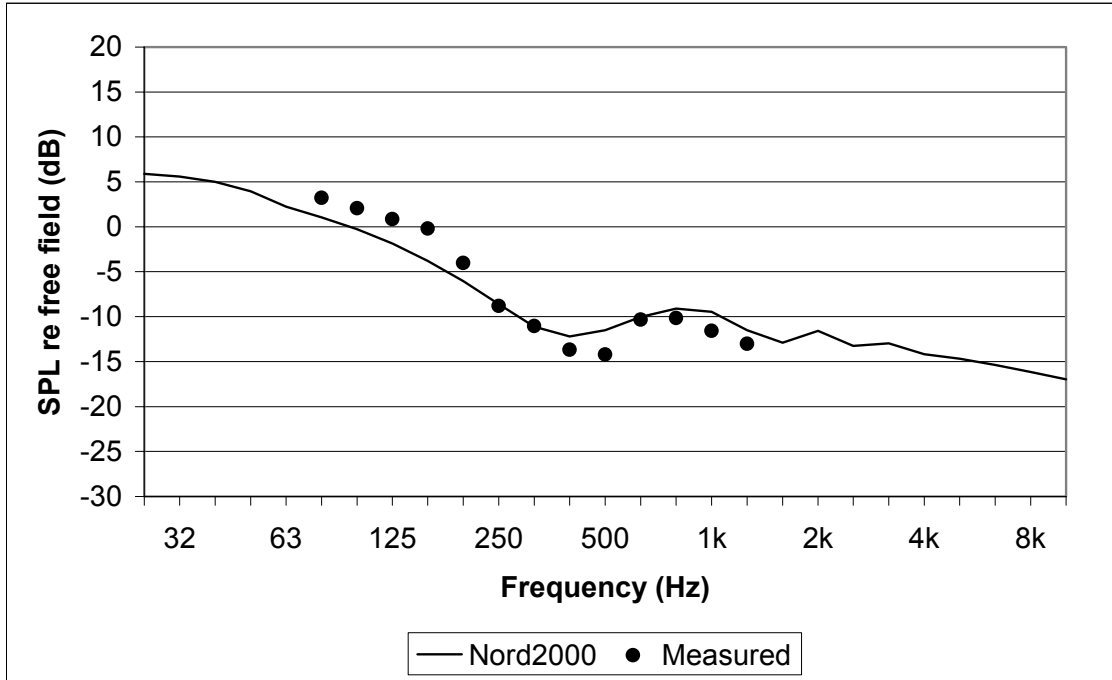
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
1.80	0.00	80000	0
6.58	1.48	80000	0
7.48	1.48	80000	0
12.32	-0.28	300000	0
16.32	-0.28	0	0

Calculation parameters

hs	1.20	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 49



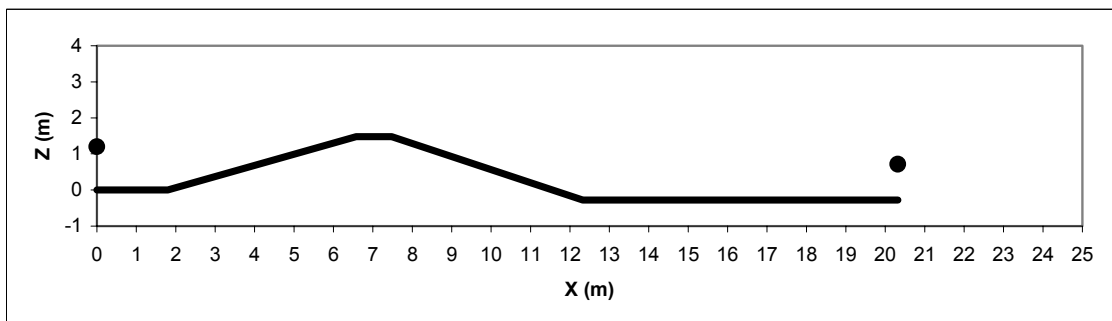
Nord2000 A-weighted ground effect (dB)	-13.9
A-weighted difference re. measured (dB)	0.4

Terrain profile

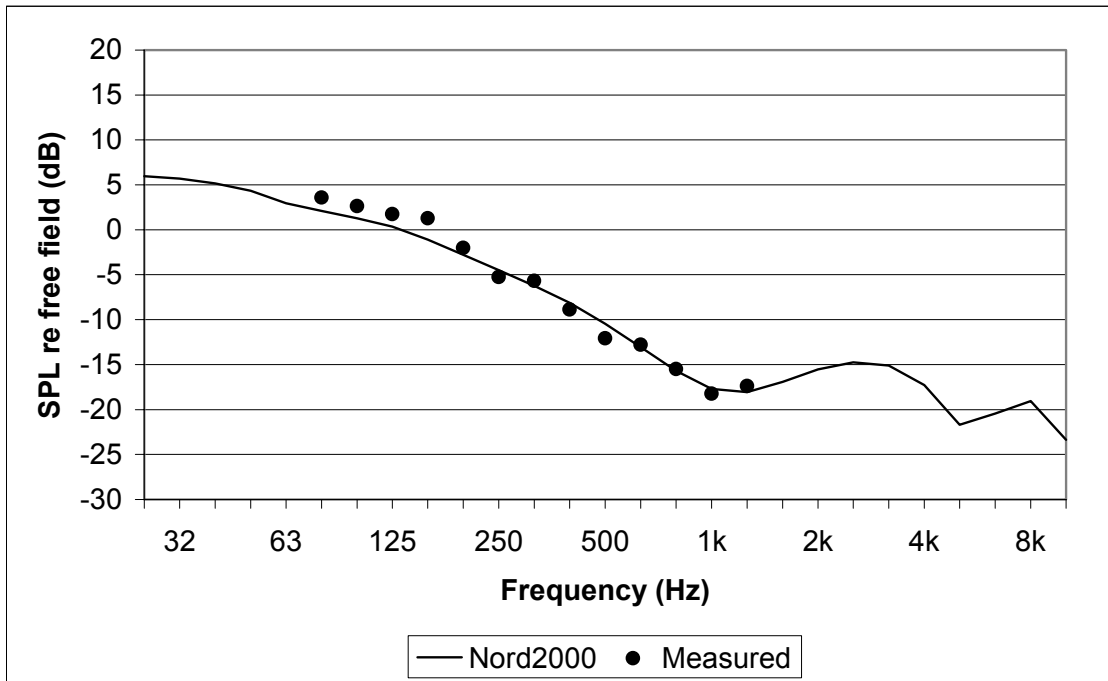
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
1.80	0.00	80000	0
6.58	1.48	80000	0
7.48	1.48	80000	0
12.32	-0.28	300000	0
20.32	-0.28	0	0

Calculation parameters

hs	1.20	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 50



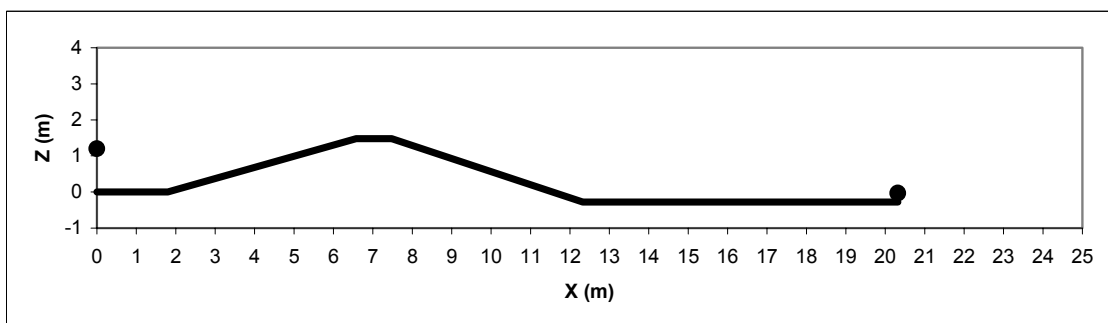
Nord2000 A-weighted ground effect (dB)	-14.9
A-weighted difference re. measured (dB)	-0.4

Terrain profile

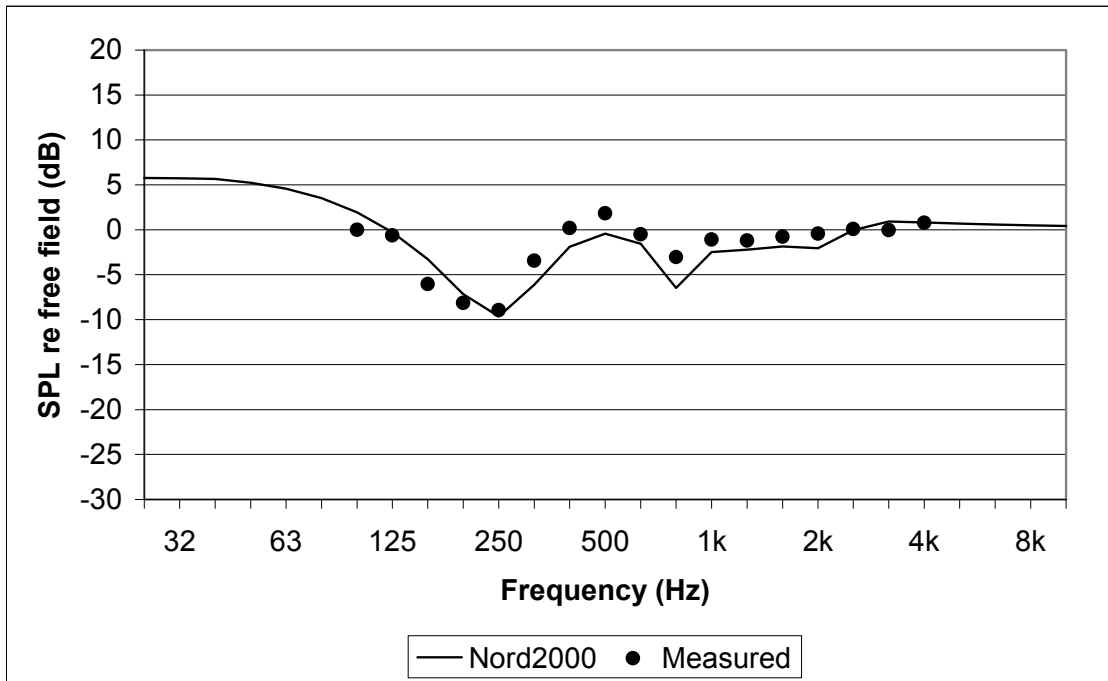
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
1.80	0.00	80000	0
6.58	1.48	80000	0
7.48	1.48	80000	0
12.32	-0.28	300000	0
20.32	-0.28	0	0

Calculation parameters

hs	1.20	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 51



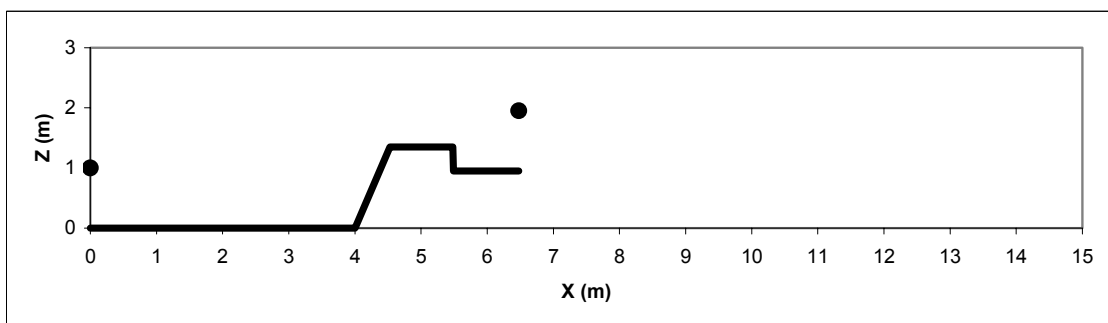
Nord2000 A-weighted ground effect (dB)	-2.8
A-weighted difference re. measured (dB)	-0.7

Terrain profile

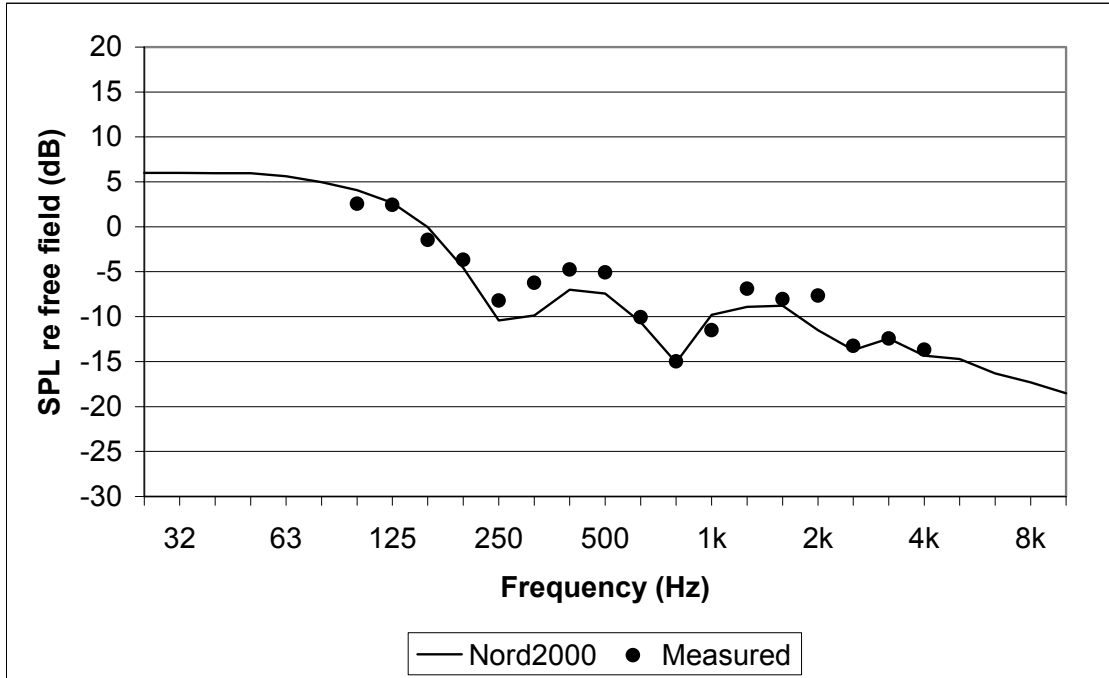
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
4.00	0.00	300000	0
4.53	1.35	300000	0
5.48	1.35	300000	0
5.49	0.95	300000	0
6.48	0.95	0	0

Calculation parameters

hs	1.00	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 52



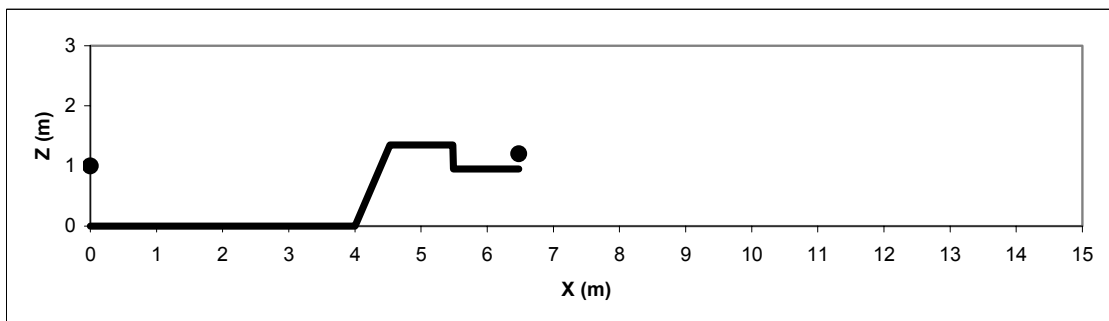
Nord2000 A-weighted ground effect (dB)	-11.8
A-weighted difference re. measured (dB)	-1.2

Terrain profile

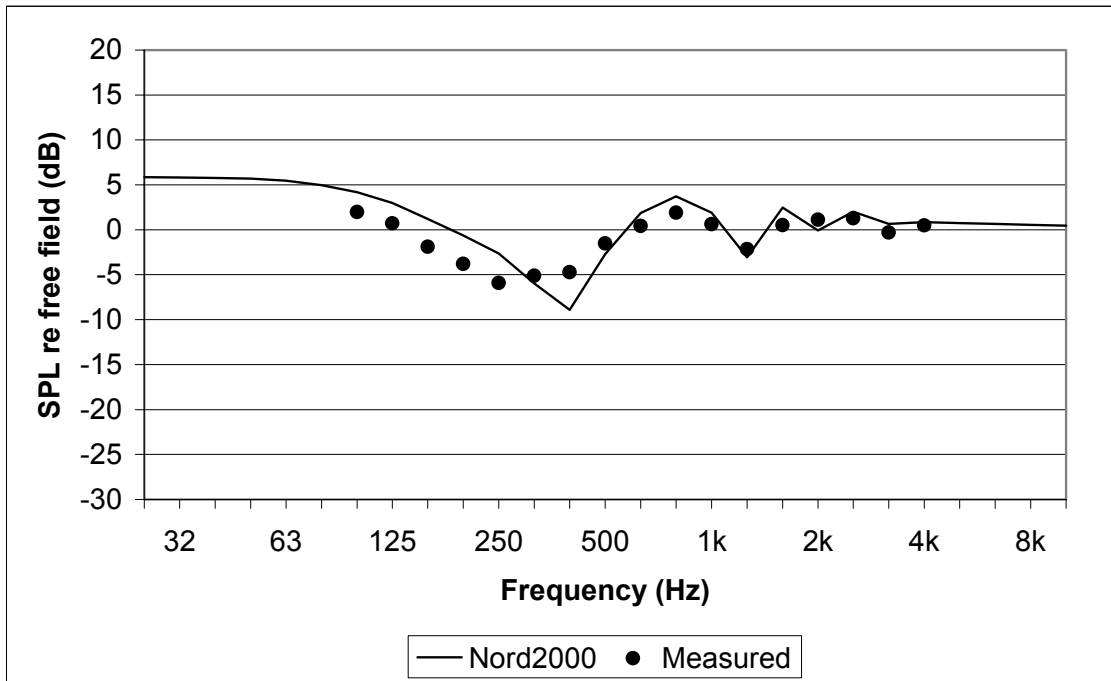
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
4.00	0.00	300000	0
4.53	1.35	300000	0
5.48	1.35	300000	0
5.49	0.95	300000	0
6.48	0.95	0	0

Calculation parameters

hs	1.00	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 53



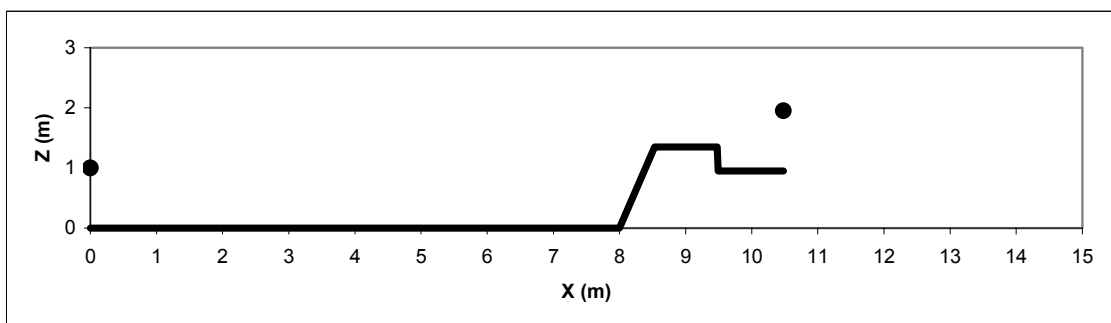
Nord2000 A-weighted ground effect (dB)	-0.7
A-weighted difference re. measured (dB)	0.8

Terrain profile

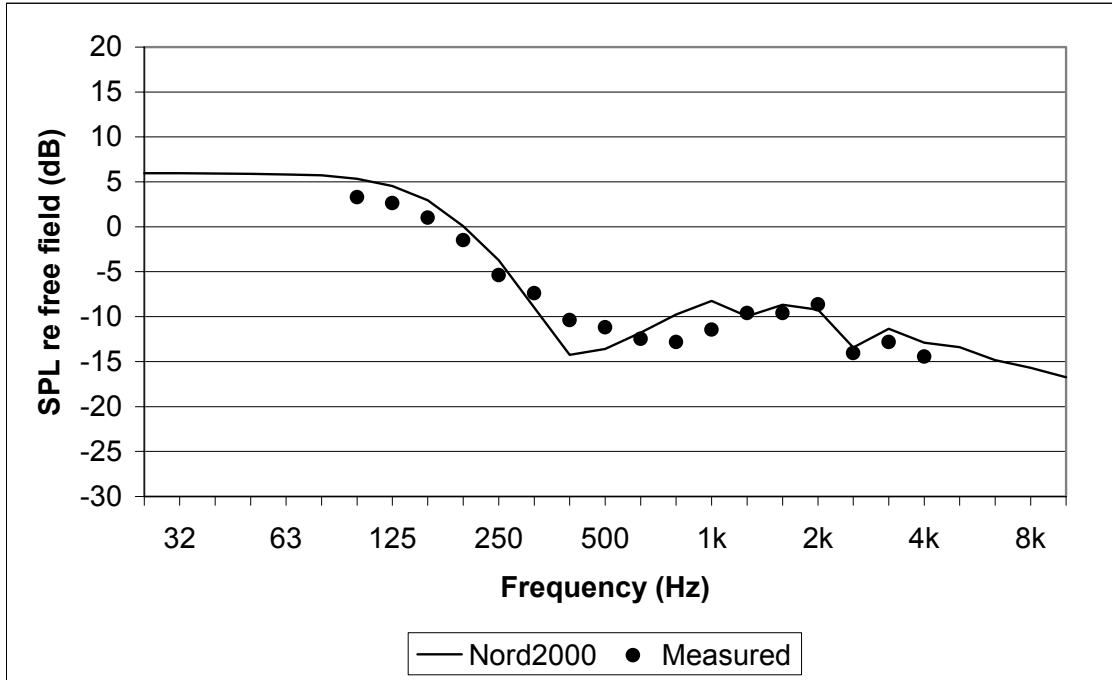
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
8.00	0.00	300000	0
8.53	1.35	300000	0
9.48	1.35	300000	0
9.49	0.95	300000	0
10.48	0.95	0	0

Calculation parameters

hs	1.00	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 54



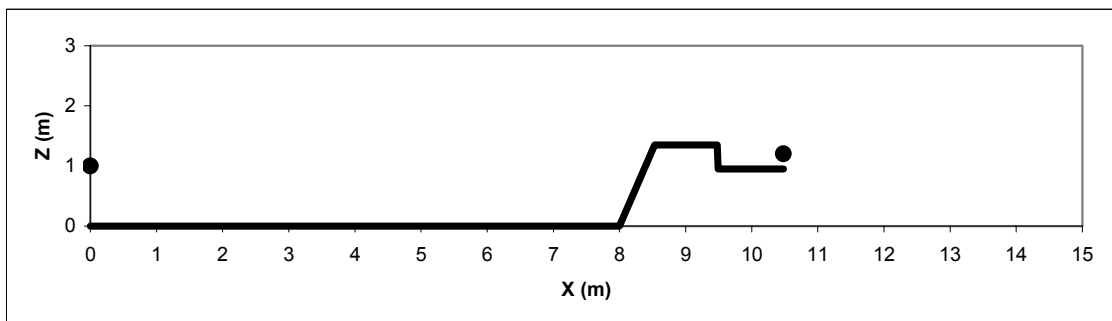
Nord2000 A-weighted ground effect (dB)	-11.0
A-weighted difference re. measured (dB)	0.9

Terrain profile

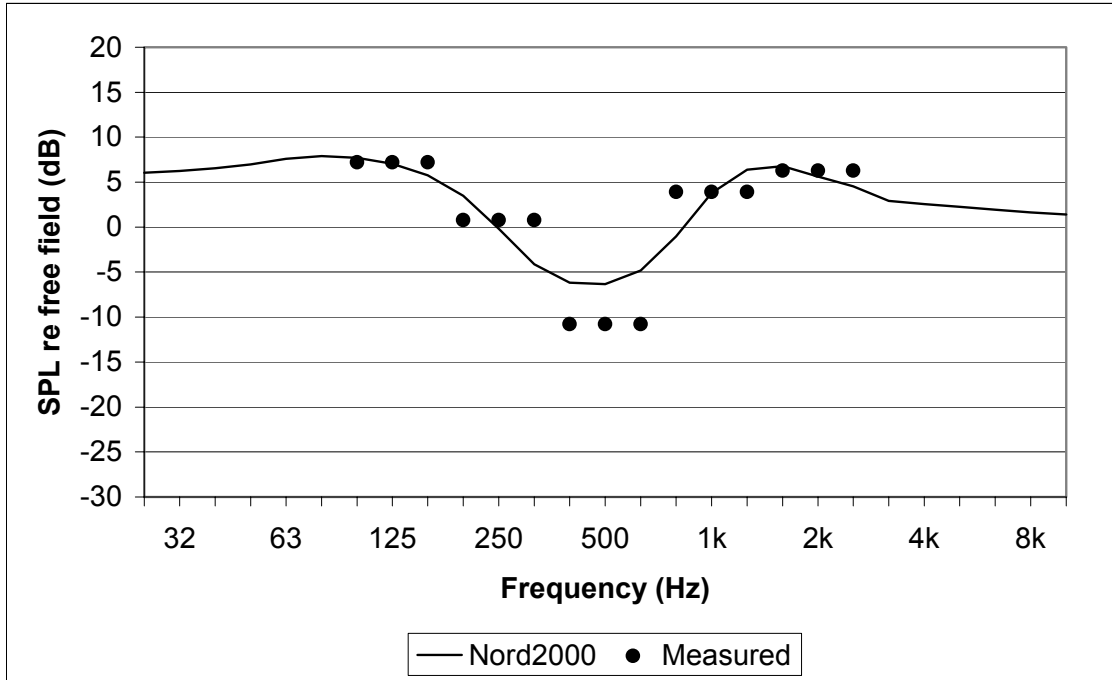
X	Z	Flow resist.	Roughness
0.00	0.00	300000	0
8.00	0.00	300000	0
8.53	1.35	300000	0
9.48	1.35	300000	0
9.49	0.95	300000	0
10.48	0.95	0	0

Calculation parameters

hs	1.00	m
hr	0.25	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 1



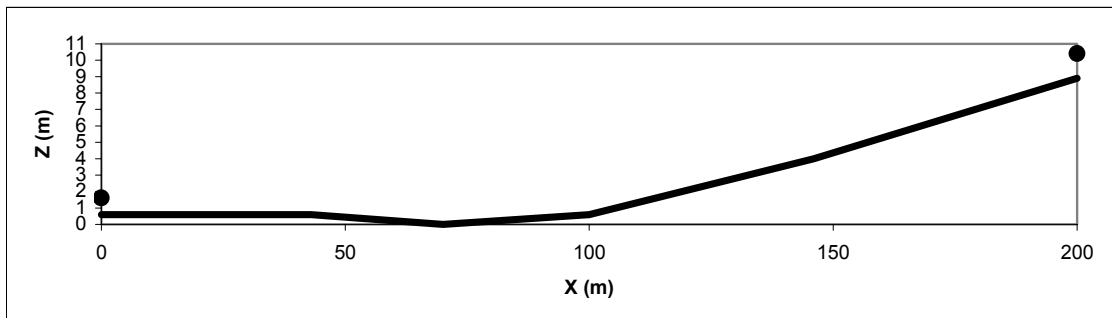
Nord2000 A-weighted ground effect (dB)	2.0
A-weighted difference re. measured (dB)	-0.2

Terrain profile

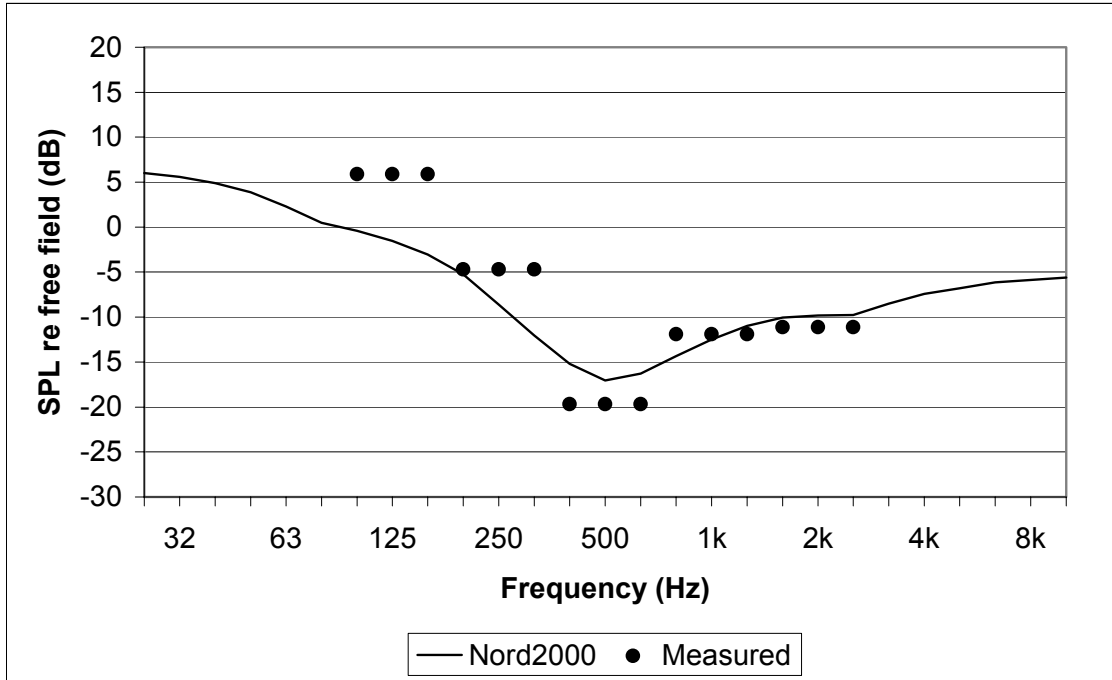
X	Z	Flow resist.	Roughness
0.00	0.60	500000	0
43.00	0.60	500000	0
70.00	0.00	500000	0
100.00	0.60	500000	0
146.00	4.00	500000	0
200.00	8.90	0	0

Calculation parameters

hs	1.00	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 2



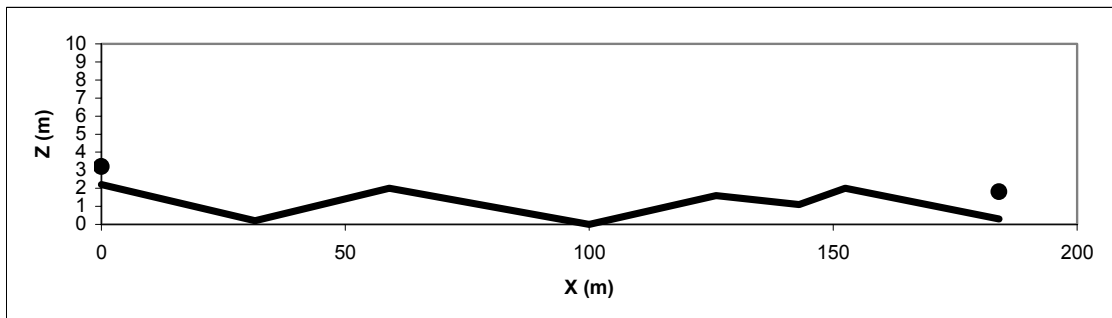
Nord2000 A-weighted ground effect (dB)	-13.2
A-weighted difference re. measured (dB)	-1.3

Terrain profile

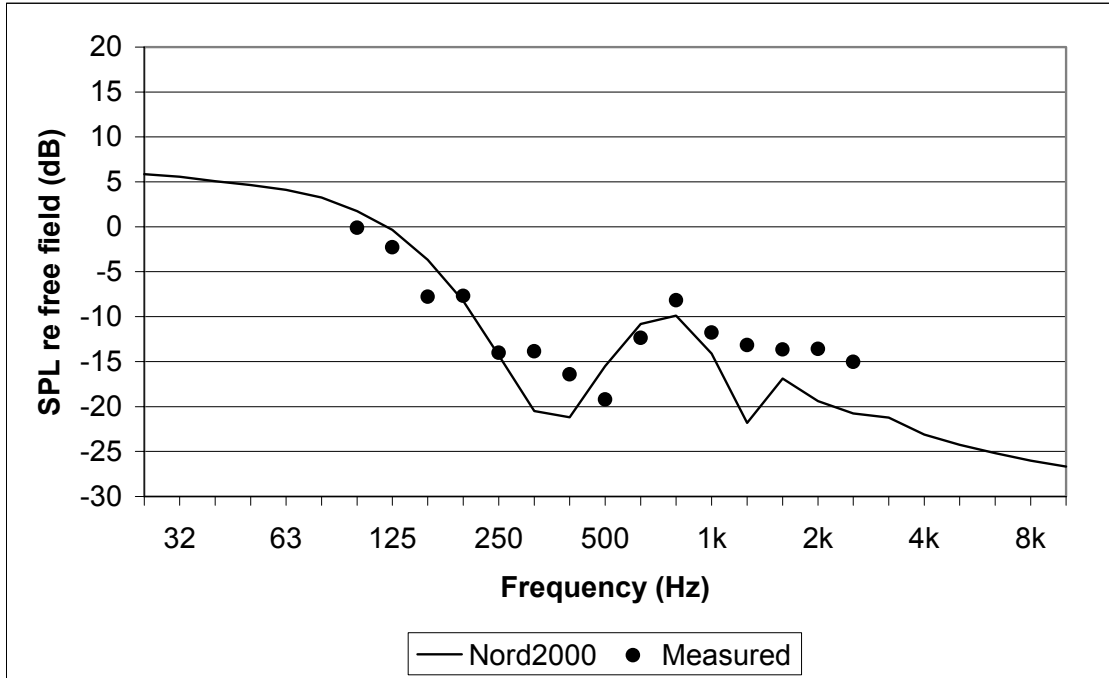
X	Z	Flow resist.	Roughness
0.00	2.20	400000	0
31.50	0.20	400000	0
59.00	2.00	400000	0
100.00	0.00	400000	0
126.00	1.60	400000	0
143.00	1.10	400000	0
152.50	2.00	400000	0
184.00	0.30	0	0

Calculation parameters

hs	1.00	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 39



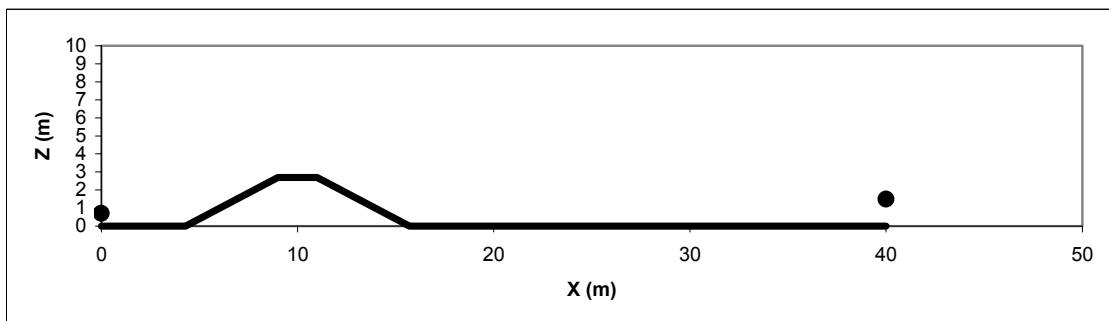
Nord2000 A-weighted ground effect (dB)	-16.5
A-weighted difference re. measured (dB)	-1.9

Terrain profile

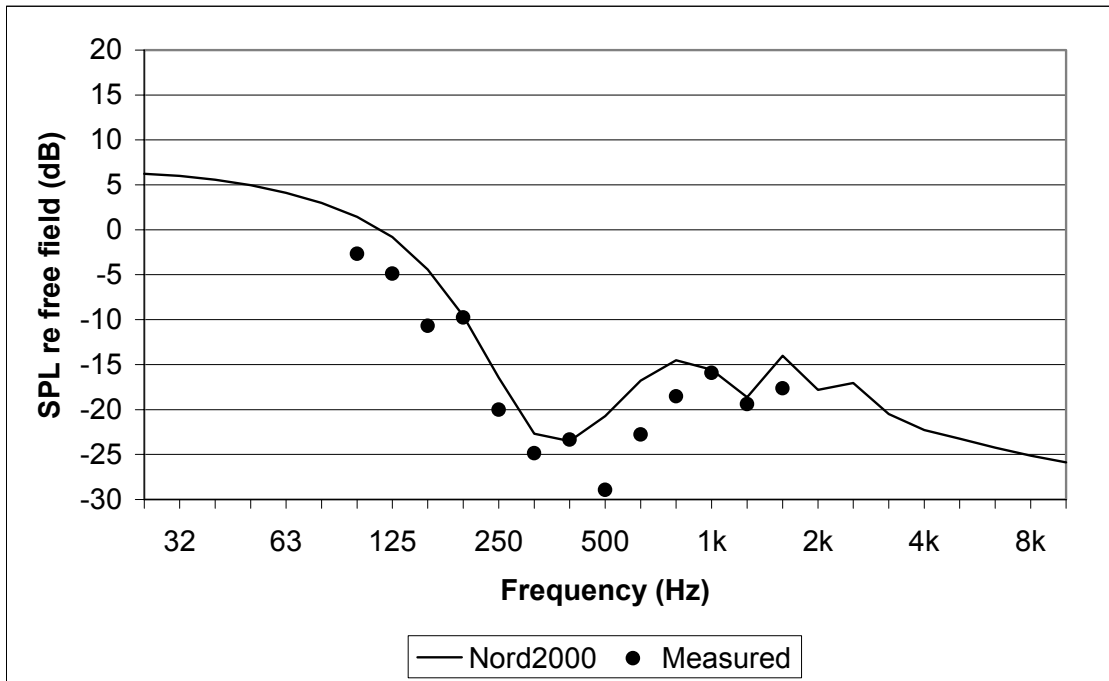
X	Z	Flow resist.	Roughness
0.00	0.00	50000000	0
2.30	0.00	200000	0
4.30	0.00	200000	0
9.00	2.70	200000	0
11.00	2.70	200000	0
15.70	0.00	200000	0
40.00	0.00	0	0

Calculation parameters

hs	0.70	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 40



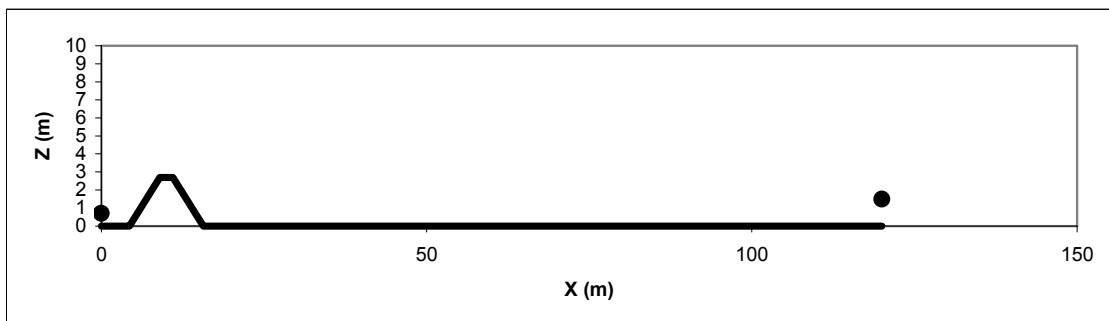
Nord2000 A-weighted ground effect (dB)	-17.9
A-weighted difference re. measured (dB)	2.9

Terrain profile

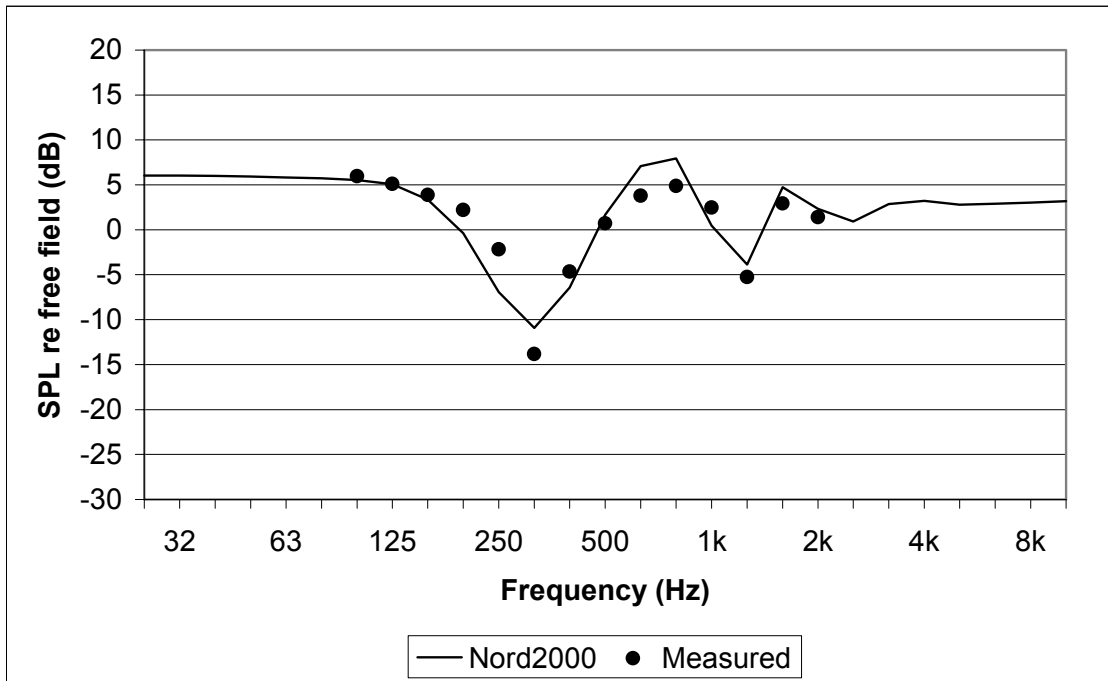
X	Z	Flow resist.	Roughness
0.00	0.00	50000000	0
2.30	0.00	200000	0
4.30	0.00	200000	0
9.00	2.70	200000	0
11.00	2.70	200000	0
15.70	0.00	200000	0
120.00	0.00	0	0

Calculation parameters

hs	0.70	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 61



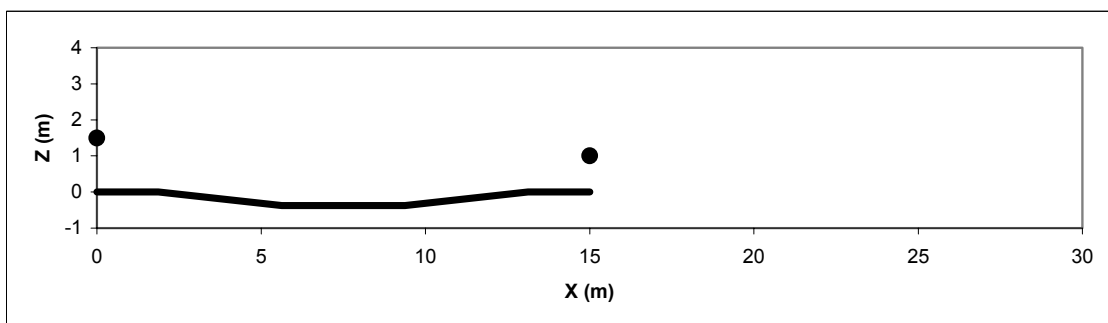
Nord2000 A-weighted ground effect (dB)	0.9
A-weighted difference re. measured (dB)	1.7

Terrain profile

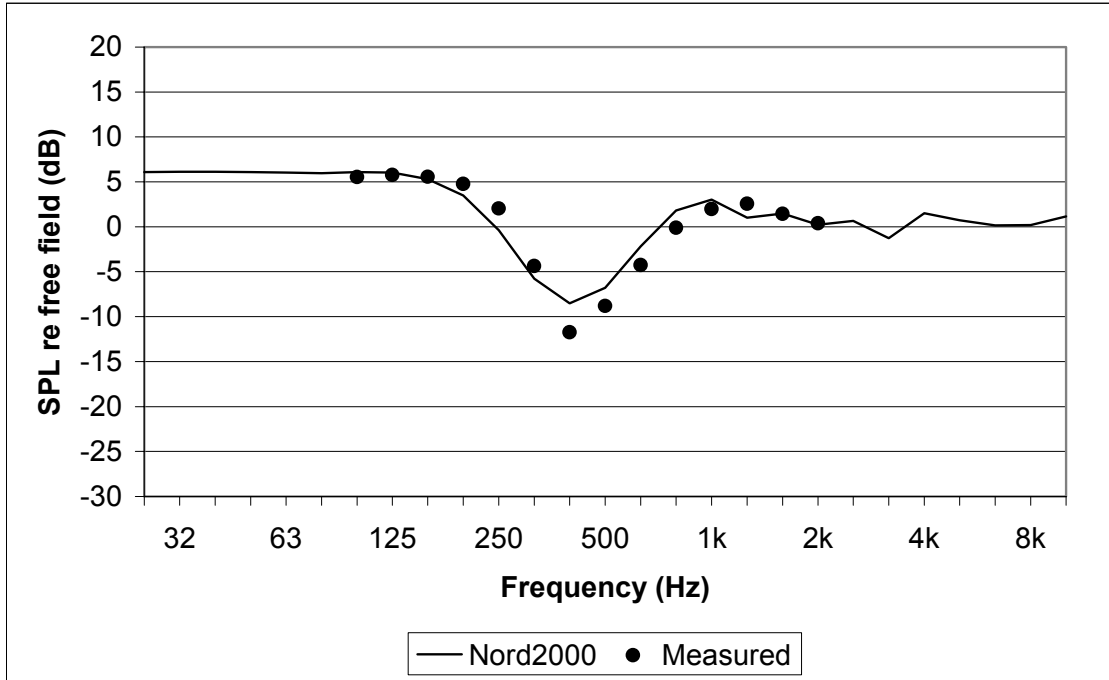
X	Z	Flow resist.	Roughness
0.00	0.00	5	0
1.88	0.00	5	0
5.63	-0.38	5	0
9.38	-0.38	5	0
13.13	0.00	5	0
15.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 62



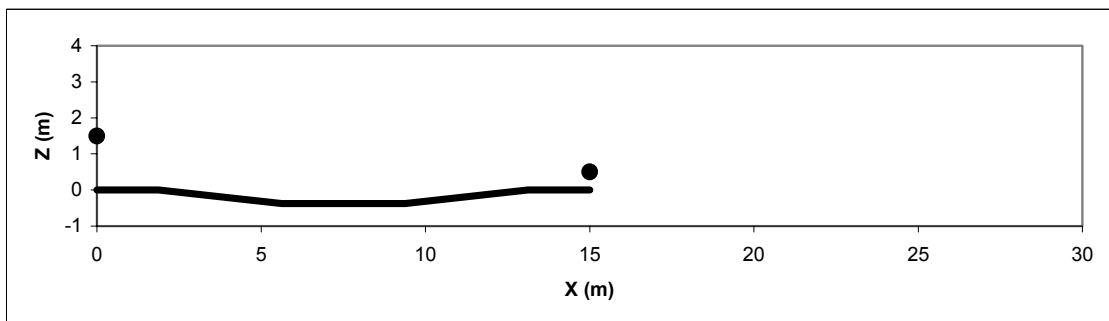
Nord2000 A-weighted ground effect (dB)	-1.9
A-weighted difference re. measured (dB)	0.1

Terrain profile

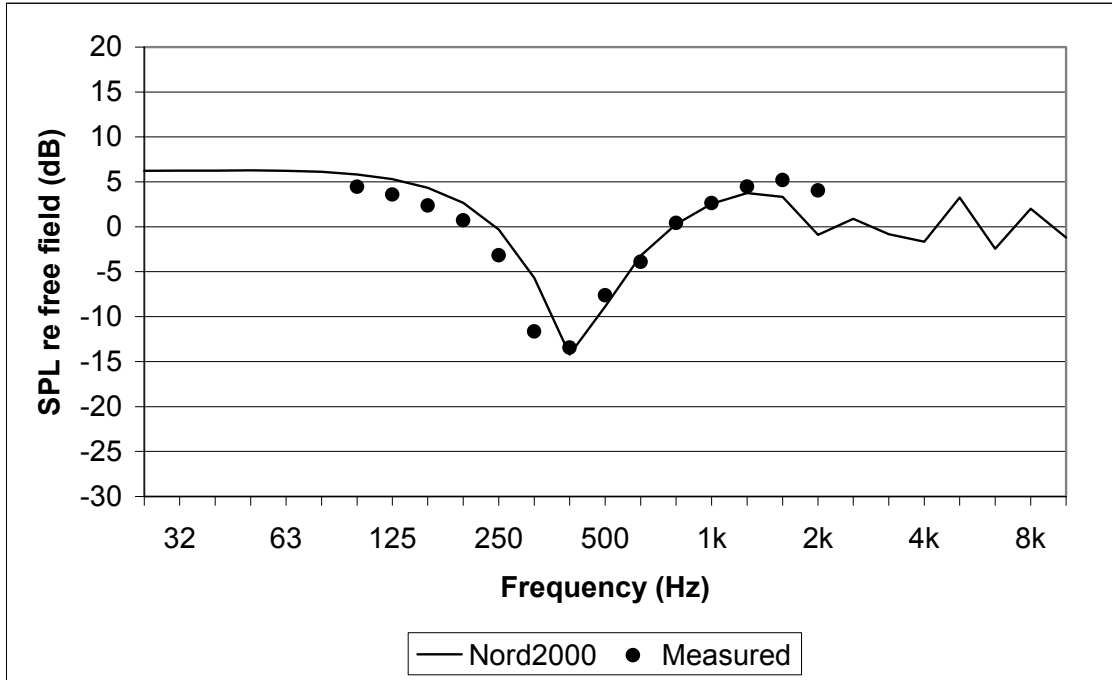
X	Z	Flow resist.	Roughness
0.00	0.00	5	0
1.88	0.00	5	0
5.63	-0.38	5	0
9.38	-0.38	5	0
13.13	0.00	5	0
15.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 63



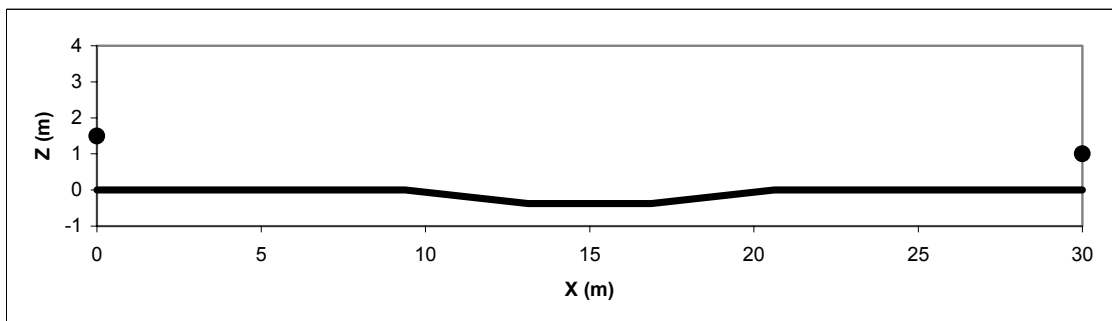
Nord2000 A-weighted ground effect (dB)	-1.4
A-weighted difference re. measured (dB)	-1.4

Terrain profile

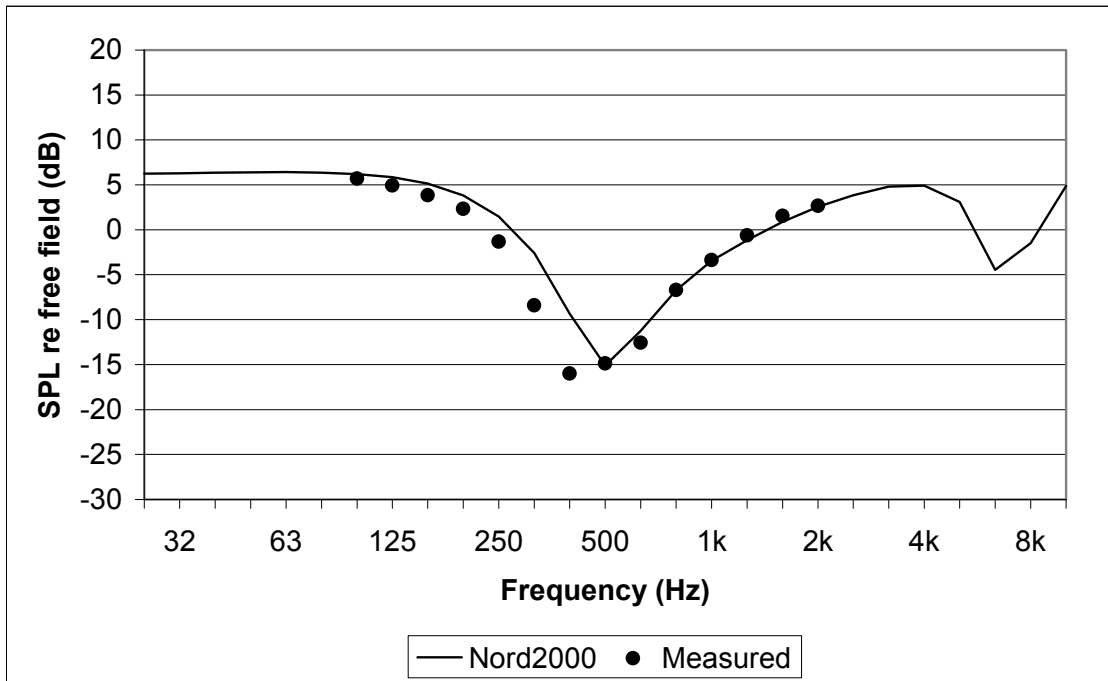
X	Z	Flow resist.	Roughness
0.00	0.00	5	0
9.38	0.00	5	0
13.13	-0.38	5	0
16.88	-0.38	5	0
20.63	0.00	5	0
30.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	1.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 64



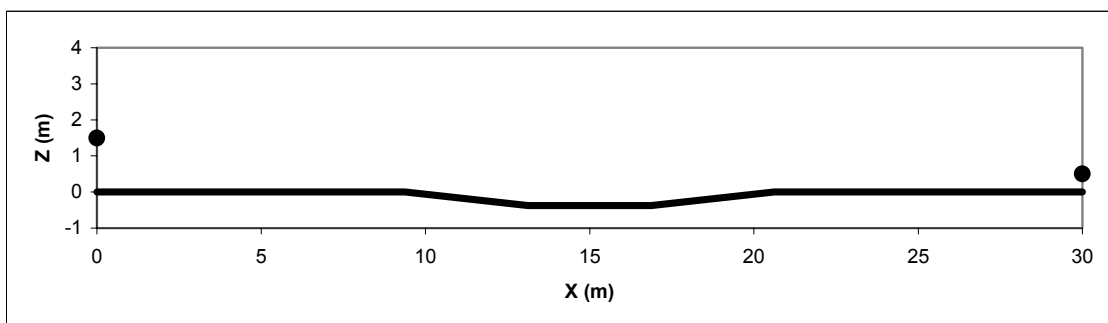
Nord2000 A-weighted ground effect (dB)	-3.4
A-weighted difference re. measured (dB)	0.0

Terrain profile

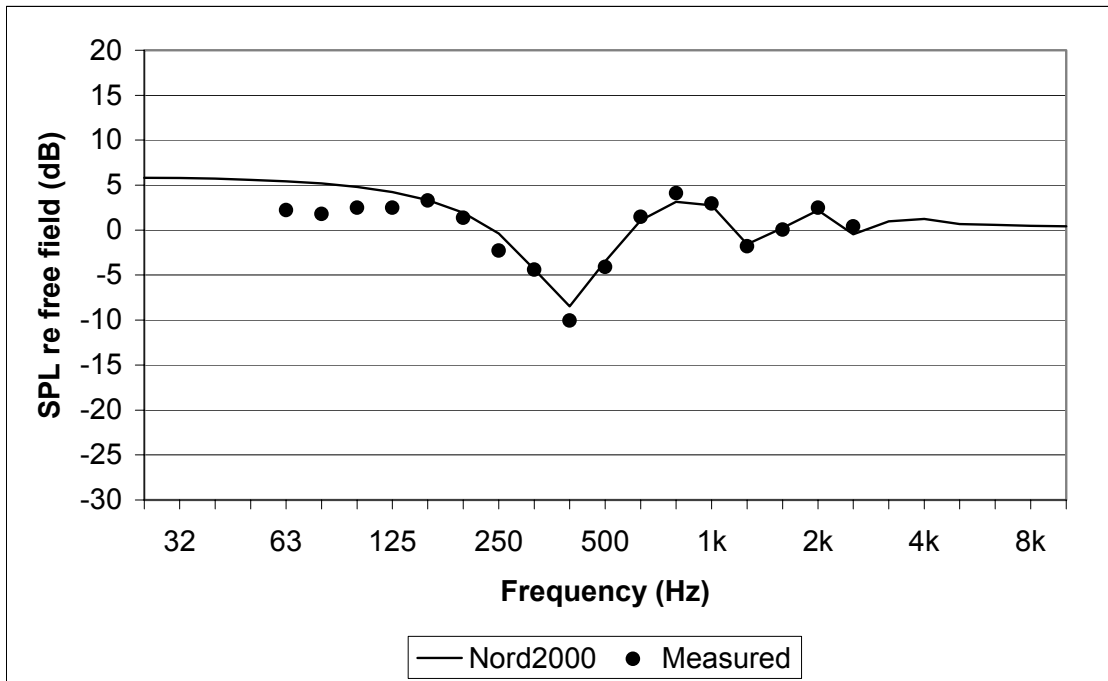
X	Z	Flow resist.	Roughness
0.00	0.00	5	0
9.38	0.00	5	0
13.13	-0.38	5	0
16.88	-0.38	5	0
20.63	0.00	5	0
30.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 71



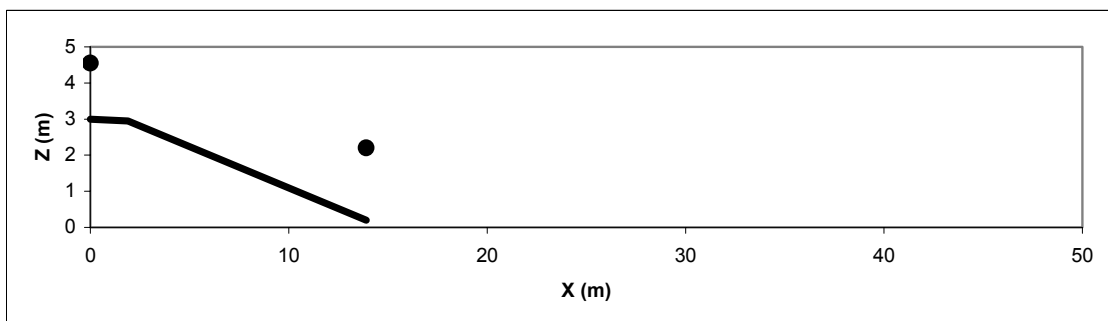
Nord2000 A-weighted ground effect (dB)	-2.0
A-weighted difference re. measured (dB)	-0.3

Terrain profile

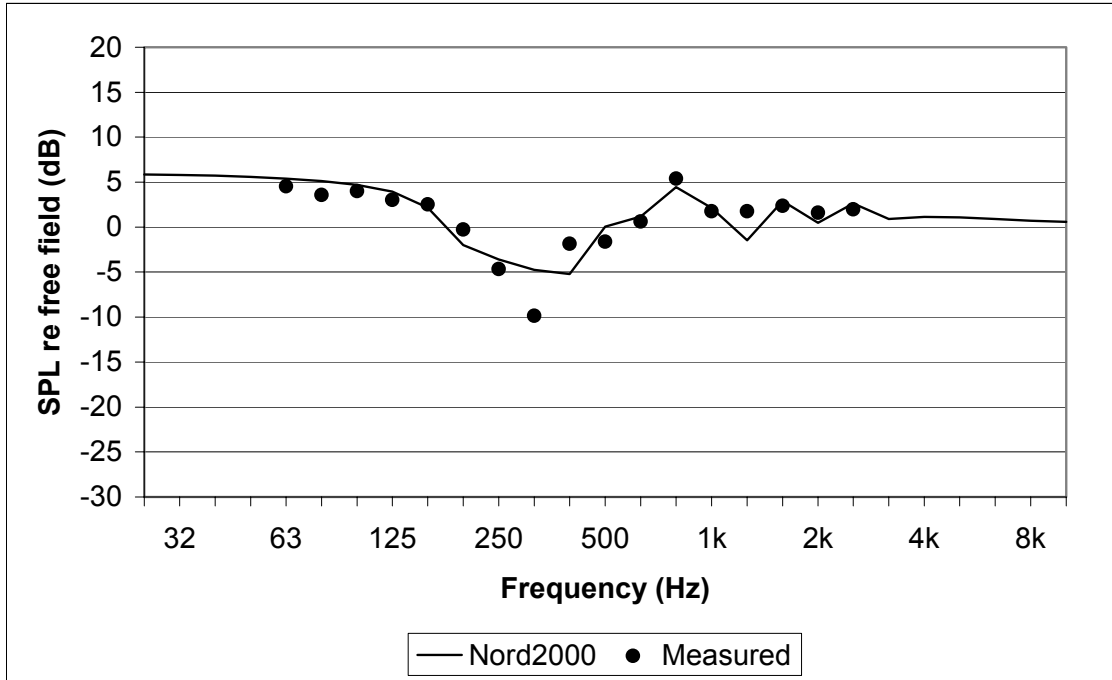
X	Z	Flow resist.	Roughness
0.00	3.00	250000	0
1.90	2.95	250000	0
13.90	0.20	0	0

Calculation parameters

hs	1.55	m
hr	2.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 72



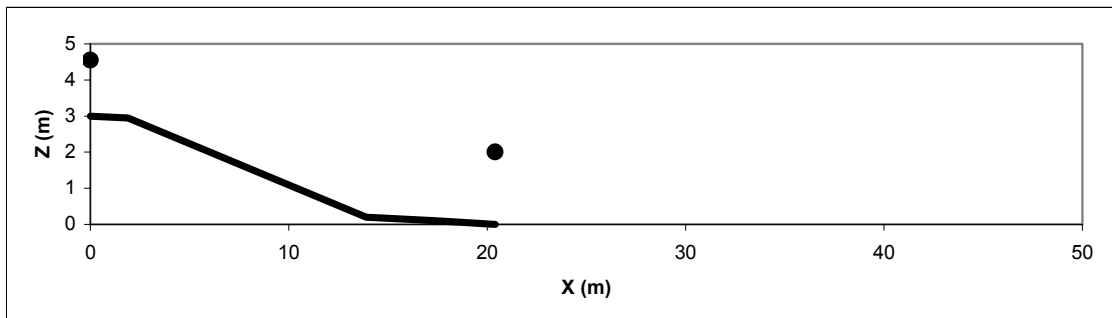
Nord2000 A-weighted ground effect (dB)	-1.2
A-weighted difference re. measured (dB)	-0.3

Terrain profile

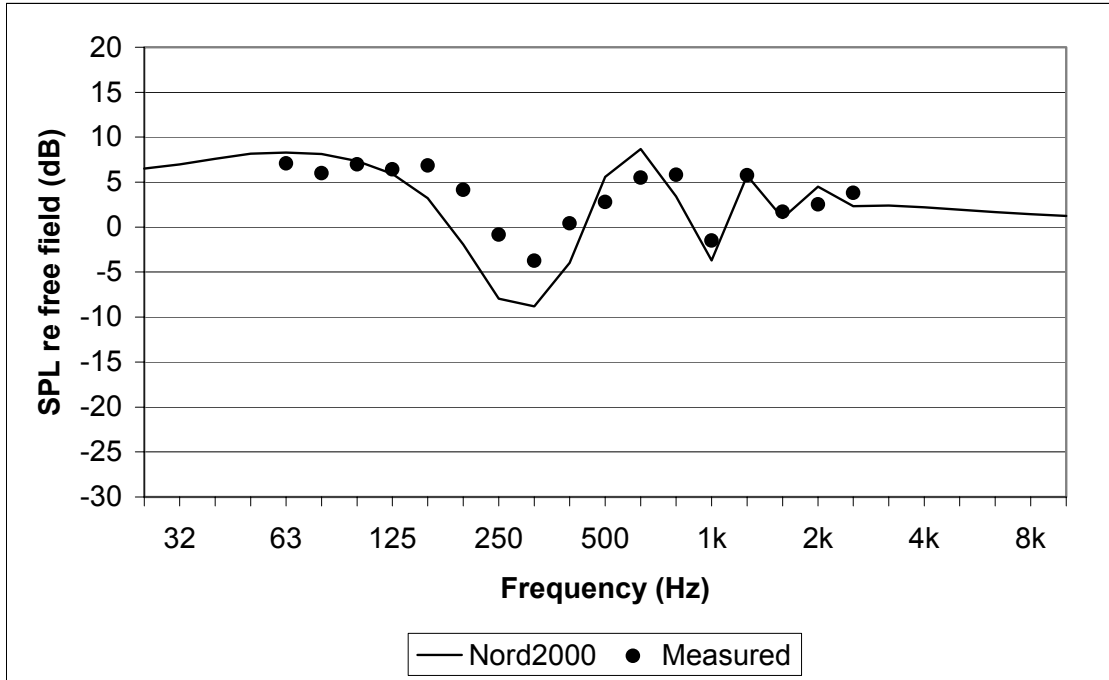
X	Z	Flow resist.	Roughness
0.00	3.00	250000	0
1.90	2.95	250000	0
13.90	0.20	2000000	0
17.40	0.10	630000	0
20.40	0.00	0	0

Calculation parameters

hs	1.55	m
hr	2.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 73



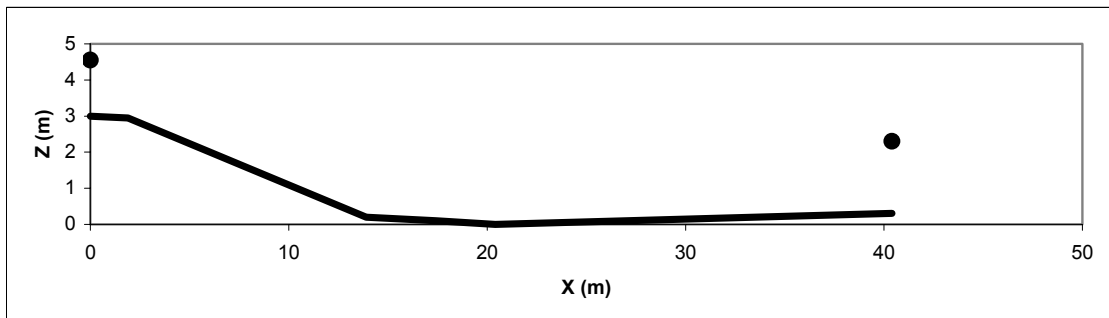
Nord2000 A-weighted ground effect (dB)	1.0
A-weighted difference re. measured (dB)	0.2

Terrain profile

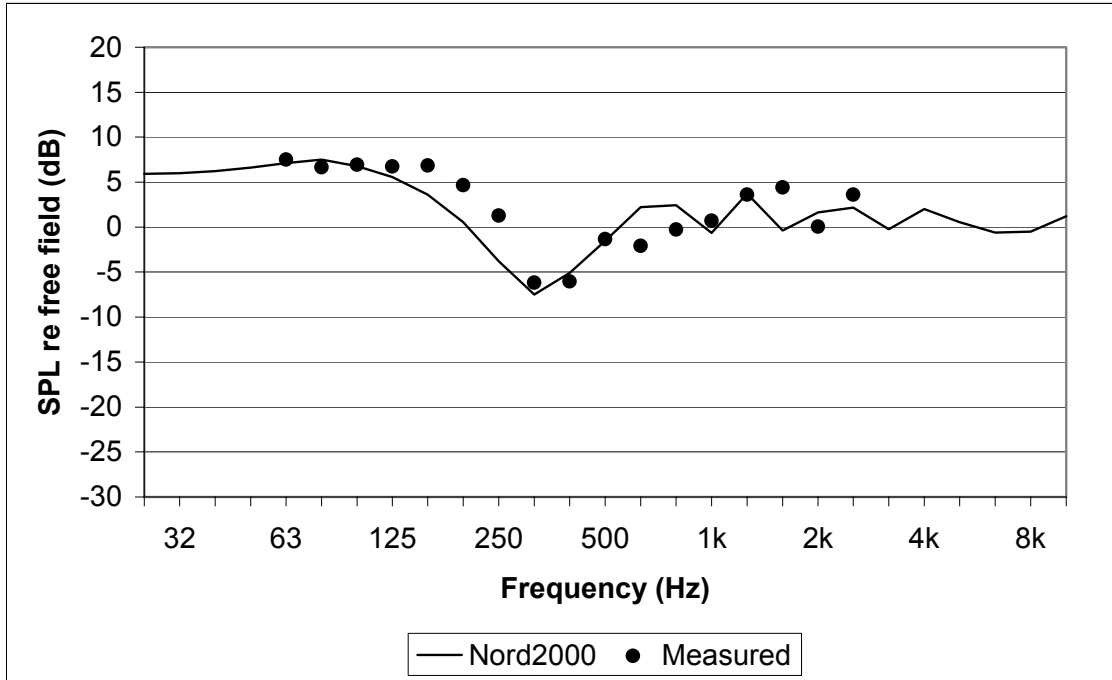
X	Z	Flow resist.	Roughness
0.00	3.00	250000	0
1.90	2.95	250000	0
13.90	0.20	2000000	0
17.40	0.10	630000	0
20.40	0.00	630000	0
40.40	0.30	0	0

Calculation parameters

hs	1.55	m
hr	2.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 74



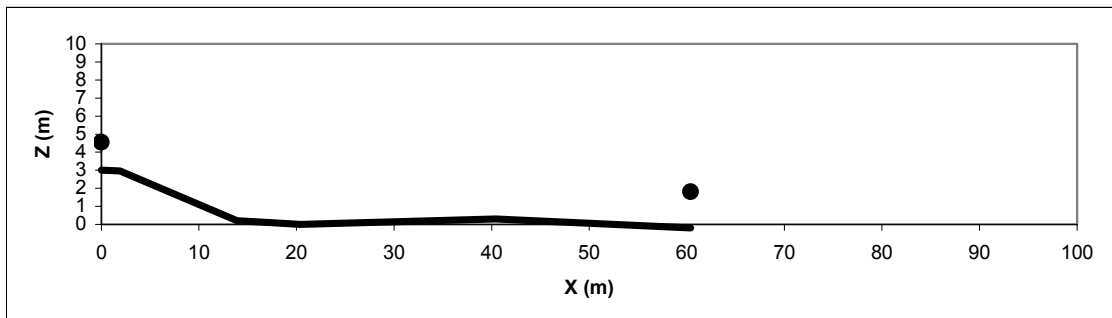
Nord2000 A-weighted ground effect (dB)	-1.4
A-weighted difference re. measured (dB)	-0.6

Terrain profile

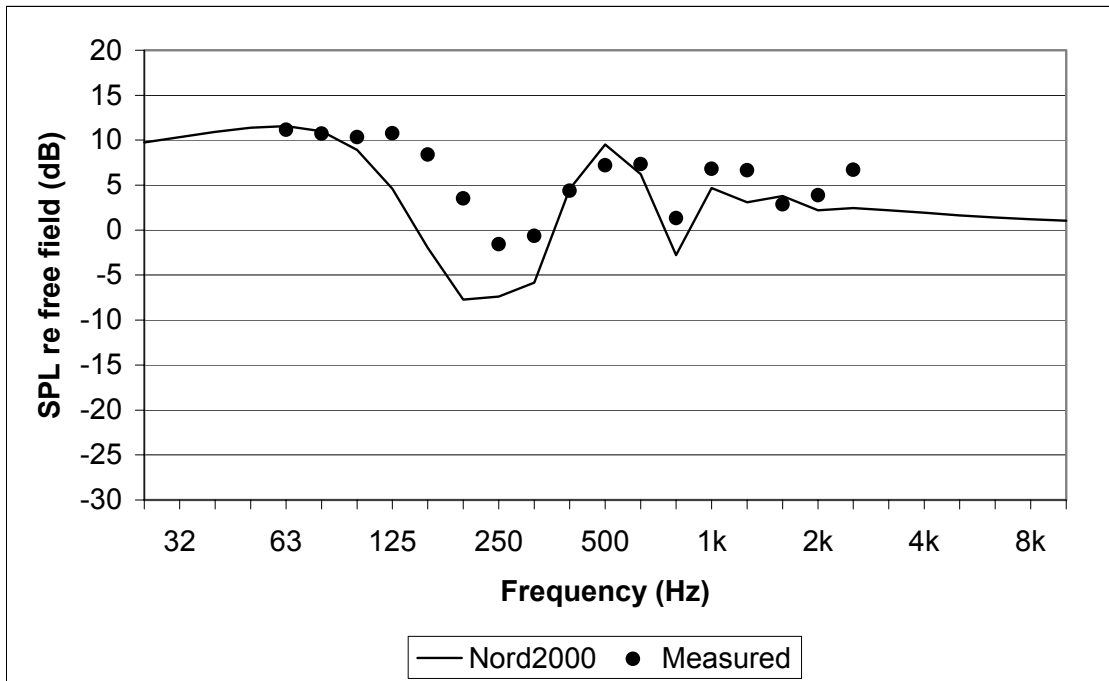
X	Z	Flow resist.	Roughness
0.00	3.00	250000	0
1.90	2.95	250000	0
13.90	0.20	2000000	0
17.40	0.10	630000	0
20.40	0.00	630000	0
40.40	0.30	630000	0
60.40	-0.20	0	0

Calculation parameters

hs	1.55	m
hr	2.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 75



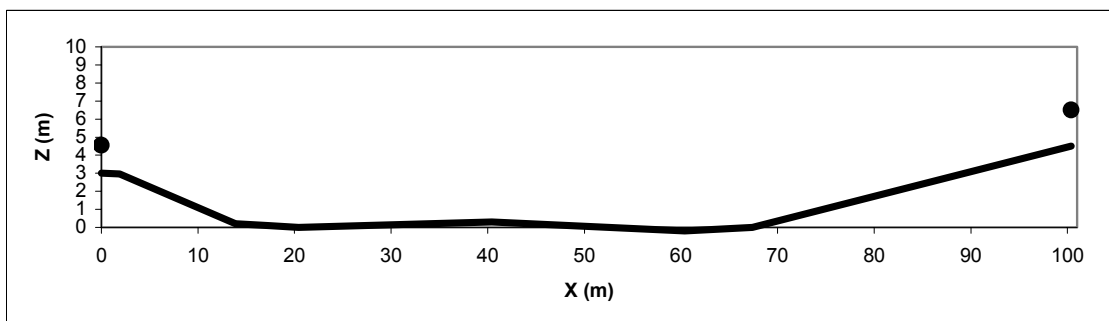
Nord2000 A-weighted ground effect (dB)	1.0
A-weighted difference re. measured (dB)	-1.6

Terrain profile

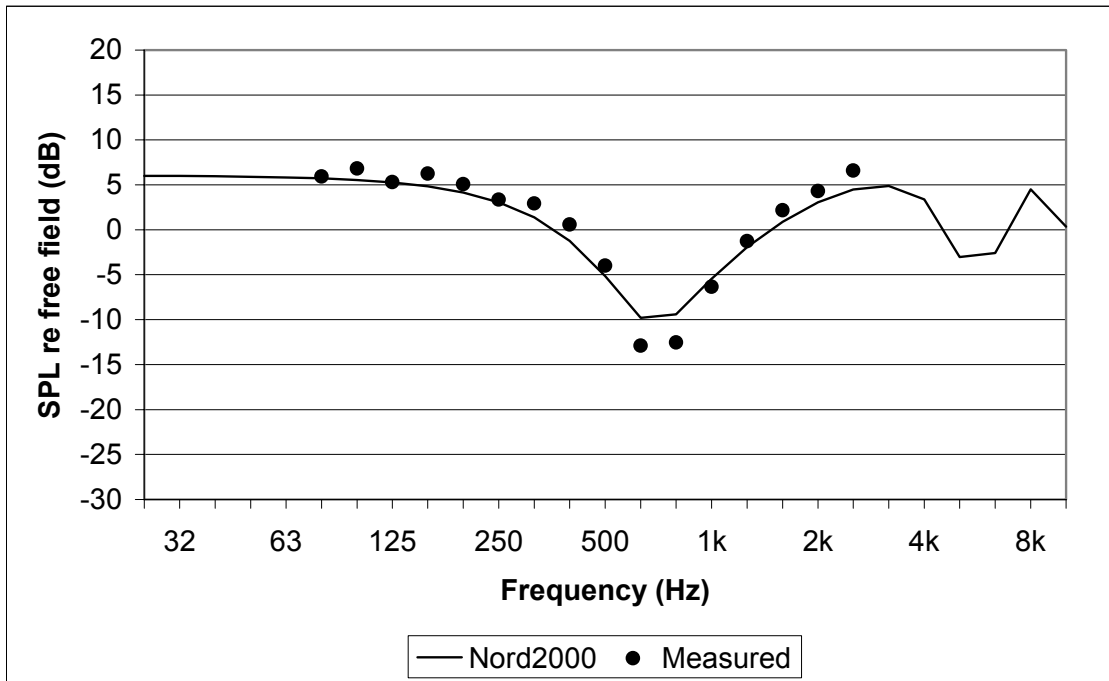
X	Z	Flow resist.	Roughness
0.00	3.00	250000	0
1.90	2.95	250000	0
13.90	0.20	2000000	0
17.40	0.10	630000	0
20.40	0.00	630000	0
40.40	0.30	630000	0
60.40	-0.20	630000	0
63.90	-0.10	20000000	0
67.40	0.00	400000	0
100.40	4.50	0	0

Calculation parameters

hs	1.55	m
hr	2.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 77



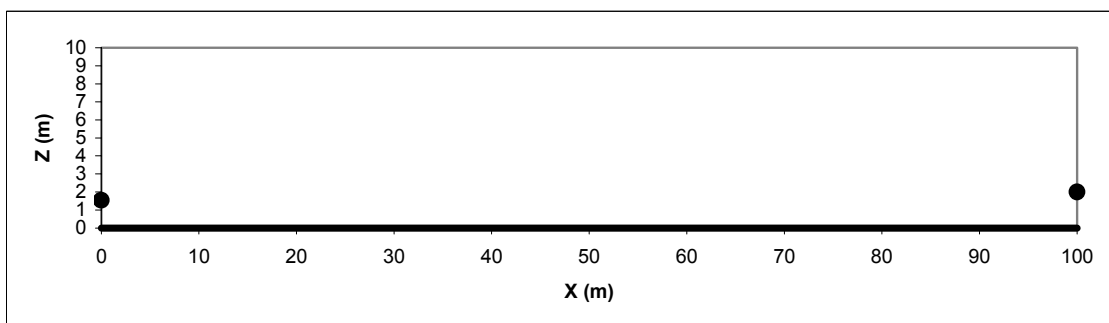
Nord2000 A-weighted ground effect (dB)	-1.8
A-weighted difference re. measured (dB)	-1.4

Terrain profile

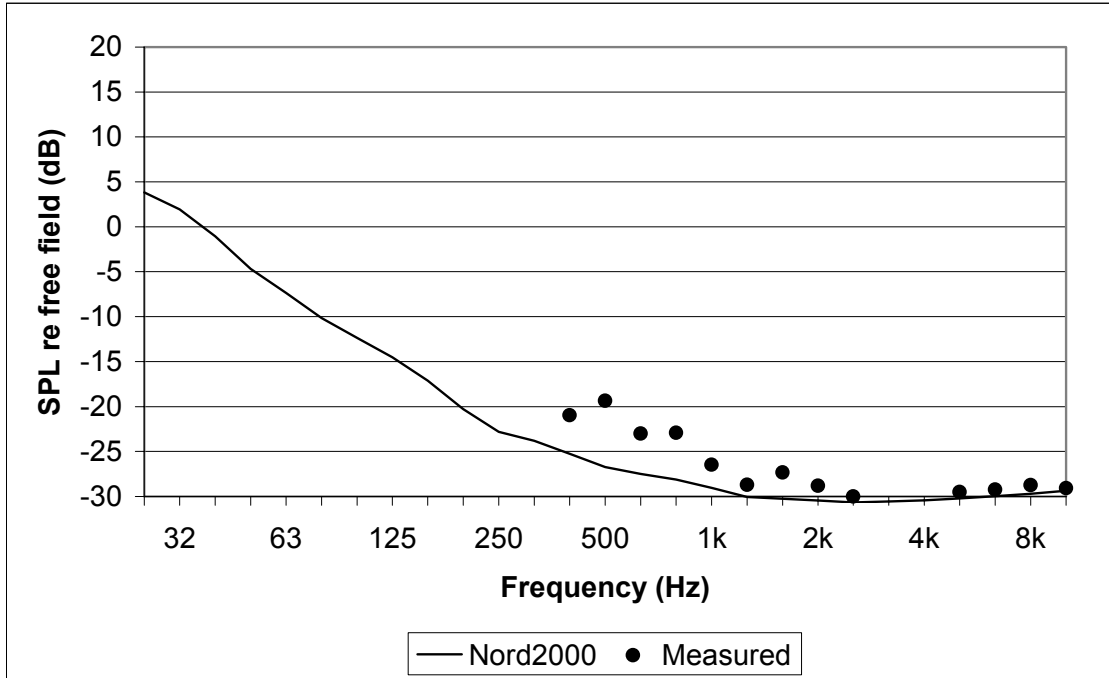
X	Z	Flow resist.	Roughness
0.00	0.00	630000	0
100.00	0.00	0	0

Calculation parameters

hs	1.55	m
hr	2.00	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 81



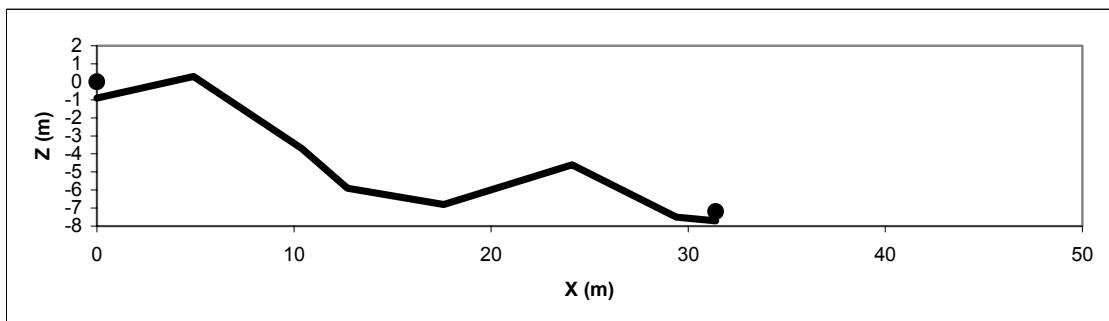
Nord2000 A-weighted ground effect (dB)	-29.7
A-weighted difference re. measured (dB)	-2.9

Terrain profile

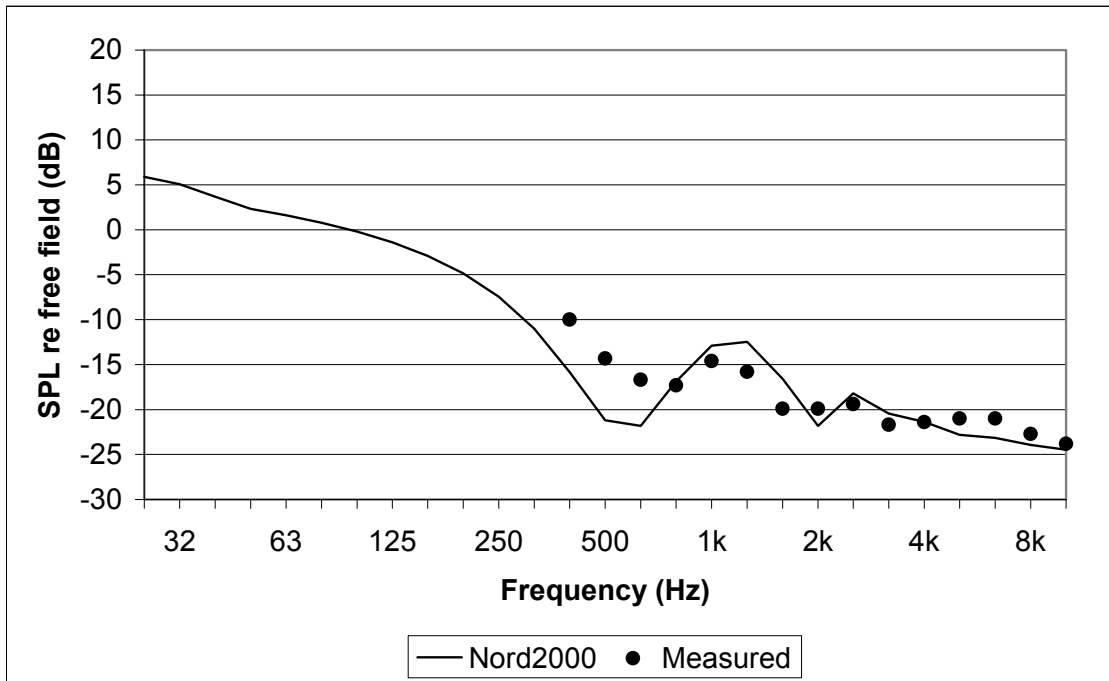
X	Z	Flow resist.	Roughness
0.00	-0.90	25000	0
4.90	0.30	63000	0
10.40	-3.70	63000	0
12.70	-5.90	63000	0
17.60	-6.80	63000	0
24.10	-4.60	63000	0
29.40	-7.50	63000	0
31.40	-7.70	0	0

Calculation parameters

hs	0.90	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.400	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 82



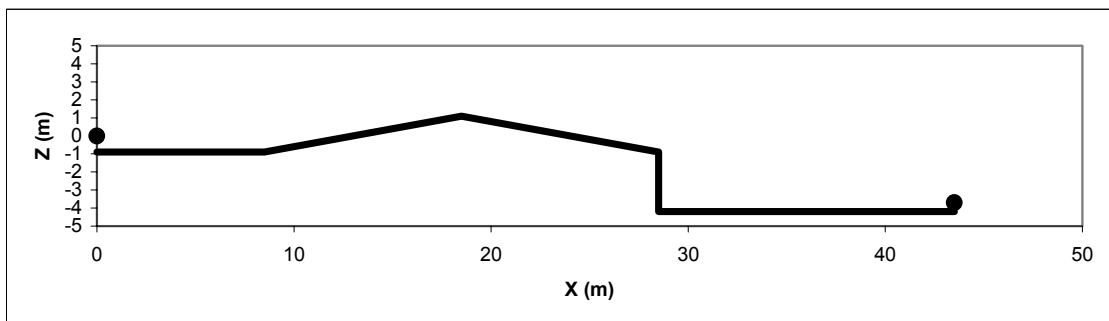
Nord2000 A-weighted ground effect (dB)	-17.9
A-weighted difference re. measured (dB)	0.3

Terrain profile

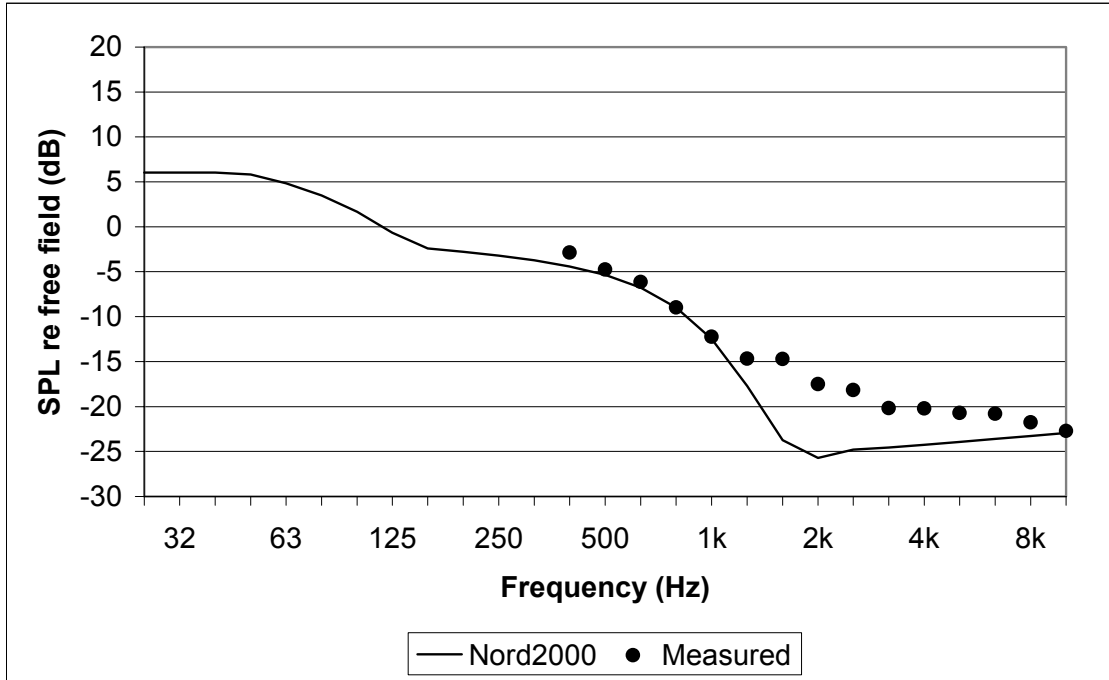
X	Z	Flow resist.	Roughness
0.00	-0.90	400000	0
8.50	-0.90	2000000	0
18.50	1.10	2000000	0
28.50	-0.90	2000000	0
28.51	-4.20	400000	0
43.50	-4.20	0	0

Calculation parameters

hs	0.90	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 83



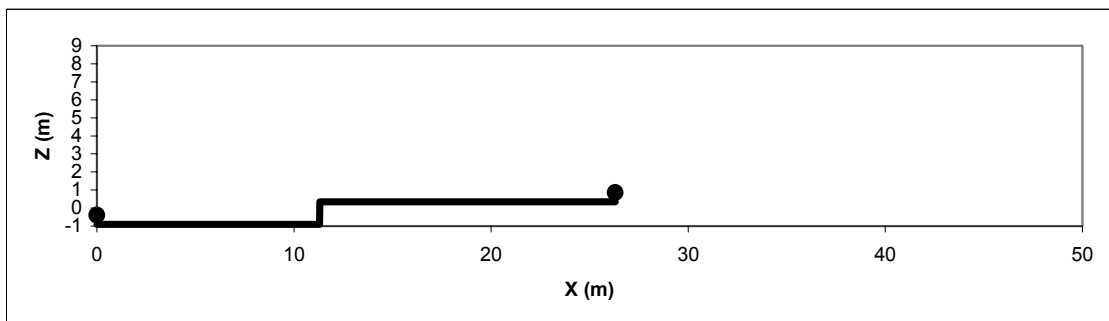
Nord2000 A-weighted ground effect (dB)	-13.9
A-weighted difference re. measured (dB)	-1.3

Terrain profile

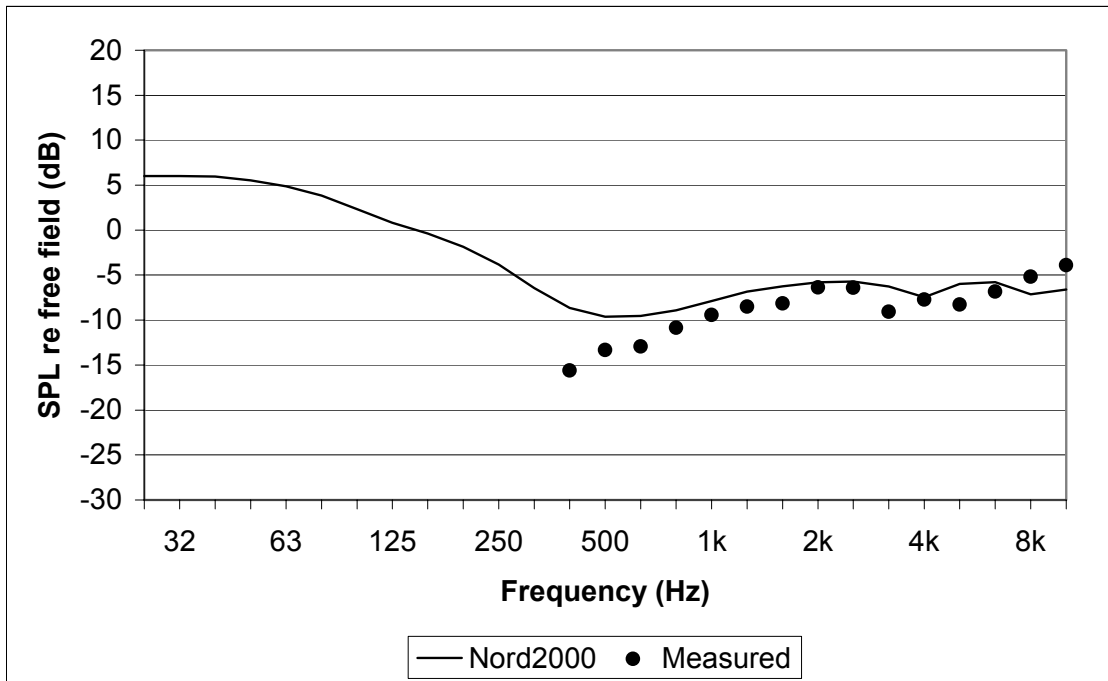
X	Z	Flow resist.	Roughness
0.00	-0.90	630000	0
11.30	-0.90	20000000	0
11.31	0.35	630000	0
26.30	0.35	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	-6.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.400	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 84



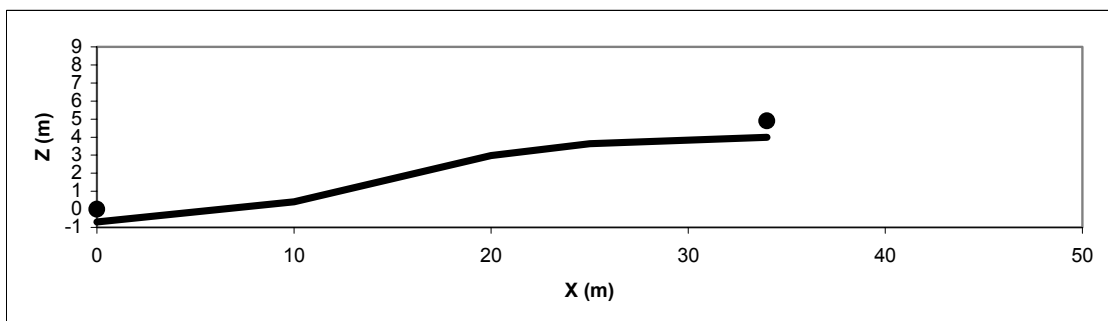
Nord2000 A-weighted ground effect (dB)	-6.9
A-weighted difference re. measured (dB)	1.0

Terrain profile

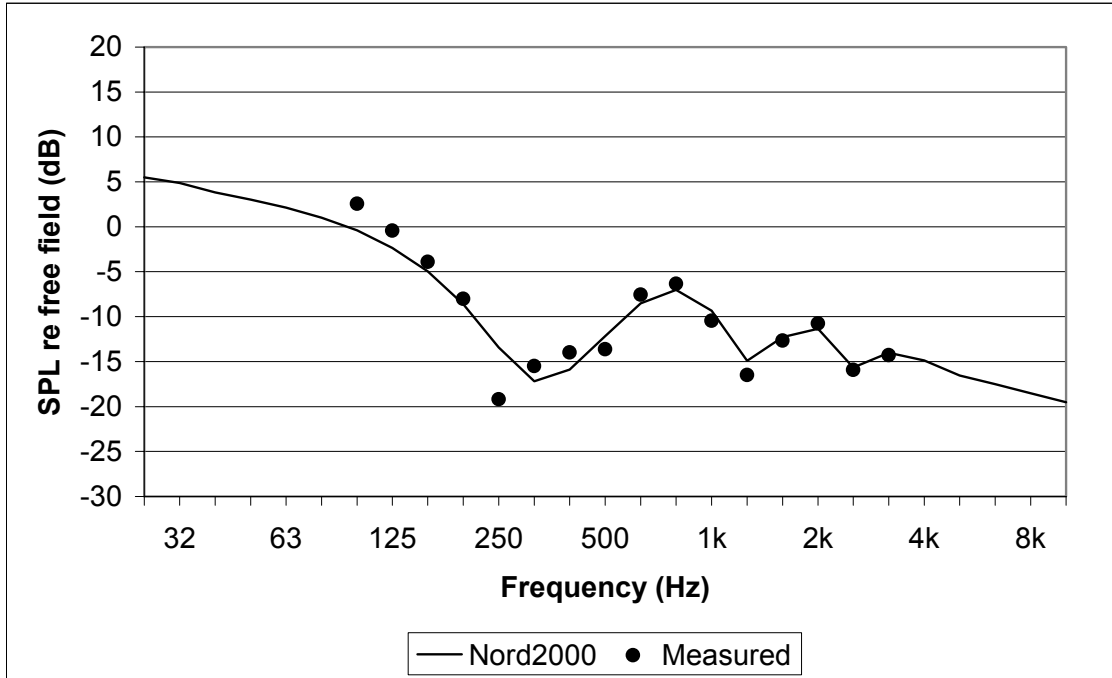
X	Z	Flow resist.	Roughness
0.00	-0.70	100000	0
10.00	0.42	100000	0
20.00	2.97	100000000	0
25.00	3.63	100000	0
34.00	4.00	0	0

Calculation parameters

hs	0.70	m
hr	0.90	m
z0	0.050	m
zu	10	m
u	2.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.120	m ^{4/3} /s ²
Ct2	0.008	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 91



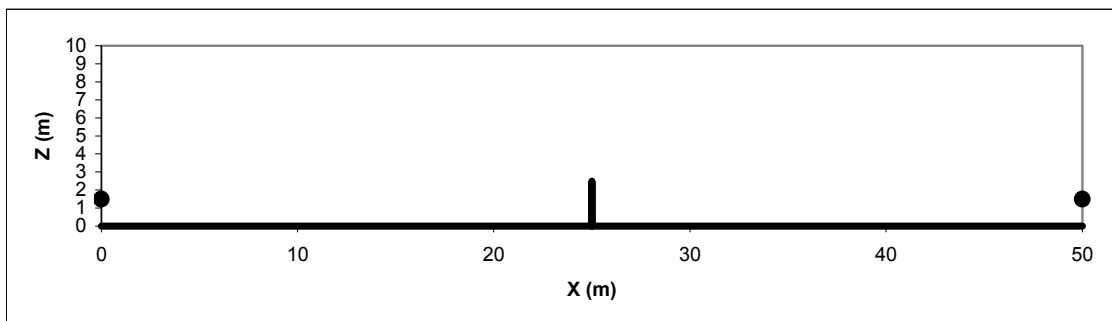
Nord2000 A-weighted ground effect (dB)	-13.2
A-weighted difference re. measured (dB)	-0.2

Terrain profile

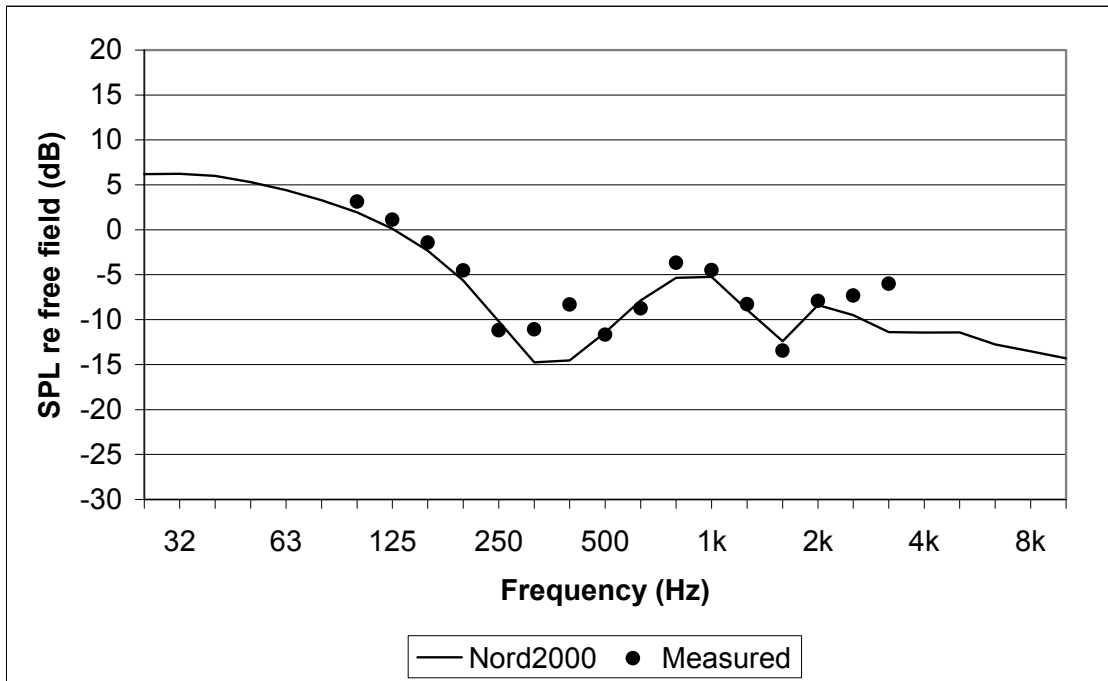
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
24.99	0.00	250000	0
25.00	2.50	250000	0
25.01	0.00	250000	0
50.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 92



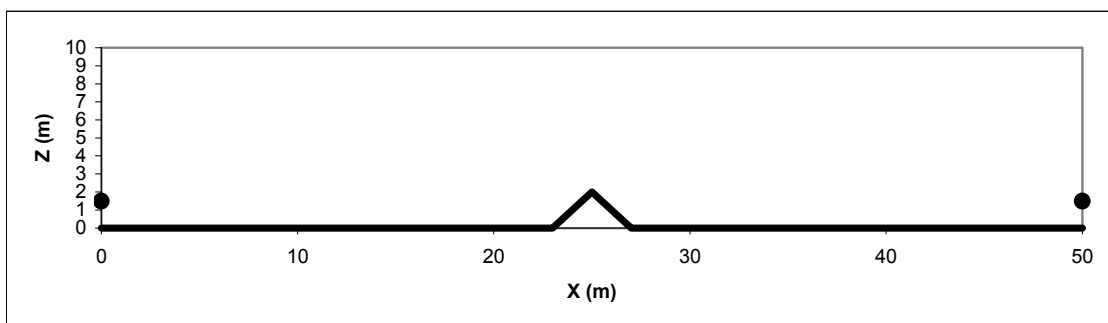
Nord2000 A-weighted ground effect (dB)	-10.4
A-weighted difference re. measured (dB)	-1.4

Terrain profile

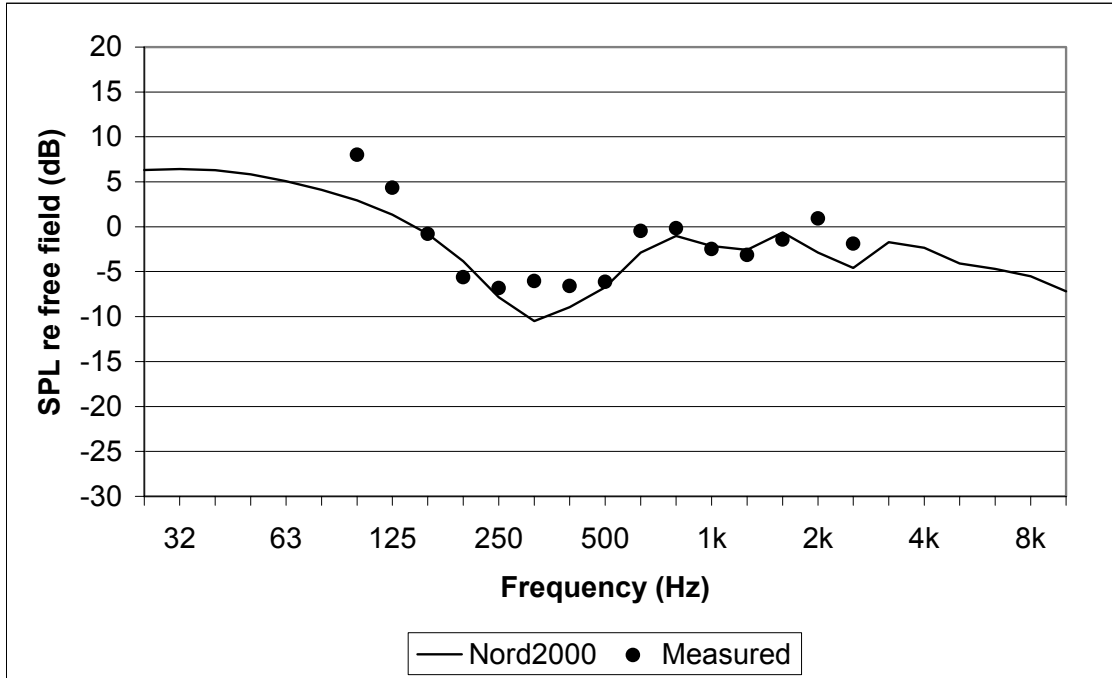
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
23.00	0.00	250000	0
25.00	2.00	250000	0
27.00	0.00	250000	0
50.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Measurements. Case No. 93



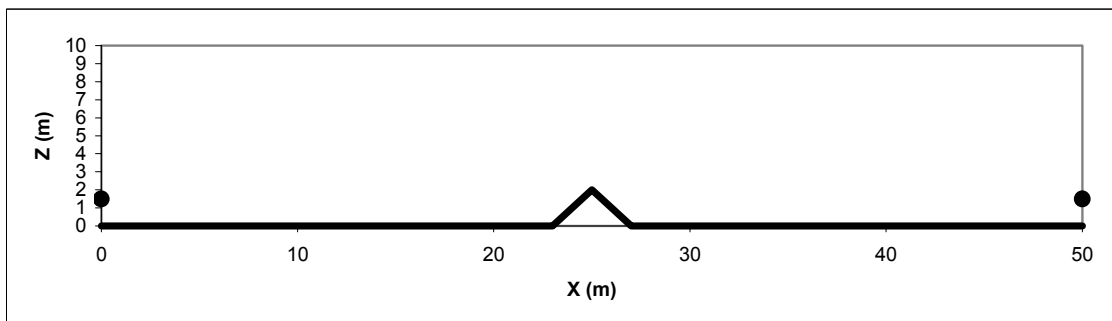
Nord2000 A-weighted ground effect (dB)	-5.0
A-weighted difference re. measured (dB)	-1.2

Terrain profile

X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
23.00	0.00	250000	0
25.00	2.00	250000	0
27.00	0.00	250000	0
50.00	0.00	0	0

Calculation parameters

hs	1.50	m
hr	1.50	m
z0	0.050	m
zu	10	m
u	4.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%

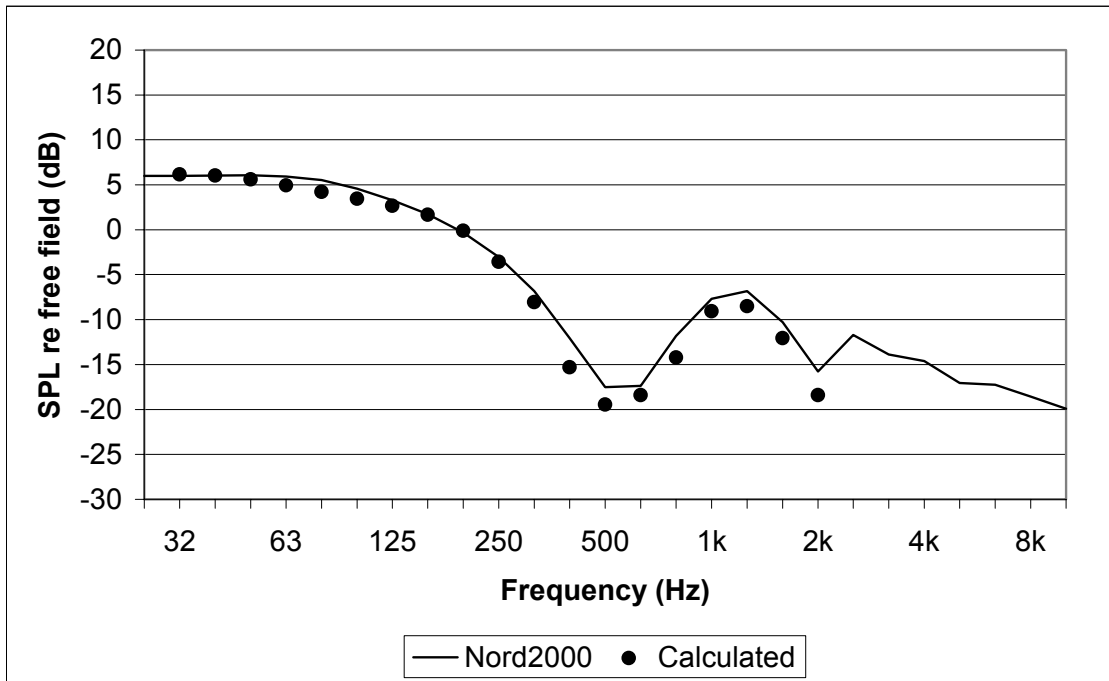


Appendix B

Results from Validation Group 2 Based on Reference Calculation Results

In some of the cases shown in this appendix a flow resistivity value of 1 or 2 can be found in the terrain profile table. The value 1 indicates a rigid surface (spherical wave reflection coefficient $Q = 1$), and the value 2 indicates impedance for porous asphalt calculated by the Hamet impedance model with model parameters as described in [13].

Nord2000 Validation. Calculations. Case No. 111



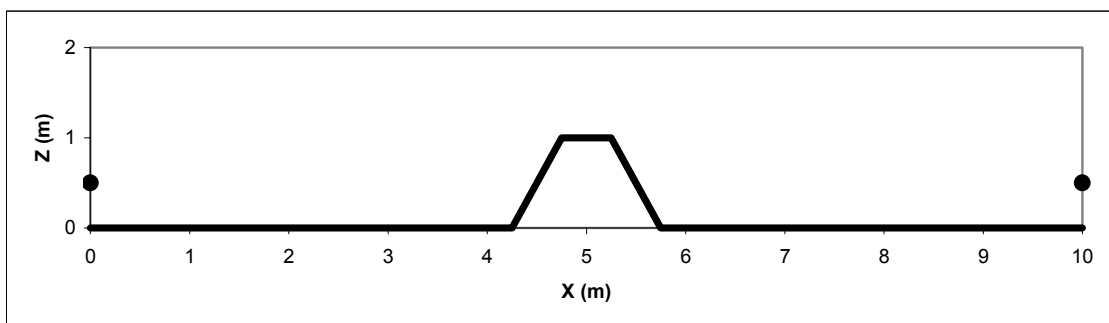
Nord2000 A-weighted ground effect (dB)	-12.6
A-weighted difference re. calculated (dB)	1.2

Terrain profile

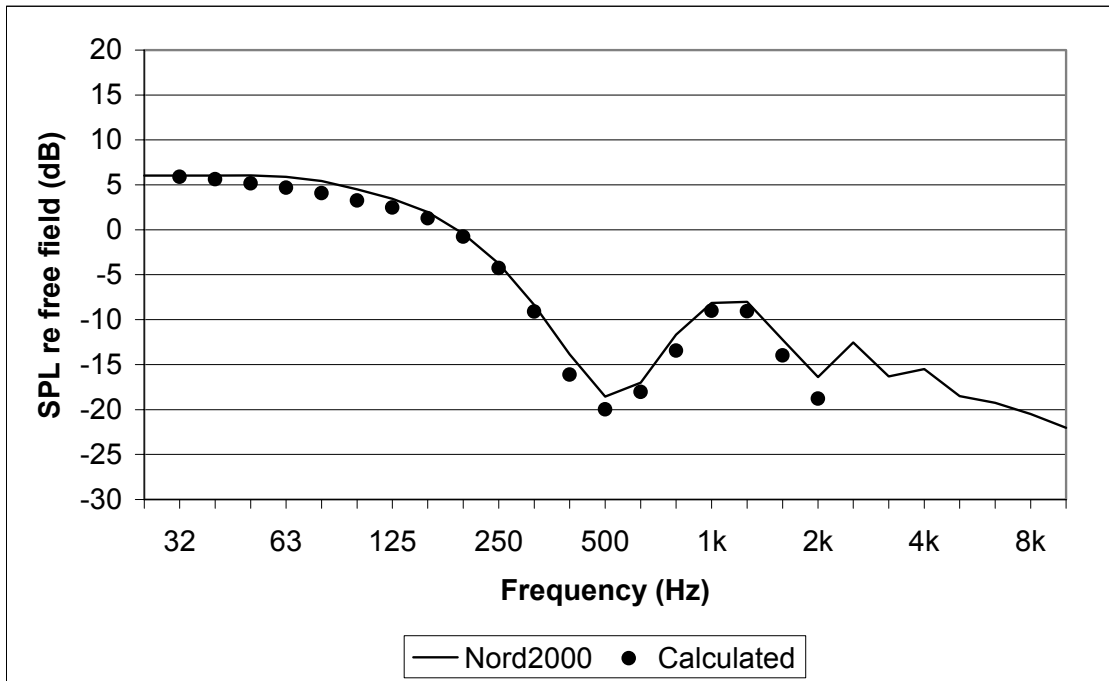
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
4.25	0.00	200000	0
4.75	1.00	100000000	0
5.25	1.00	200000	0
5.75	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 112



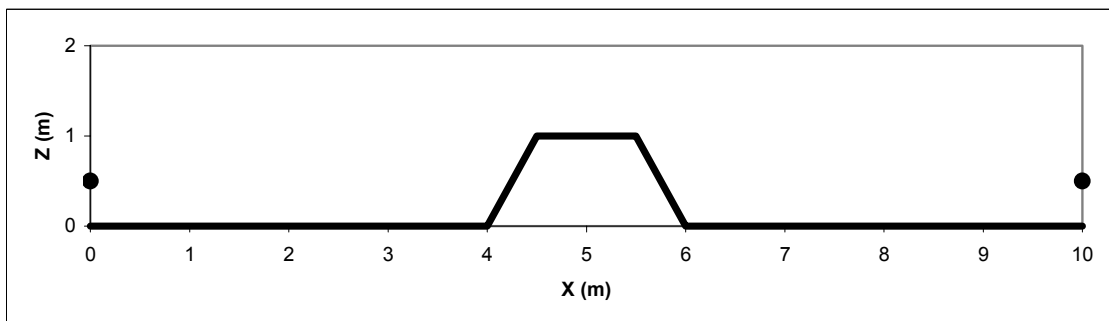
Nord2000 A-weighted ground effect (dB)	-13.3
A-weighted difference re. calculated (dB)	1.0

Terrain profile

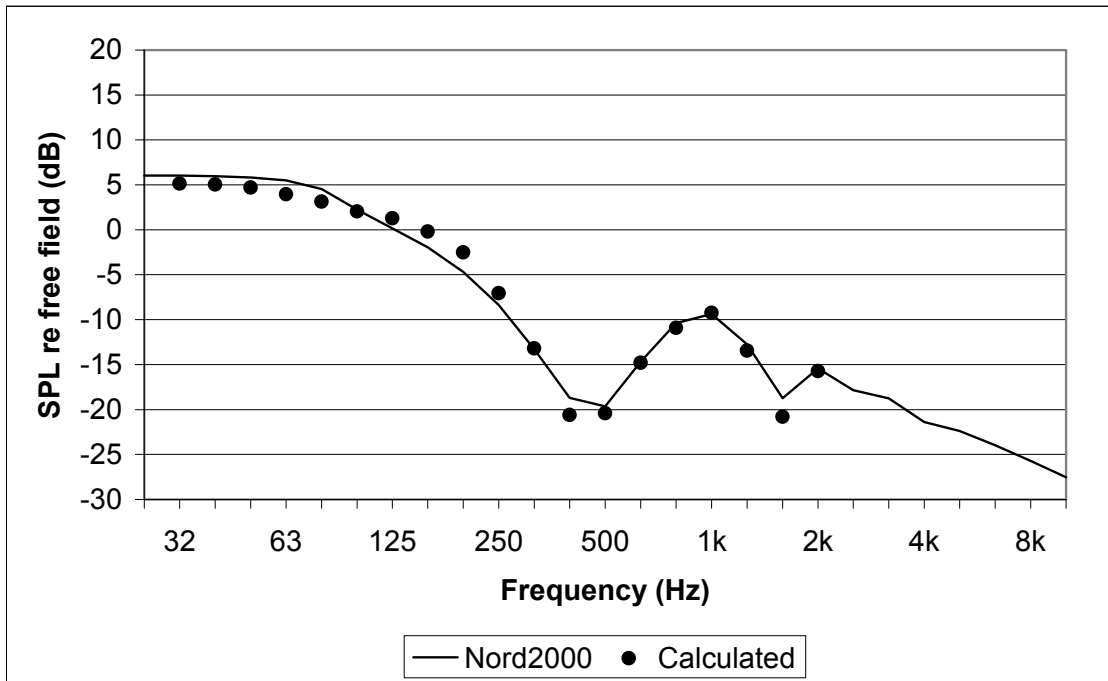
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
4.00	0.00	200000	0
4.50	1.00	100000000	0
5.50	1.00	200000	0
6.00	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 113



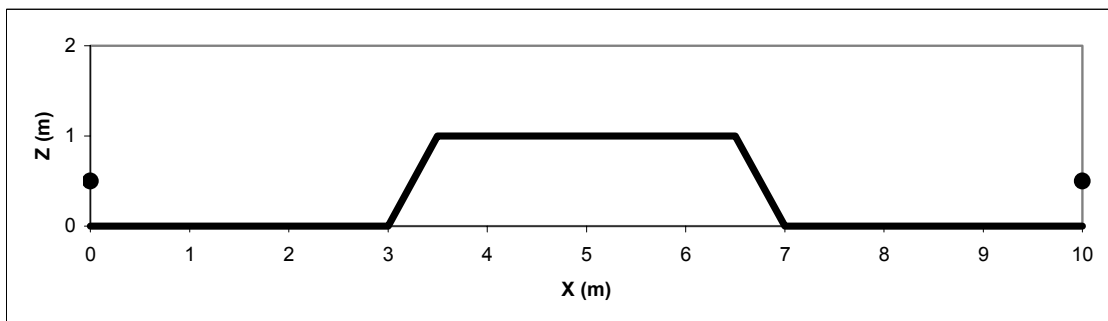
Nord2000 A-weighted ground effect (dB)	-15.8
A-weighted difference re. calculated (dB)	-0.1

Terrain profile

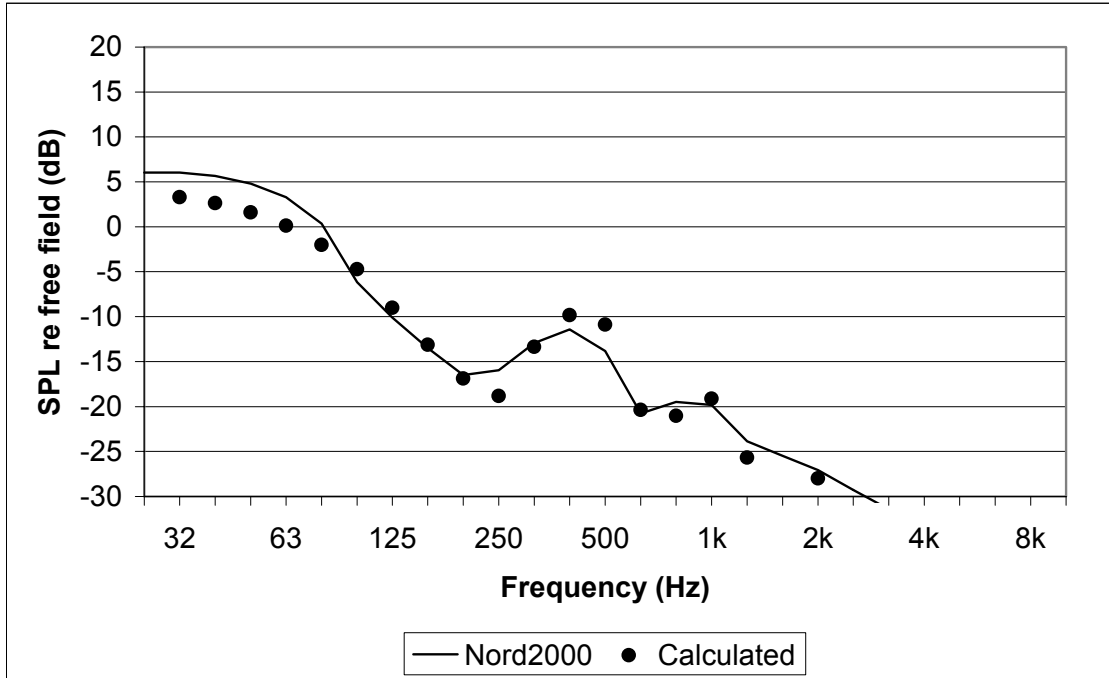
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
3.00	0.00	200000	0
3.50	1.00	100000000	0
6.50	1.00	200000	0
7.00	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 114



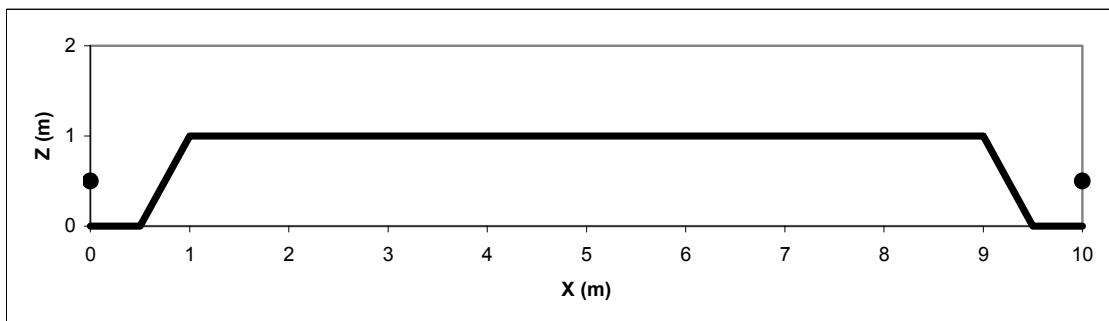
Nord2000 A-weighted ground effect (dB)	-22.0
A-weighted difference re. calculated (dB)	-0.5

Terrain profile

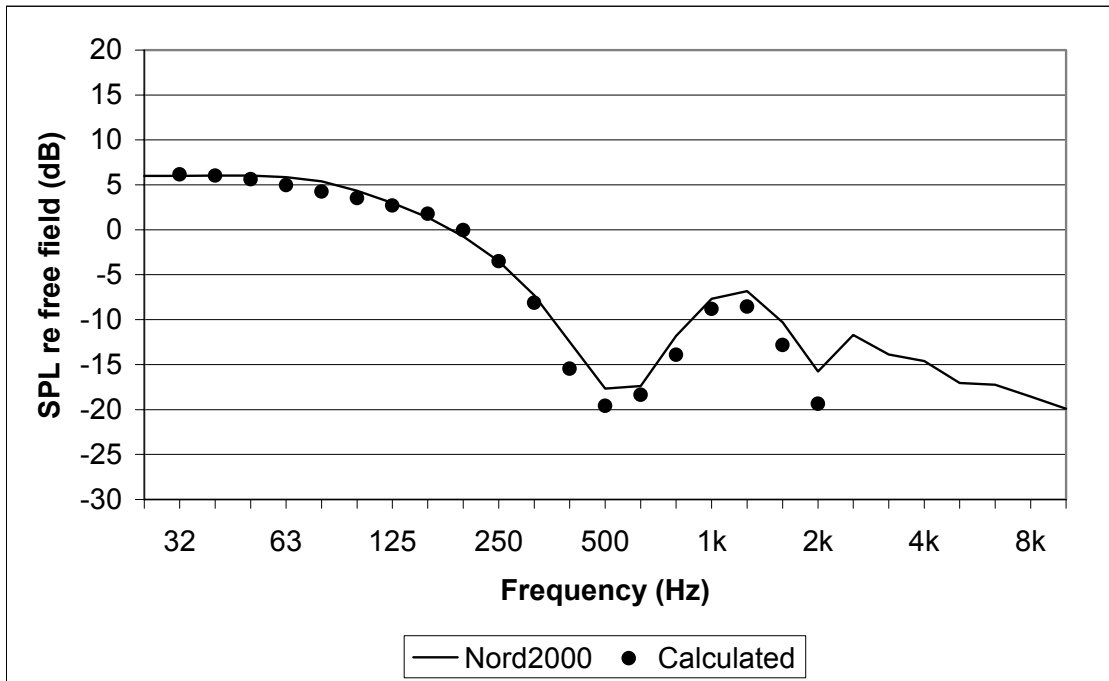
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
0.50	0.00	200000	0
1.00	1.00	100000000	0
9.00	1.00	200000	0
9.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 115



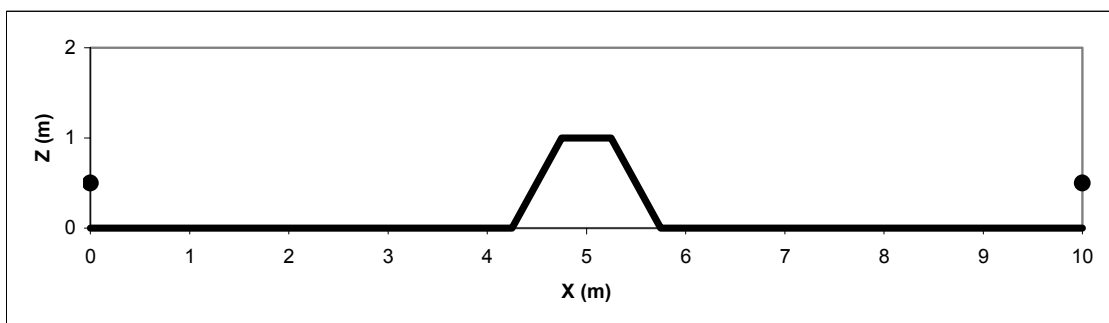
Nord2000 A-weighted ground effect (dB)	-12.8
A-weighted difference re. calculated (dB)	1.1

Terrain profile

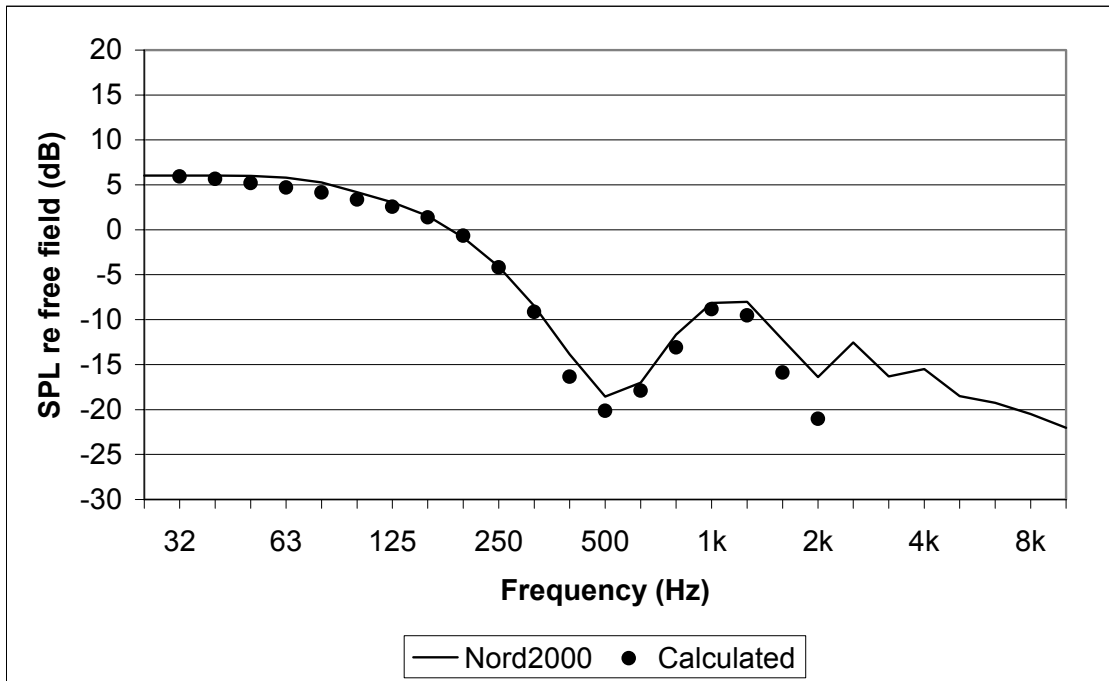
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
4.25	0.00	200000	0
4.75	1.00	200000	0
5.25	1.00	200000	0
5.75	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 116



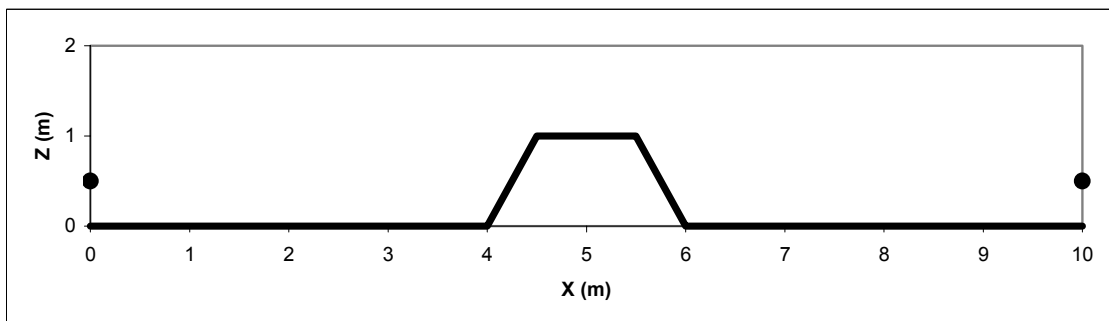
Nord2000 A-weighted ground effect (dB)	-13.4
A-weighted difference re. calculated (dB)	1.1

Terrain profile

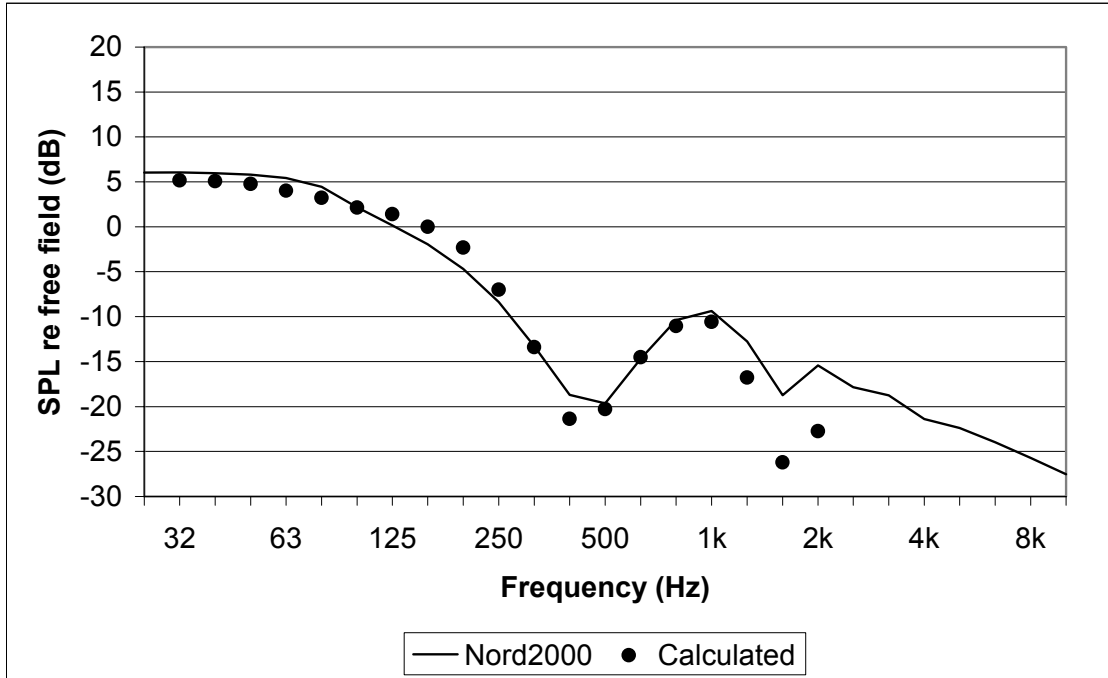
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
4.00	0.00	200000	0
4.50	1.00	200000	0
5.50	1.00	200000	0
6.00	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 117



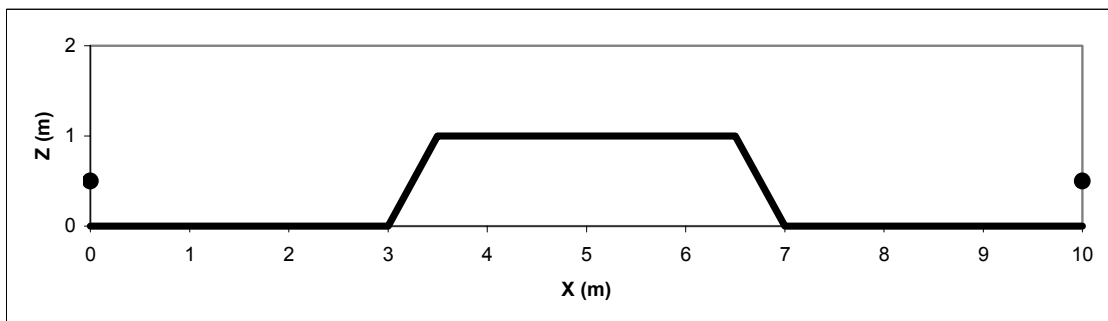
Nord2000 A-weighted ground effect (dB)	-15.8
A-weighted difference re. calculated (dB)	0.7

Terrain profile

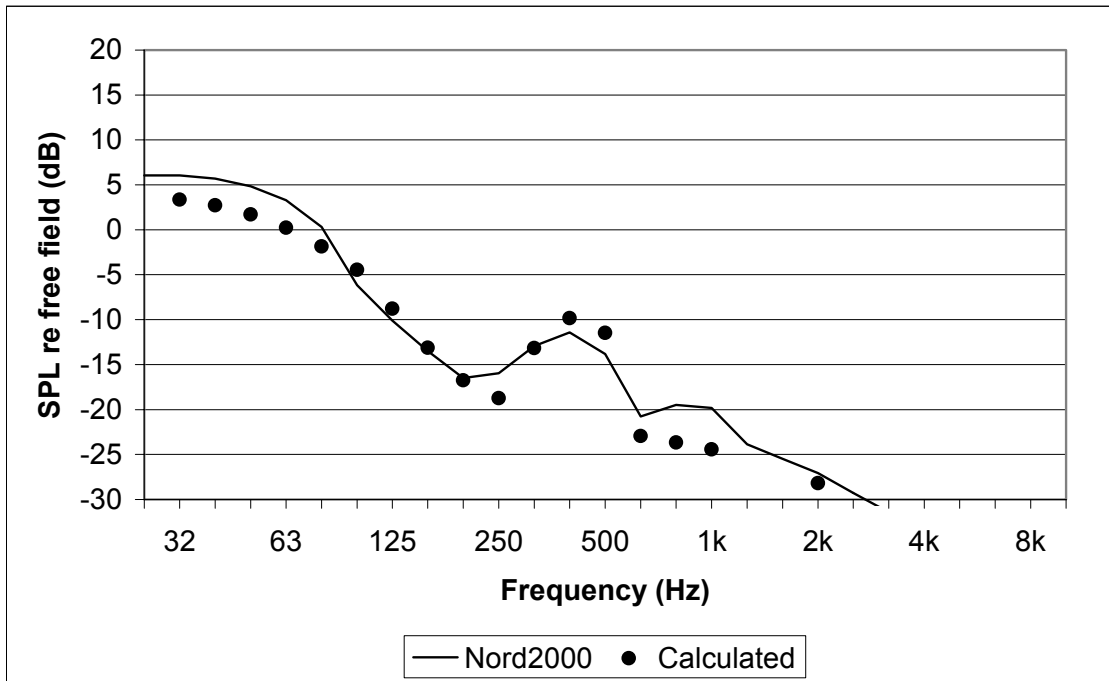
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
3.00	0.00	200000	0
3.50	1.00	200000	0
6.50	1.00	200000	0
7.00	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 118



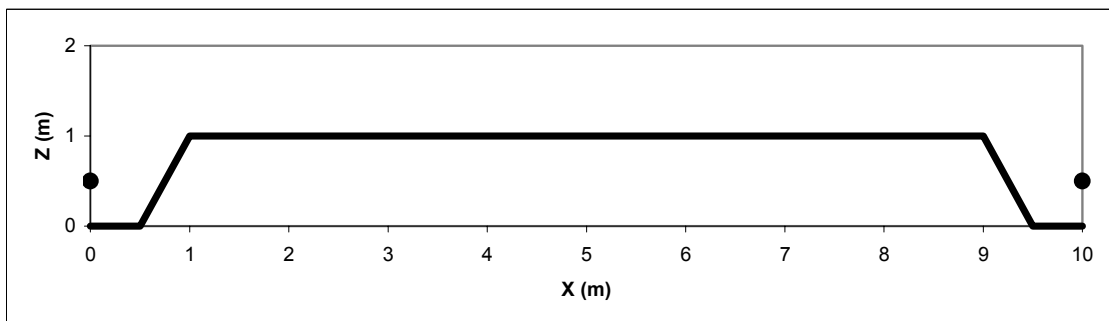
Nord2000 A-weighted ground effect (dB)	-22.0
A-weighted difference re. calculated (dB)	0.2

Terrain profile

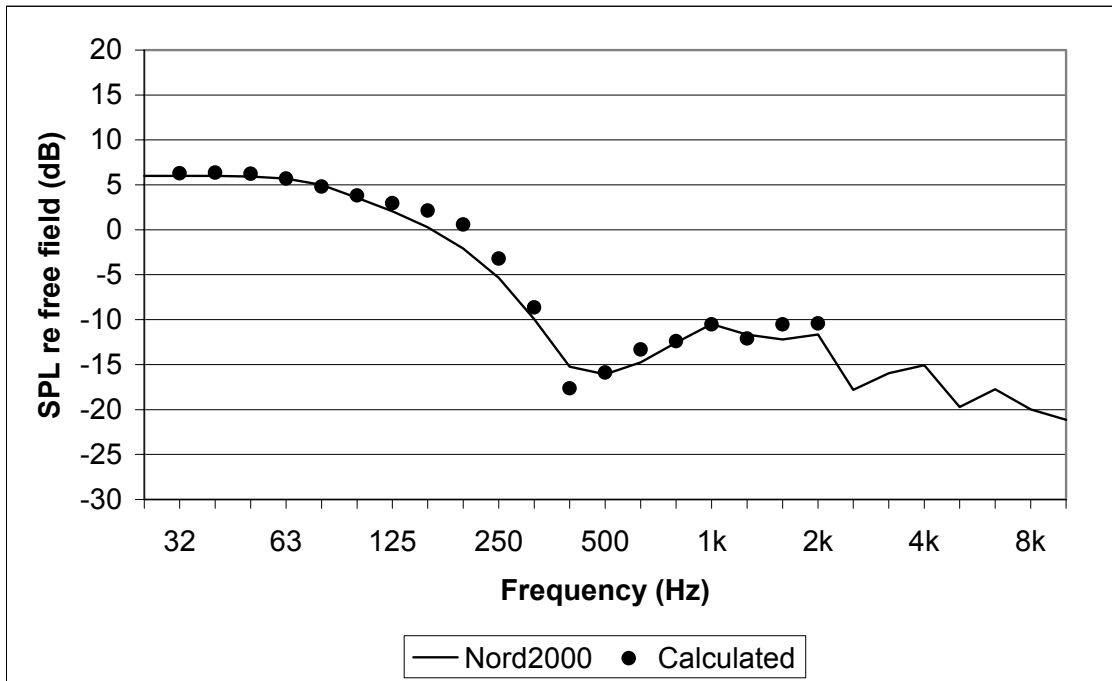
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
0.50	0.00	200000	0
1.00	1.00	200000	0
9.00	1.00	200000	0
9.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 121



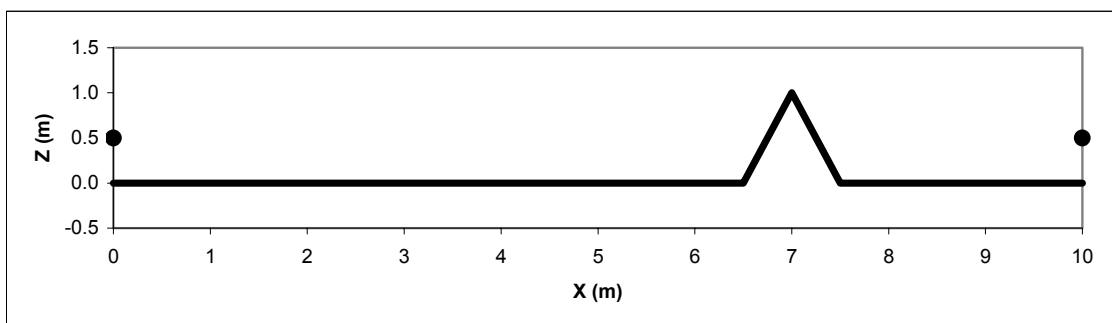
Nord2000 A-weighted ground effect (dB)	-14.4
A-weighted difference re. calculated (dB)	-1.0

Terrain profile

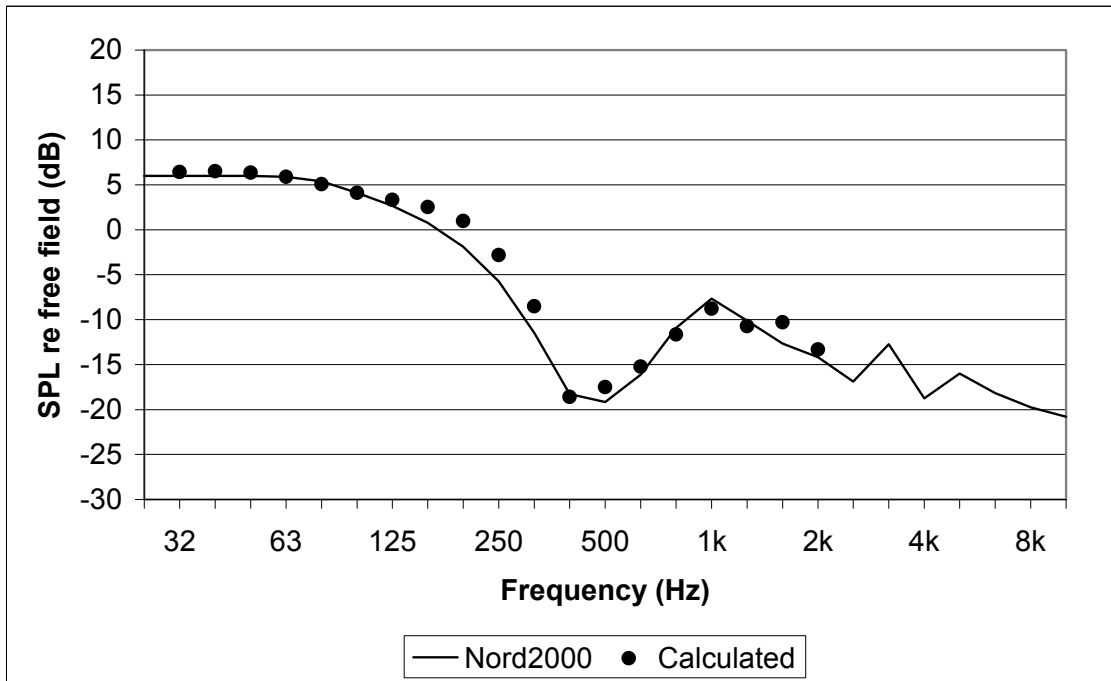
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 122



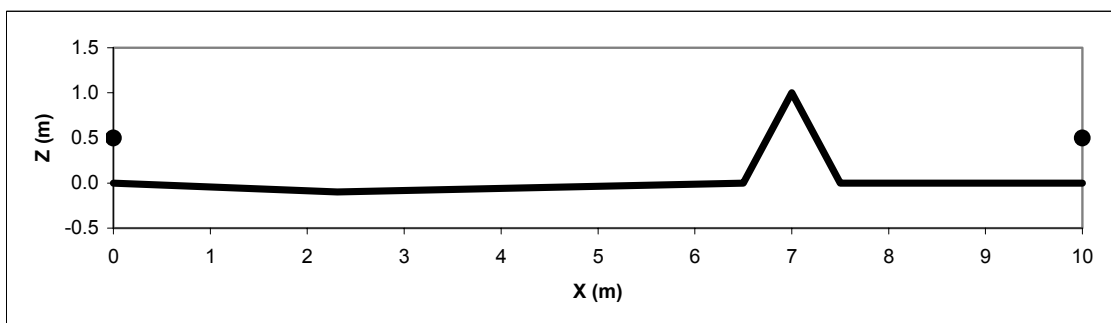
Nord2000 A-weighted ground effect (dB)	-13.9
A-weighted difference re. calculated (dB)	-0.7

Terrain profile

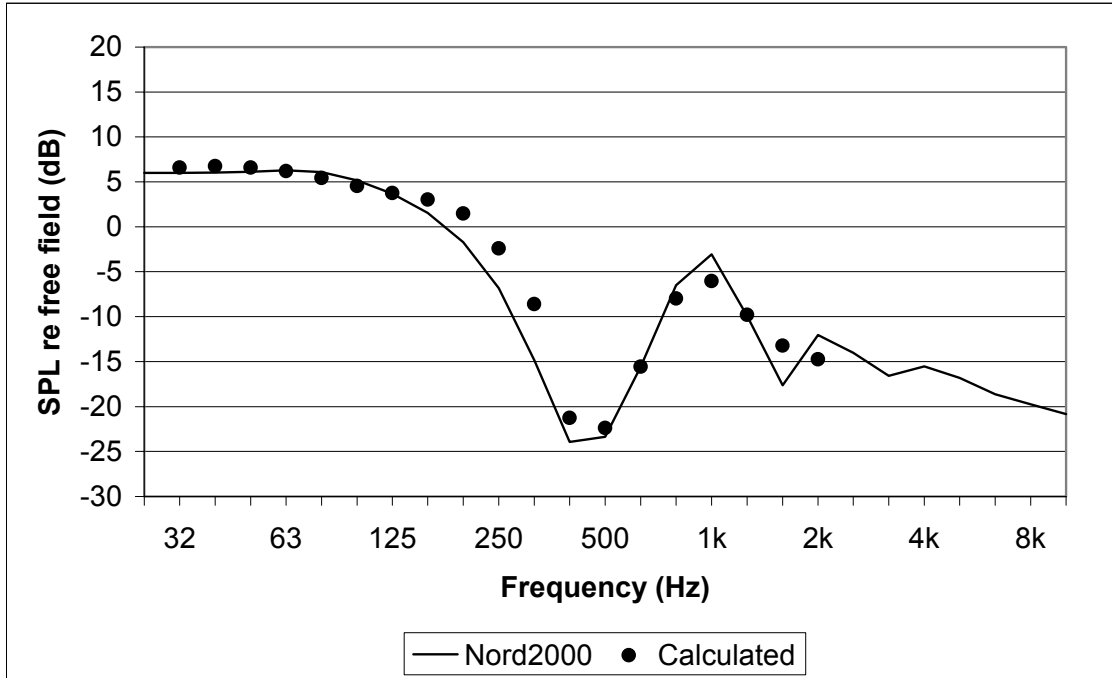
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
2.31	-0.10	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 123



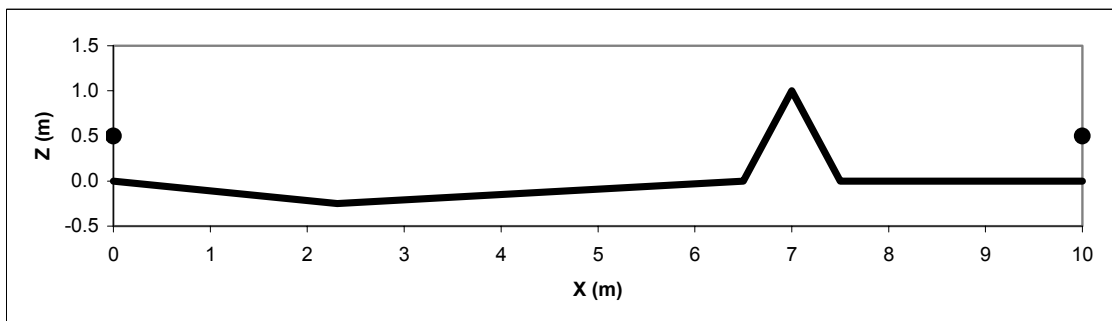
Nord2000 A-weighted ground effect (dB)	-11.9
A-weighted difference re. calculated (dB)	0.5

Terrain profile

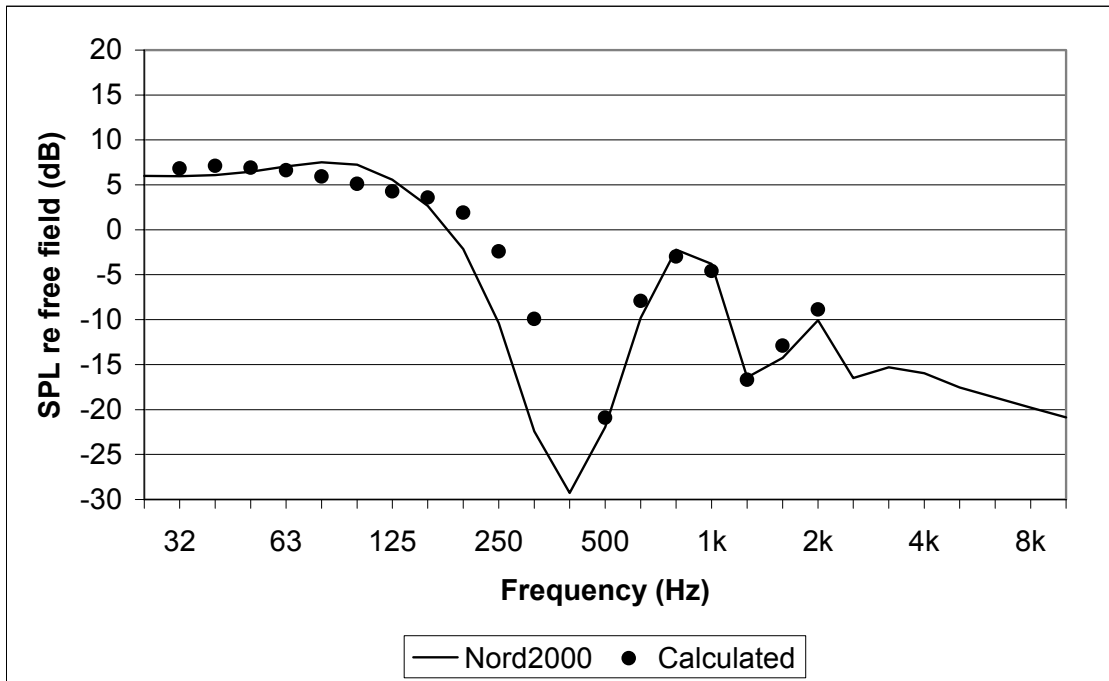
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
2.31	-0.25	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 124



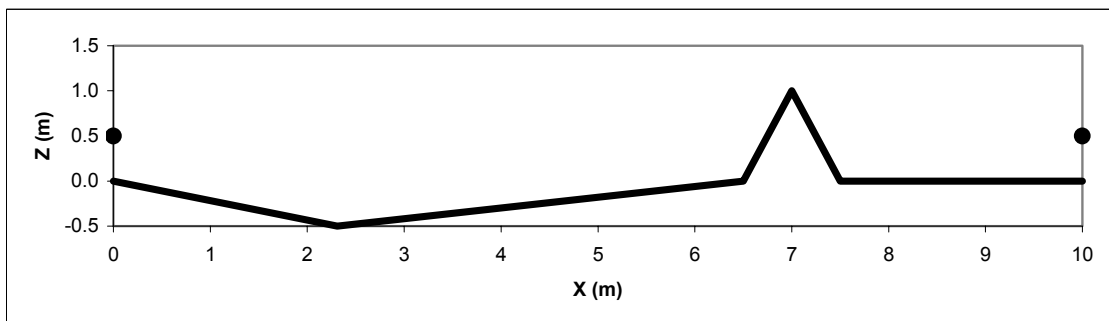
Nord2000 A-weighted ground effect (dB)	-10.9
A-weighted difference re. calculated (dB)	-0.2

Terrain profile

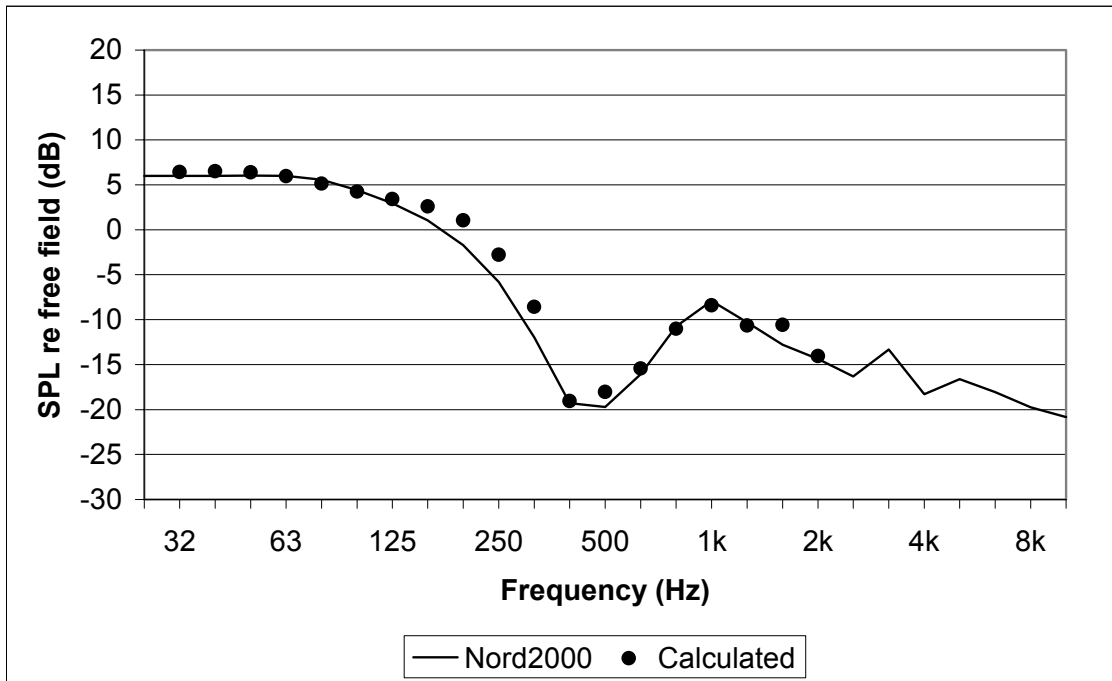
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
2.31	-0.50	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 125



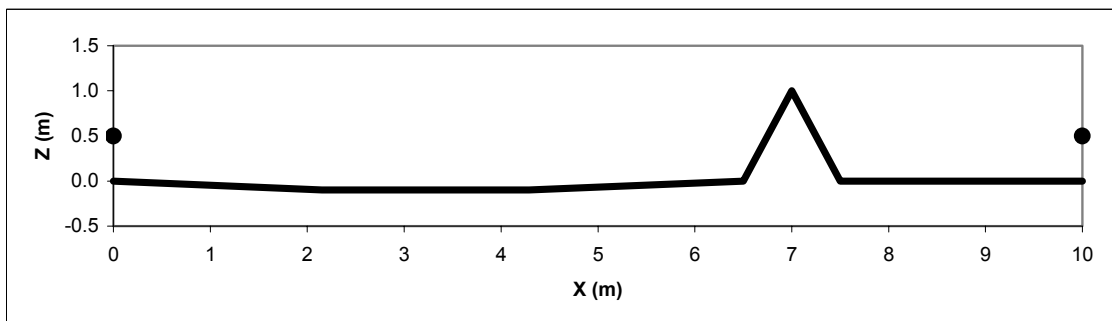
Nord2000 A-weighted ground effect (dB)	-14.0
A-weighted difference re. calculated (dB)	-0.8

Terrain profile

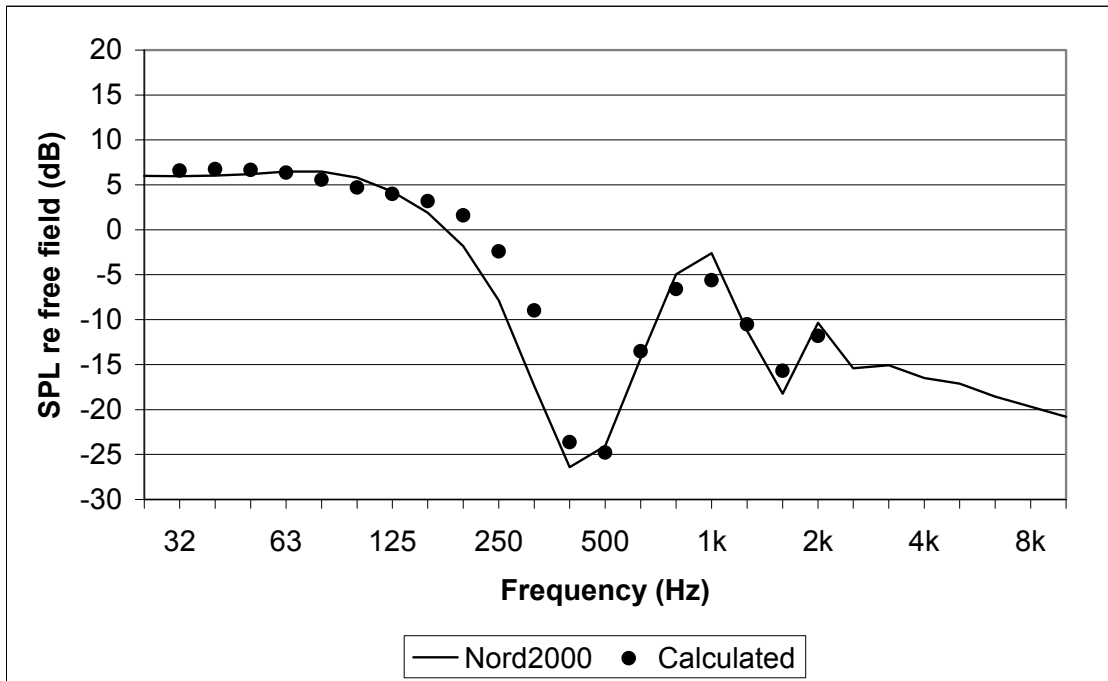
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
2.15	-0.10	200000	0
4.29	-0.10	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 126



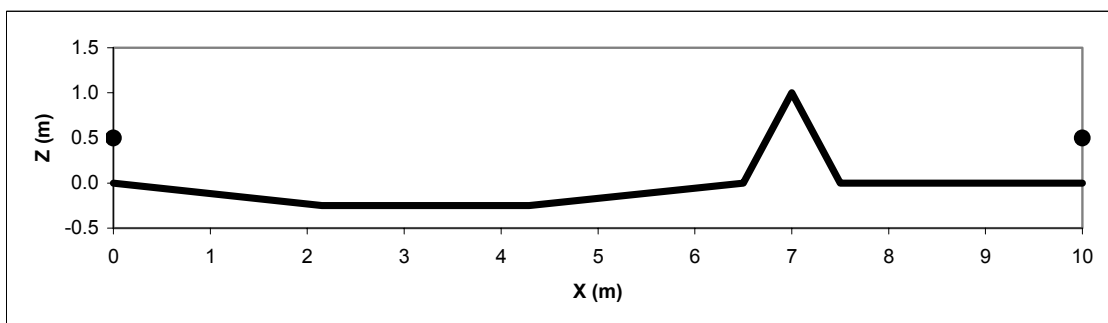
Nord2000 A-weighted ground effect (dB)	-11.4
A-weighted difference re. calculated (dB)	0.7

Terrain profile

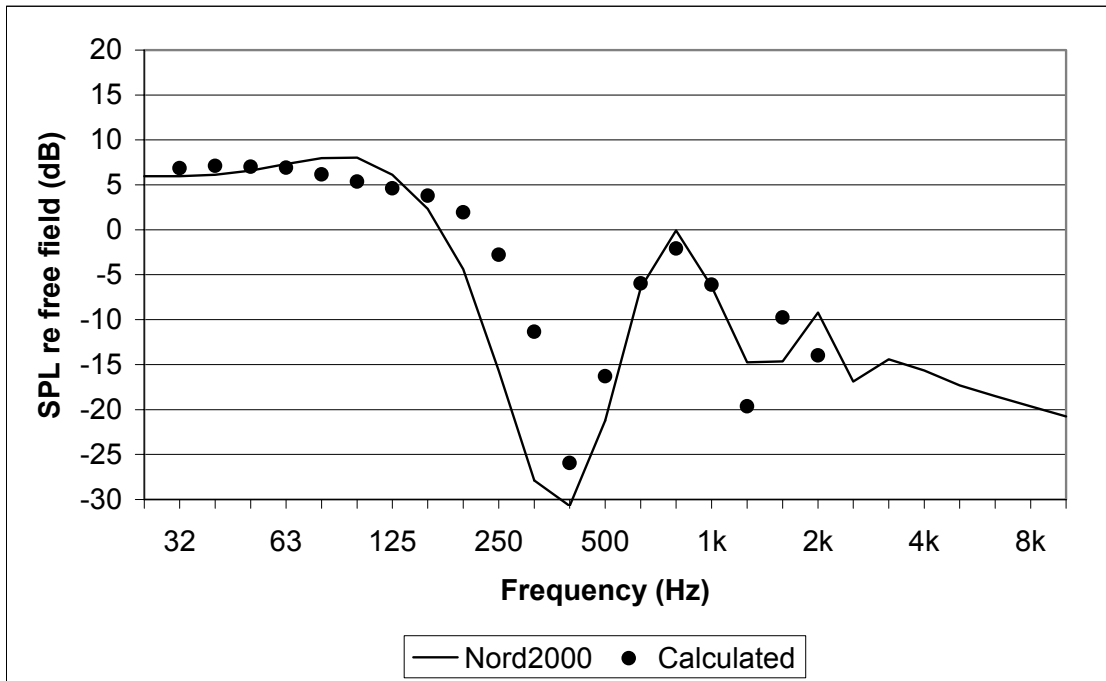
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
2.15	-0.25	200000	0
4.29	-0.25	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 127



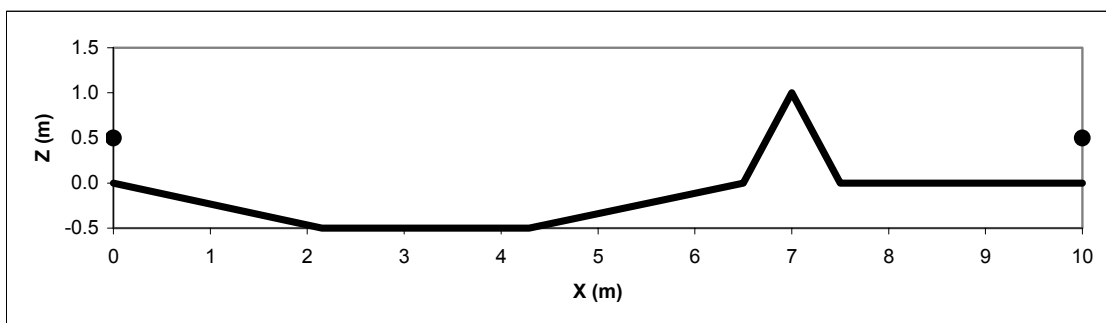
Nord2000 A-weighted ground effect (dB)	-10.3
A-weighted difference re. calculated (dB)	0.4

Terrain profile

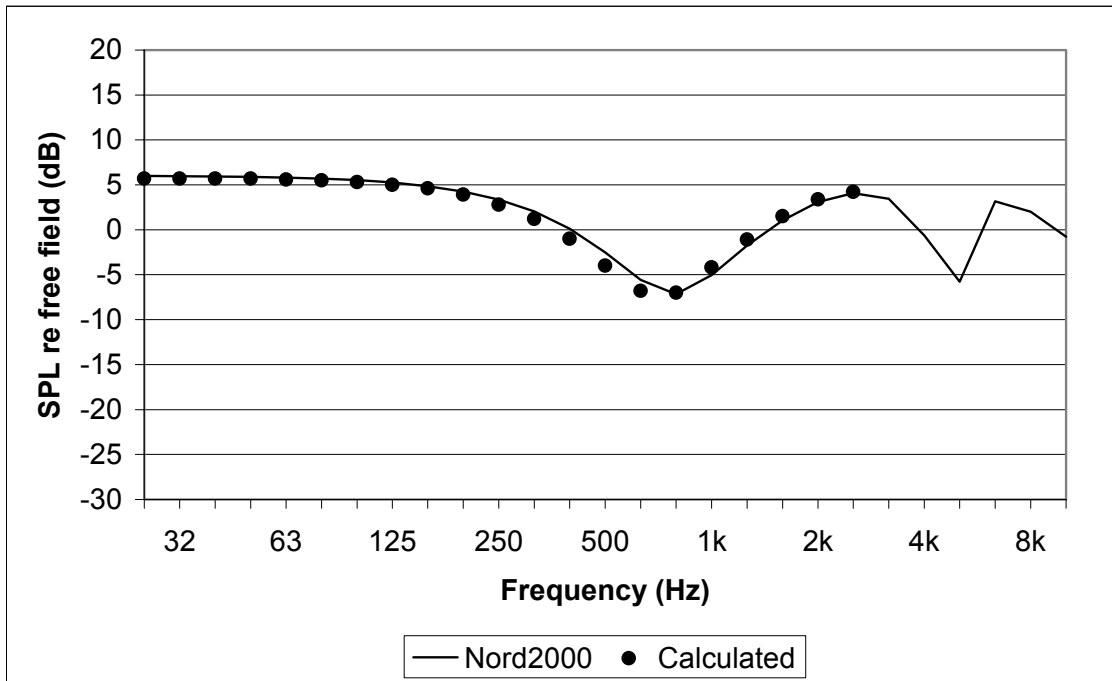
X	Z	Flow resist.	Roughness
0.00	0.00	200000	0
2.15	-0.50	200000	0
4.29	-0.50	200000	0
6.50	0.00	200000	0
7.00	1.00	200000	0
7.50	0.00	200000	0
10.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	0.50	m
z0	0.050	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1001



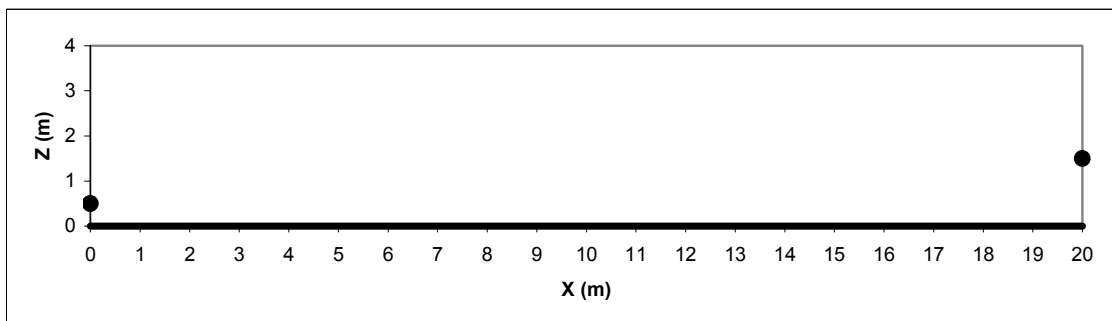
Nord2000 A-weighted ground effect (dB)	-2.8
A-weighted difference re. calculated (dB)	-0.1

Terrain profile

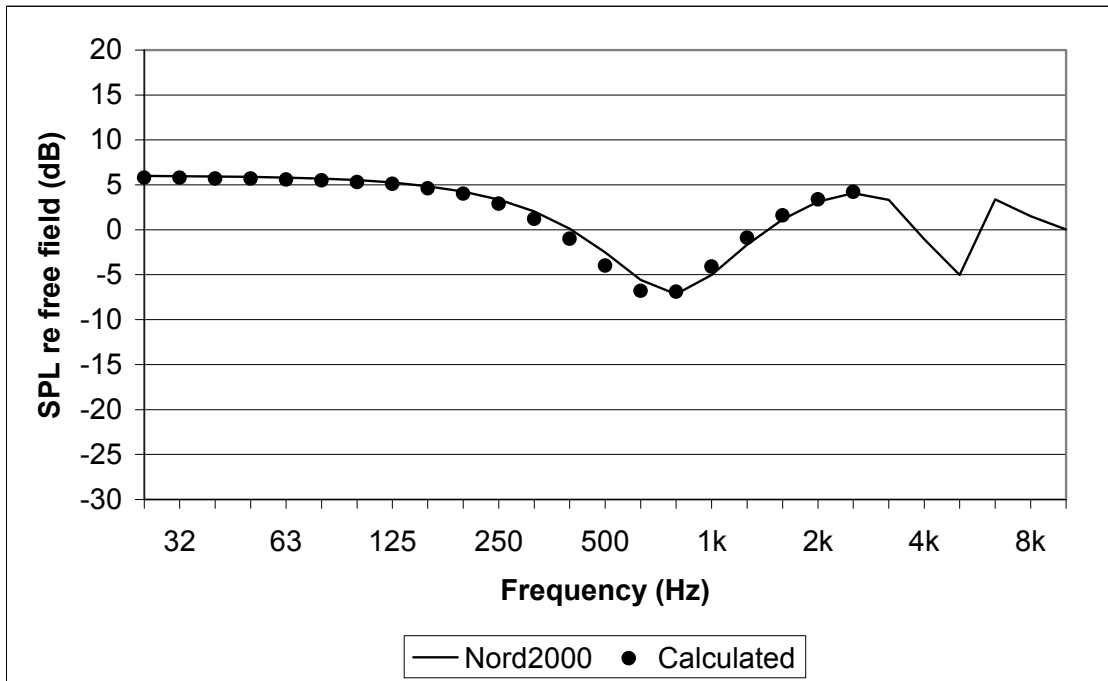
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1002



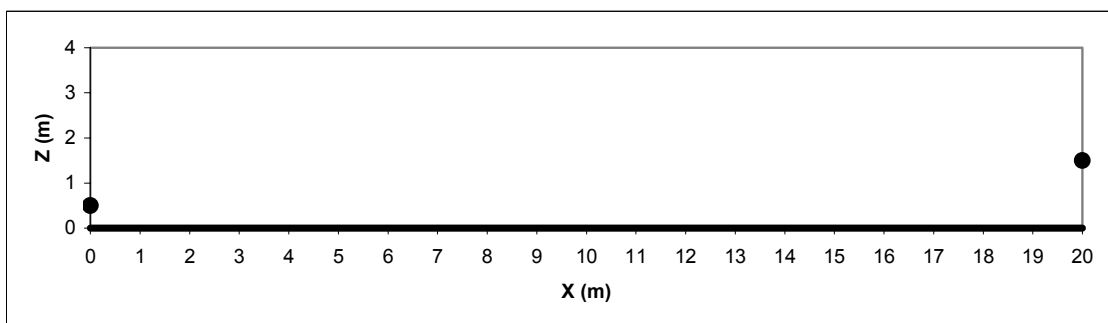
Nord2000 A-weighted ground effect (dB)	-2.8
A-weighted difference re. calculated (dB)	-0.1

Terrain profile

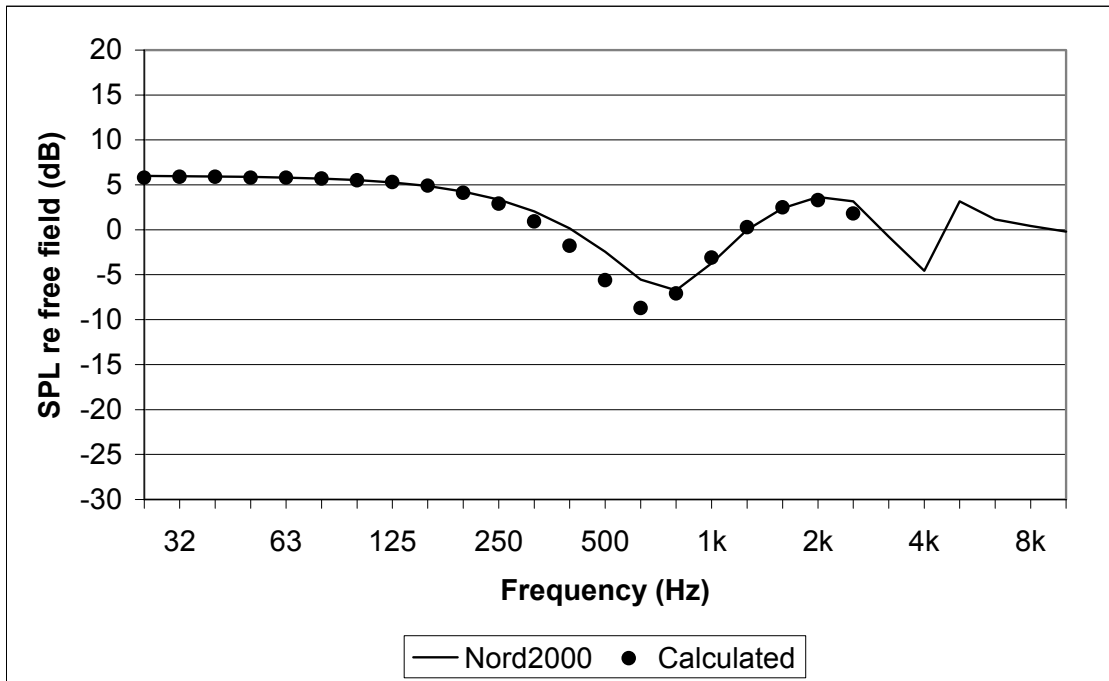
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1003



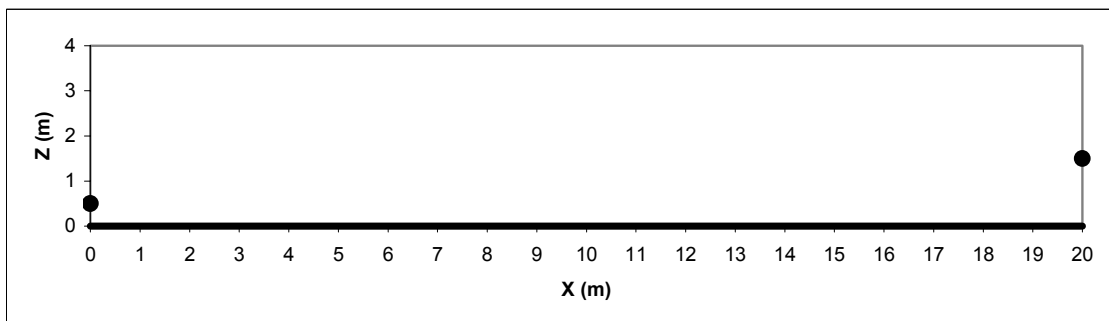
Nord2000 A-weighted ground effect (dB)	-2.5
A-weighted difference re. calculated (dB)	0.5

Terrain profile

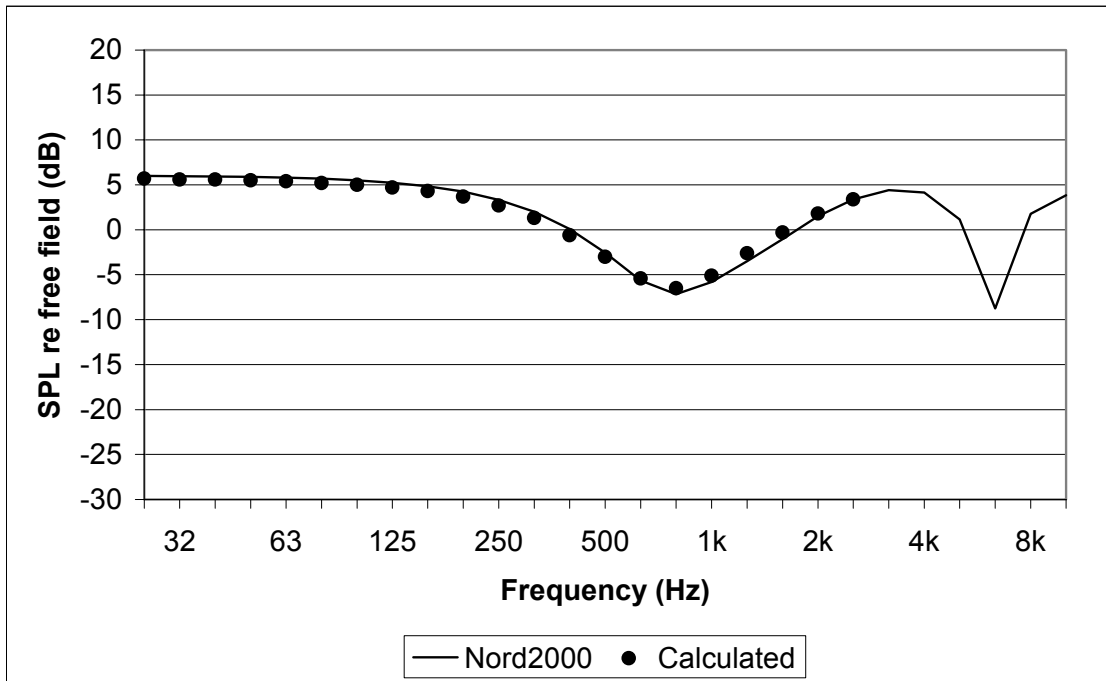
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1004



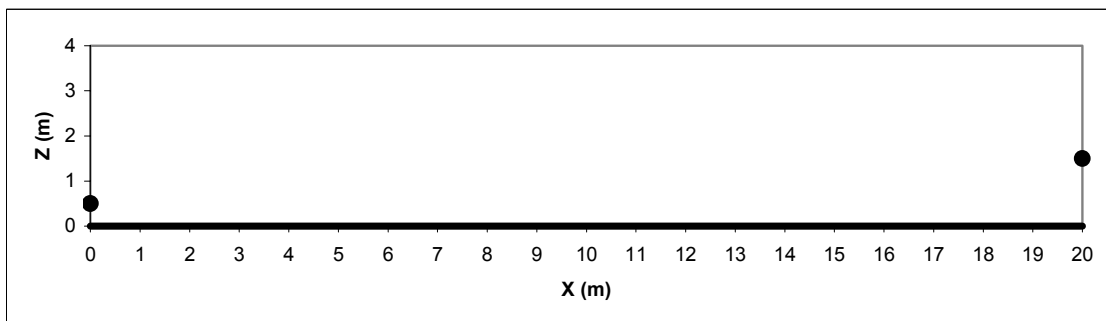
Nord2000 A-weighted ground effect (dB)	-3.8
A-weighted difference re. calculated (dB)	-0.1

Terrain profile

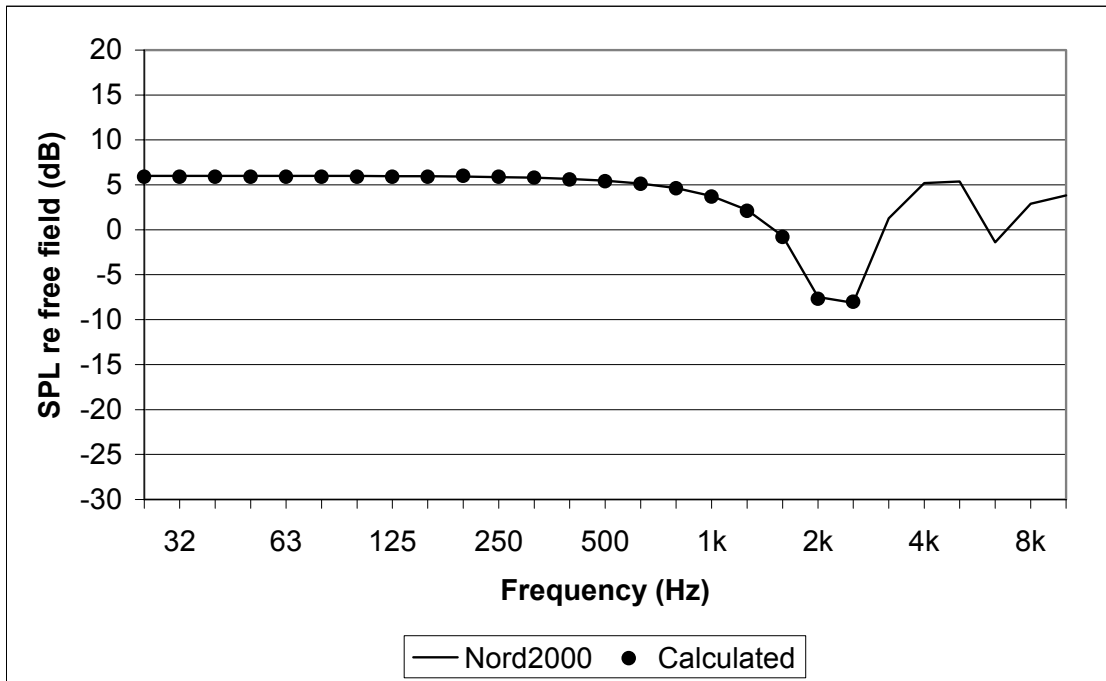
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1005



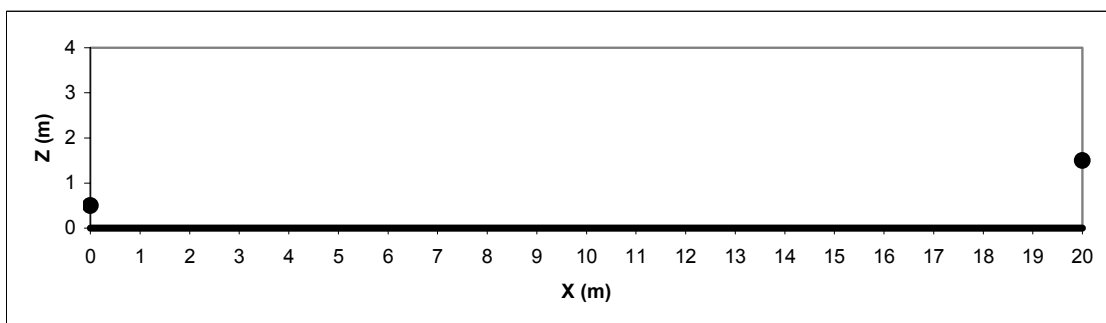
Nord2000 A-weighted ground effect (dB)	-1.4
A-weighted difference re. calculated (dB)	0.1

Terrain profile

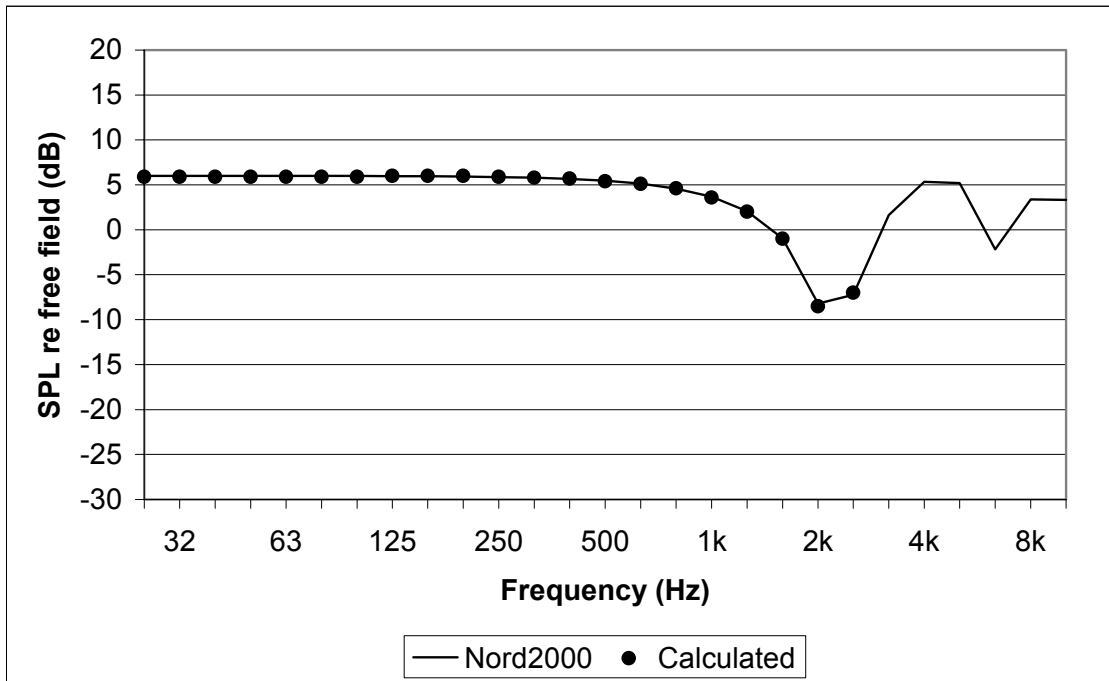
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1006



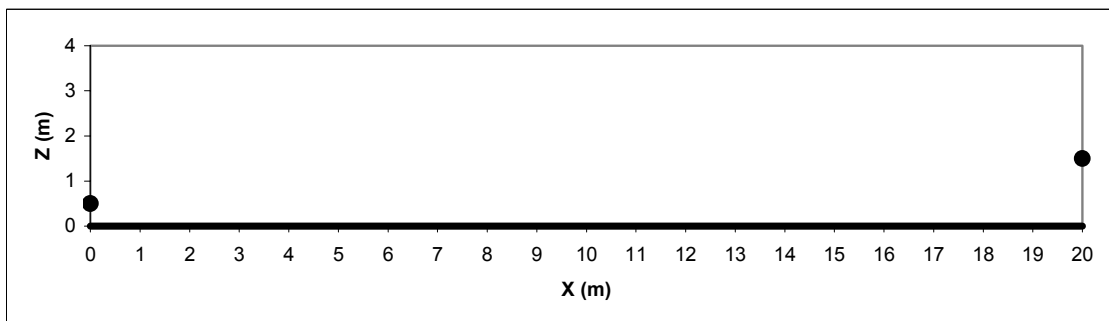
Nord2000 A-weighted ground effect (dB)	-1.4
A-weighted difference re. calculated (dB)	0.0

Terrain profile

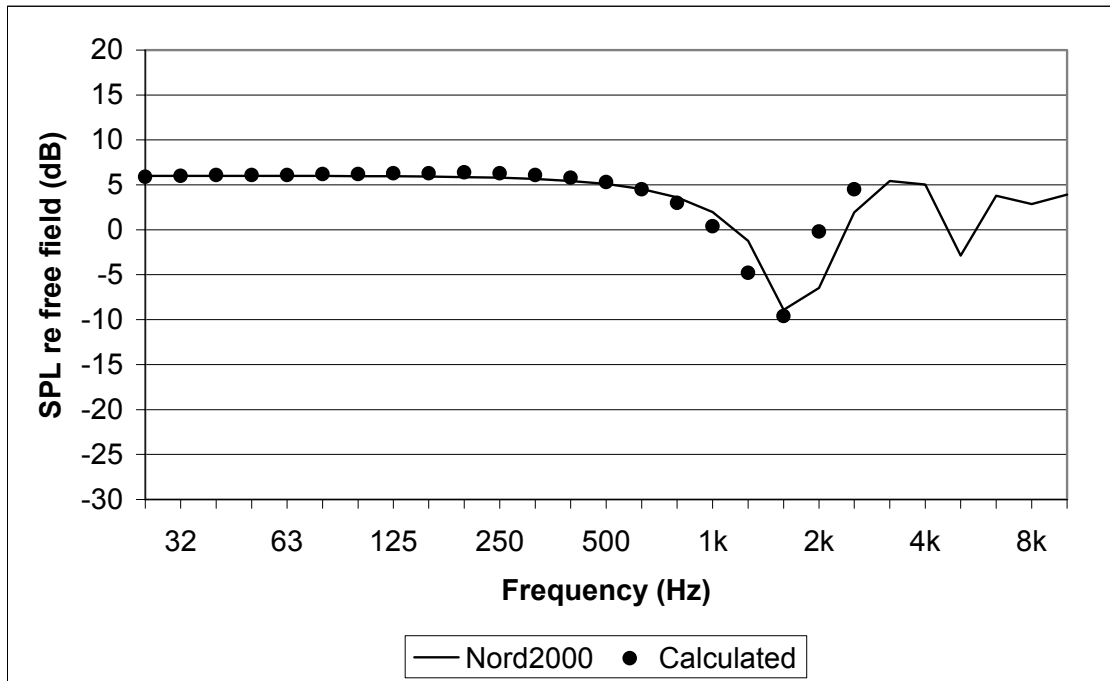
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1007



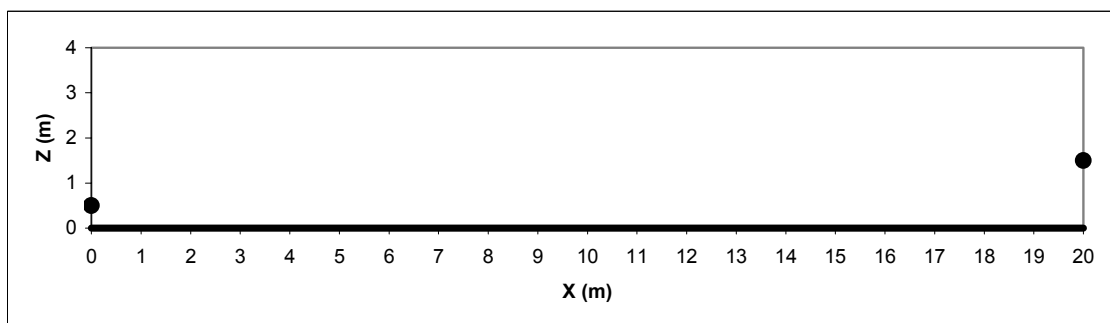
Nord2000 A-weighted ground effect (dB)	-1.9
A-weighted difference re. calculated (dB)	-0.5

Terrain profile

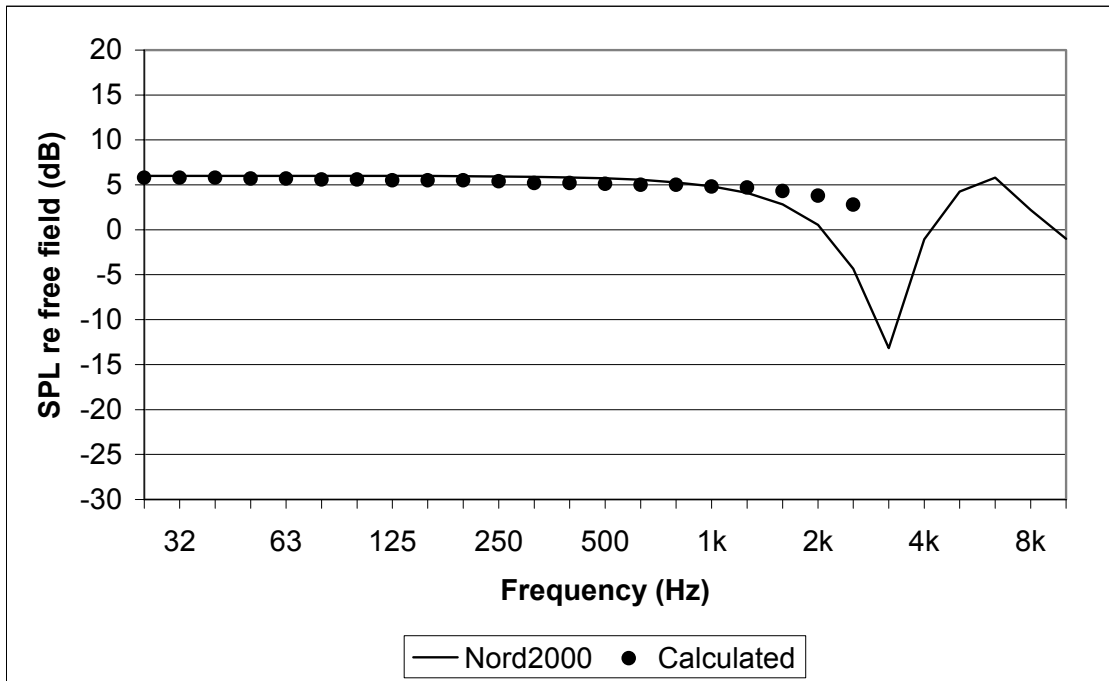
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1008



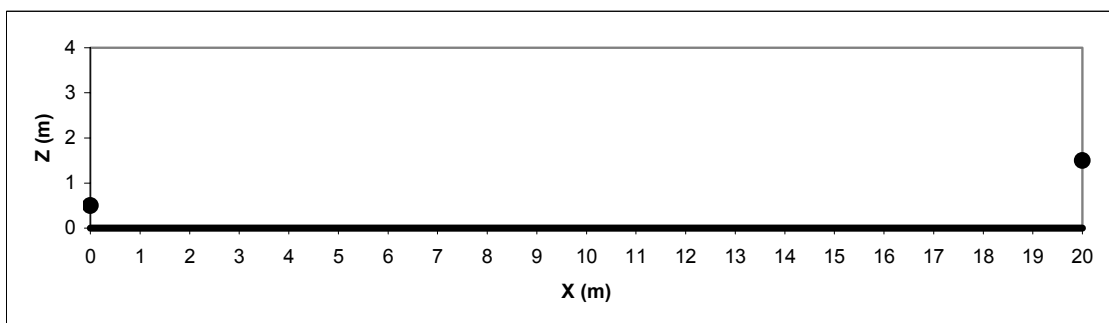
Nord2000 A-weighted ground effect (dB)	-0.1
A-weighted difference re. calculated (dB)	-0.8

Terrain profile

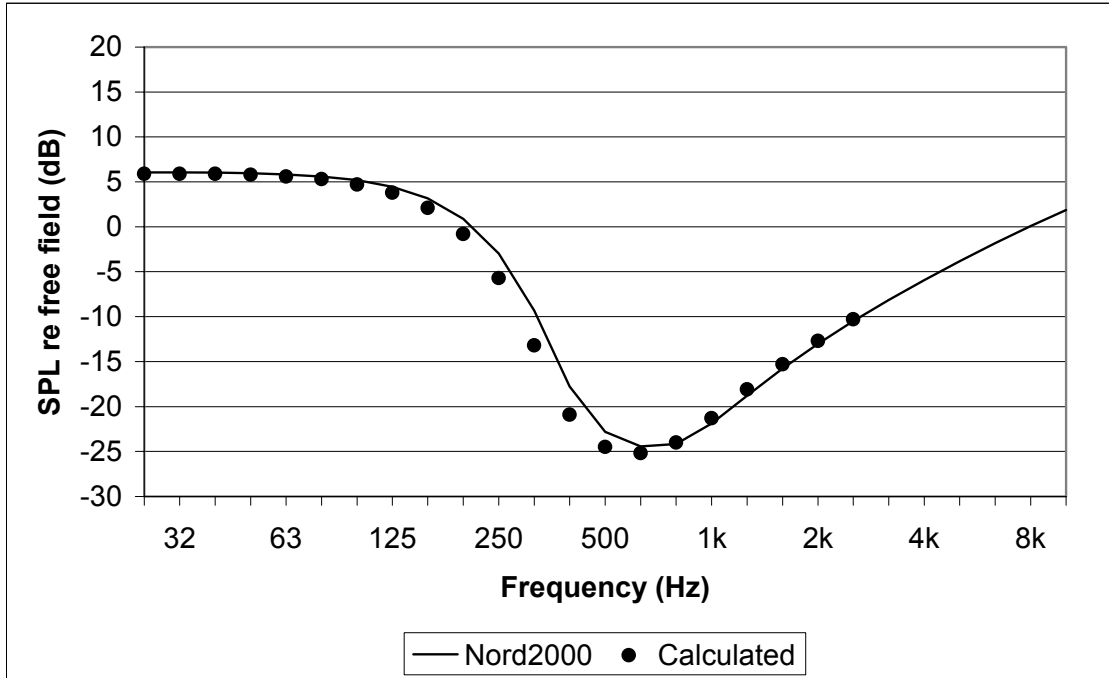
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
20.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1011



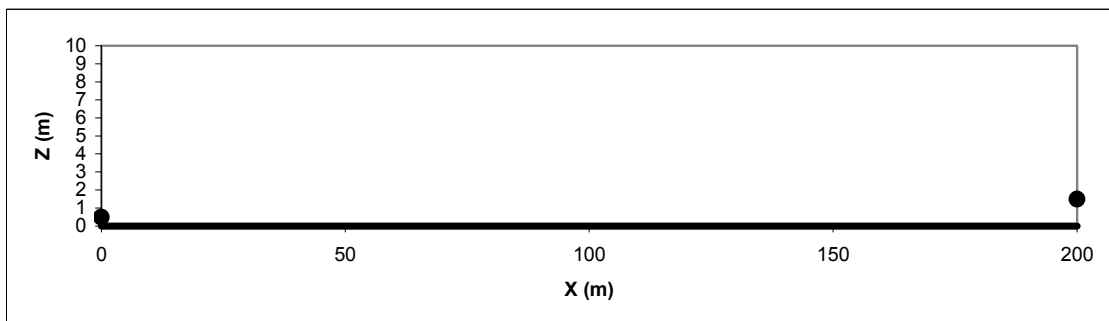
Nord2000 A-weighted ground effect (dB)	-14.8
A-weighted difference re. calculated (dB)	0.7

Terrain profile

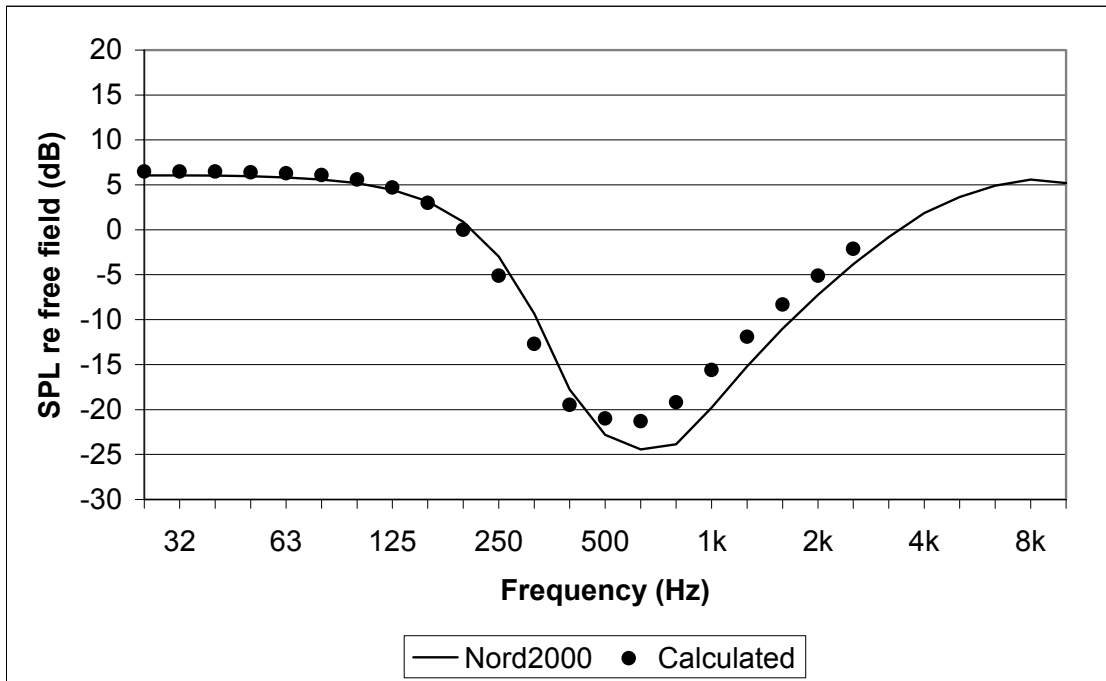
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1012



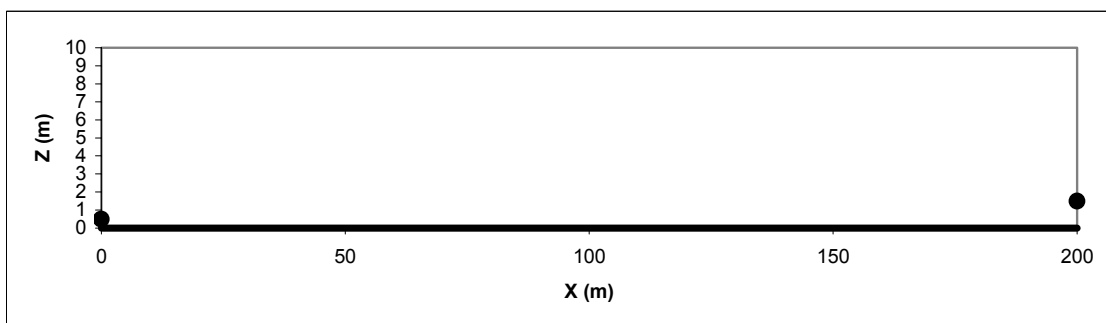
Nord2000 A-weighted ground effect (dB)	-11.7
A-weighted difference re. calculated (dB)	-1.4

Terrain profile

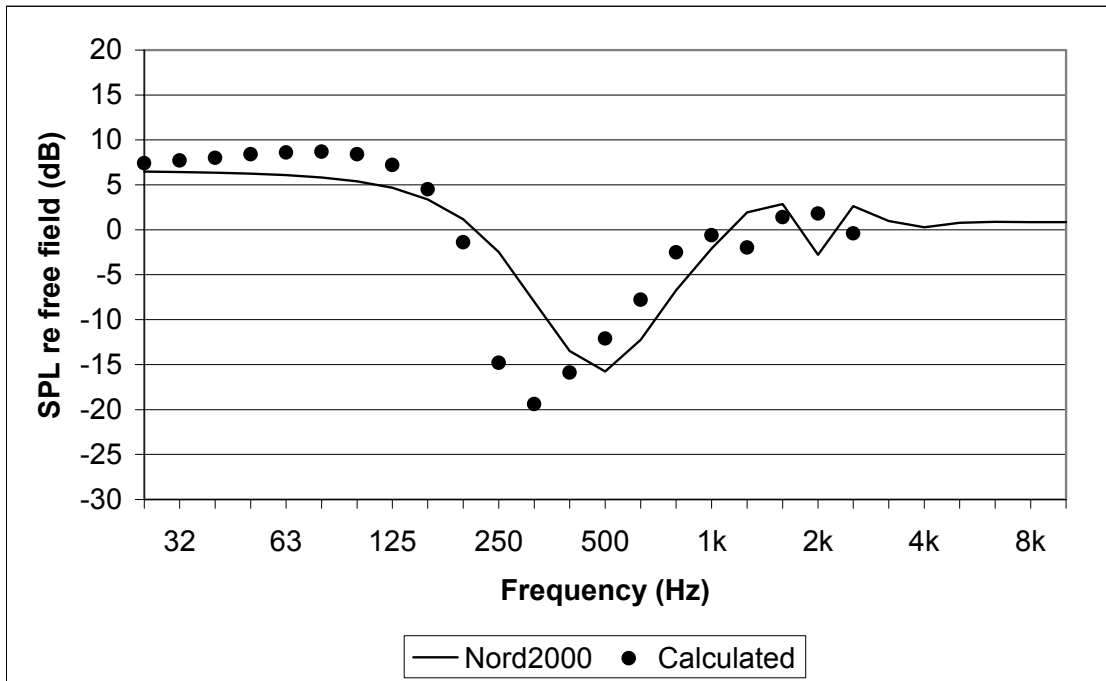
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1013



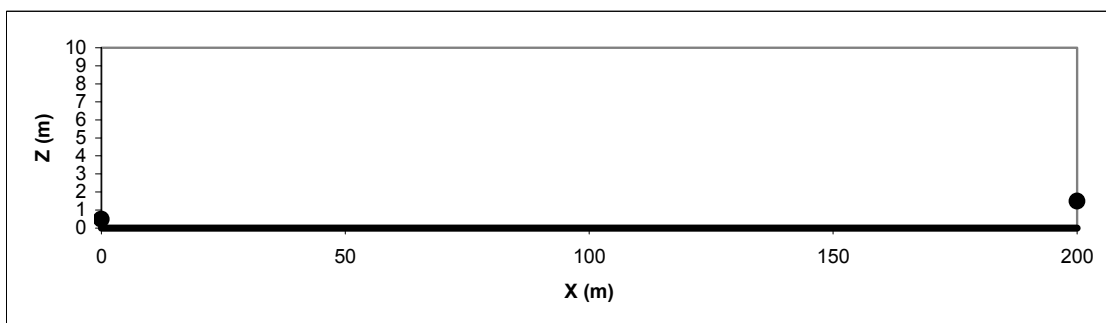
Nord2000 A-weighted ground effect (dB)	-3.8
A-weighted difference re. calculated (dB)	0.6

Terrain profile

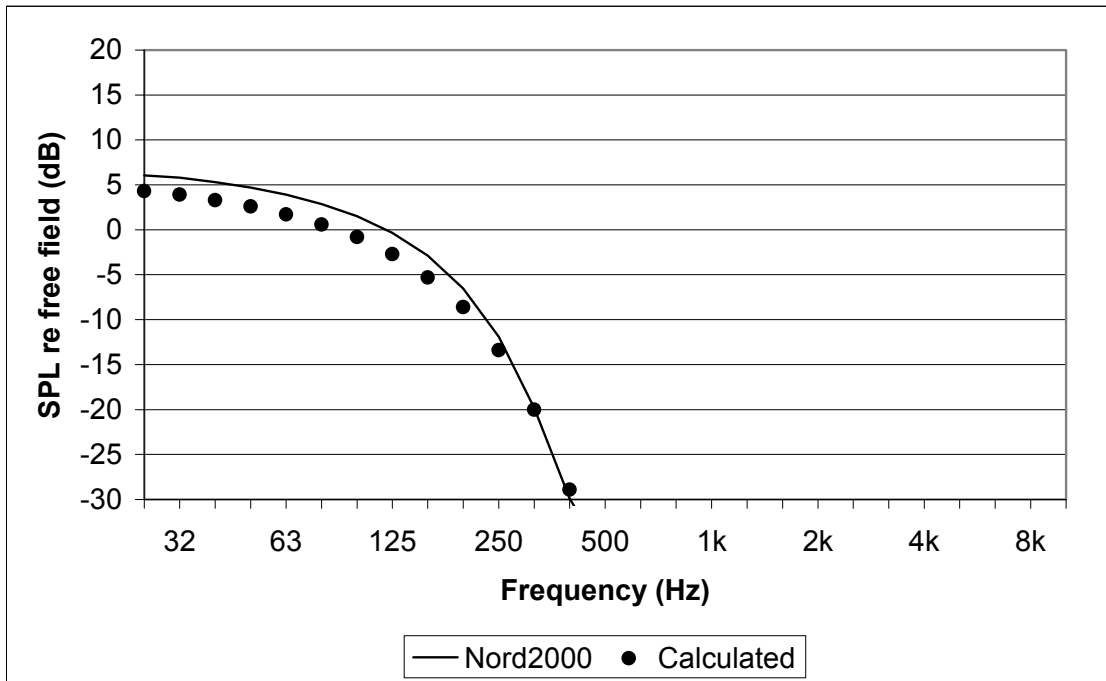
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1014



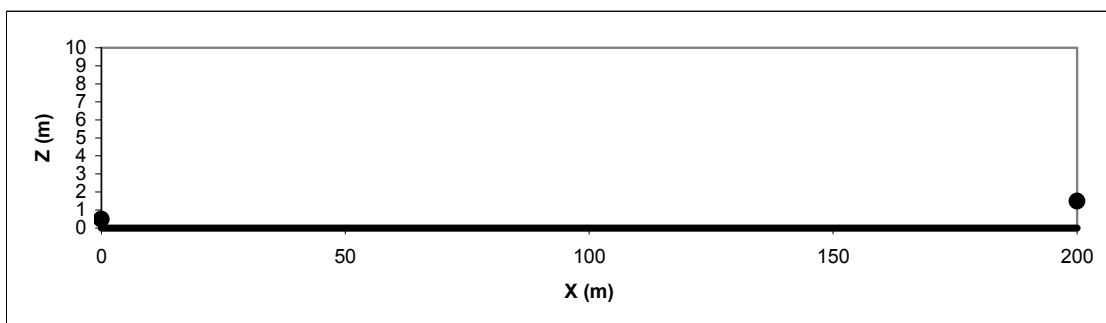
Nord2000 A-weighted ground effect (dB)	-21.4
A-weighted difference re. calculated (dB)	2.1

Terrain profile

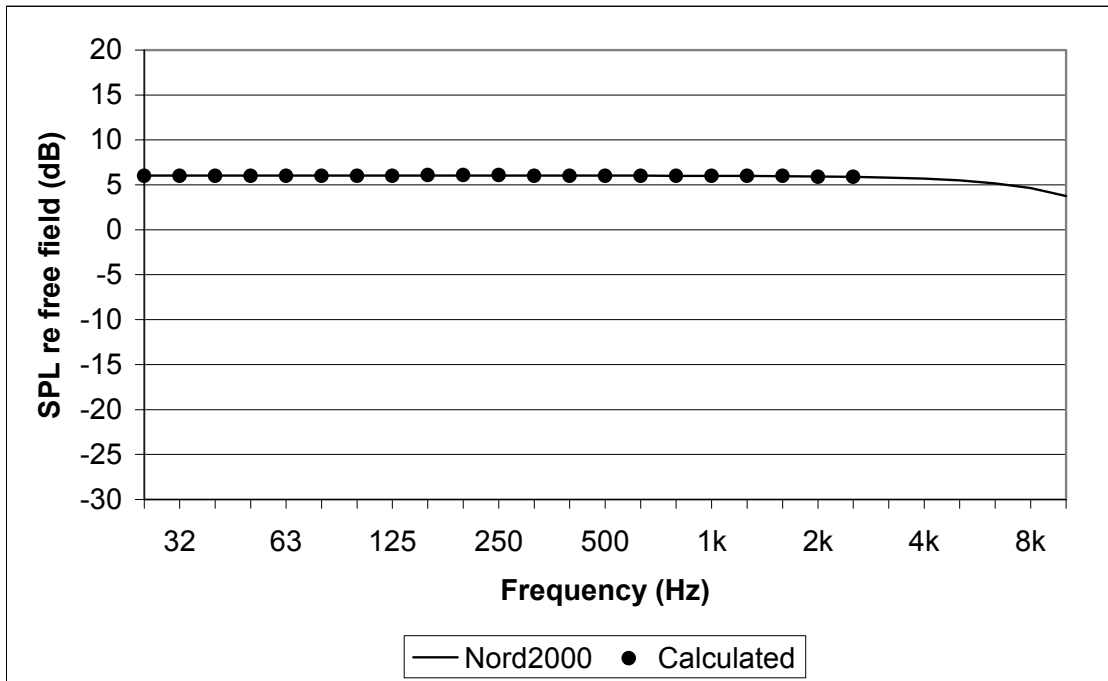
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1015



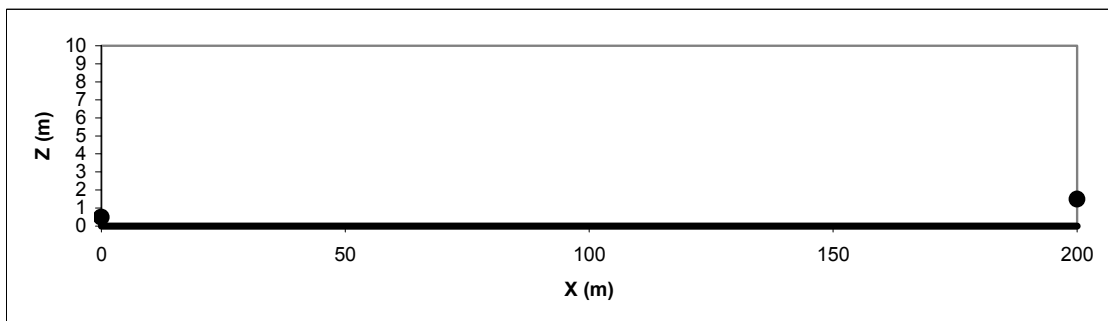
Nord2000 A-weighted ground effect (dB)	2.2
A-weighted difference re. calculated (dB)	0.0

Terrain profile

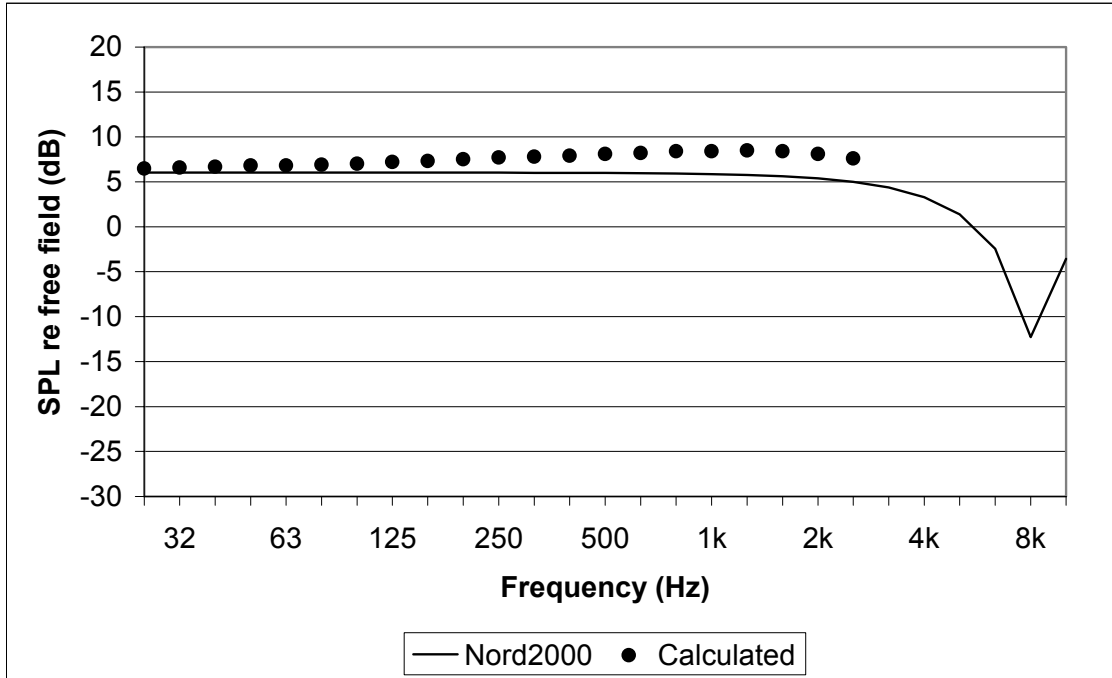
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1016



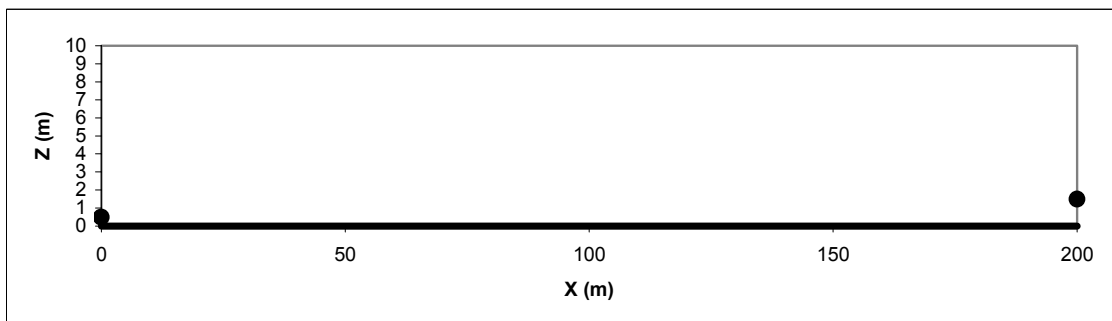
Nord2000 A-weighted ground effect (dB)	1.9
A-weighted difference re. calculated (dB)	-2.5

Terrain profile

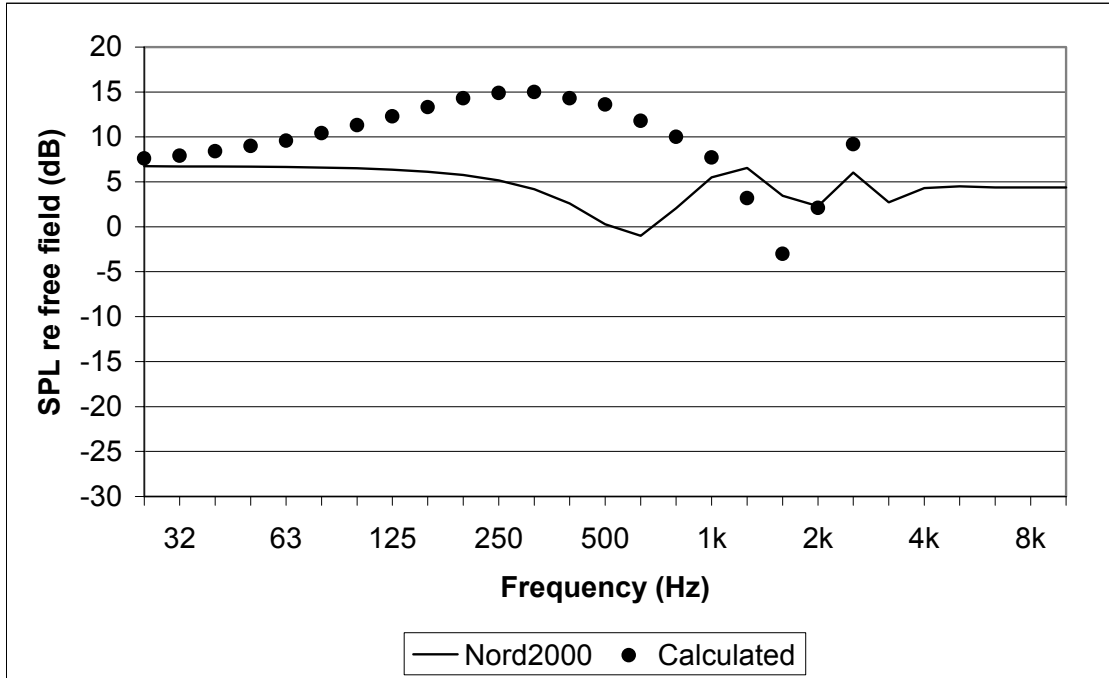
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1017



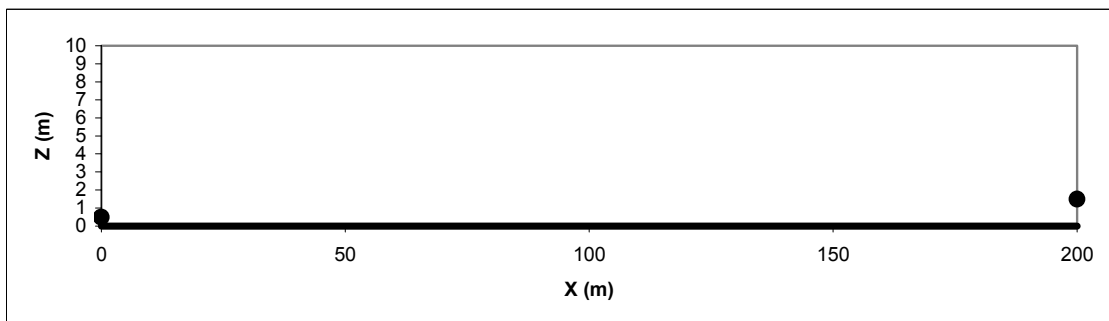
Nord2000 A-weighted ground effect (dB)	0.6
A-weighted difference re. calculated (dB)	-5.0

Terrain profile

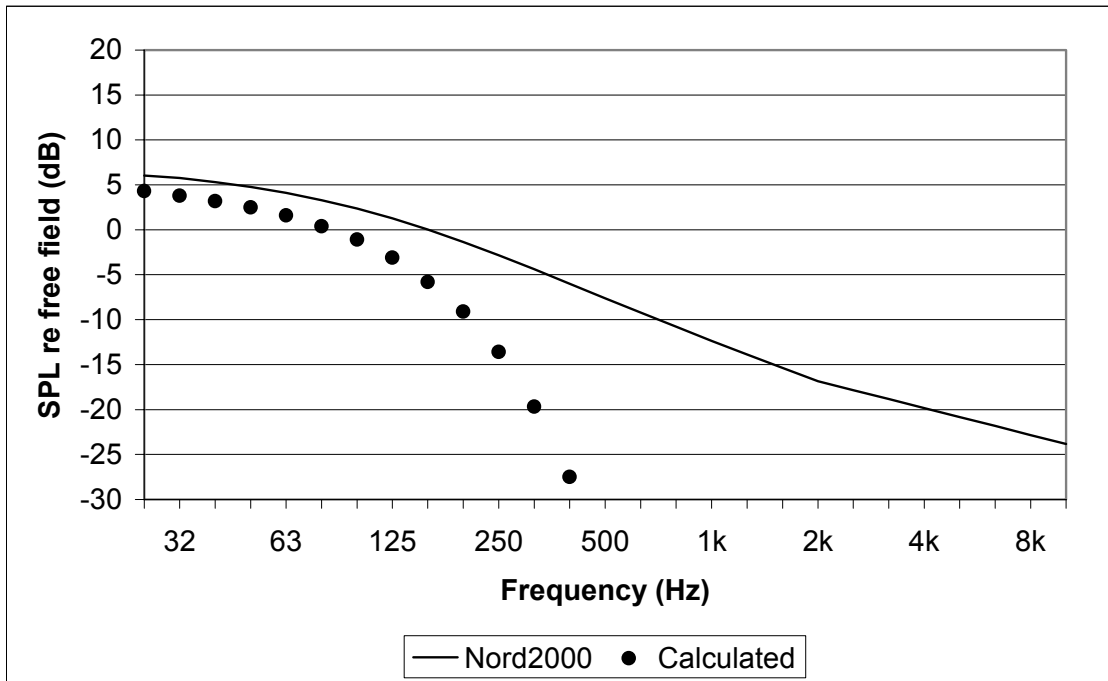
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1018



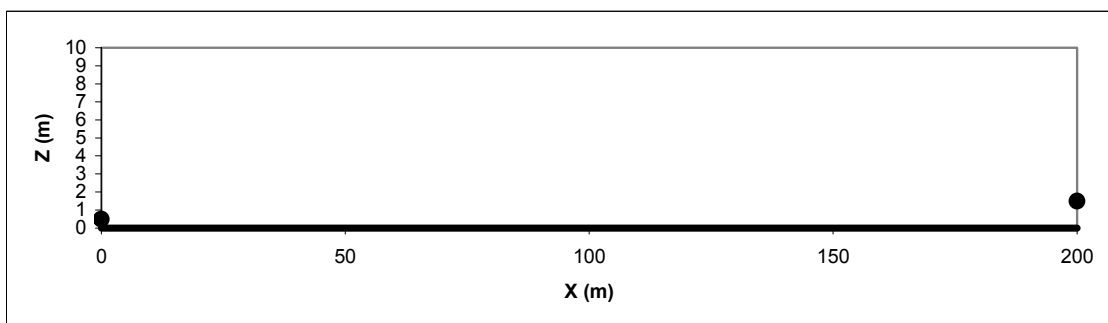
Nord2000 A-weighted ground effect (dB)	-14.3
A-weighted difference re. calculated (dB)	9.7

Terrain profile

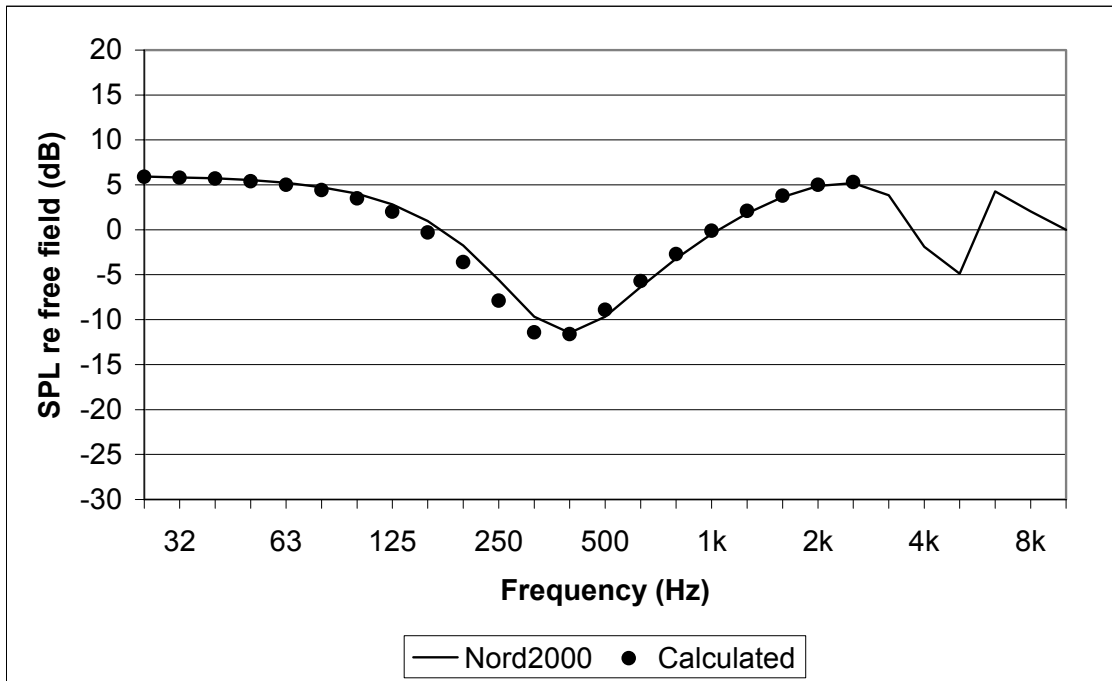
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1021



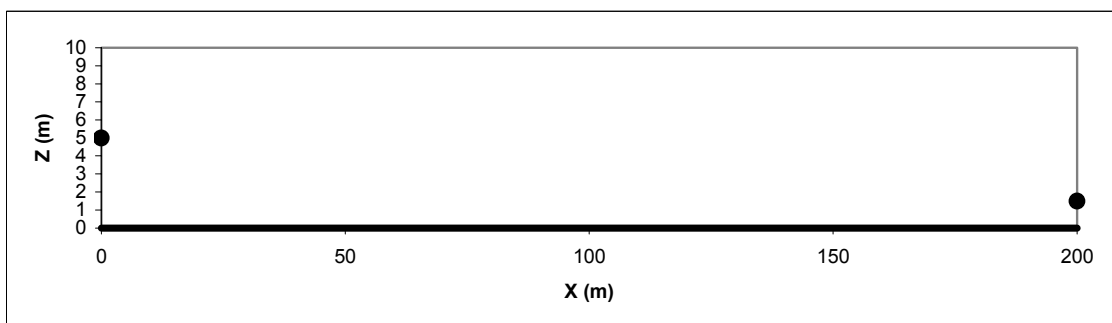
Nord2000 A-weighted ground effect (dB)	-1.5
A-weighted difference re. calculated (dB)	-0.2

Terrain profile

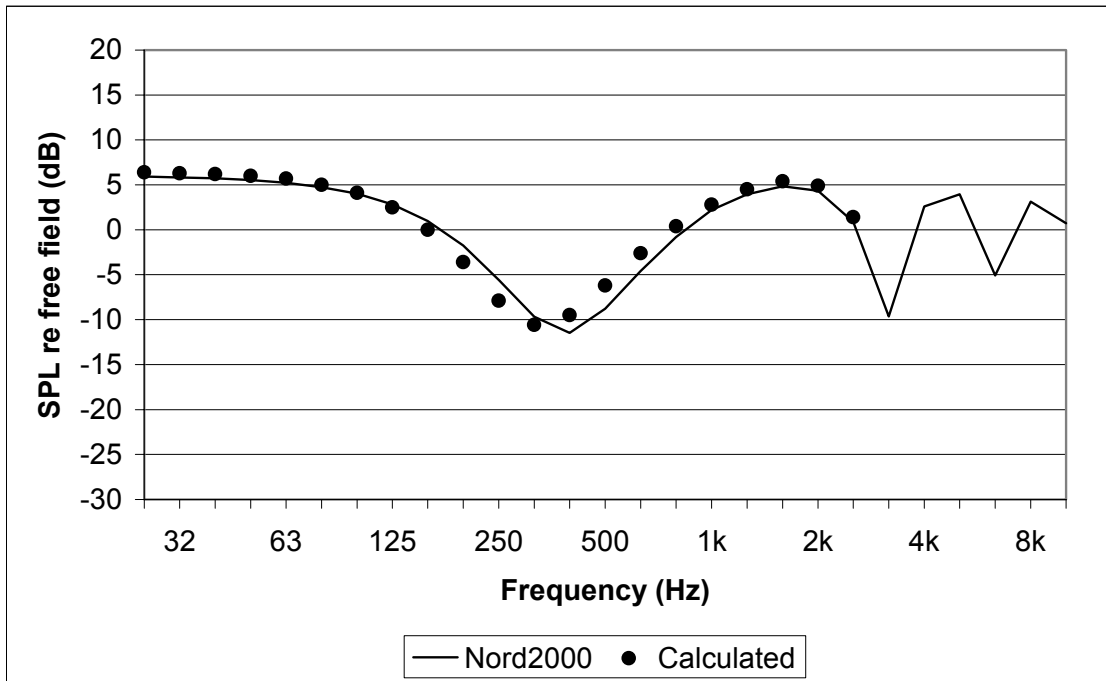
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1022



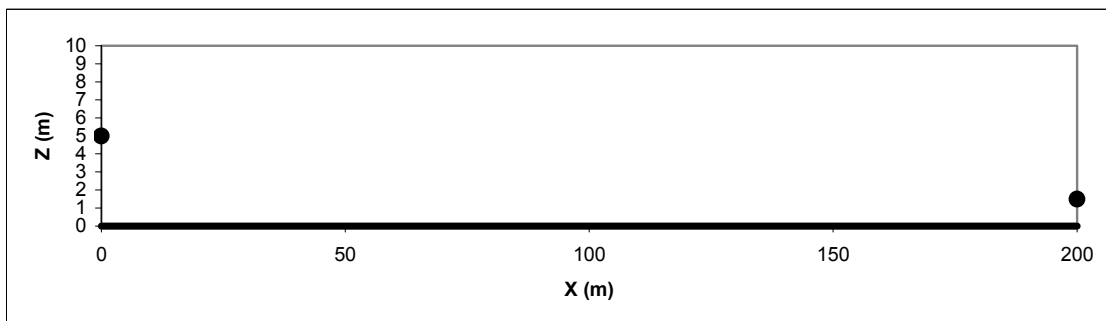
Nord2000 A-weighted ground effect (dB)	-1.5
A-weighted difference re. calculated (dB)	-0.6

Terrain profile

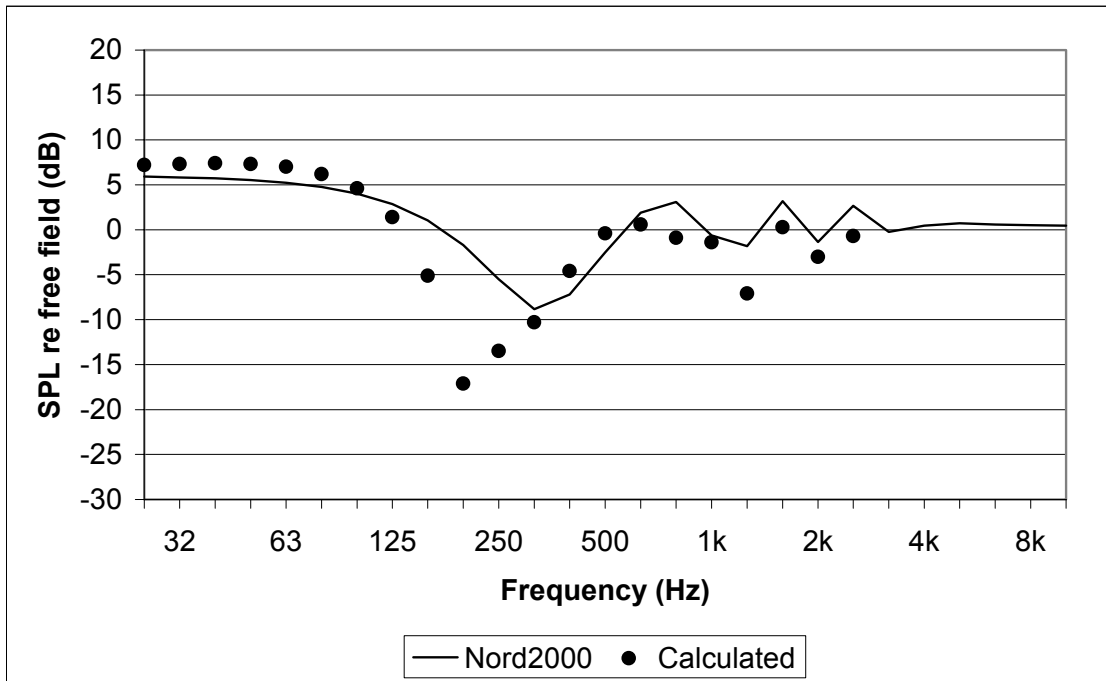
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1023



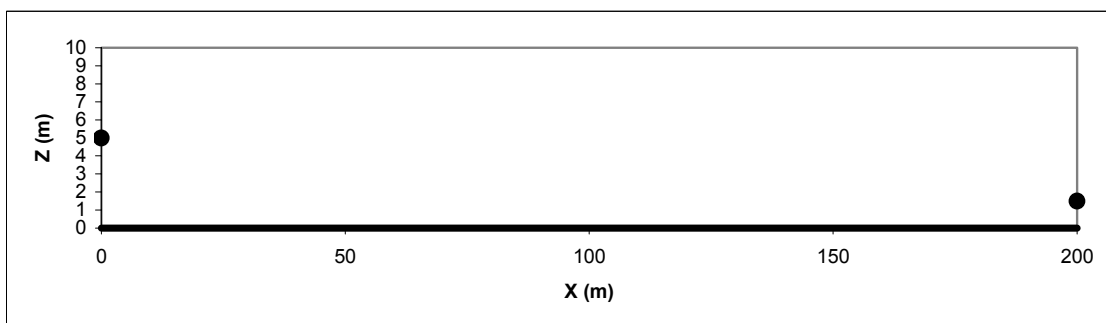
Nord2000 A-weighted ground effect (dB)	-2.8
A-weighted difference re. calculated (dB)	2.5

Terrain profile

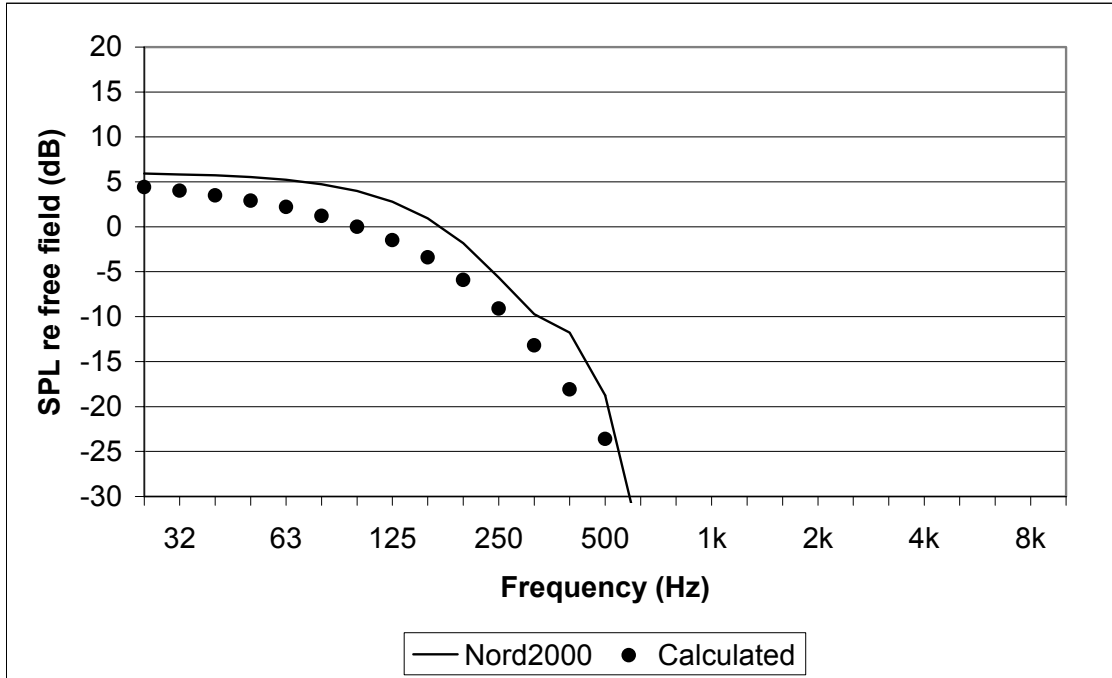
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1024



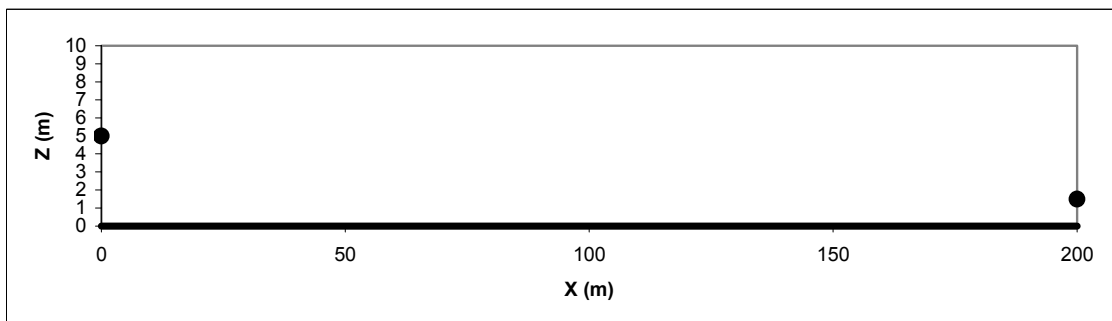
Nord2000 A-weighted ground effect (dB)	-17.4
A-weighted difference re. calculated (dB)	4.0

Terrain profile

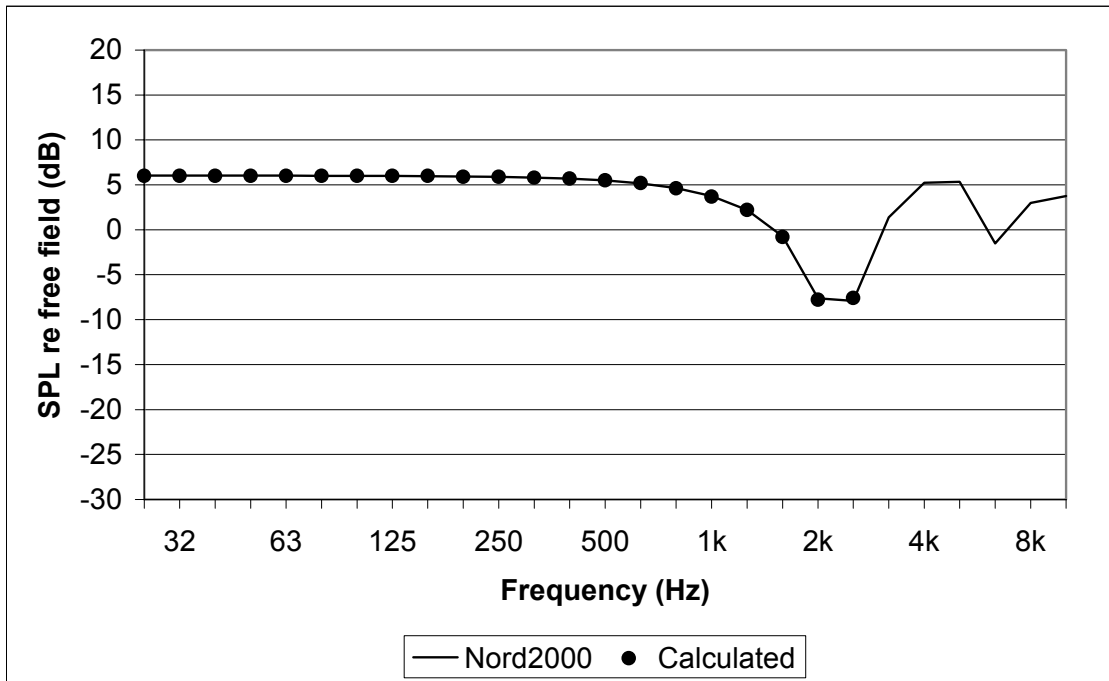
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1025



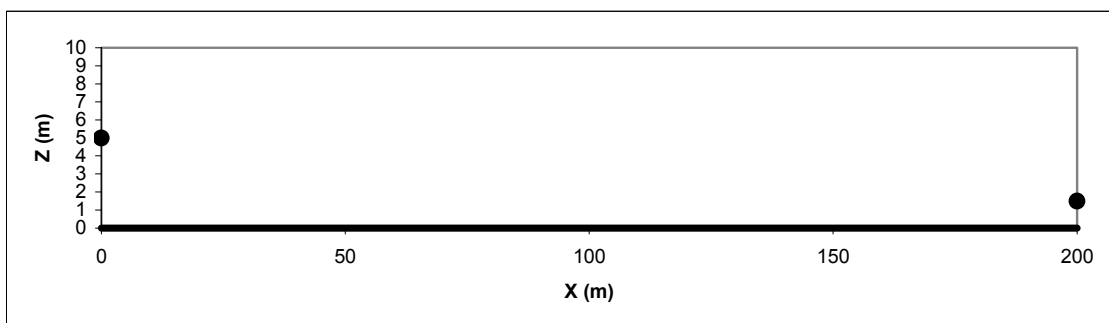
Nord2000 A-weighted ground effect (dB)	-1.4
A-weighted difference re. calculated (dB)	0.0

Terrain profile

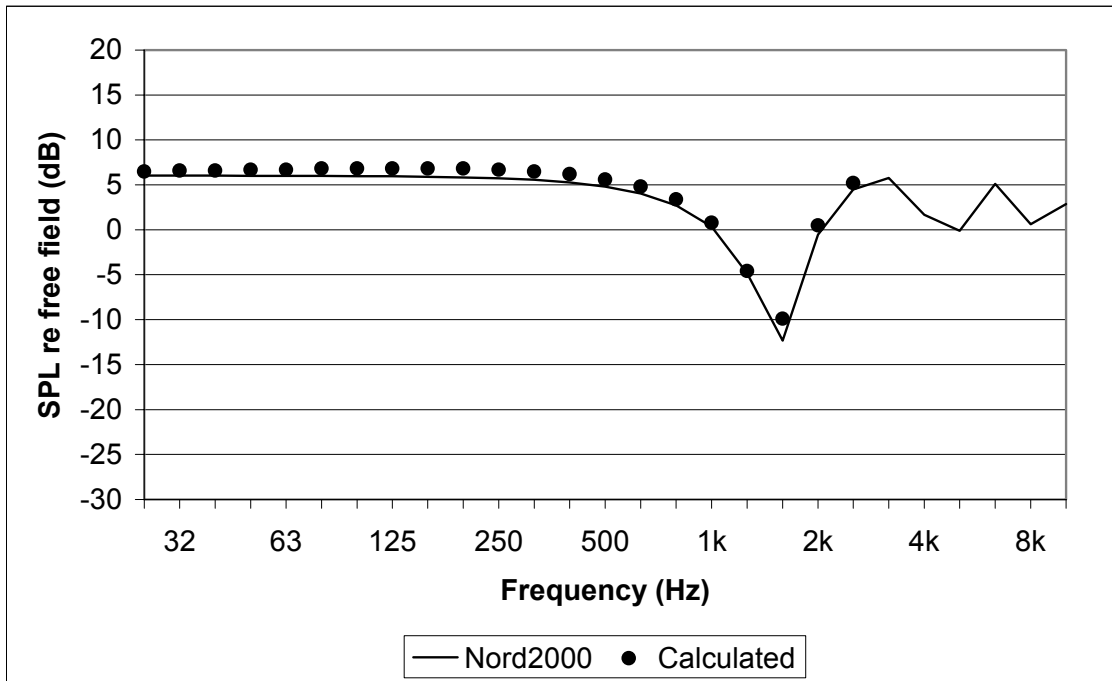
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1026



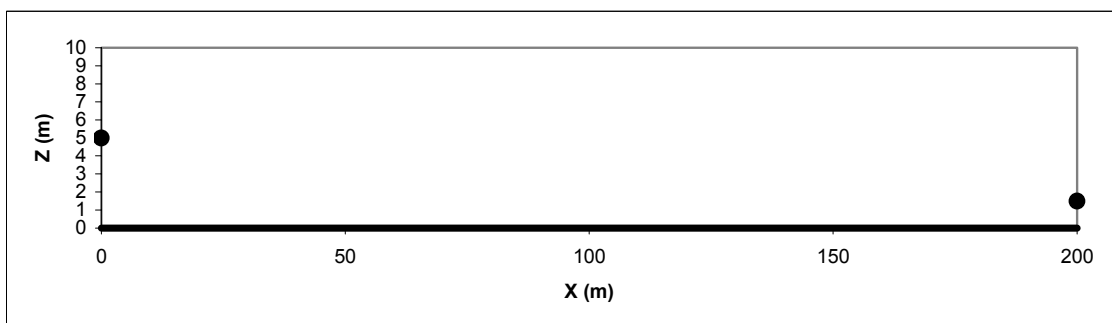
Nord2000 A-weighted ground effect (dB)	-1.7
A-weighted difference re. calculated (dB)	-0.8

Terrain profile

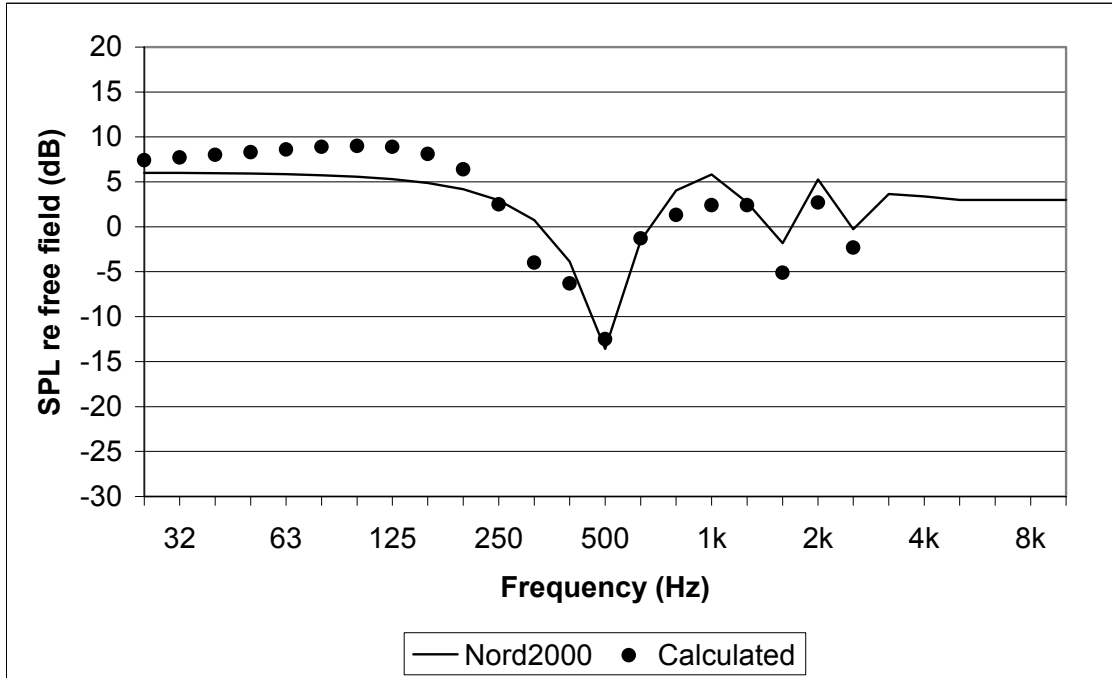
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1027



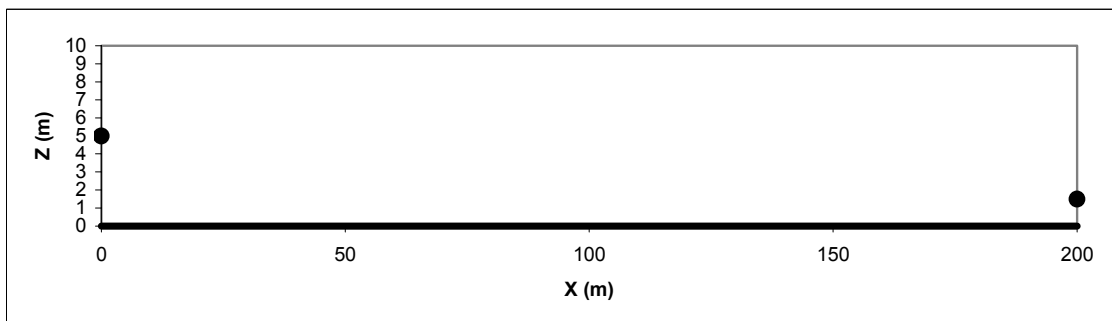
Nord2000 A-weighted ground effect (dB)	-1.1
A-weighted difference re. calculated (dB)	1.9

Terrain profile

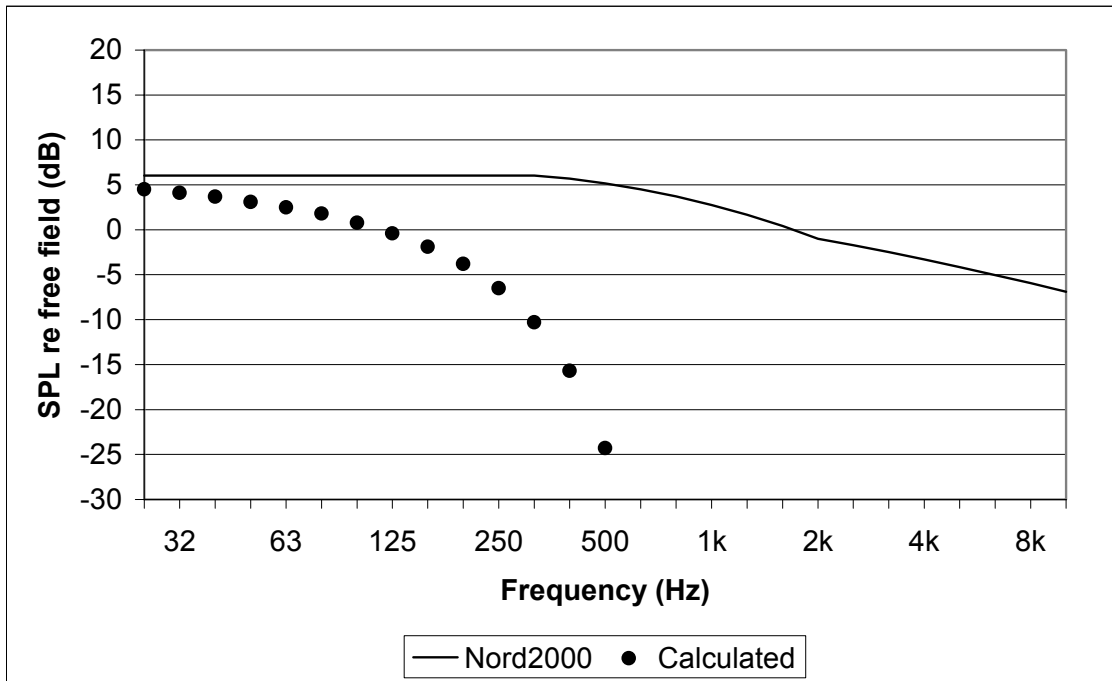
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1028



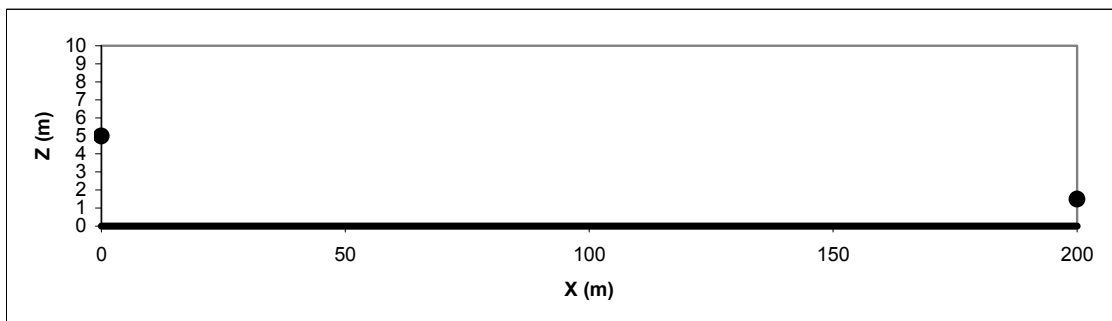
Nord2000 A-weighted ground effect (dB)	-2.3
A-weighted difference re. calculated (dB)	17.7

Terrain profile

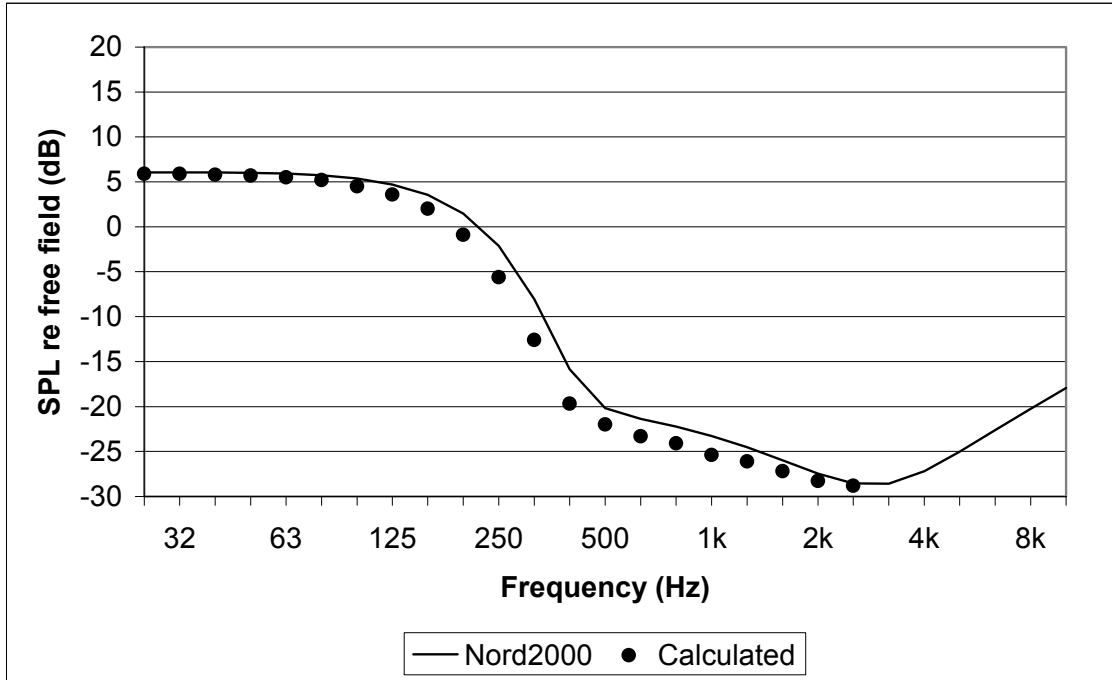
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	5.00	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1031



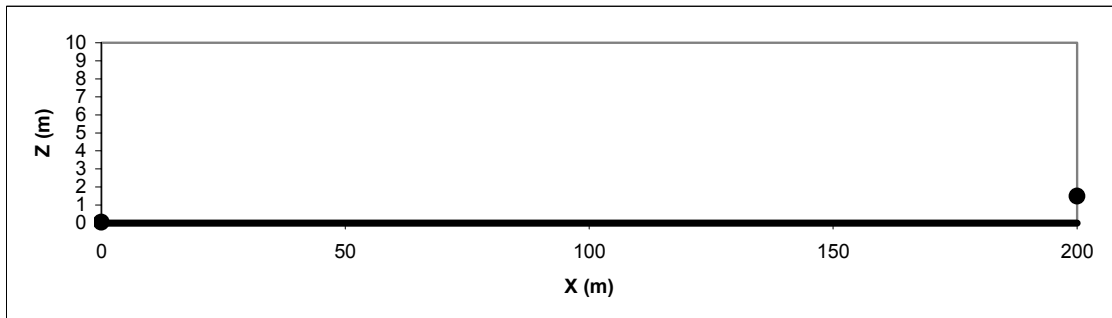
Nord2000 A-weighted ground effect (dB)	-16.0
A-weighted difference re. calculated (dB)	1.9

Terrain profile

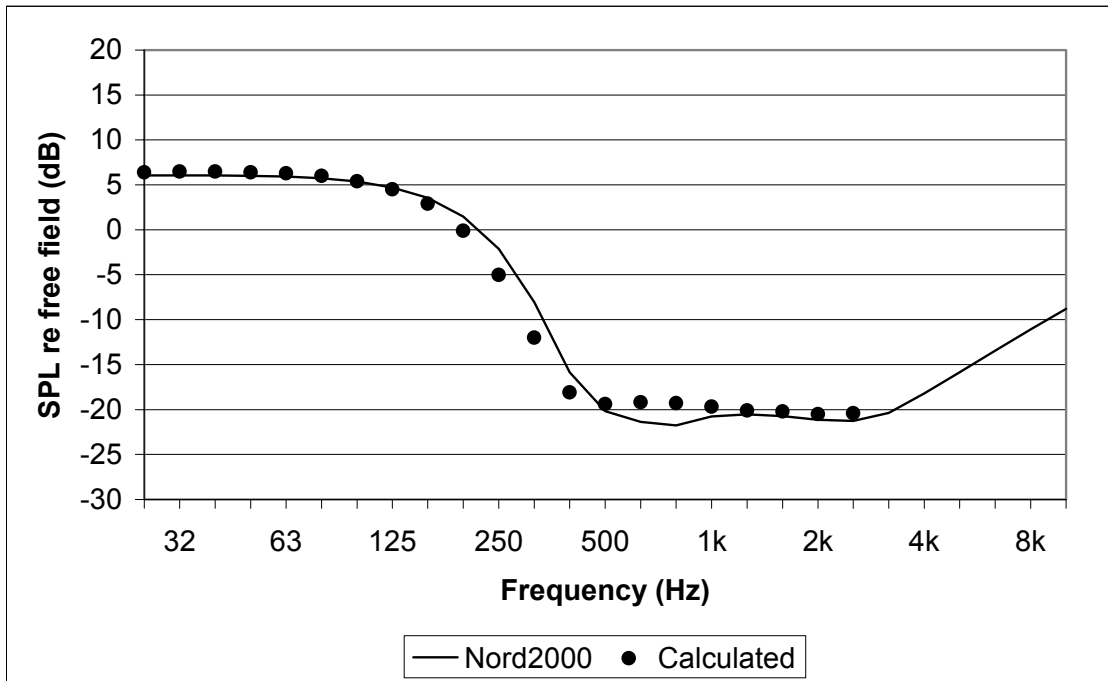
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.05	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1032



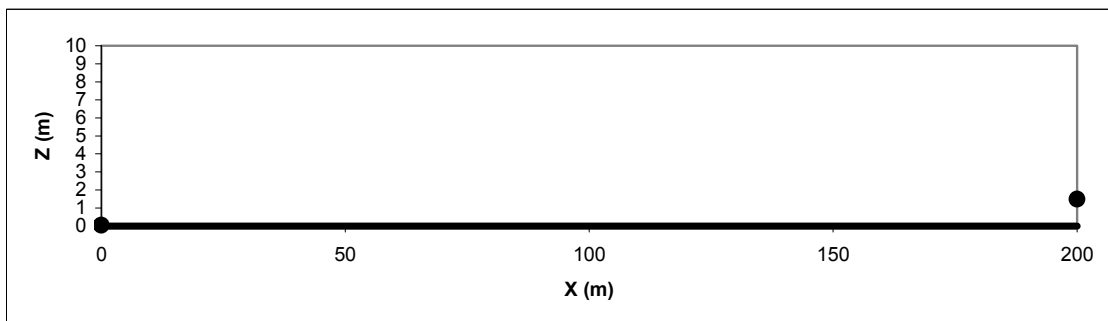
Nord2000 A-weighted ground effect (dB)	-15.7
A-weighted difference re. calculated (dB)	0.8

Terrain profile

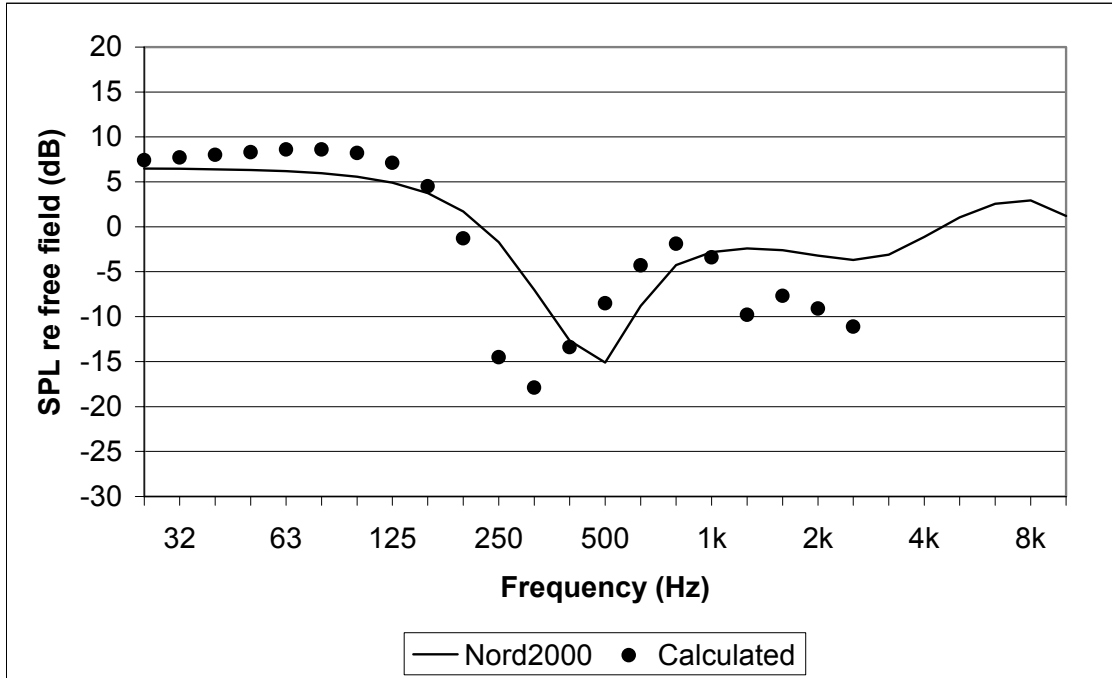
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.05	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1033



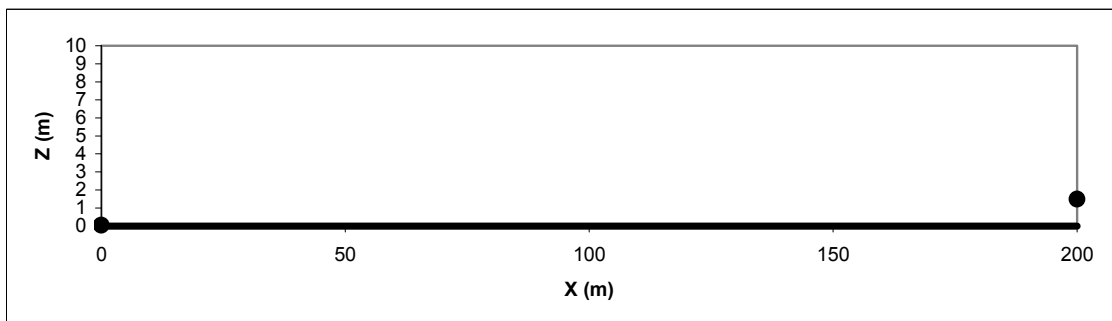
Nord2000 A-weighted ground effect (dB)	-7.2
A-weighted difference re. calculated (dB)	2.3

Terrain profile

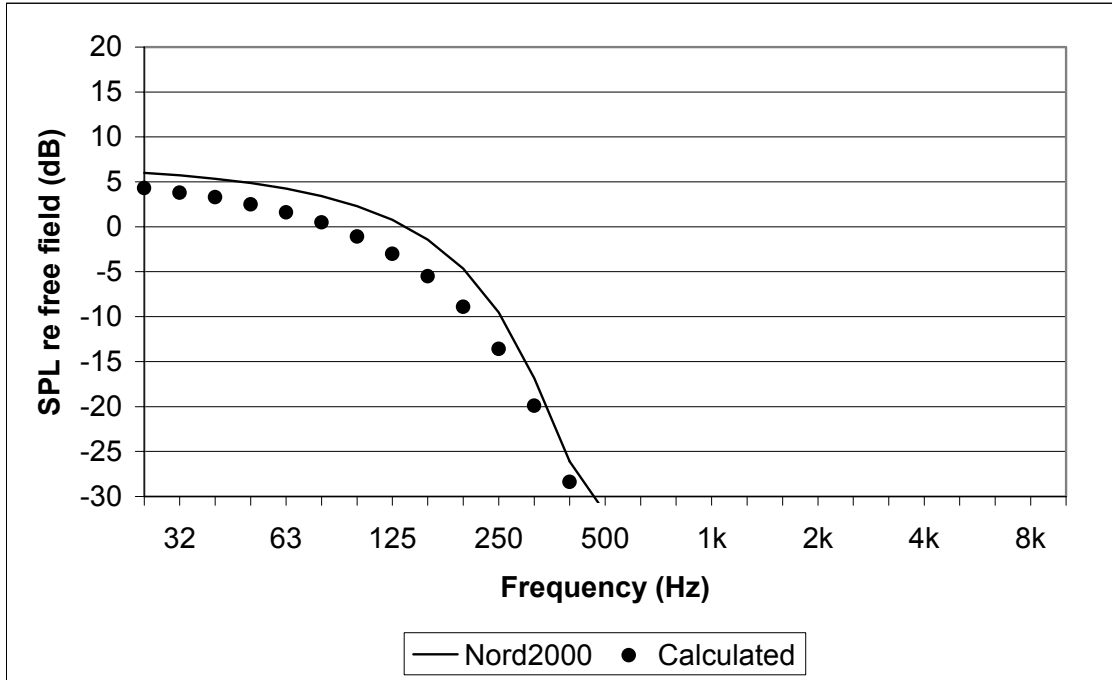
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.05	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1034



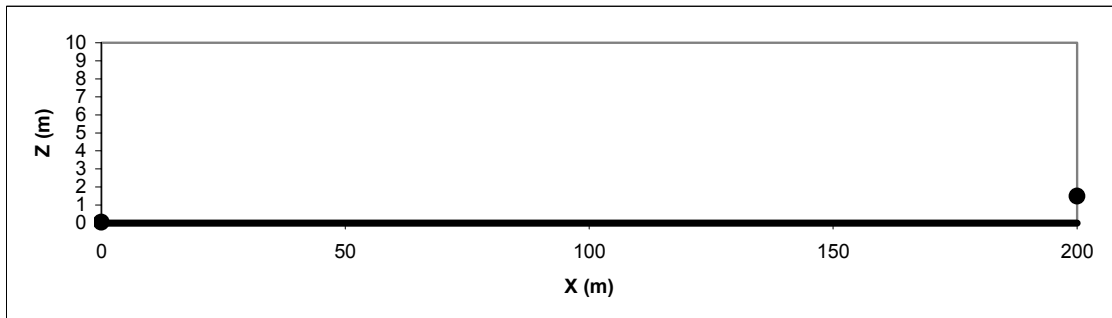
Nord2000 A-weighted ground effect (dB)	-19.8
A-weighted difference re. calculated (dB)	3.7

Terrain profile

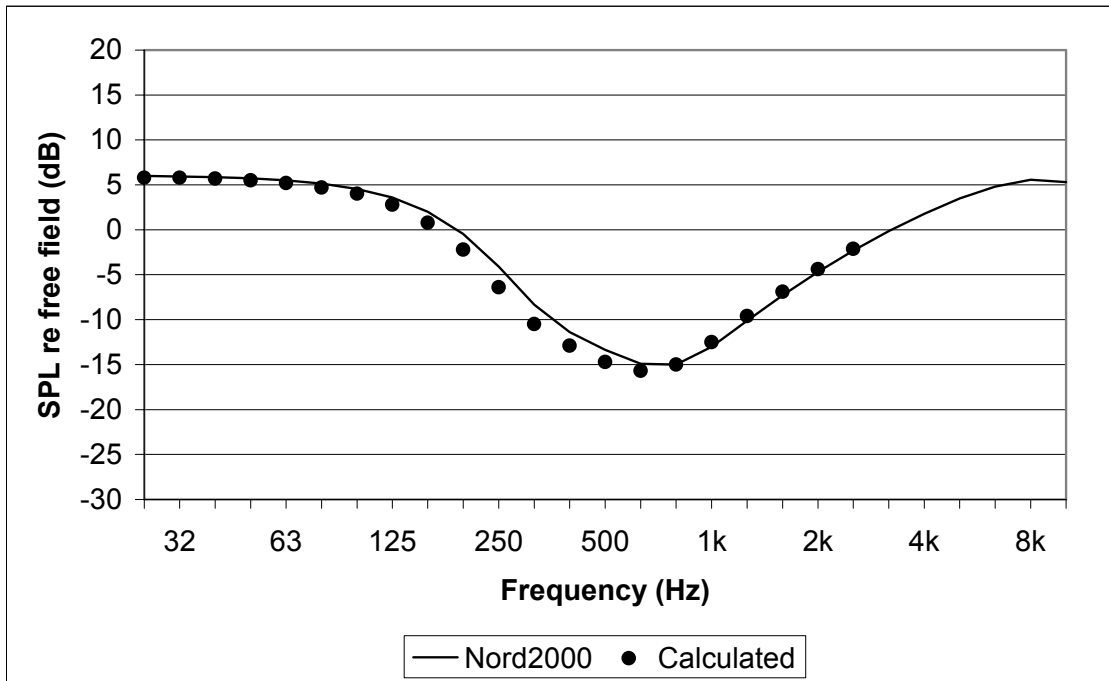
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.05	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1041



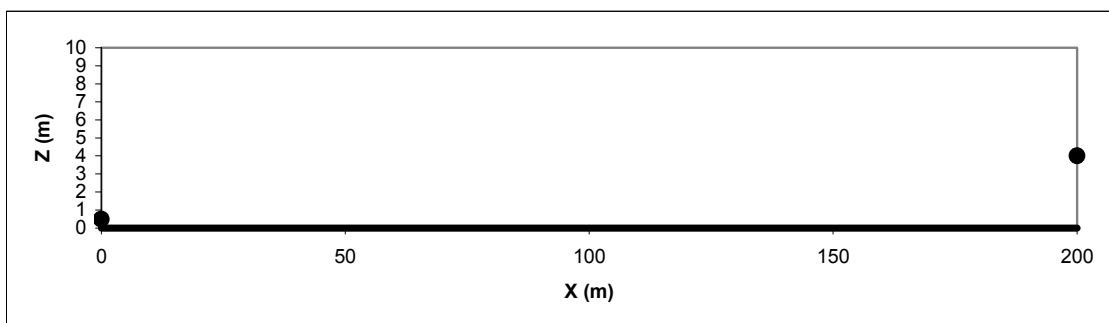
Nord2000 A-weighted ground effect (dB)	-10.0
A-weighted difference re. calculated (dB)	0.0

Terrain profile

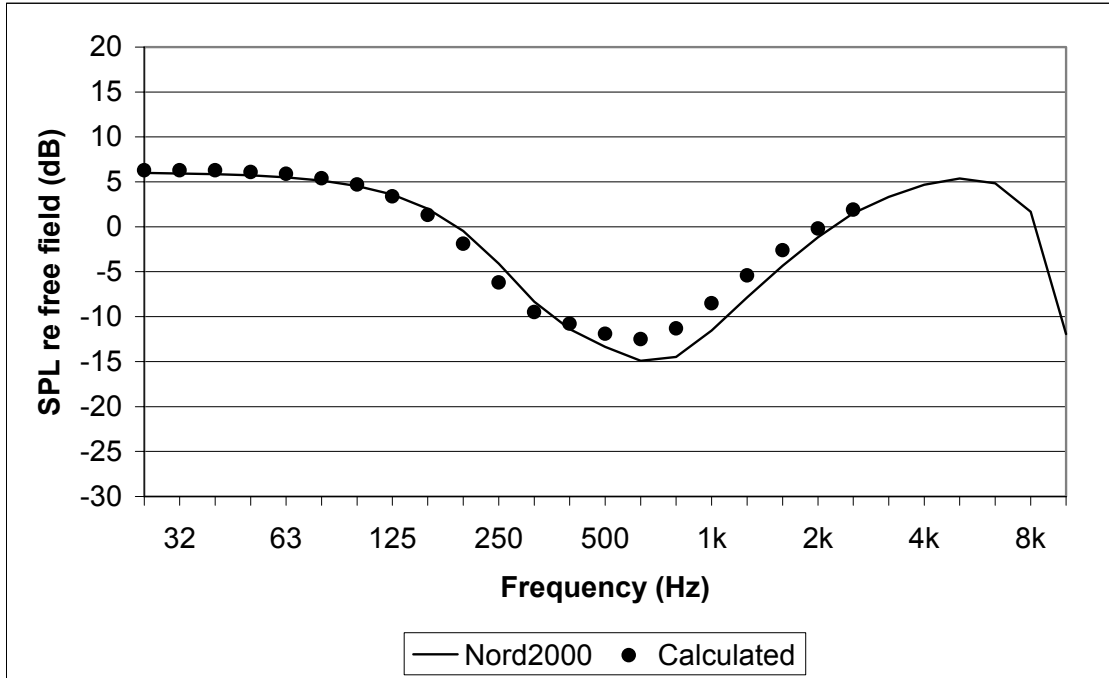
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1042



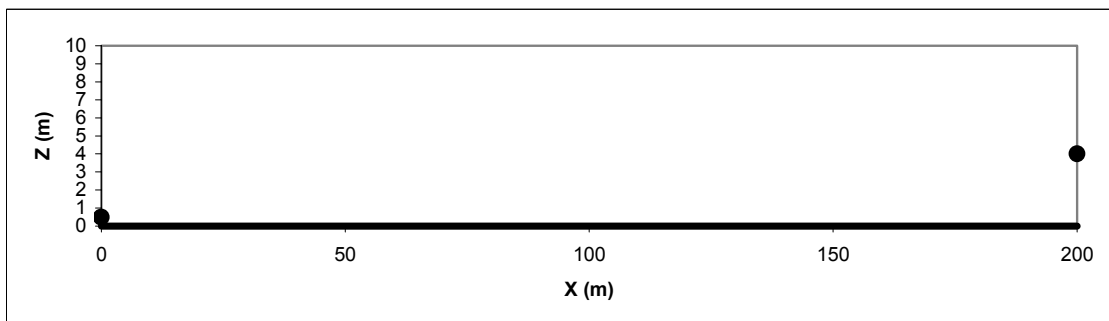
Nord2000 A-weighted ground effect (dB)	-7.1
A-weighted difference re. calculated (dB)	-0.8

Terrain profile

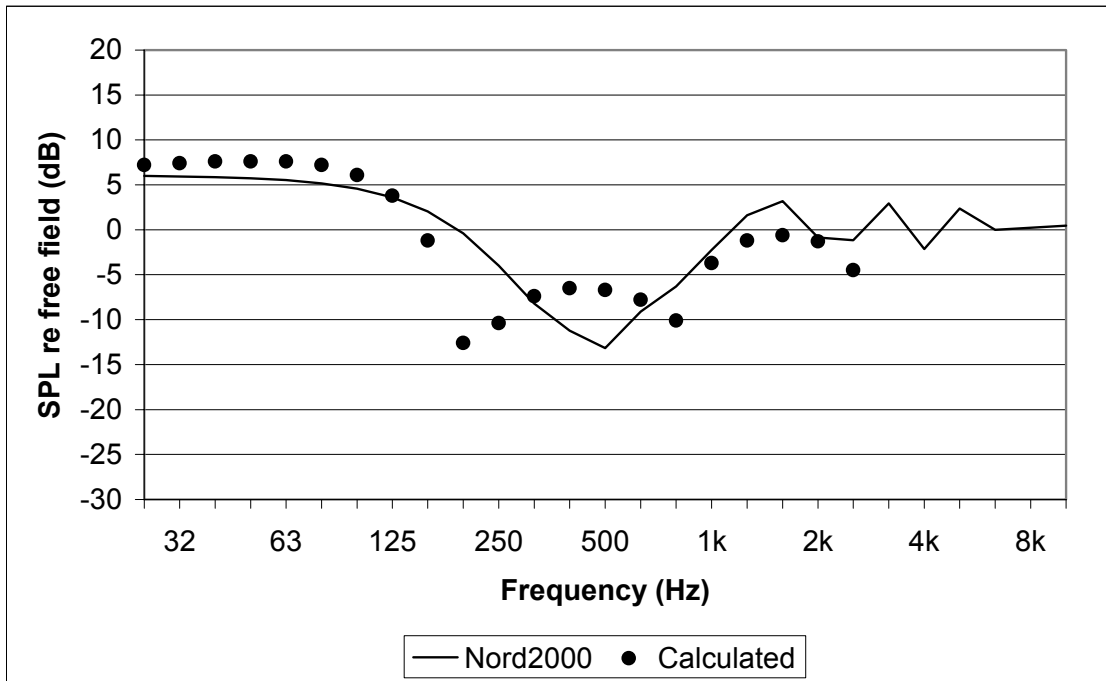
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1043



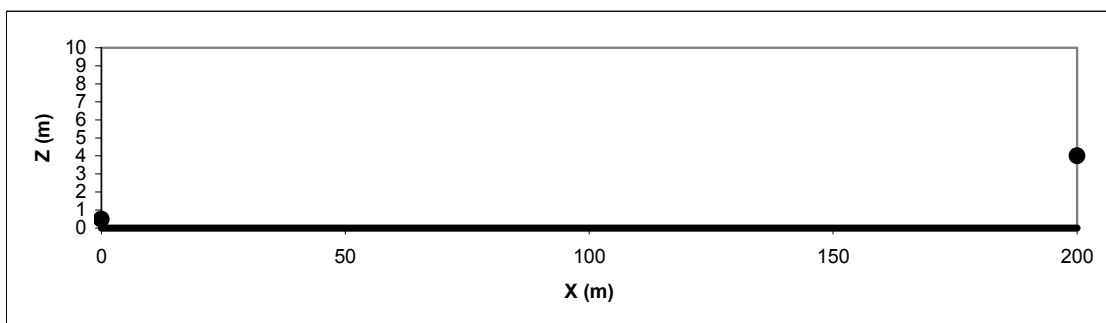
Nord2000 A-weighted ground effect (dB)	-4.4
A-weighted difference re. calculated (dB)	2.3

Terrain profile

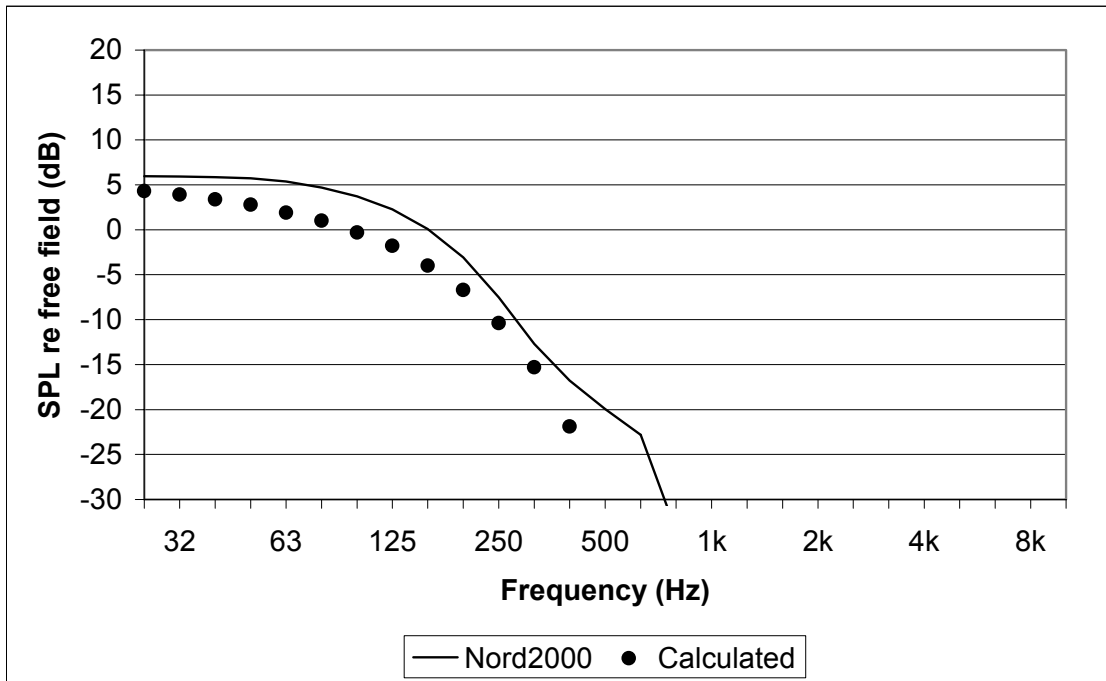
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1044



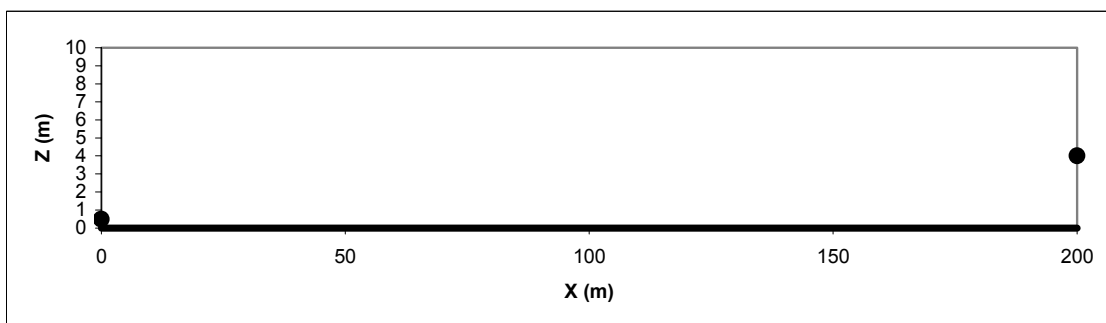
Nord2000 A-weighted ground effect (dB)	-18.2
A-weighted difference re. calculated (dB)	3.8

Terrain profile

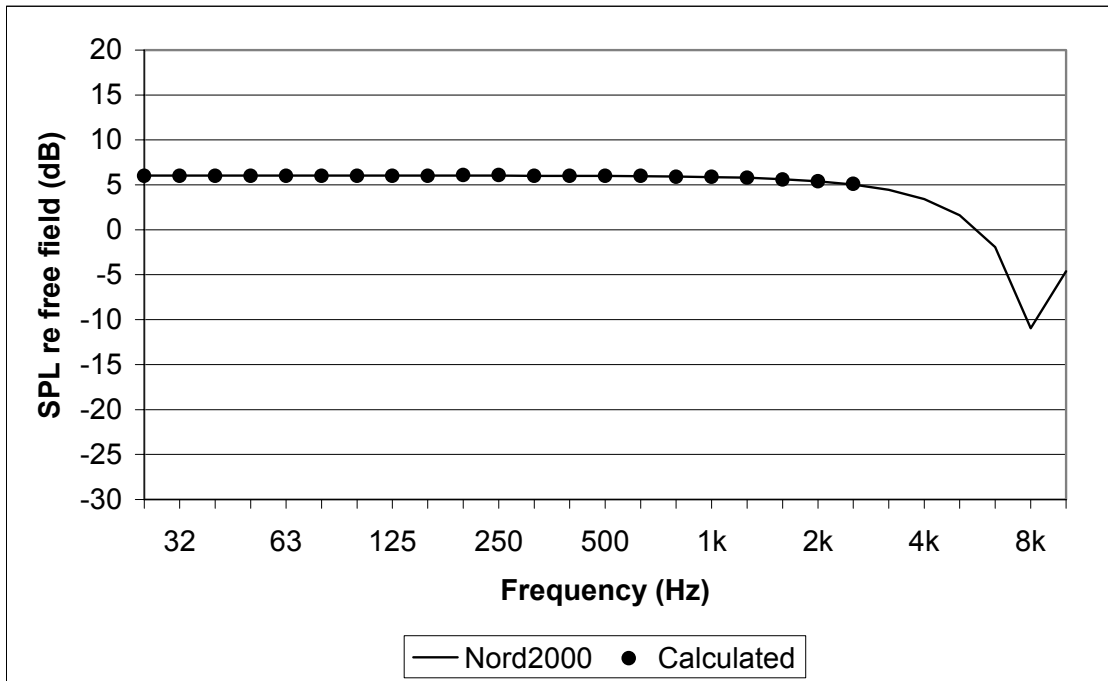
X	Z	Flow resist.	Roughness
0.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1045



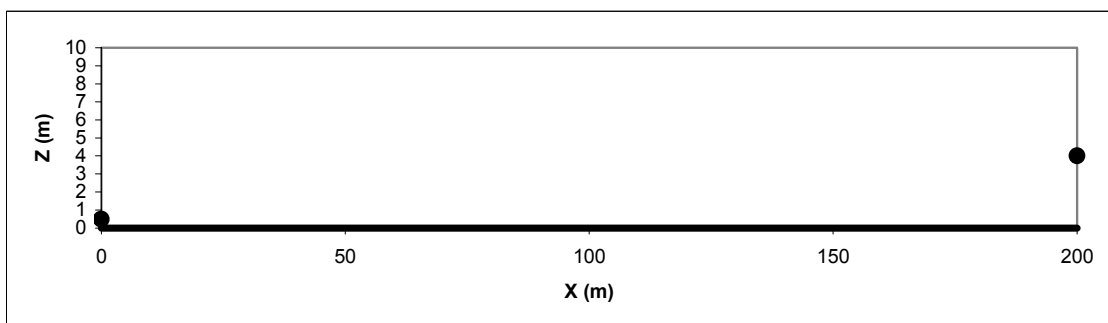
Nord2000 A-weighted ground effect (dB)	1.9
A-weighted difference re. calculated (dB)	0.0

Terrain profile

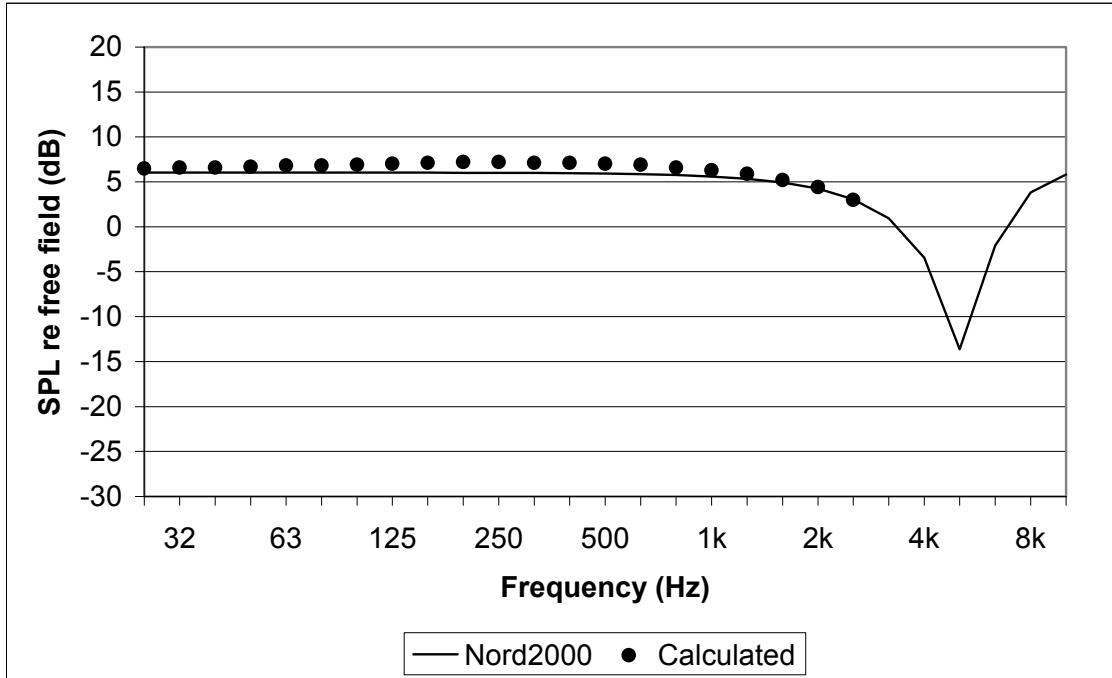
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1046



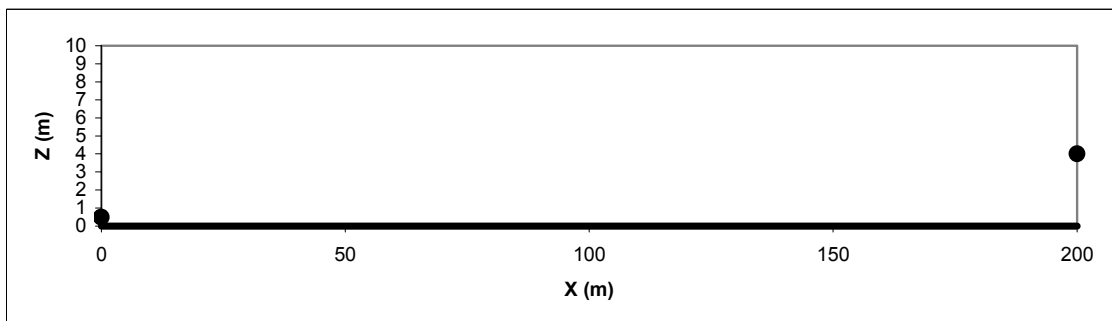
Nord2000 A-weighted ground effect (dB)	1.3
A-weighted difference re. calculated (dB)	-0.6

Terrain profile

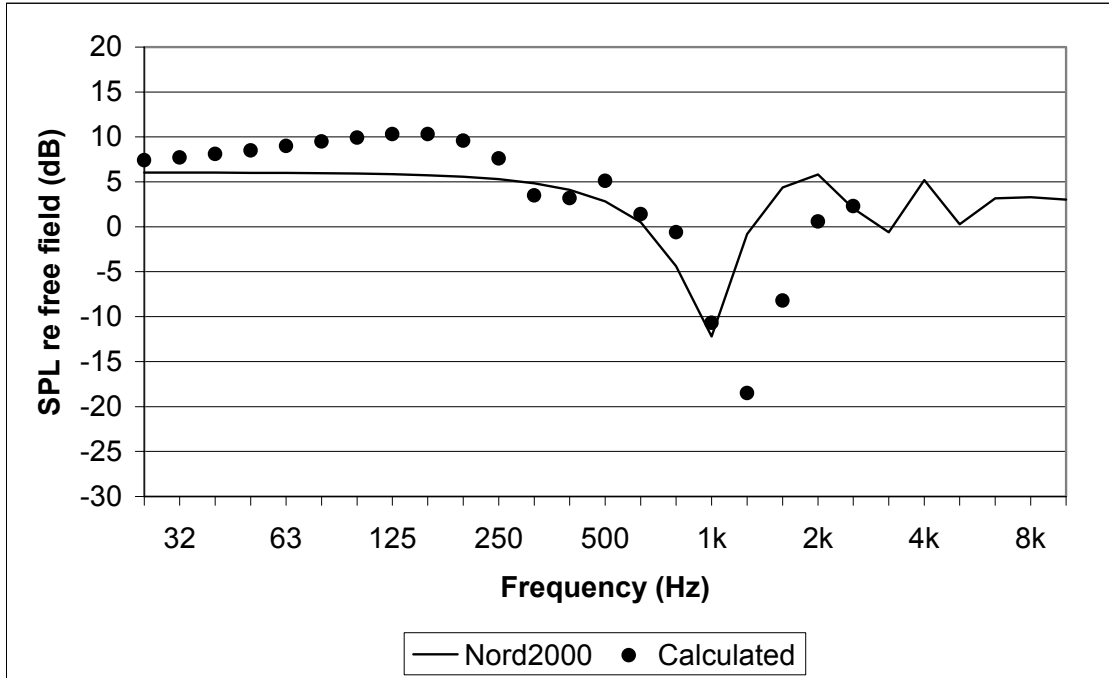
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1047



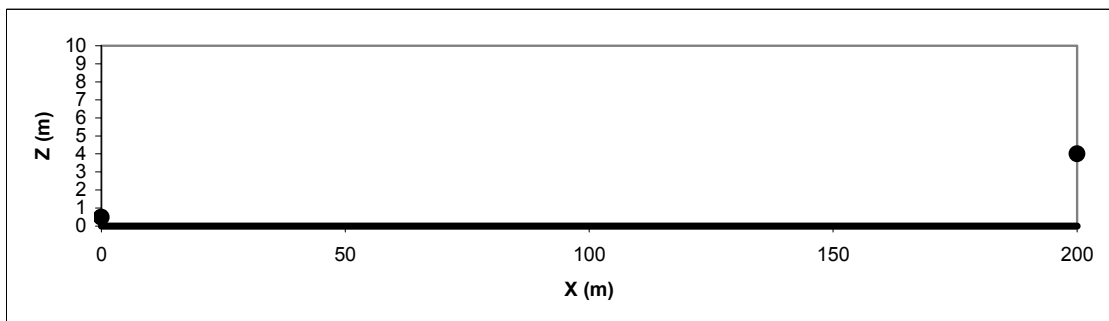
Nord2000 A-weighted ground effect (dB)	-1.1
A-weighted difference re. calculated (dB)	1.7

Terrain profile

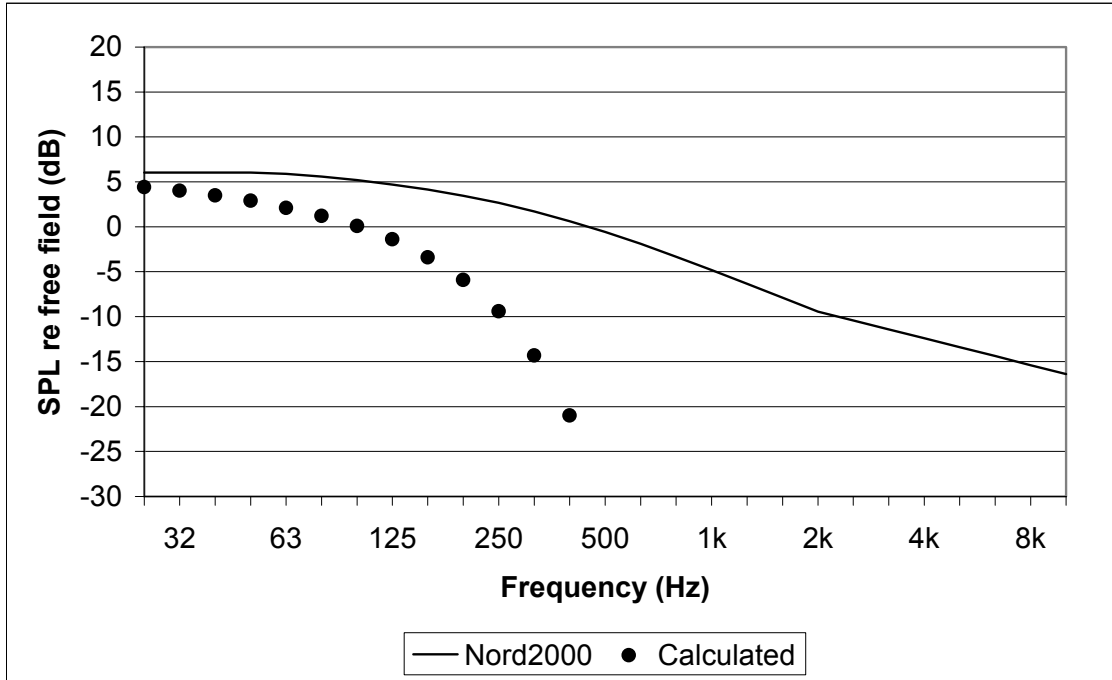
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1048



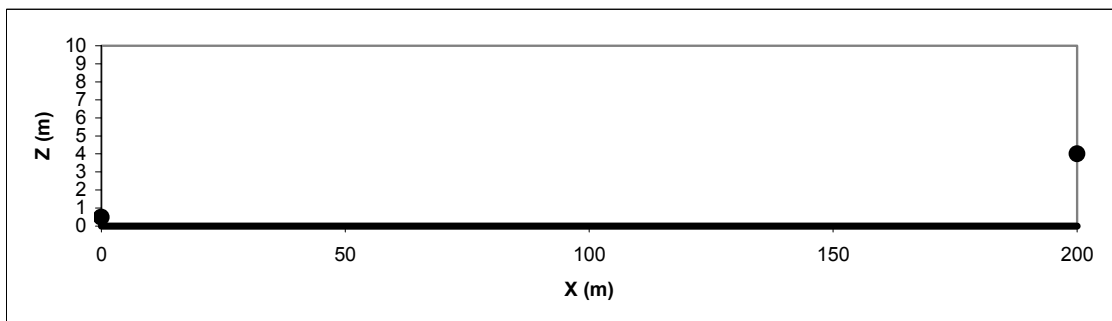
Nord2000 A-weighted ground effect (dB)	-7.9
A-weighted difference re. calculated (dB)	14.0

Terrain profile

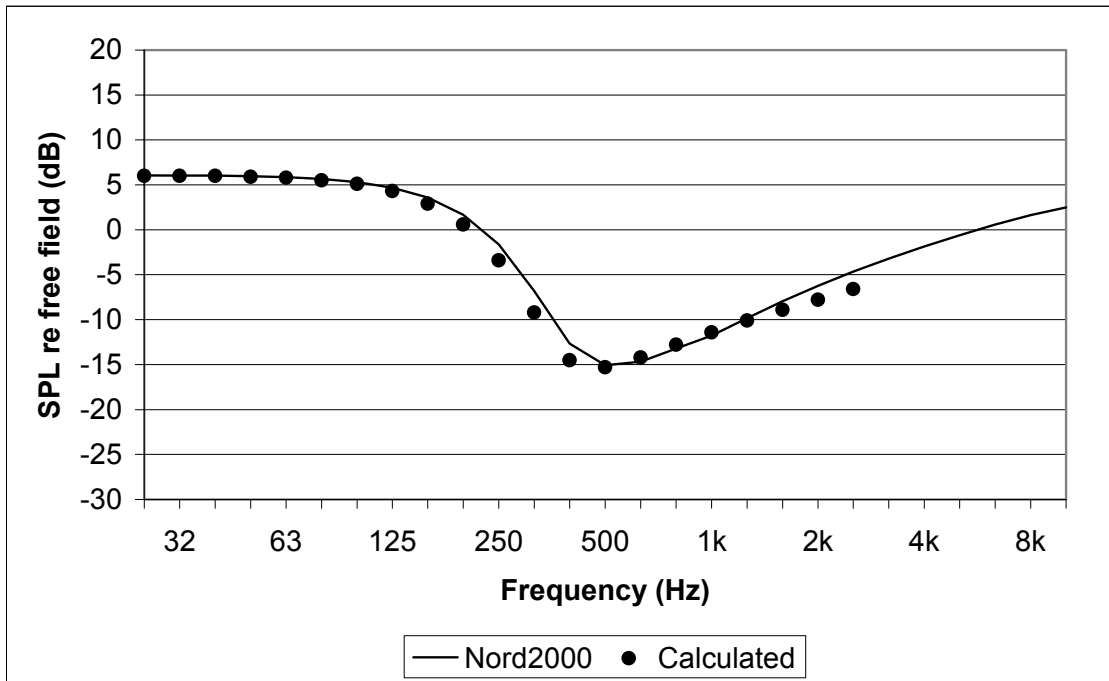
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	4.00	m
z0	0.100	m
zu	10	m
u	-4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1051



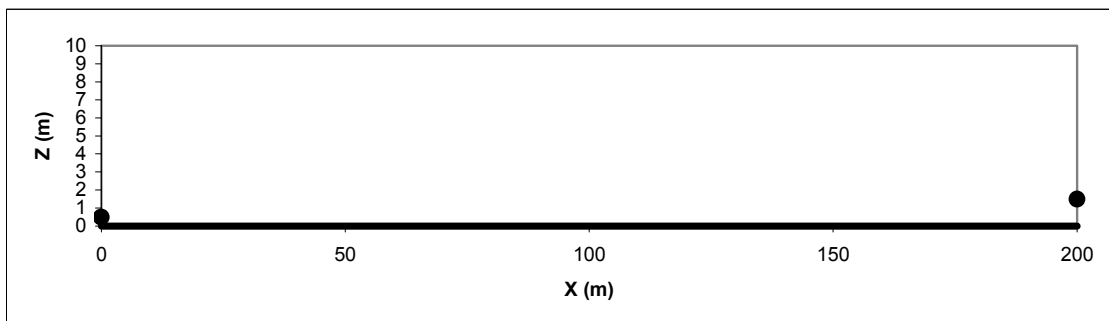
Nord2000 A-weighted ground effect (dB)	-10.7
A-weighted difference re. calculated (dB)	1.1

Terrain profile

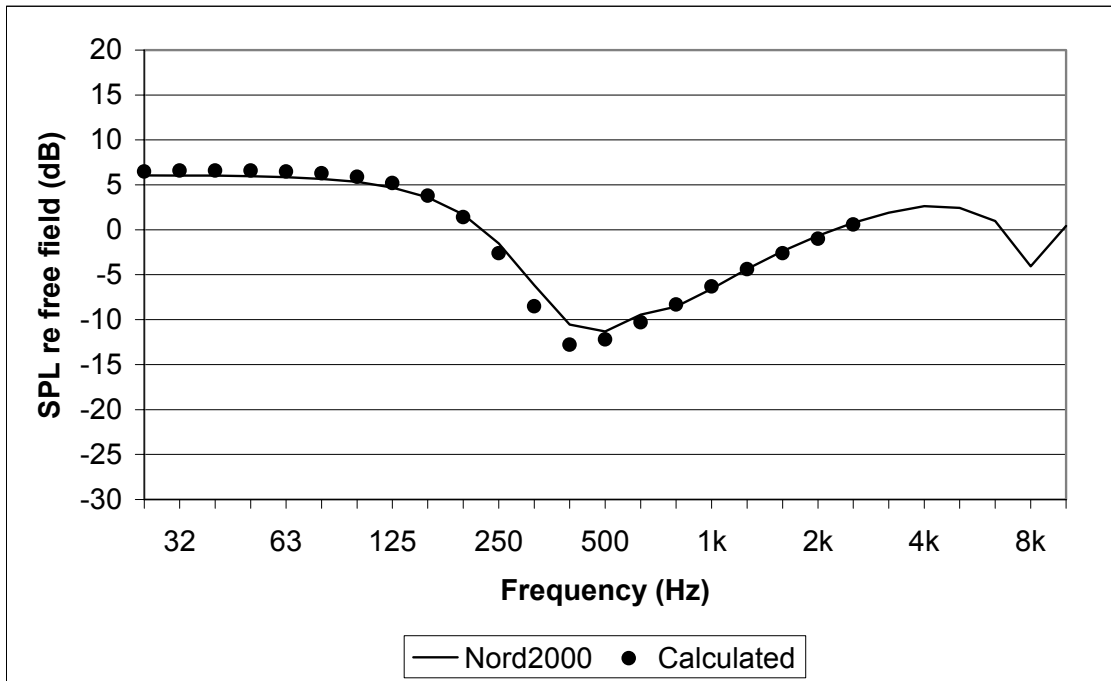
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
30.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1052



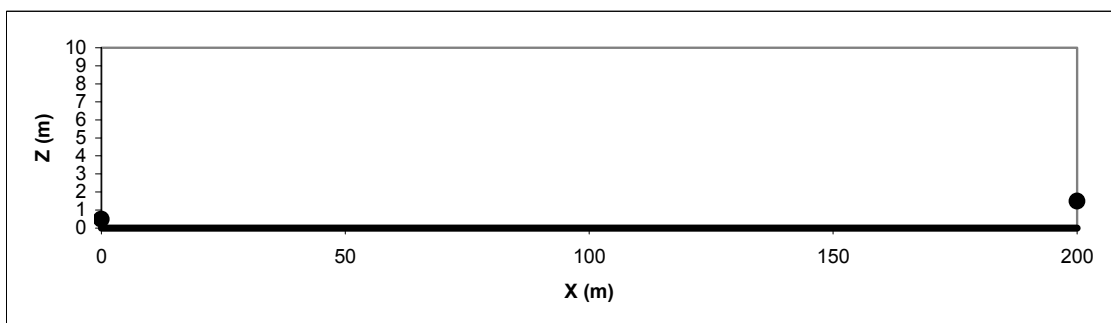
Nord2000 A-weighted ground effect (dB)	-6.3
A-weighted difference re. calculated (dB)	0.2

Terrain profile

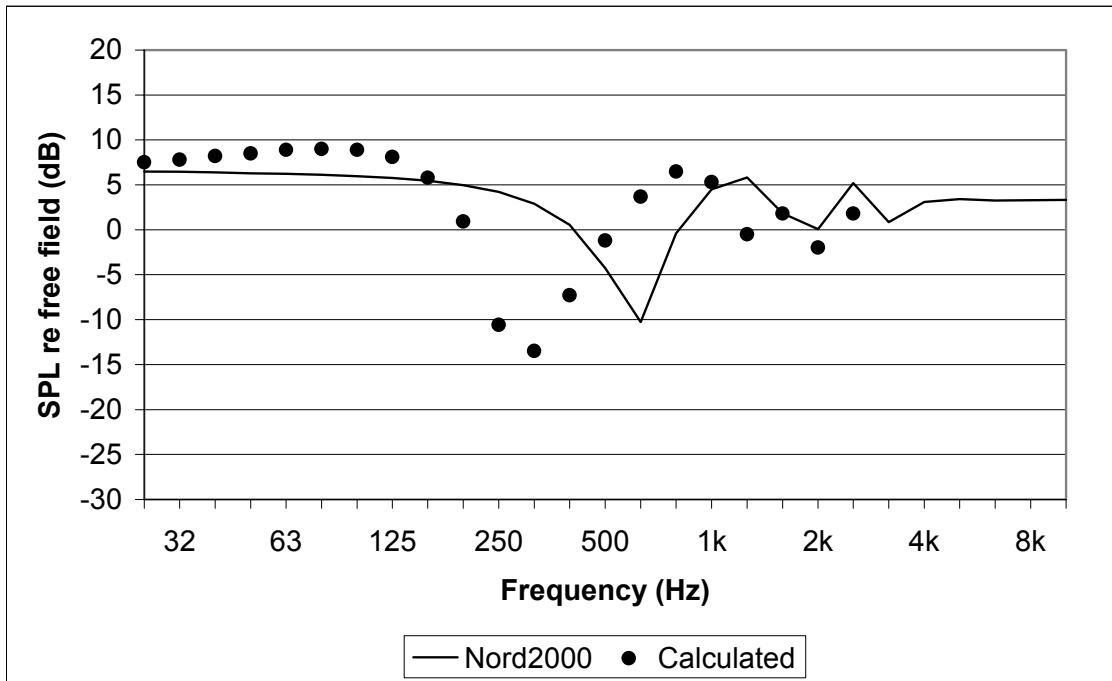
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
30.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1053



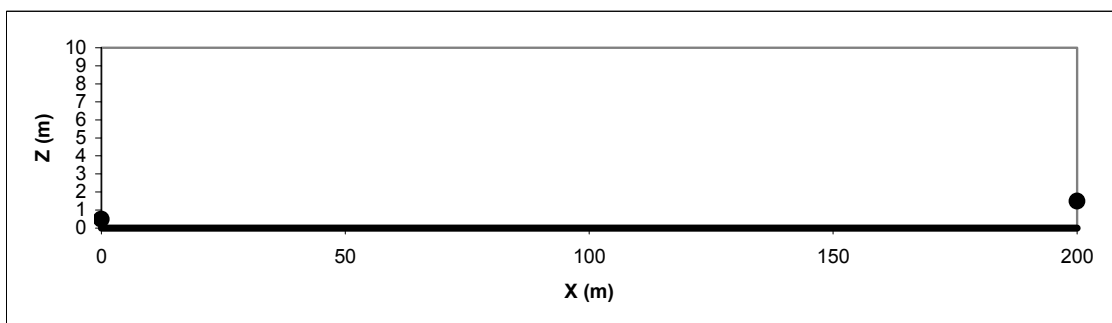
Nord2000 A-weighted ground effect (dB)	-0.7
A-weighted difference re. calculated (dB)	0.6

Terrain profile

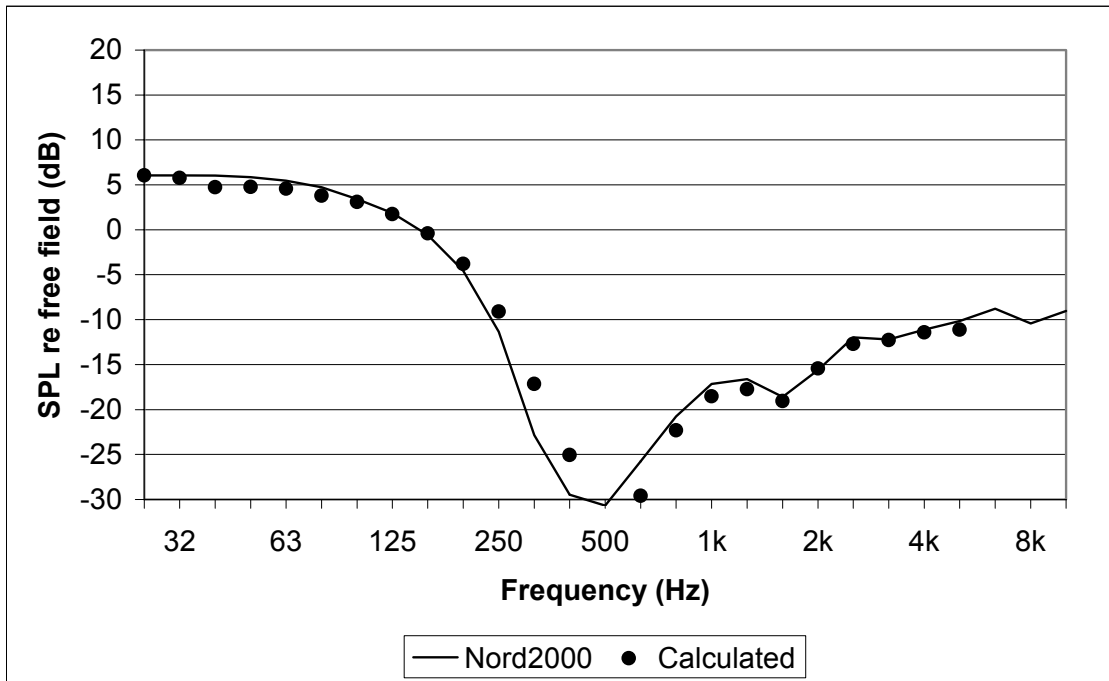
X	Z	Flow resist.	Roughness
0.00	0.00	1000000000	0
30.00	0.00	250000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1061



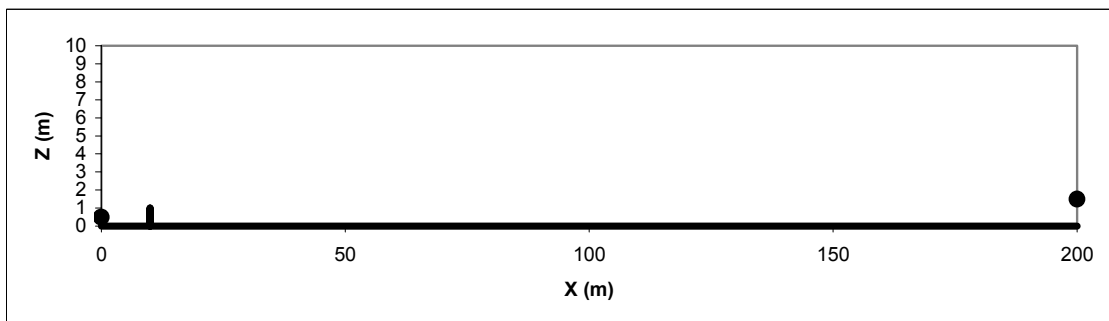
Nord2000 A-weighted ground effect (dB)	-15.6
A-weighted difference re. calculated (dB)	0.3

Terrain profile

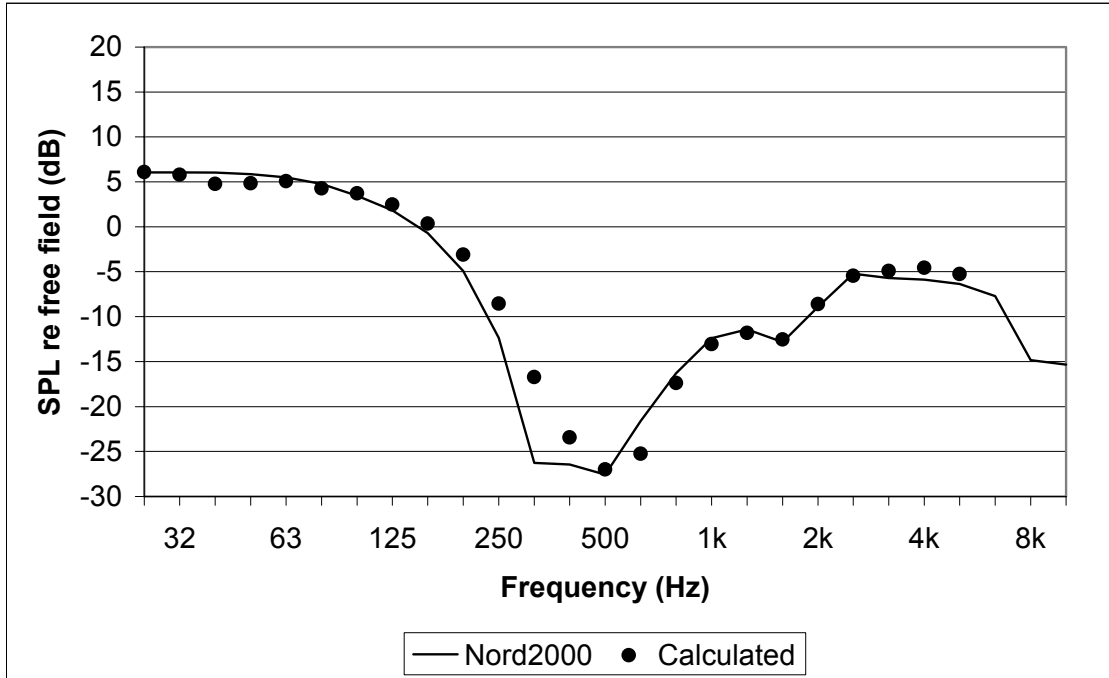
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	1.00	1	0
10.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1062



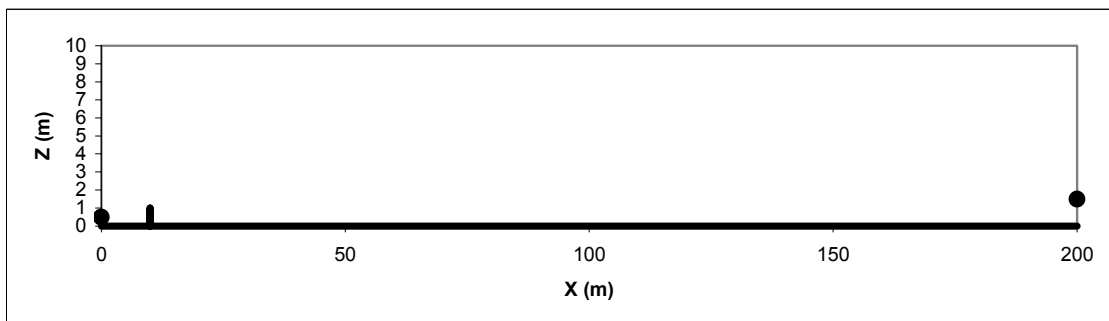
Nord2000 A-weighted ground effect (dB)	-11.0
A-weighted difference re. calculated (dB)	-0.6

Terrain profile

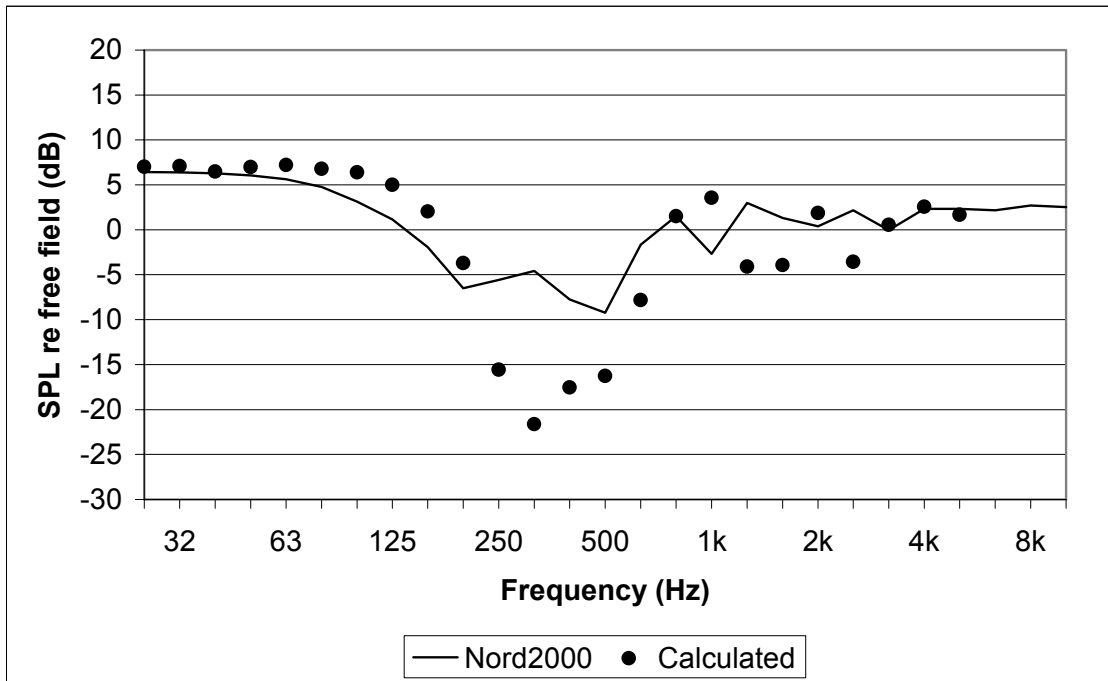
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	1.00	1	0
10.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1063



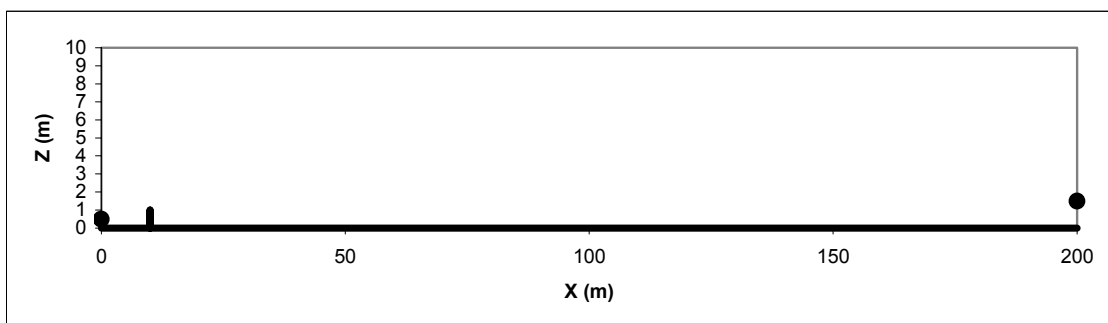
Nord2000 A-weighted ground effect (dB)	-1.9
A-weighted difference re. calculated (dB)	0.8

Terrain profile

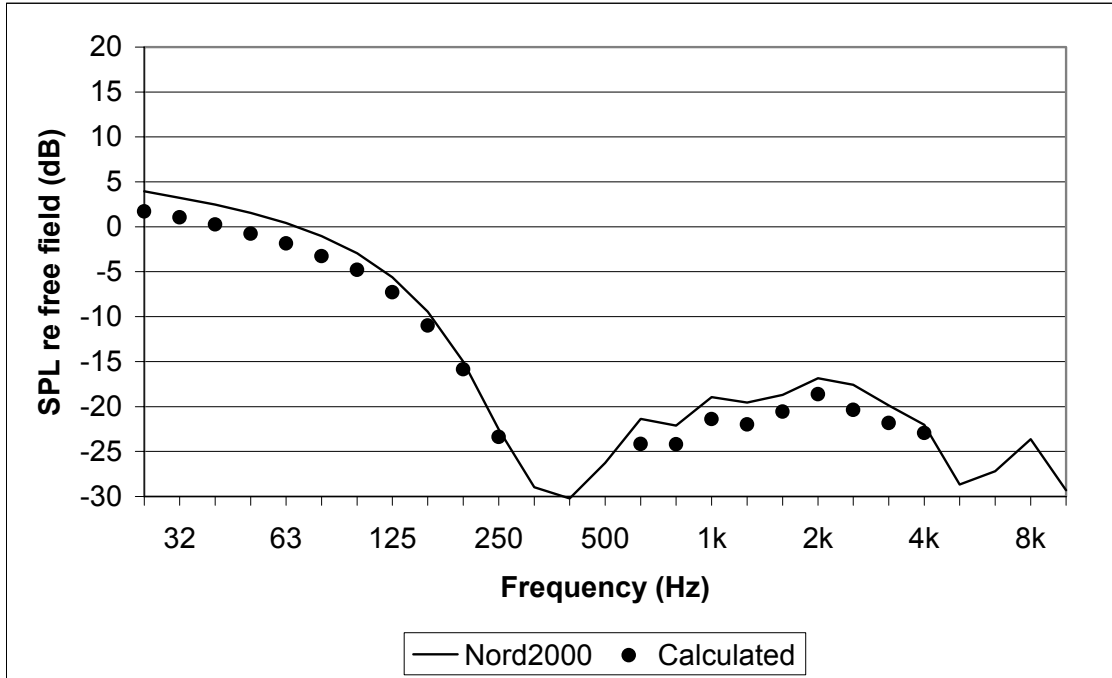
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	1.00	1	0
10.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdt dz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1064



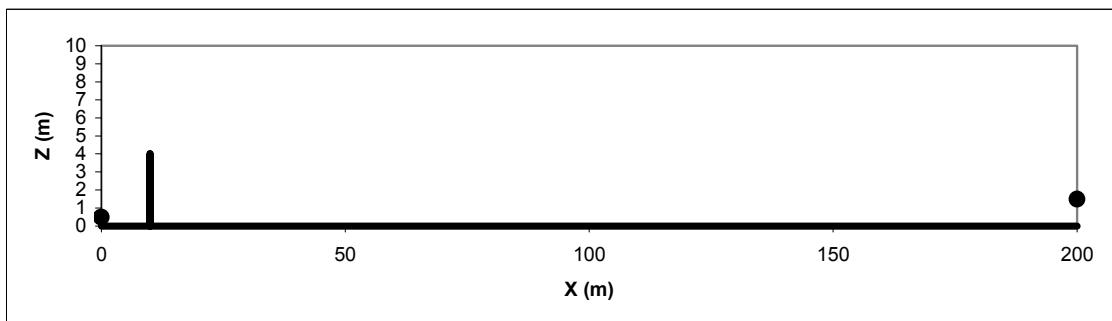
Nord2000 A-weighted ground effect (dB)	-21.8
A-weighted difference re. calculated (dB)	2.1

Terrain profile

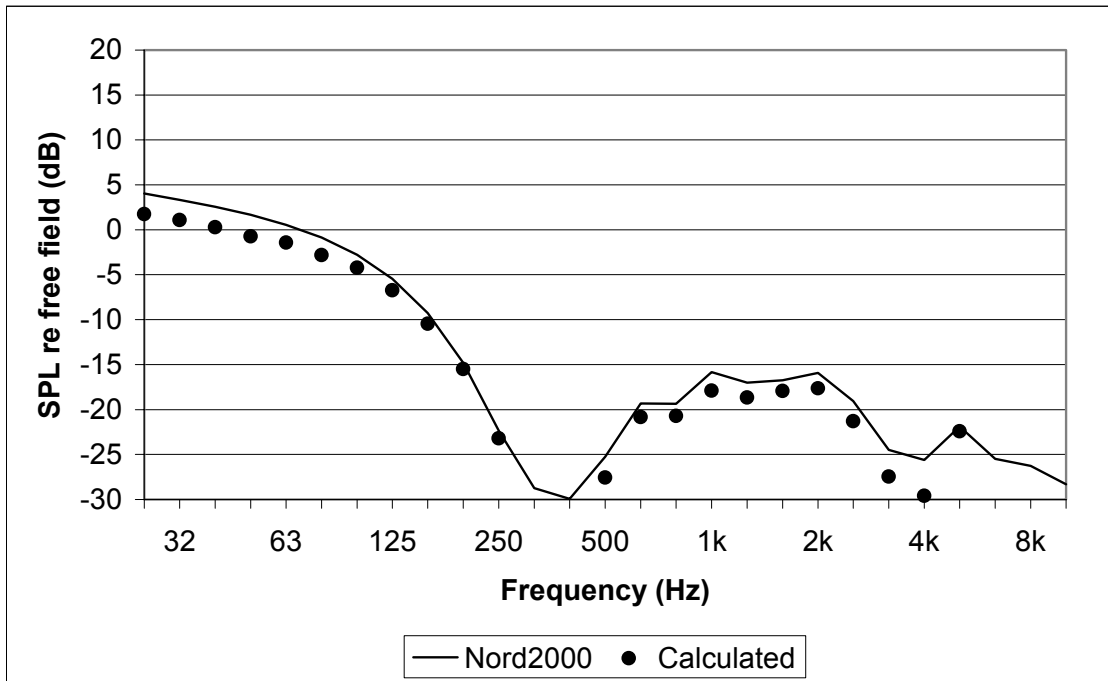
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	4.00	1	0
10.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1065



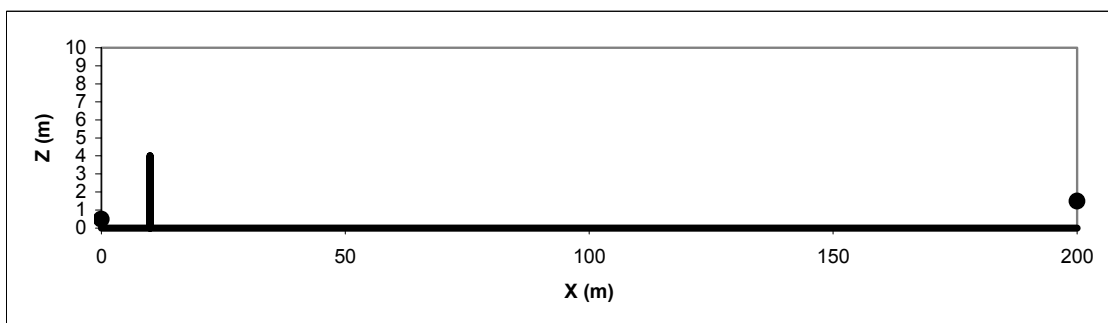
Nord2000 A-weighted ground effect (dB)	-20.9
A-weighted difference re. calculated (dB)	1.7

Terrain profile

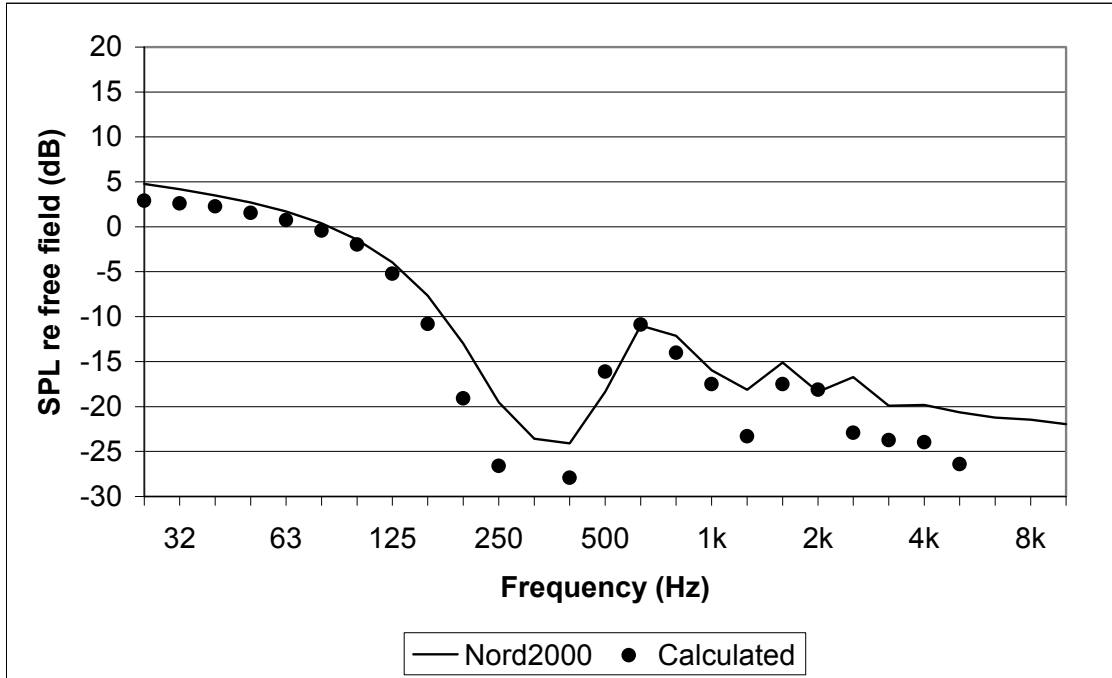
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	4.00	1	0
10.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0846	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1066



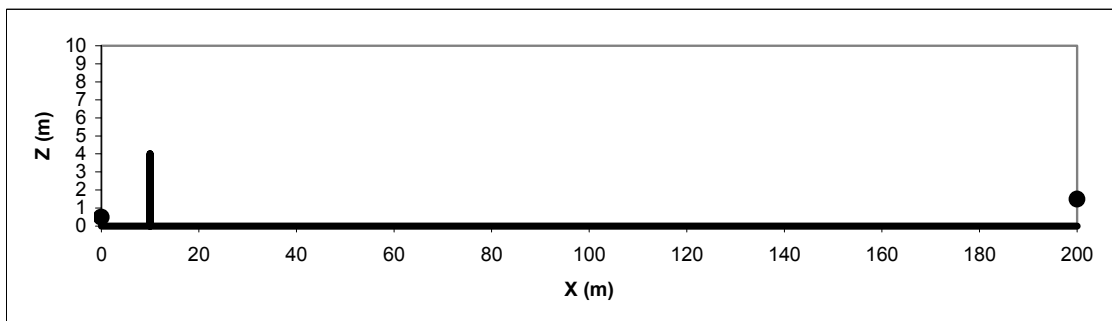
Nord2000 A-weighted ground effect (dB)	-18.7
A-weighted difference re. calculated (dB)	1.8

Terrain profile

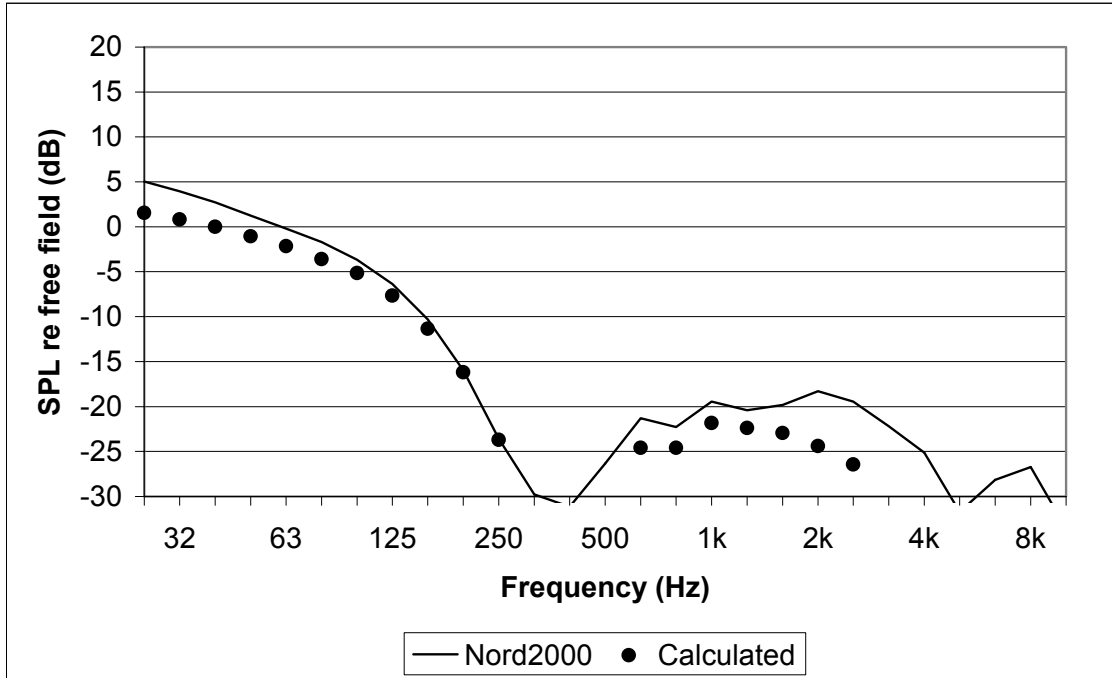
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	4.00	1	0
10.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1071



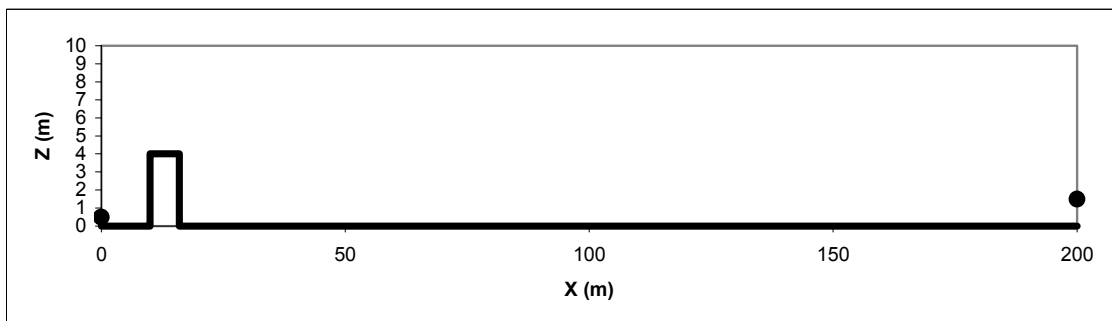
Nord2000 A-weighted ground effect (dB)	-23.0
A-weighted difference re. calculated (dB)	3.5

Terrain profile

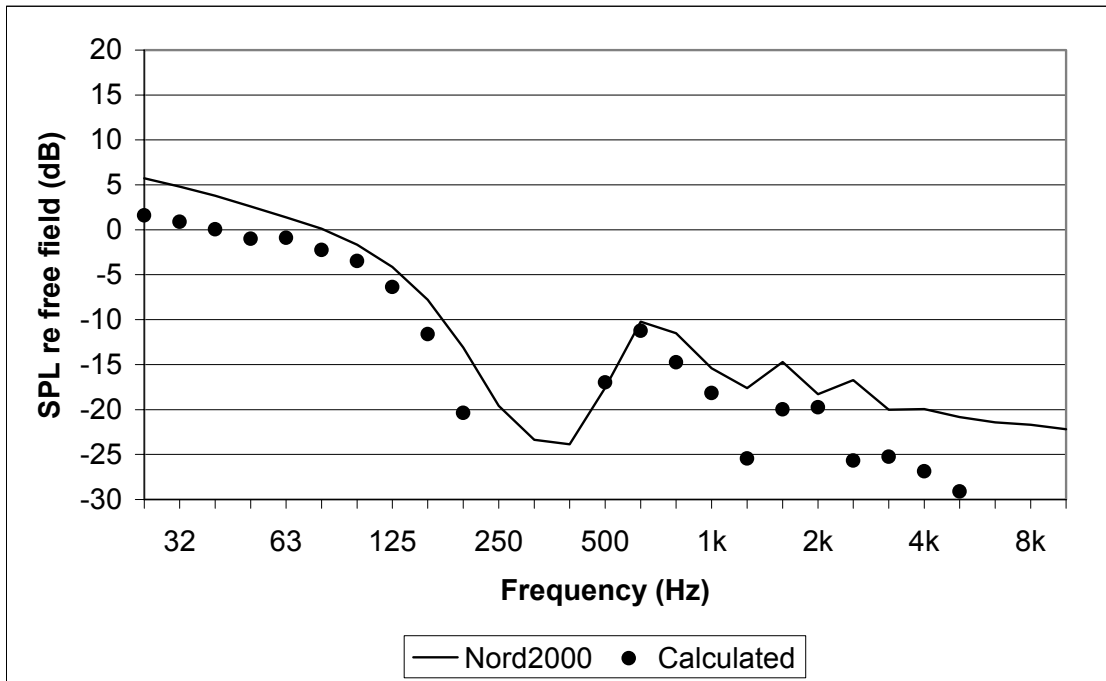
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	4.00	200000	0
16.00	4.00	1	0
16.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1072



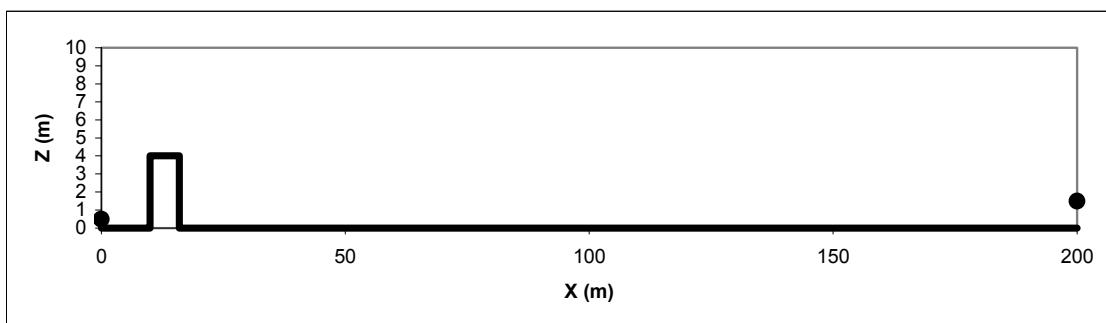
Nord2000 A-weighted ground effect (dB)	-18.4
A-weighted difference re. calculated (dB)	3.3

Terrain profile

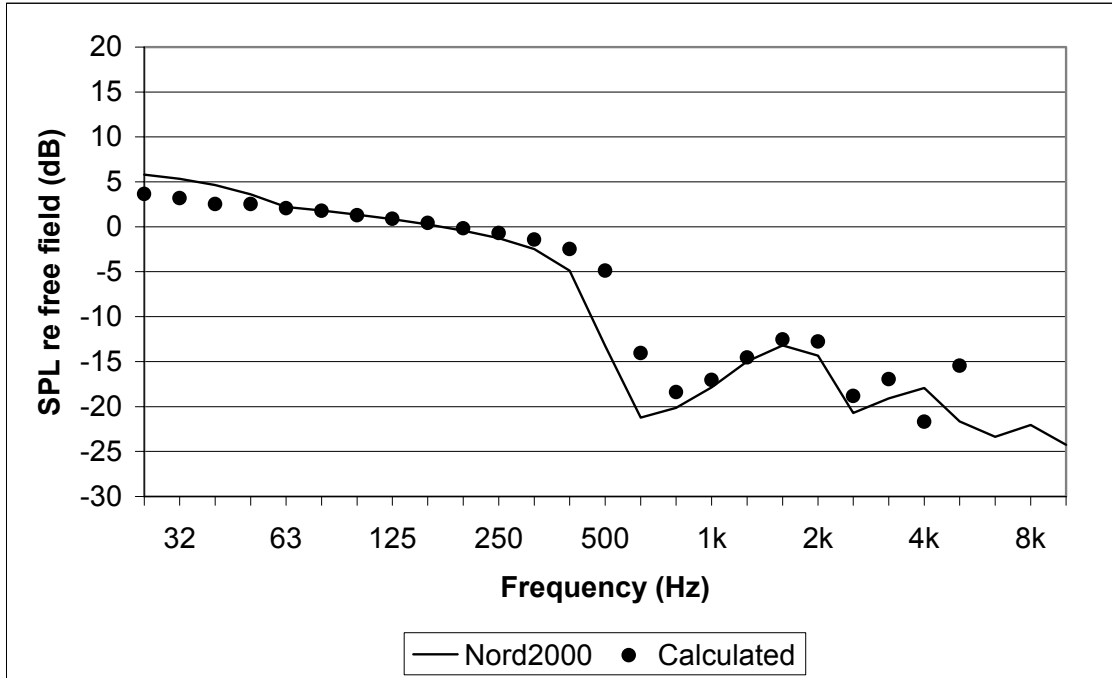
X	Z	Flow resist.	Roughness
0.00	0.00	2	0
9.99	0.00	1	0
10.00	4.00	200000	0
16.00	4.00	1	0
16.01	0.00	200000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	4.615	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1081



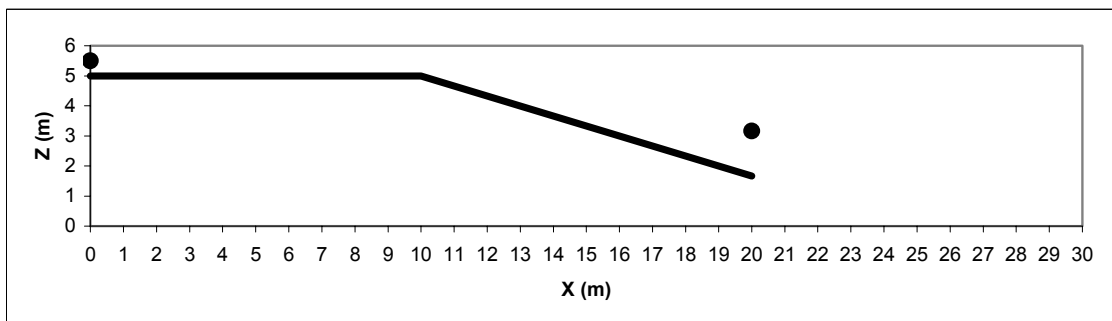
Nord2000 A-weighted ground effect (dB)	-14.9
A-weighted difference re. calculated (dB)	-1.7

Terrain profile

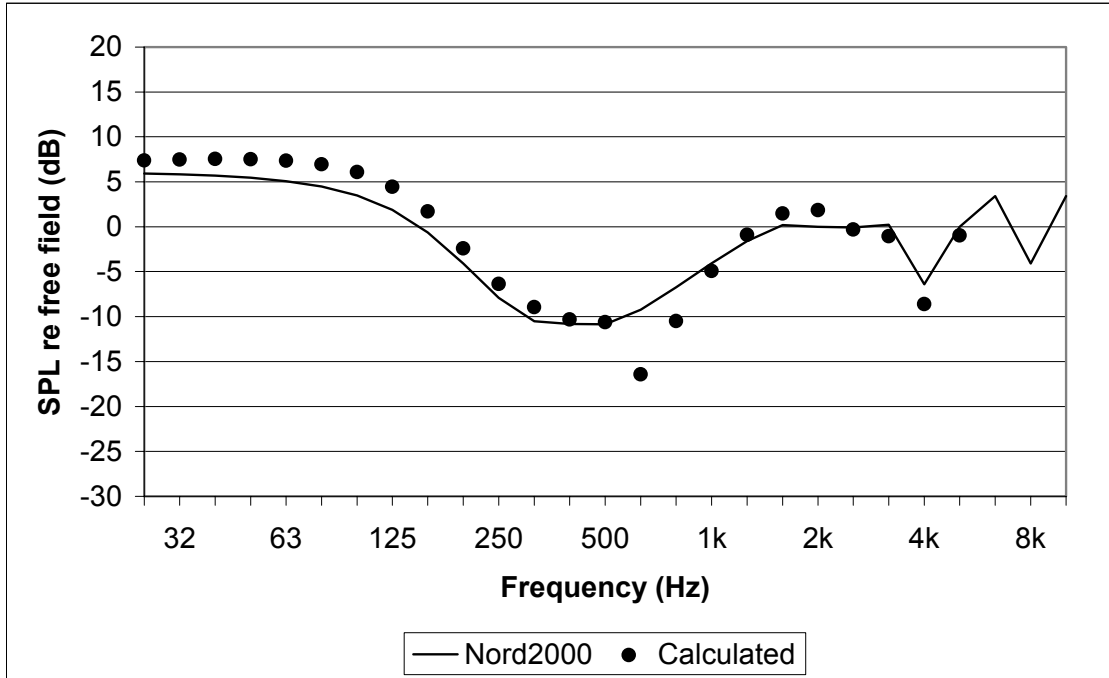
X	Z	Flow resist.	Roughness
0.00	5.00	2	0
10.00	5.00	200000	0
20.00	1.67	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%



Nord2000 Validation. Calculations. Case No. 1082



Nord2000 A-weighted ground effect (dB)	-4.5
A-weighted difference re. calculated (dB)	-0.2

Terrain profile

X	Z	Flow resist.	Roughness
0.00	5.00	2	0
10.00	5.00	20000	0
25.00	0.00	20000	0
200.00	0.00	0	0

Calculation parameters

hs	0.50	m
hr	1.50	m
z0	0.100	m
zu	10	m
u	0.000	m/s
su	0.000	m/s
t0	15	°C
dtdz	0.0000	K/m
sdtz	0.0000	K/m
Cv2	0.000	m ^{4/3} /s ²
Ct2	0.000	K/s ²
RH	0	%

