LEAF BLOWER NOISE

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ABSTRACT

Acoustics laboratory of Kuopio Regional Institute of Occupational Health examined noise of leaf blowers and other professional gardening and municipal machines. Noise emission and noise exposure of users was measured. In total of 9 leaf blowers were tested. Noise emission data of leaf blowers were compared with noise data from other gardening machines.
Noise exposure of leaf blower users varied between 93-102 dB(A). Highest noise exposures were measured with machines powered by 2-stroke engines, e.g. leaf blowers and brush cutters. Noise emissions of leaf blowers varied between 102-111 dB(A). Only lawn mowers noise emission was less than 100 dB(A). Especially noise of machines powered by 2-stroke engines included tonal components. Tonal components of noise are perceived more irritating. Penetration of gardening machine noise to indoors was calculated. Low frequency components of noise from leaf blowers engine penetrate outer wall constructions well. Transportation of noise through wall also increases relative importance of low frequency tonal components of leaf blower noise.

1. INTRODUCTION

Noise from leaf blowers is often described very loud and irritating. Every year at spring and autumn time many letters to the editor complaining noise of leaf blowers can be read in the newspapers. Acoustics laboratory of Kuopio Regional Institute of Occupational Health examined noise of leaf blowers and other professional gardening and municipal machines.

2. MATERIALS AND METHODS

Machine types tested were leaf blower, brush cutter, grass trimmer, lawn mower, snow blower, garden tractor with lawn mowing equipment and two types of sweeping machines. All the machines tested were used. Leaf blowers were 1 to 7 years old and other machines 2 to 21 years. Eight of the leaf blowers tested were backpack models and one of the leaf blowers was handheld.
2-stroke petrol engines power leaf blowers, brush cutter and grass trimmer. 4 stroke petrol engines power lawn mower and snow blower. Diesel engines power garden tractor and sweeping machines. Garden tractor and sweeping machines are equipped with driver cabins.
Noise emissions of machines were tested according to European Directive 2000/14/EC [1]. In this Directive noise emission test method is based on standard EN ISO 3744:1995 [2]. More detailed measurement methods for each type of machines are also laid down in the directive.

Hemispherical measurement surface with six microphone positions was used for all machines (figure 1). Noise in microphone positions was recorded using sound level meter and DAT-recorder. In addition, users noise exposure was recorded according to standard ISO 11202 [3]. Recordings were analyzed with real time analyzer in 1/3 octave bands. Test site was lawn for leaf blowers and lawn mowers and asphalt for other machines. Leaf blower noise emission test site and test procedure is presented in figure 2.

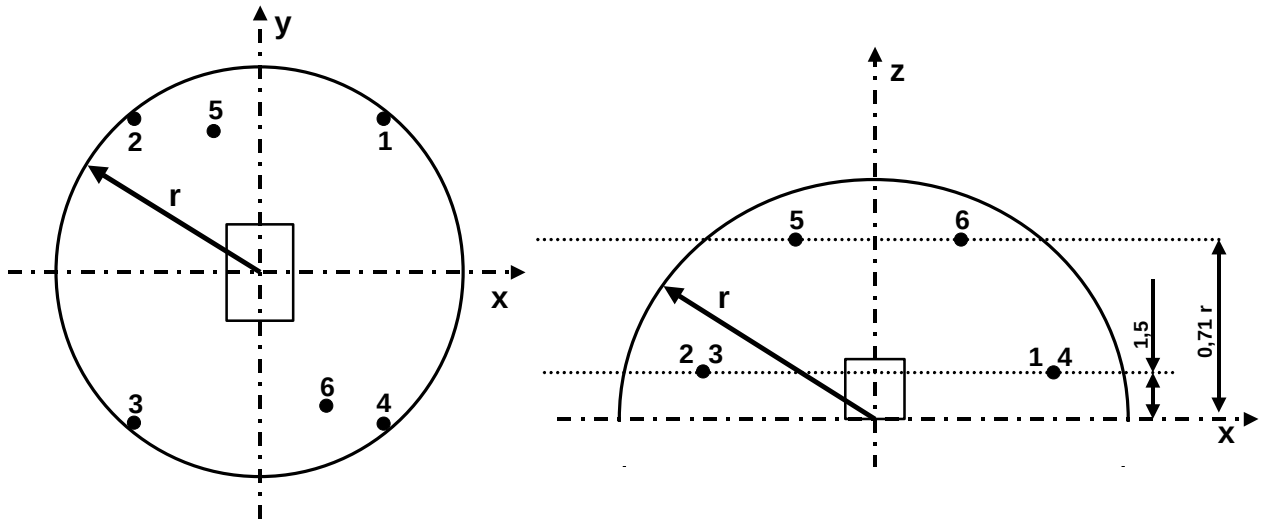

Figure 1. Hemispherical measurement surface with six microphone positions.

Figure 2. Leaf blower noise emission test site. Microphone positions are marked with white buckets.

People spend most of their time indoors. Therefore exposure to environmental noise can also occur indoors. Penetration of noise from gardening machines to indoors was calculated using measured noise emission and estimated outer wall transmission loss (figure 3). In calculations it was assumed that machines were used at 10 meters distance from wall. Estimated outer wall transmission loss is based on mass law and measurements made in practical circumstances. Goal of this estimation is to describe sound insulation of typical outer wall construction with windows.

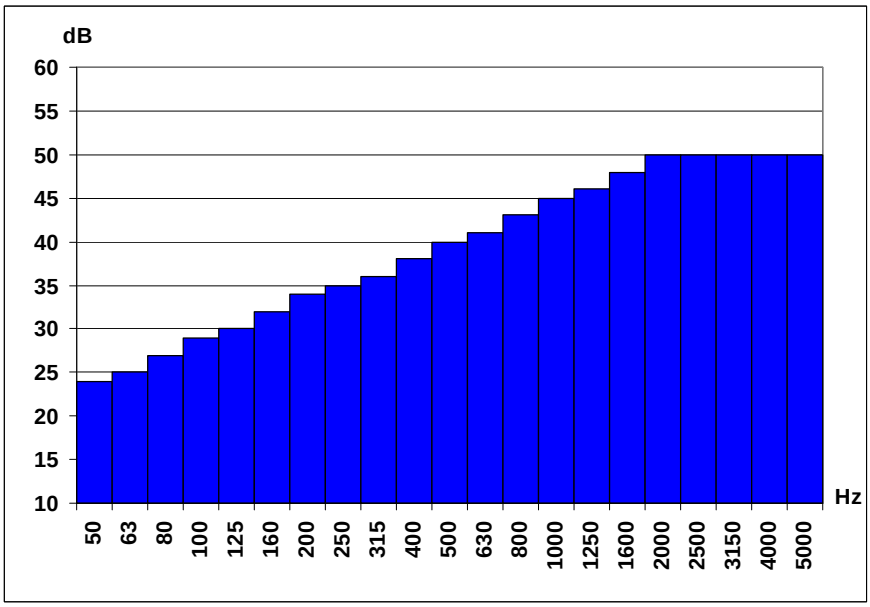

Figure 3. Estimated outer wall transmission loss in 1/3 octave bands.

3. RESULTS

3.1. Noise emission and user exposure

Noise emission and users noise exposure of the leaf blowers and other gardening and municipal machines are presented in table 1. In the table there is also a figure number pointing to machines noise emission spectrum.

Table 1. Noise emission and users noise exposure of the machines tested

Machine tested		Noise emission L_{WA} dB(A)	Users exposure L_{pA} dB(A)	Noise emission spectrum
1	Echo PB-6000 leaf blower	109	98	Figure 4
2	Echo PB-6000 leaf blower	108	99	-
3	Echo PB-4600 leaf blower	106	95	Figure 5
4	Echo PB-4600 leaf blower	106	97	-
5	Husqvarna 155 B leaf blower	111	100	Figure 6
6	Husqvarna 141 B leaf blower	107	97	Figure 7
7	Husqvarna 141 B leaf blower	107	98	-
8	Stihl BR 420 leaf blower	110	102	Figure 8
9	Husqvarna 225 BV leaf blower / vacuum	102	93	-
10	Echo CLS-4600 brush cutter	115	105	Figure 10
11	Echo CLS-4600 grass trimmer	113	104	-
12	Klippo PRO 4 OHV lawn mover	93	80	Figure 11
13	Toro 421 snow blower	109	92	Figure 12
14	Wille 345 Park garden tractor + lawn mowing equipment	107	76	-
15	Bucher Schörling City Cat 2000 sweeping machine	108	77	Figure 13
16	Sisu SK 177 / Schörling sweeping machine	114	71	-

Noise exposure of leaf blower users varied between 93-102 dB(A). Highest noise exposures were measured with machines powered by 2-stroke engines. Noise emissions of leaf blowers varied between 102-111 dB(A). The leaf blower with highest rated engine power was also noisiest. Lowest noise emission of the leaf blowers was from Husqvarna 225 BV leaf blower / vacuum. This machine is handheld and not powerful enough for professional use. Only lawn mowers noise emission was less than 100 dB(A).

3.2. Spectrum analyzes

A-weighted 1/3 octave sound power level spectrums of selected machines are presented in figures 4-13.

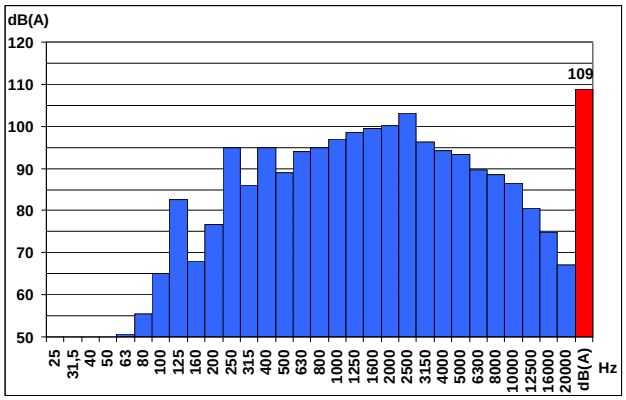

Figure 4. Echo 6000 leaf blower

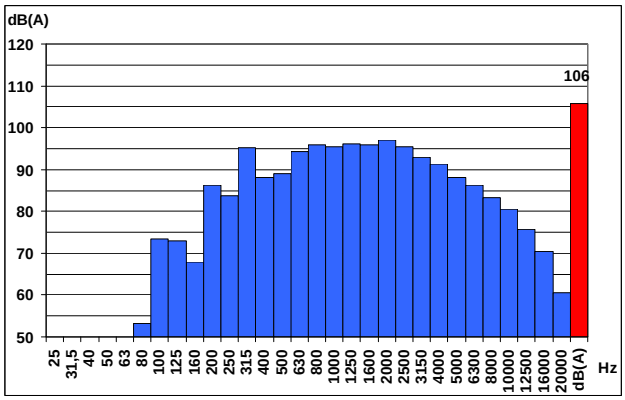

Figure 5. Echo 4600 leaf blower

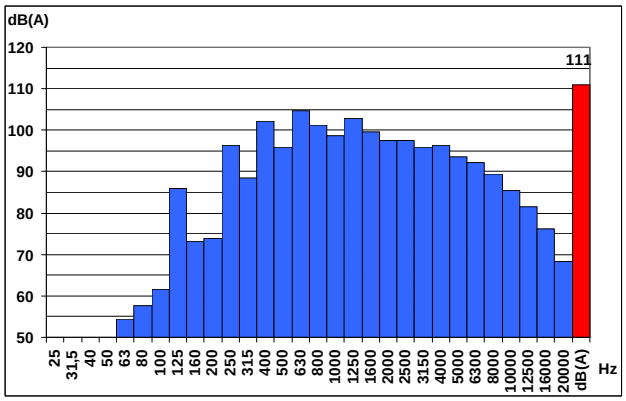

Figure 6. Husqvarna 155 B leaf blower

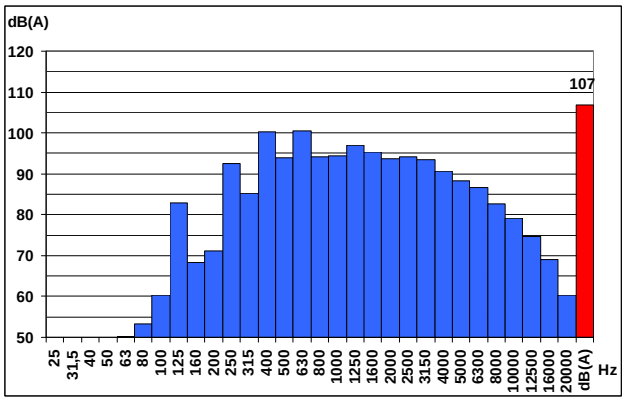

Figure 7. Husqvarna 141 B leaf blower

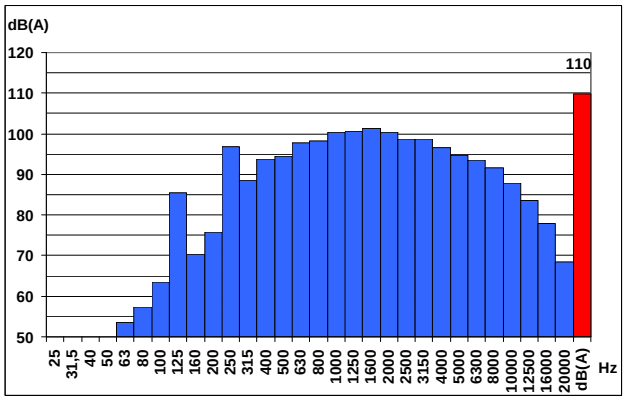

Figure 8. Stihl BR 420 leaf blower

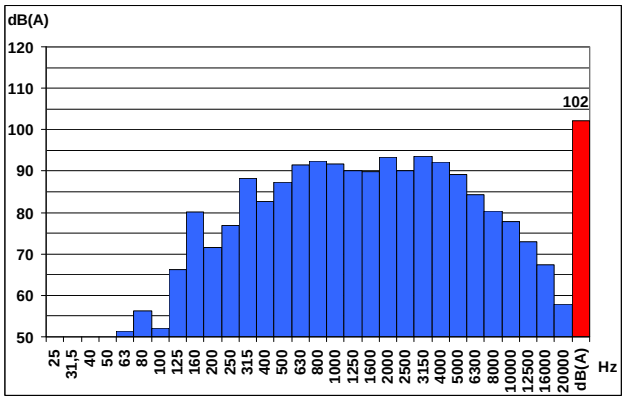

Figure 9. Husqvarna 225 BV leaf blower / vacuum

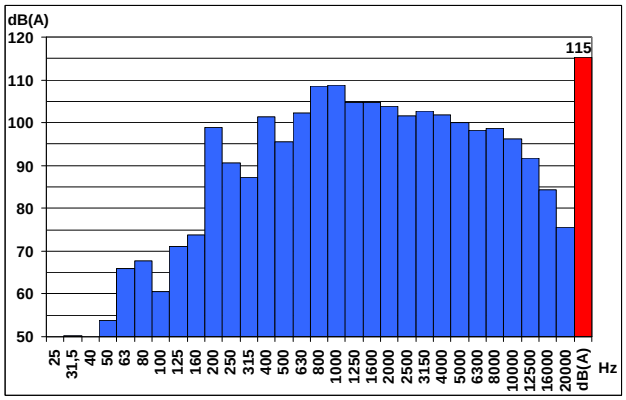

Figure 10. Echo 4600 brush cutter

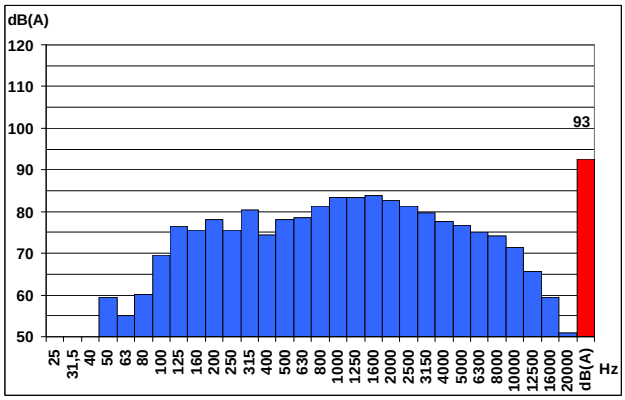

Figure 11. Klippo Pro 4 OHV lawn mower

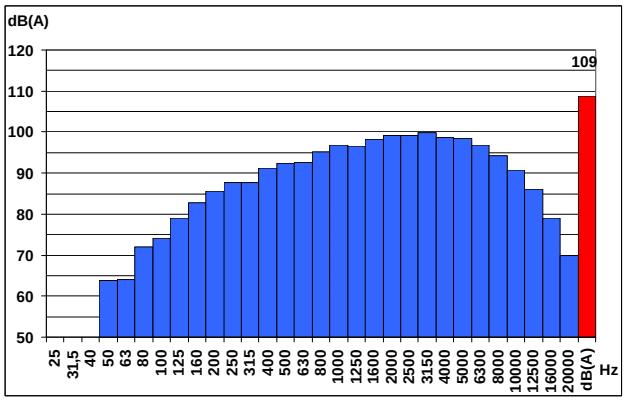

Figure 12. Toro 421 snow blower

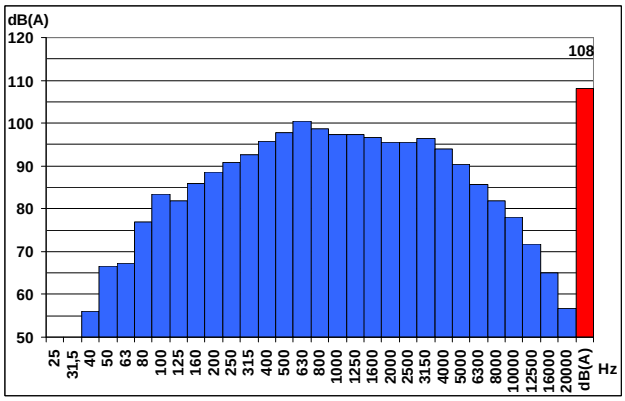

Figure 13. Bucher Schörling City Cat 2000 sweeping machine

3.3. Calculated noise penetration to indoors

Calculated A-weighted spectrums of noise penetrated to indoors are presented in figures 14-17. Calculations were made with two leaf blowers, lawn mower and snow blower noise.

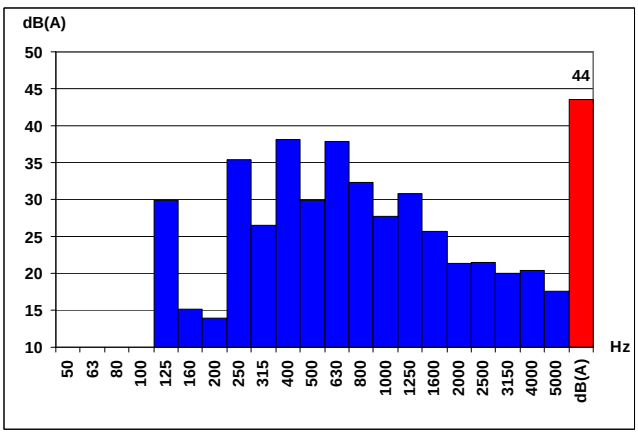

Figure 14. Husqvarna 155 B leaf blower

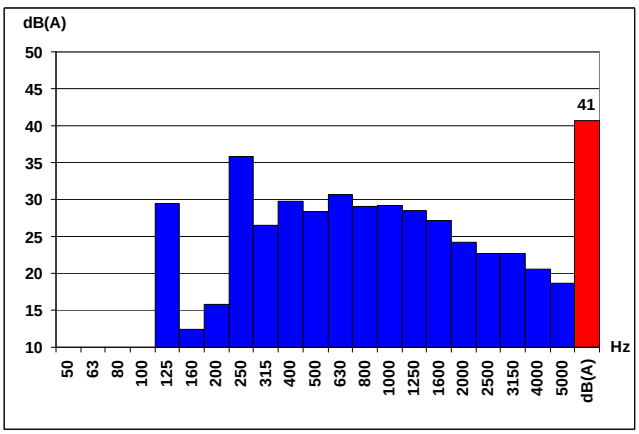

Figure 15. Stihl BR 420 leaf blower

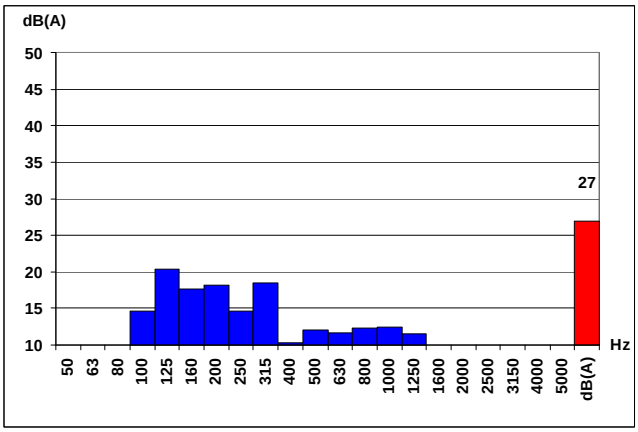

Figure 16. Klippo Pro 4 OHV lawn mower

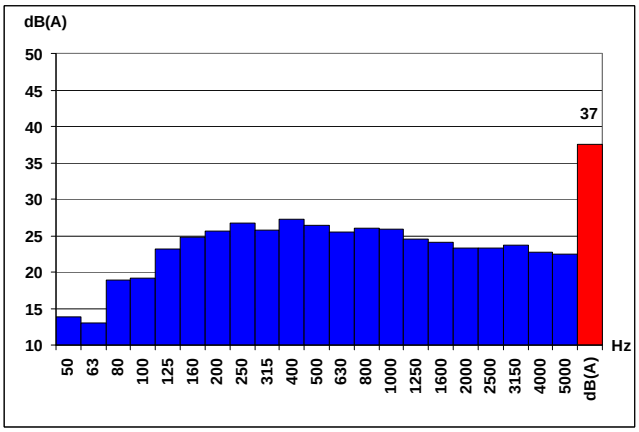

Figure 12. Toro 421 snow blower

4. CONCLUSIONS

The engine power of the leaf blowers seems to contribute more to noise emission than other parameters. The noise of machines powered by 2-stroke engines includes tonal components in the low frequency area (figures 4-10). These tonal components are in the frequency area equivalent to engine speed of the machines. Tonal components of noise are perceived more irritating. Low frequency components of noise from leaf blowers engine penetrate outer wall constructions well. Transportation of noise through wall also increases relative importance of low frequency tonal components of leaf blower noise. This filtration of leaf blower noise through outer wall seems to make it more irritable. This may partly explain the strong public reaction to leaf blower use.

5. REFERENCES

[1] DIRECTIVE 2000/14/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors. Official Journal of the European Communities. L162/1. 3.7.2000.

[2] ISO 3744:1994 Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method, International Organization for Standardization (ISO), Geneva, 1994.

[3] ISO 11202:1995 Acoustics – Noise emitted by machinery and equipment – Measurement of emission sound pressure levels at a work station and other specified positions – Survey method in situ; International Organization for Standardization (ISO), Geneva, 1995.