

Test report

LHX+ 5kW

Revision 1.0

DUT type:	LHX+ 5kW	Test date:	2020.11.05 – 2020.11.10
DUT p/n:	29714-017	Firmware:	-
DUT s/n:	Engineering sample	Test also applies to p/n:	-
Test item: Determine the acoustic noise of the LHX+ 5kW			
Results: <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL <input type="checkbox"/> MIXED			
Document history:			
Revision	Date	Author	Description of changes
1.0	2020.11.10	DD	Initial release



Information about Producer:
Schroff GmbH
D-75334 Straubenhardt
nvent.com

The details in this manual have been carefully compiled and checked - supported by certified Quality Management System to EN ISO 9001/2000.

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1 Executive Summary

- **Noise measurement of the LHX+ 5kW performed**
- **The LHX+ 5kW was installed in a cabinet with defined air resistance to simulate real conditions**
 - Noise measurements were performed with closed doors @ different fan speed
 - Noise measurements were performed with open front door @ different fan speed
- **Results of the noise measurements:**
 - Results meet specifications

2 General Information

The actual analysis, and the actual temperature behavior, reflects the present measuring set-up.

3 Test purpose

In this report you will find the measurement results of the **acoustic noise measurement** (description see page 5).

The LHX+ 5kW was installed in a cabinet with defined air impedance to simulate real conditions. Furthermore the fans run at **different fan speed**.

4 Description of the test

The cabinet with LHX+ 5kW was placed on the floor and tested with the **sound intensity measuring method**. The cabinet was tested with closed doors as well as open front door. The operating conditions for the fan were 40%, 50%, 60%, 70%, 80%, 90% and 100% fan speed.

5 Test Setup

5.1 Test resources/equipment

5.1.1 Noise testing equipment

- Measurement of the sound intensity in accordance to DIN EN ISO 9614-2
- Determination of the sound power with the results from the sound intensity measurement
- Measurement in all rooms with constant background sound possible
- Determination of frequency spectrums of all measurement areas
- Measurement of sound pressure level



Figure 1 Acoustic Noise Equipment

- Measurement of mechanical vibration (oscillating acceleration) with acceleration sensor
- Sound Intensity Investigator B & K – 2260
- Microphone B & K – 4181
- Sound Level Calibrator B & K - 4231

5.2 Test object

Cabinet with LHX+ 5kW.



Figure 2 Noise measurement setup for LHX+ 5kW with closed doors_Front View



Figure 3 Noise measurement setup for LHX+ 5kW with closed doors_Rear view



Perforated sheet metal to simulate air resistance to the fans

LHX+ 5kW

Figure 4 Noise measurement setup for LHX+ 5kW with open front door_Front View

6 Results

6.1 Overview

Fan Speed (%)	Closed doors		Open front door	
	Sound Power L _{WA} [dB(A)]	Sound Pressure L _{PA} [dB(A)] 0,2m distance	Sound Power L _{WA} [dB(A)]	Sound Pressure L _{PA} [dB(A)] 0,2m distance
100	72,6	65,8	88,0	81,7
90	71,2	64,6	85,8	79,4
80	68,3	61,5	83,1	76,6
70	64,8	58,1	79,0	72,6
60	60,7	54,4	74,3	67,9
50	55,7	50,4	68,8	62,6
40	-	-	62,5	56,4

Table 1 Overview

Fan Speed 100% - Closed doors

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} 72,6 dB(A)

Sound Pressure LPA 65,8 dB(A)

Measurement distance 0,2m



Figure 5 Fan Speed 100% - Closed doors_1

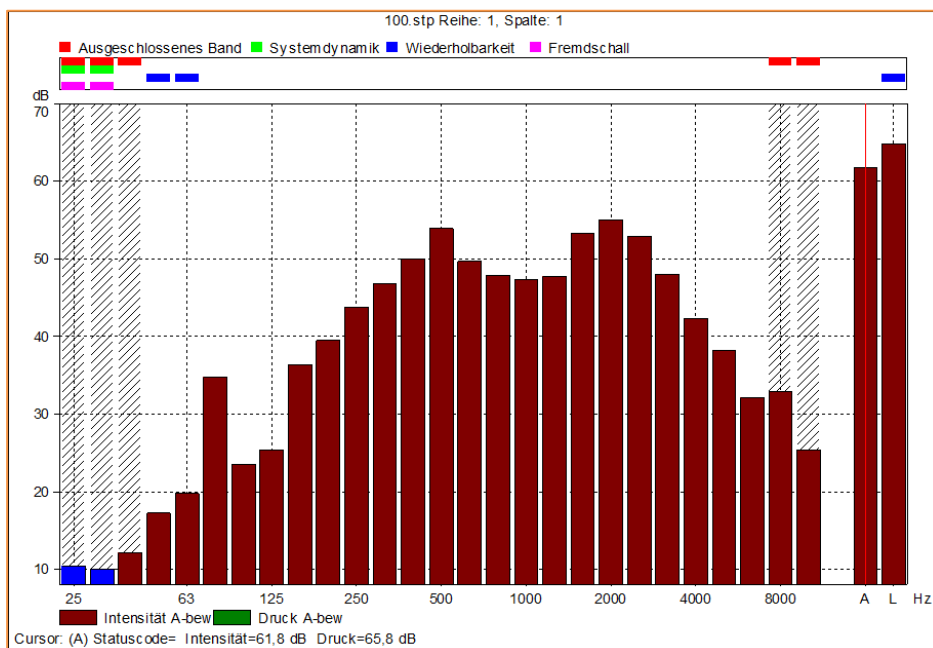


Figure 6 Fan Speed 100% - Closed doors_2

Fan Speed 90% - Closed doors

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} 71,2 dB(A)

Sound Pressure LPA 64,6 dB(A)

Measurement distance 0,2m

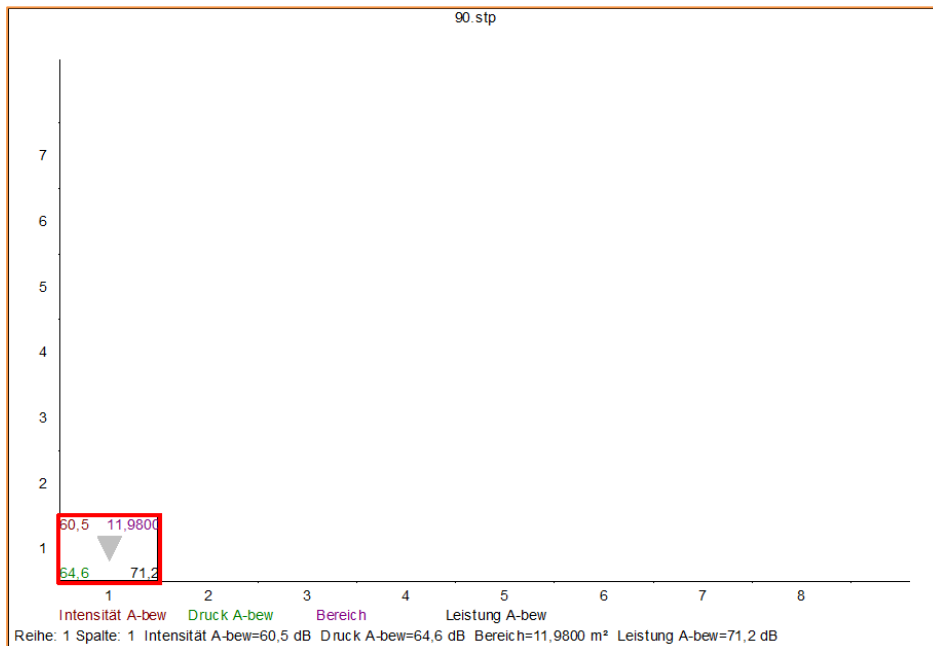


Figure 7 Fan Speed 90% - Closed doors_1

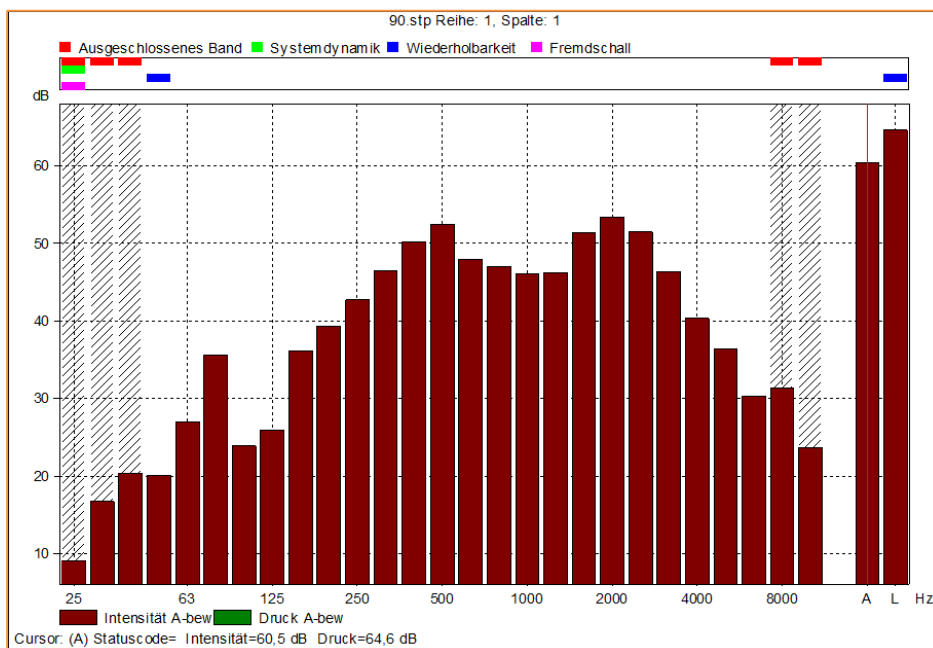


Figure 8 Fan Speed 90% - Closed doors_2

Fan Speed 80% - Closed doors

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} 68,3 dB(A)

Sound Pressure LPA 61,5 dB(A)

Measurement distance 0,2m

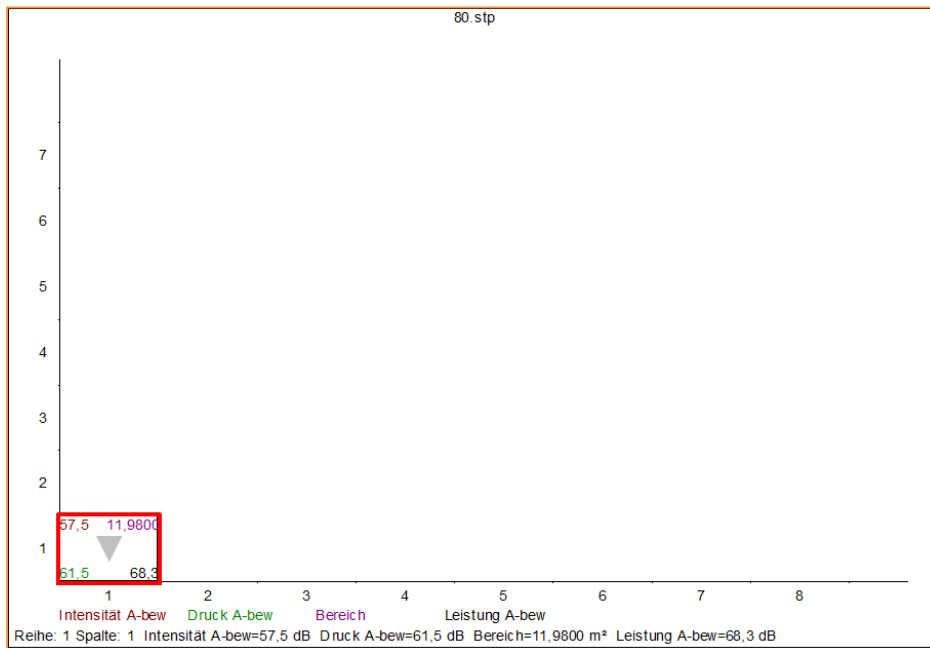


Figure 9 Fan Speed 80% - Closed doors_1

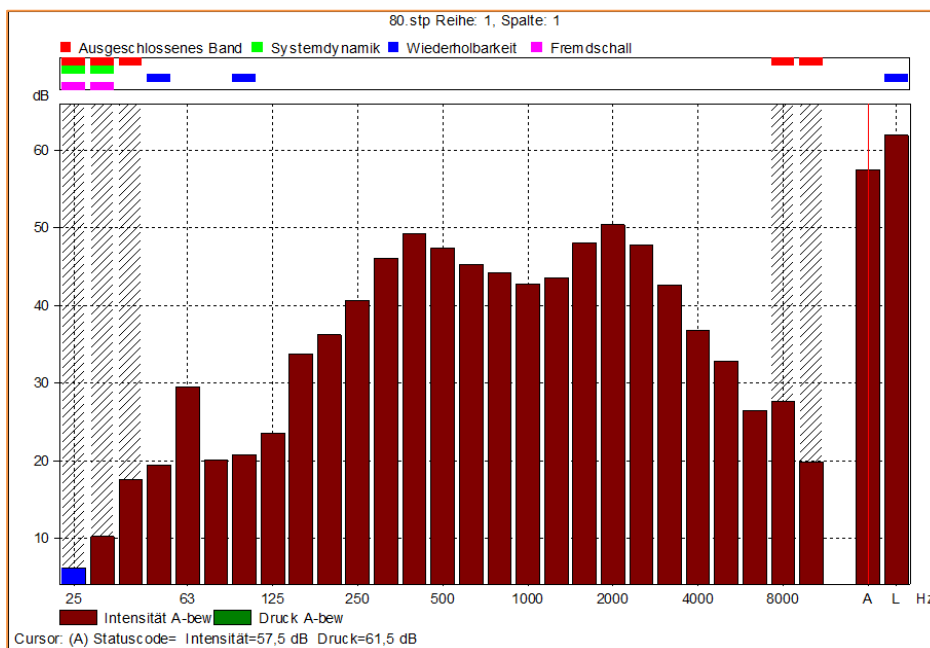


Figure 10 Fan Speed 80% - Closed doors_2

Fan Speed 70% - Closed doors

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **64,8 dB(A)**

Sound Pressure LPA **58,1 dB(A)**

Measurement distance 0,2m

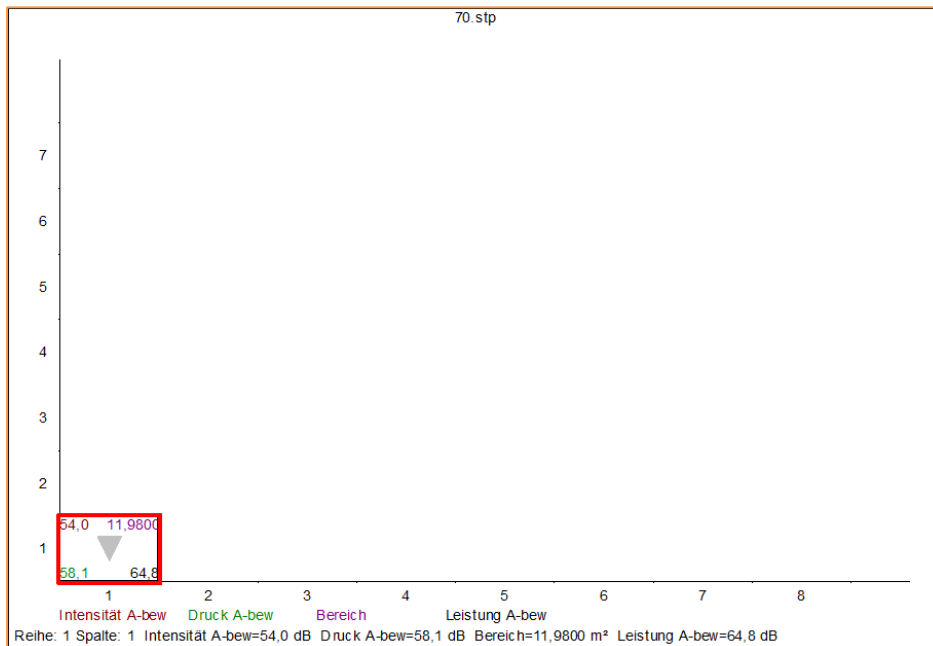


Figure 11 Fan Speed 70% - Closed doors_1

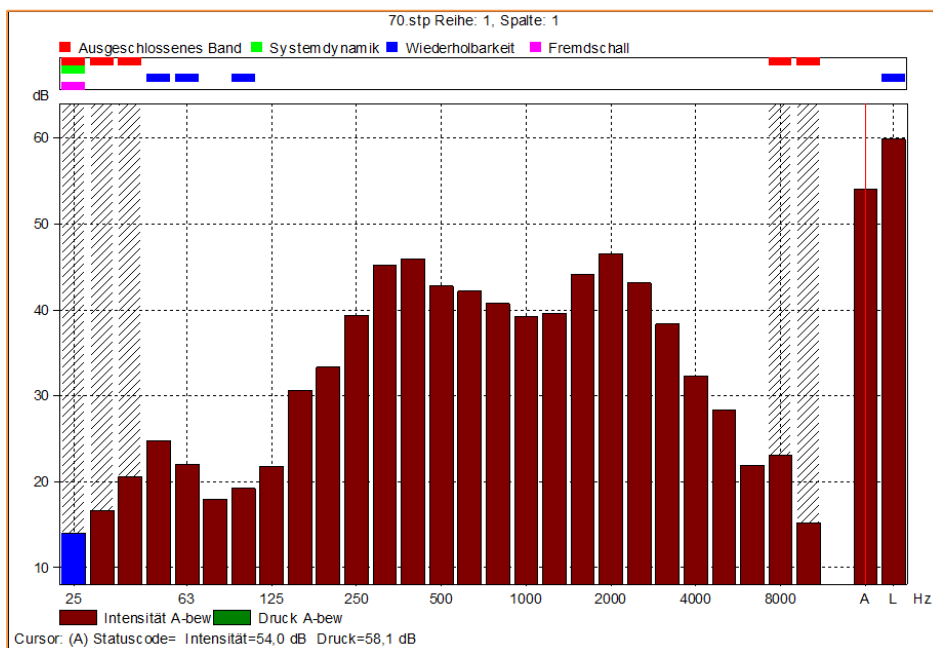


Figure 12 Fan Speed 70% - Closed doors_2

Fan Speed 60% - Closed doors

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} 60,7 dB(A)

Sound Pressure LPA 54,4 dB(A)

Measurement distance 0,2m

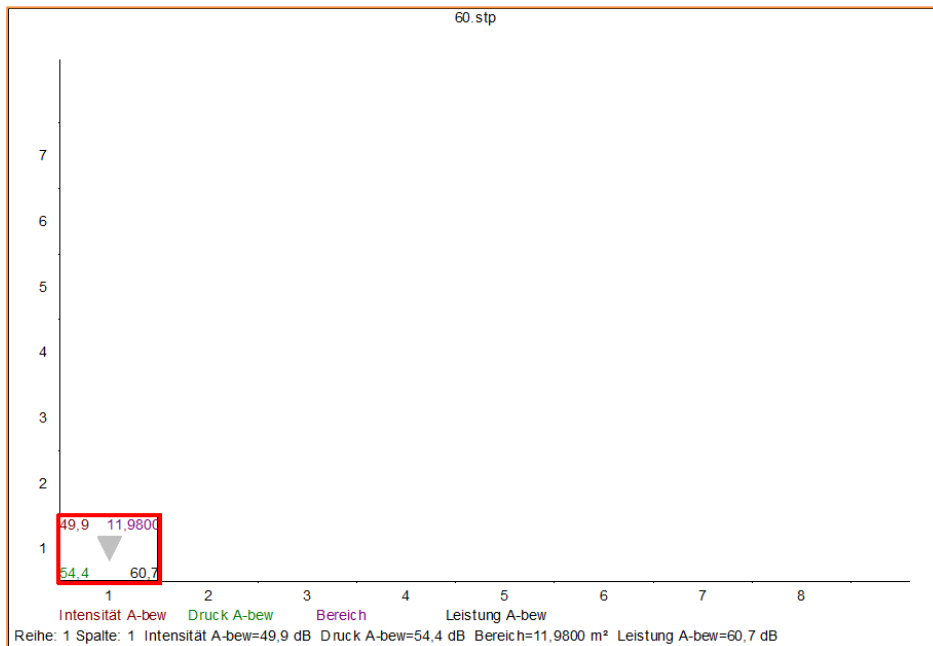


Figure 13 Fan Speed 60% - Closed doors_1

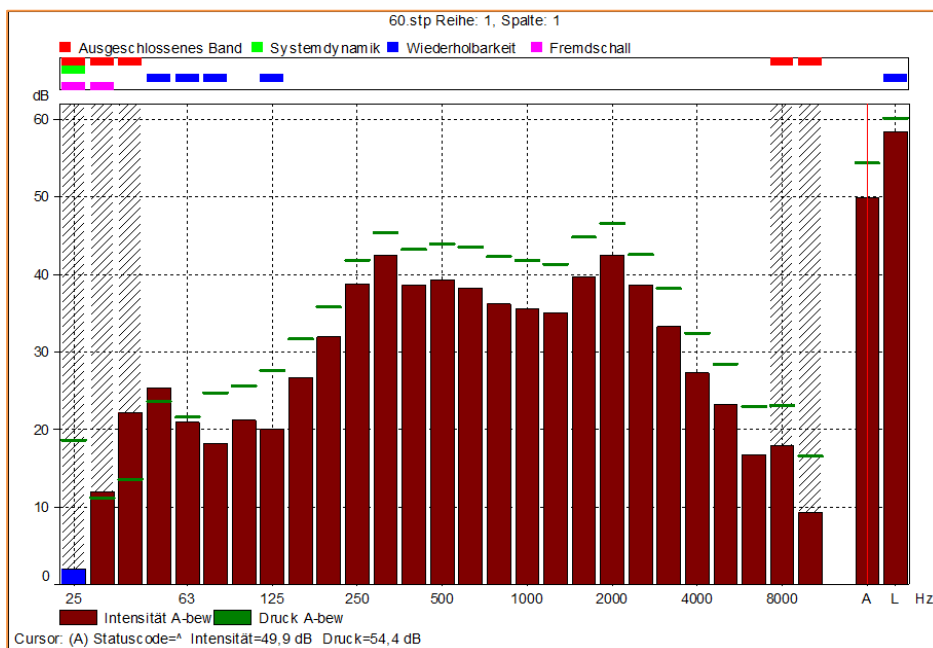


Figure 14 Fan Speed 60% - Closed doors_2

Fan Speed 50% - Closed doors

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **55,7 dB(A)**

Sound Pressure LPA **50,4 dB(A)**

Measurement distance 0,2m

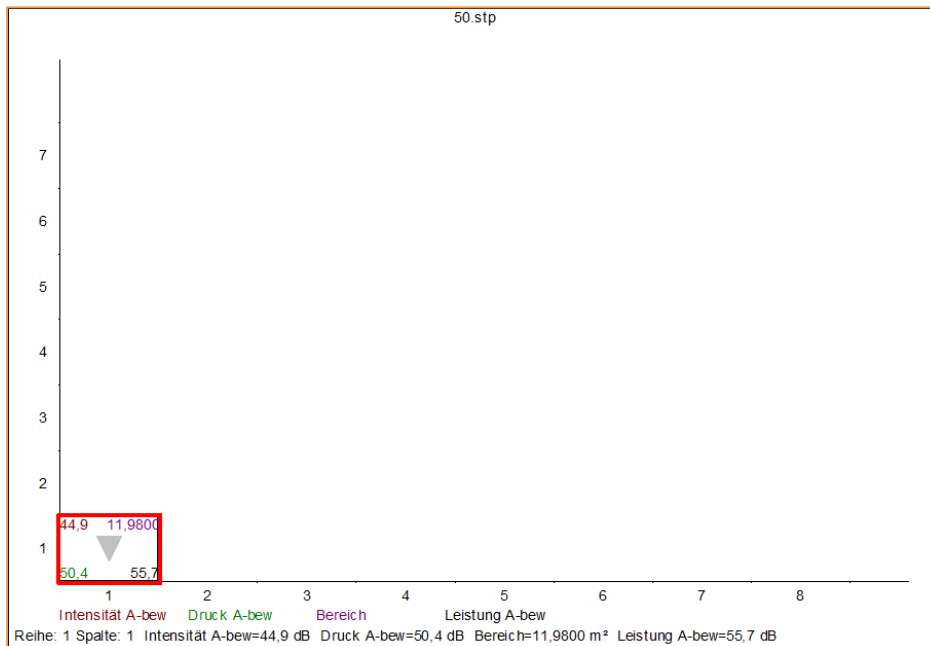


Figure 15 Fan Speed 50% - Closed doors_1

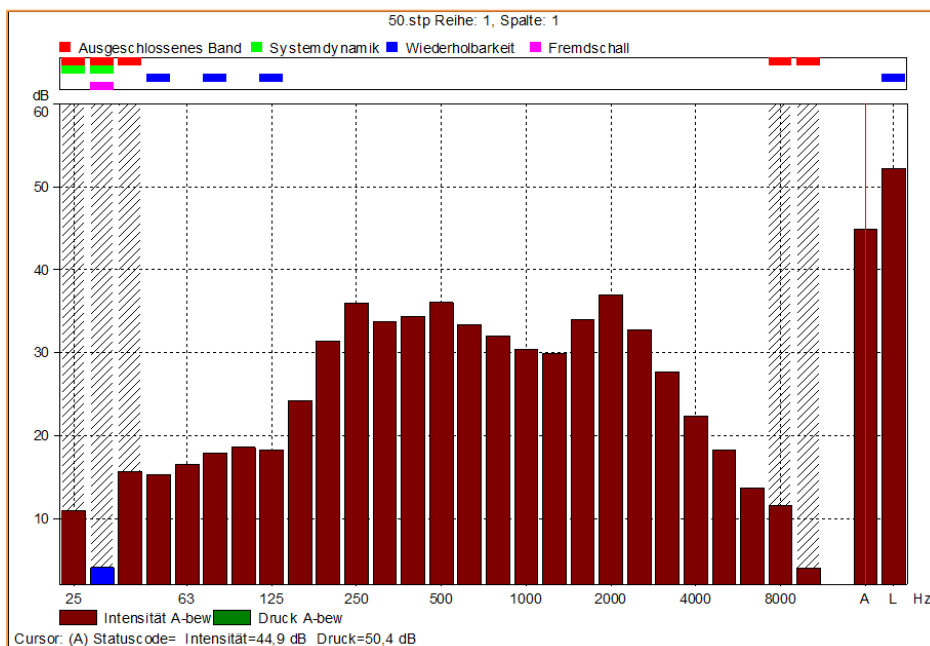


Figure 16 Fan Speed 50% - Closed doors_2

Fan Speed 100% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} 88,0 dB(A)

Sound Pressure LPA 81,7 dB(A)

Measurement distance 0,2m

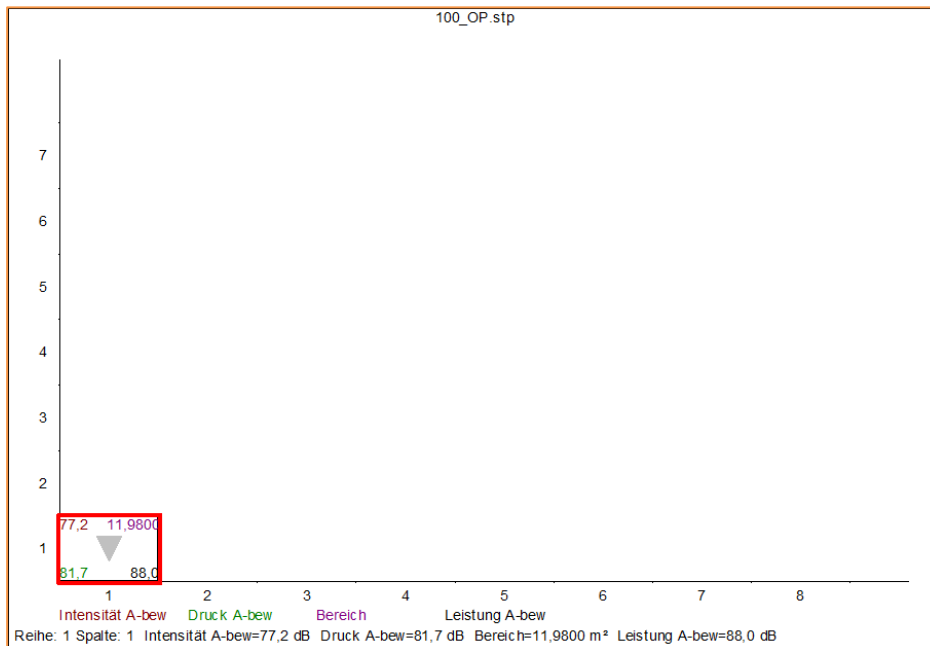


Figure 17 Fan Speed 100% - Open front door_1

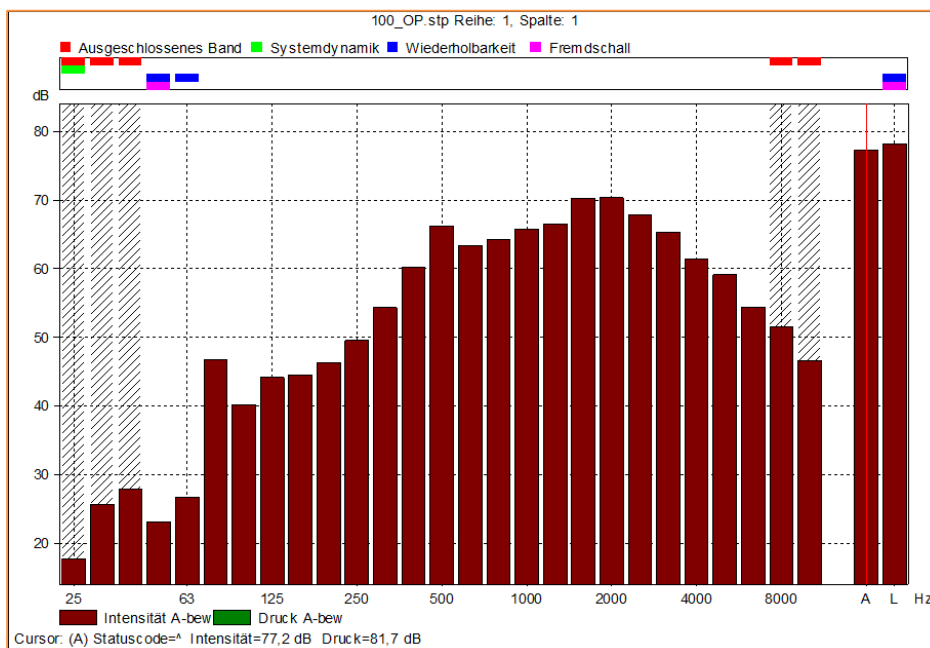


Figure 18 Fan Speed 100% - Open front door_2

Fan Speed 90% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} 85,8 dB(A)

Sound Pressure LPA 79,4 dB(A)

Measurement distance 0,2m

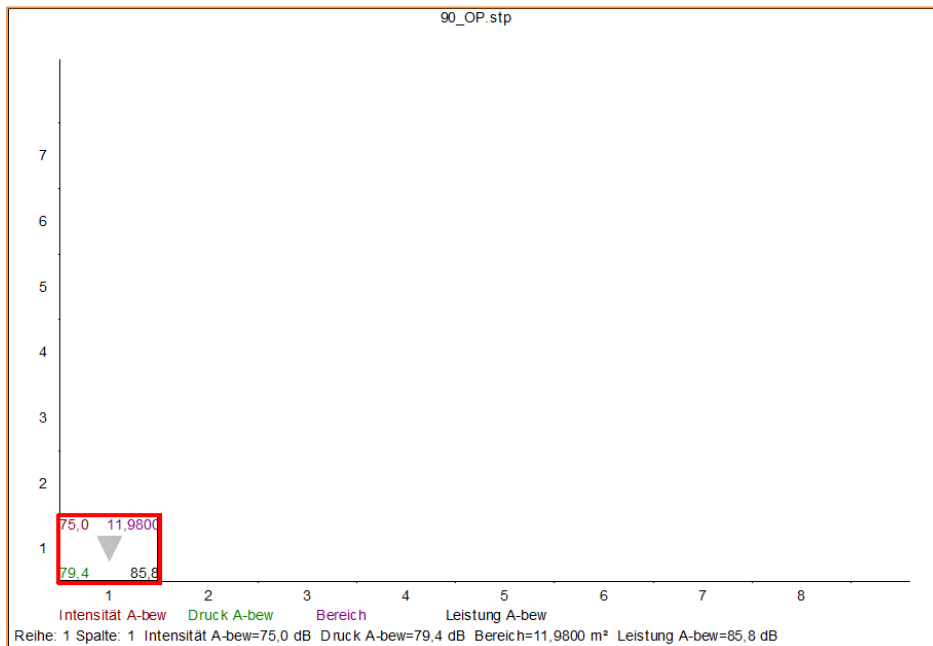


Figure 19 Fan Speed 90% - Open front door_1

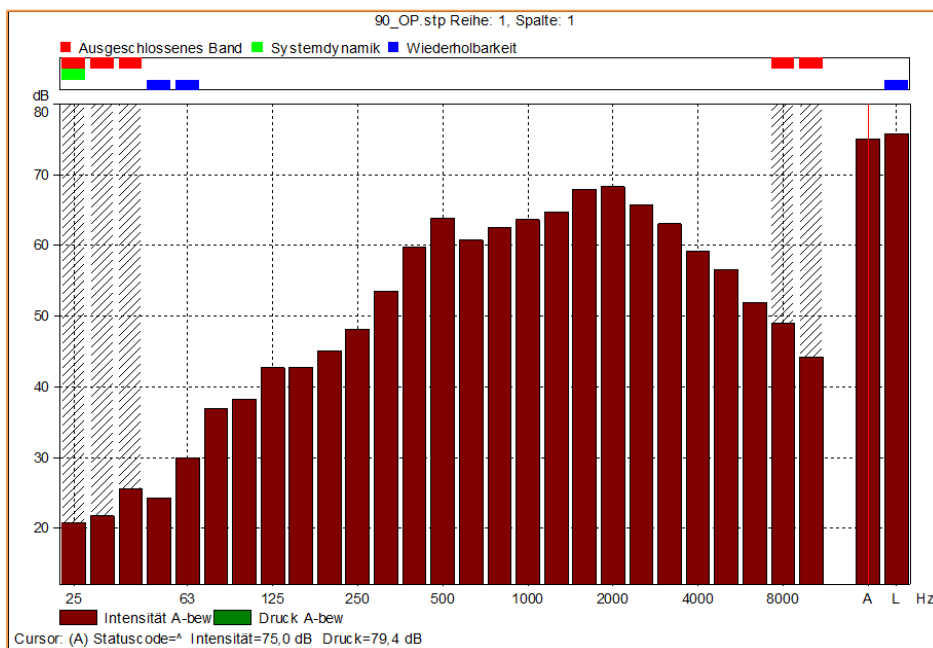


Figure 20 Fan Speed 90% - Open front door_2

Fan Speed 80% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **83,1 dB(A)**

Sound Pressure LPA **76,6 dB(A)**

Measurement distance 0,2m

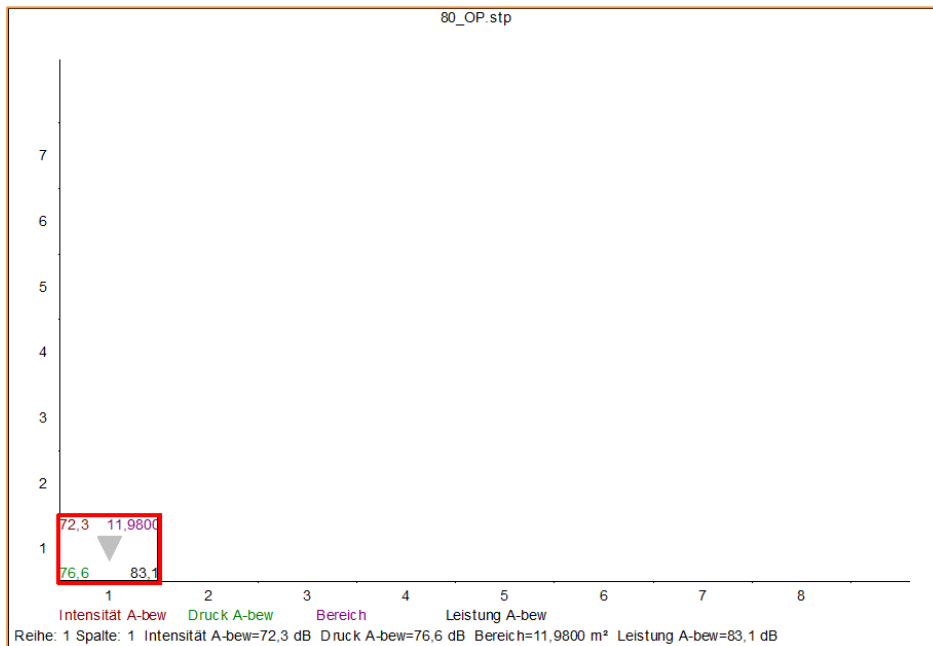


Figure 21 Fan Speed 80% - Open front door_1

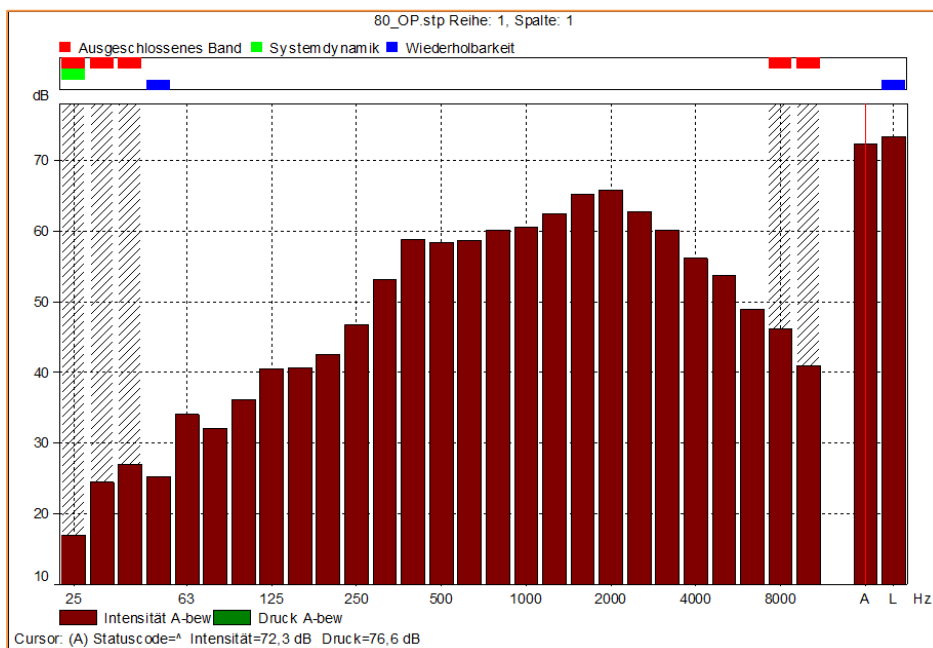


Figure 22 Fan Speed 80% - Open front door_2

Fan Speed 70% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **79,0 dB(A)**

Sound Pressure LPA **72,6 dB(A)**

Measurement distance 0,2m

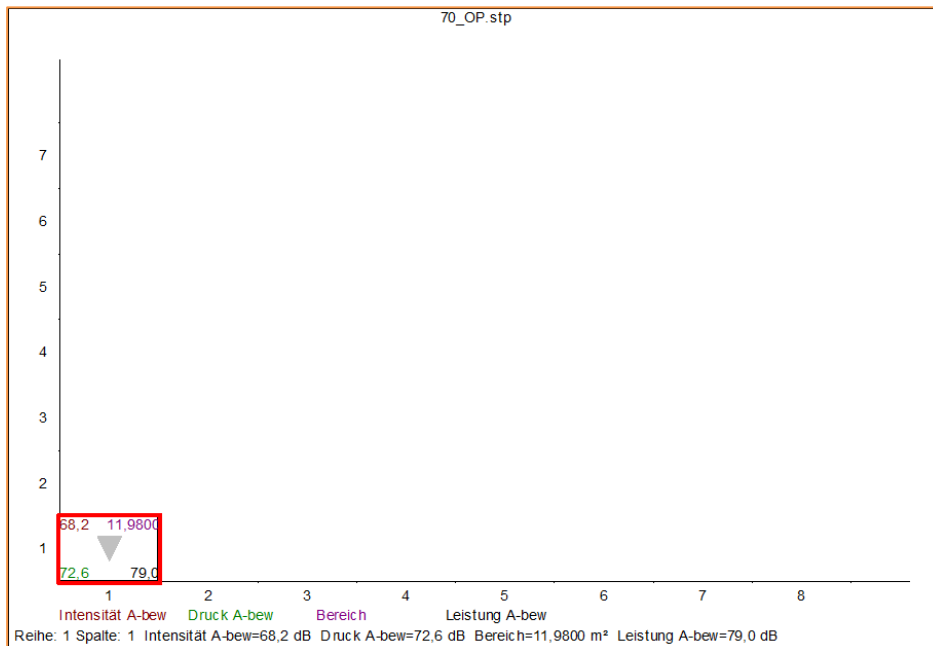


Figure 23 Fan Speed 70% - Open front door_1

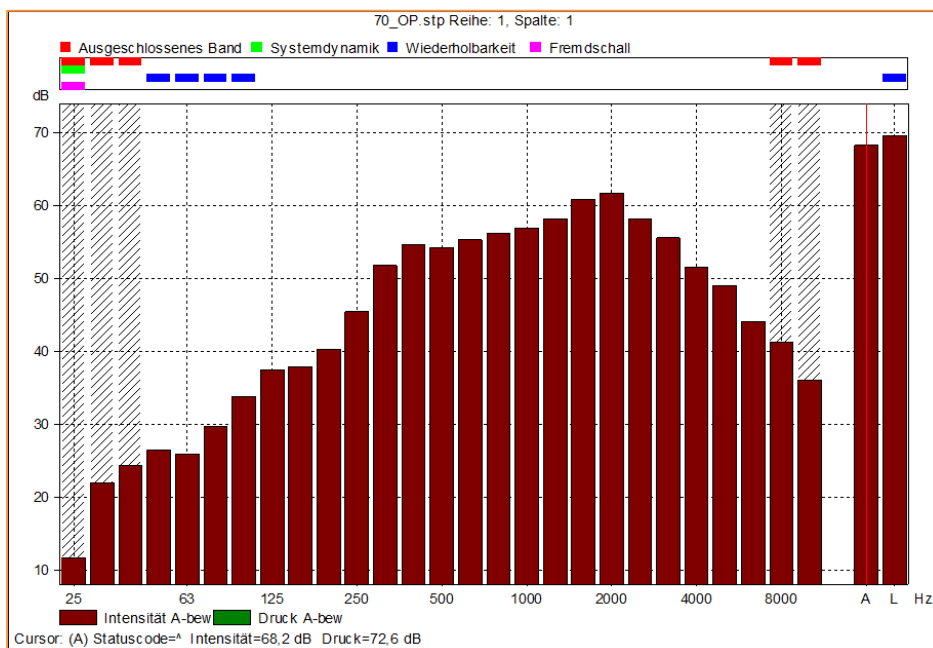


Figure 24 Fan Speed 70% - Open front door_2

Fan Speed 60% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **74,3 dB(A)**

Sound Pressure LPA **67,9 dB(A)**

Measurement distance 0,2m

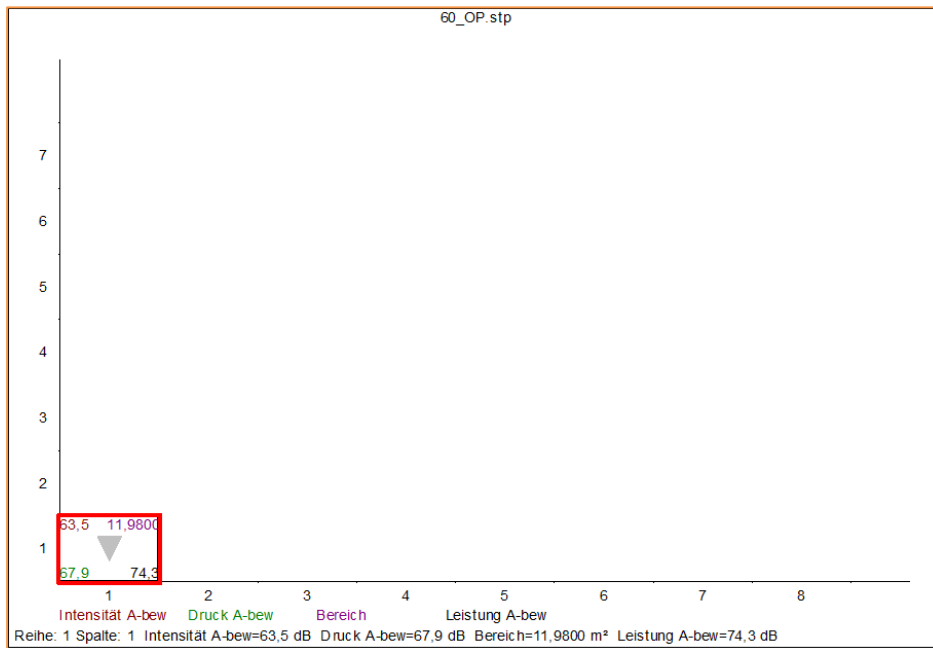


Figure 25 Fan Speed 60% - Open front door_1

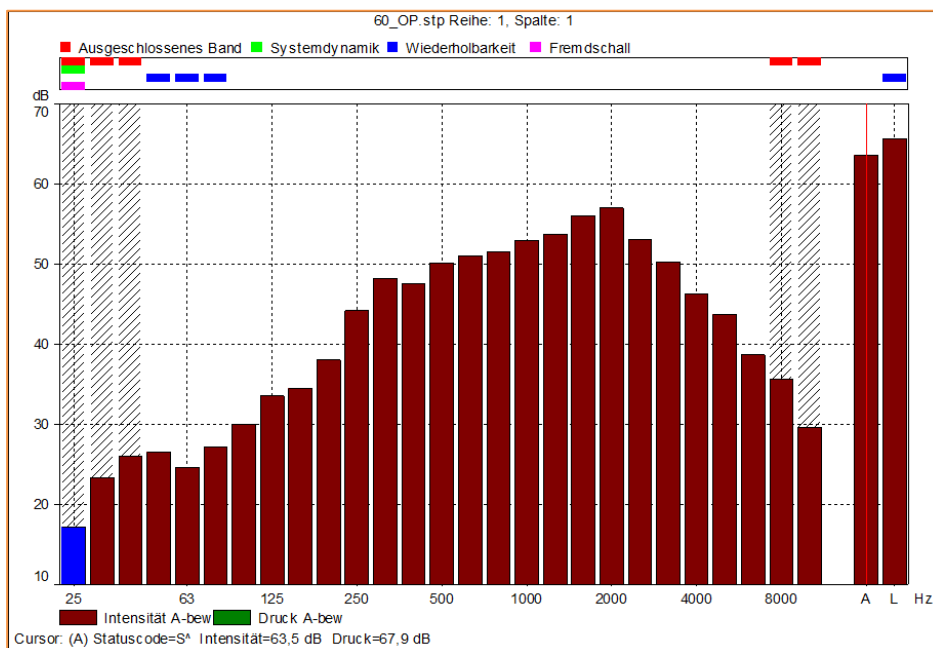


Figure 26 Fan Speed 60% - Open front door_2

Fan Speed 50% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **68,8 dB(A)**

Sound Pressure LPA **62,6 dB(A)**

Measurement distance 0,2m

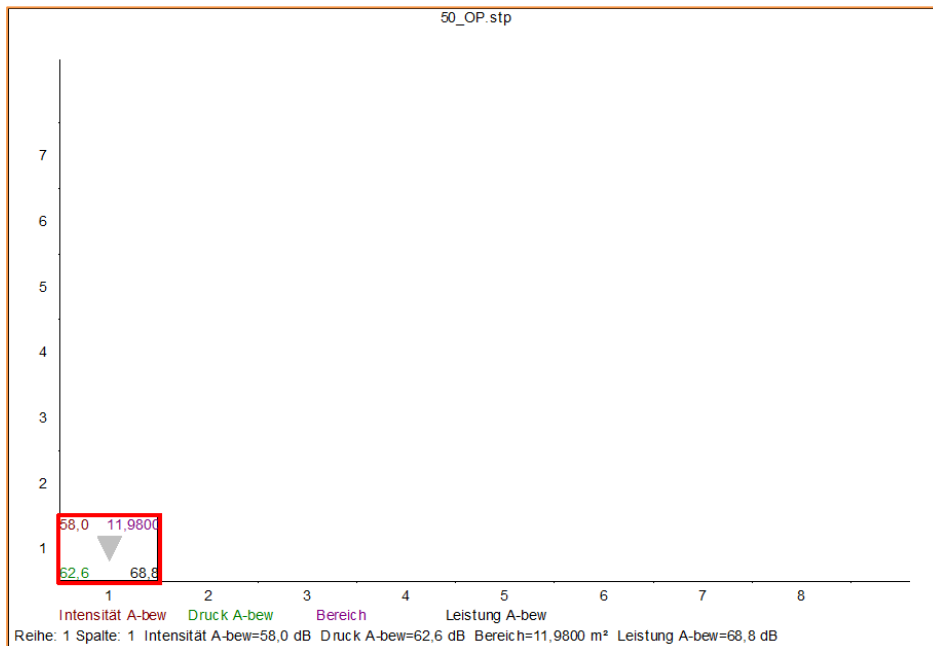


Figure 27 Fan Speed 50% - Open front door_1

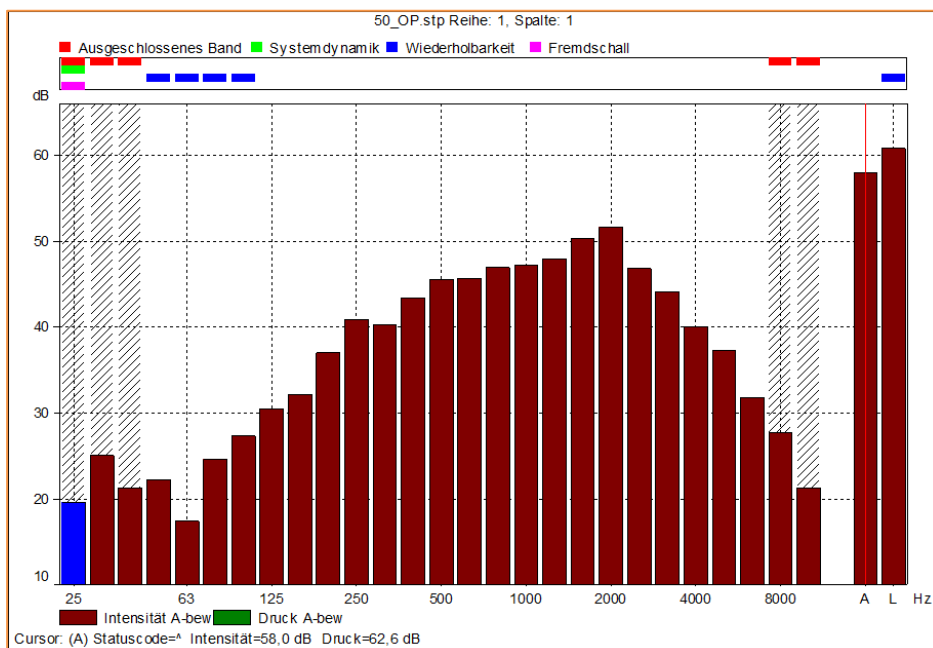


Figure 28 Fan Speed 50% - Open front door_2

Fan Speed 40% - Open front door

Sound Intensity Measurement

Sound Power according EN ISO 9614, Part 2

Sound Power L_{WA} **62,5 dB(A)**

Sound Pressure LPA **56,4 dB(A)**

Measurement distance 0,2m

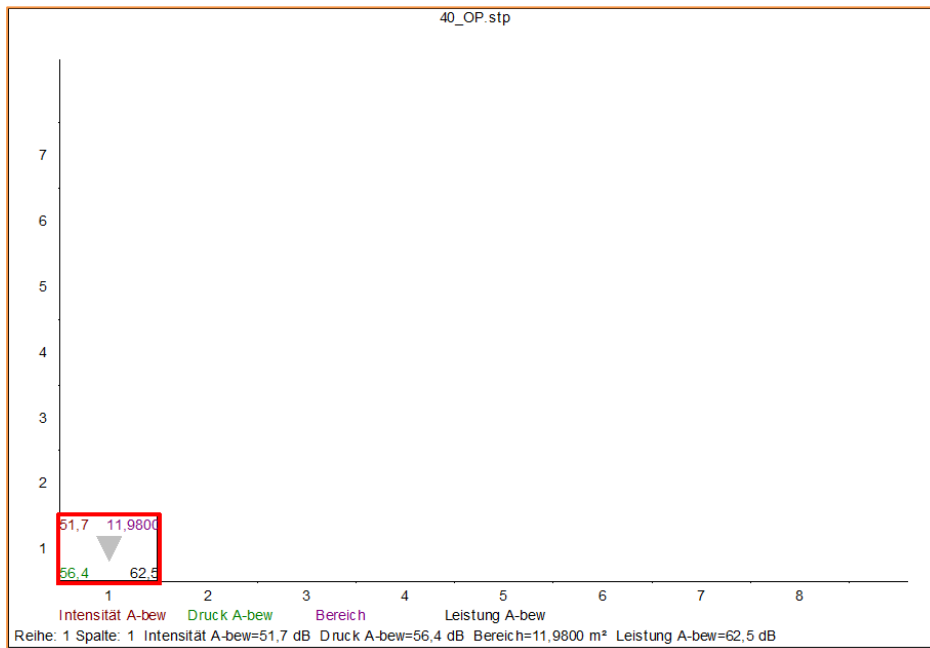


Figure 29 Fan Speed 40% - Open front door_1

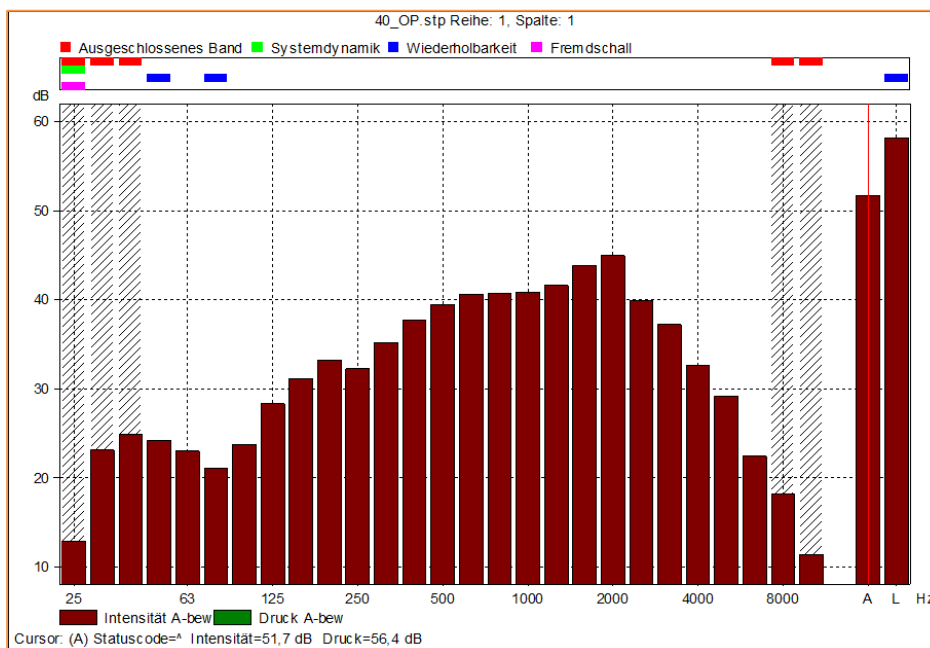


Figure 30 Fan Speed 40% - Open front door_2

7 Summary

- **Noise measurement of the LHX+ 5kW performed**
- **The LHX+ 5kW was installed in a cabinet with defined air resistance to simulate real conditions**
 - Noise measurements were performed with closed doors @ different fan speed
 - Noise measurements were performed with open front door @ different fan speed
- **Results of the noise measurements:**
 - Results meet specifications