

# 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:  
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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 <sub>WA</sub> [dB(A)]	Sound Pressure L <sub>PA</sub> [dB(A)] 0,2m distance	Sound Power L <sub>WA</sub> [dB(A)]	Sound Pressure L <sub>PA</sub> [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

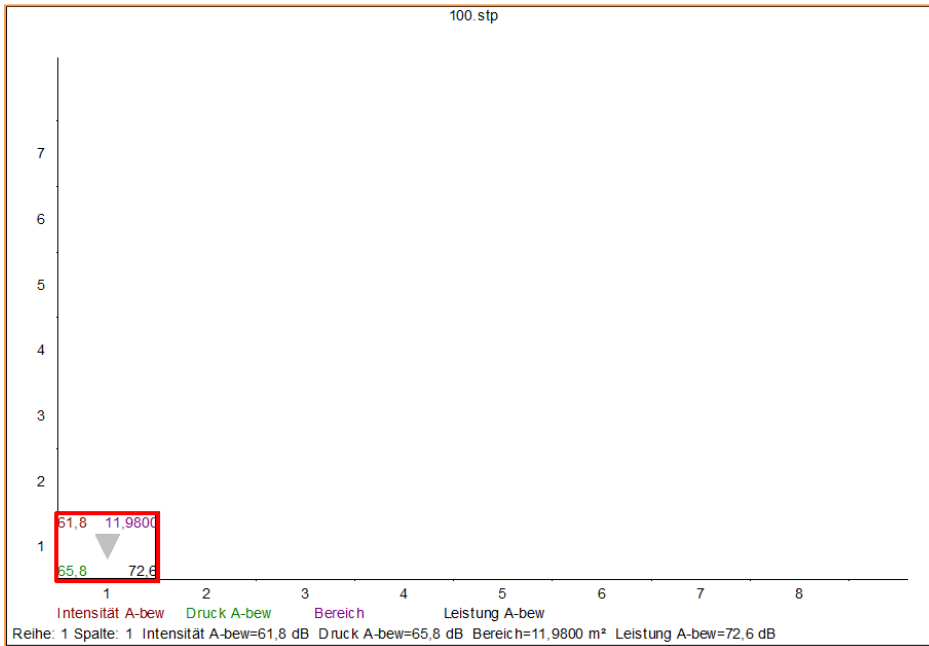


Figure 5 Fan Speed 100% - Closed doors\_1

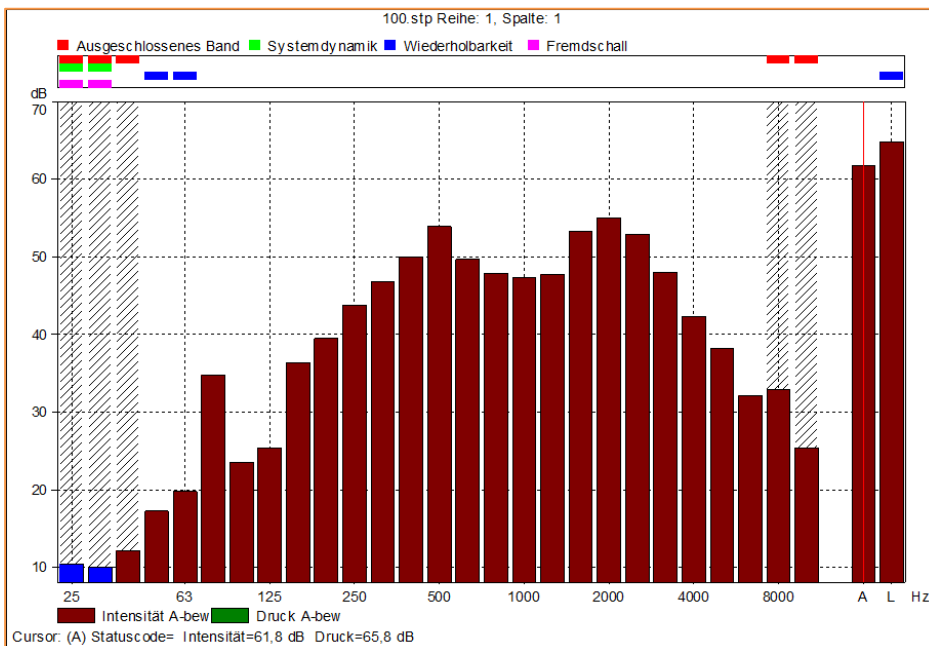


Figure 6 Fan Speed 100% - Closed doors\_2

**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  $L_{PA}$  64,6 dB(A)**

Measurement distance 0,2m

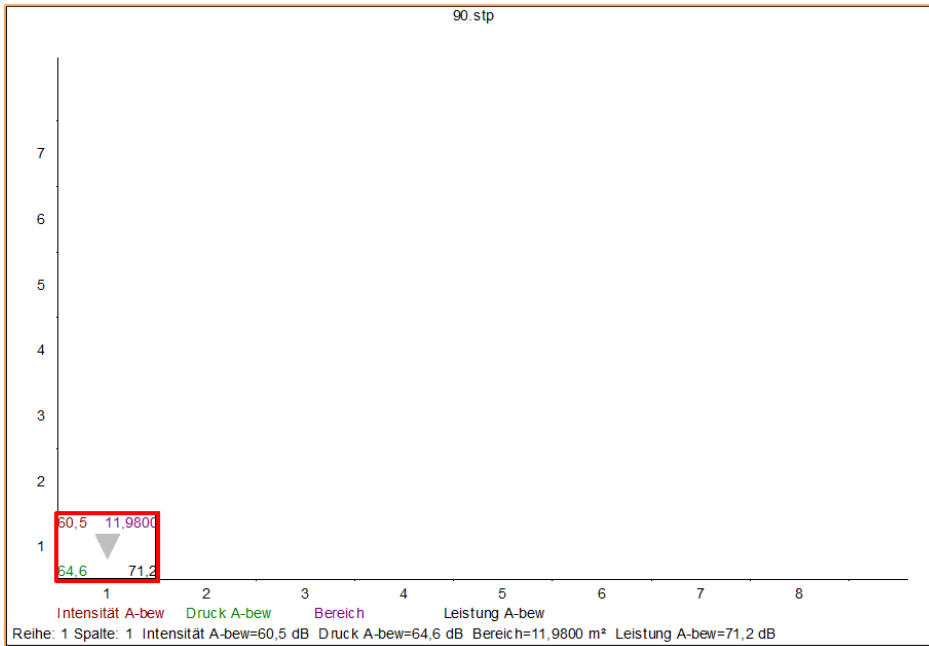


Figure 7 Fan Speed 90% - Closed doors\_1

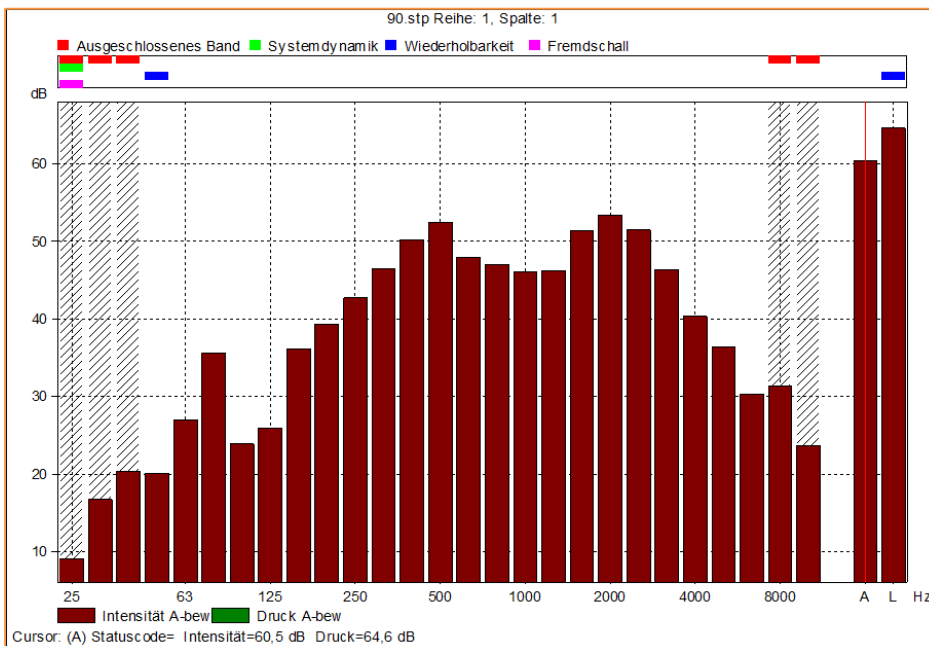


Figure 8 Fan Speed 90% - Closed doors\_2

**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

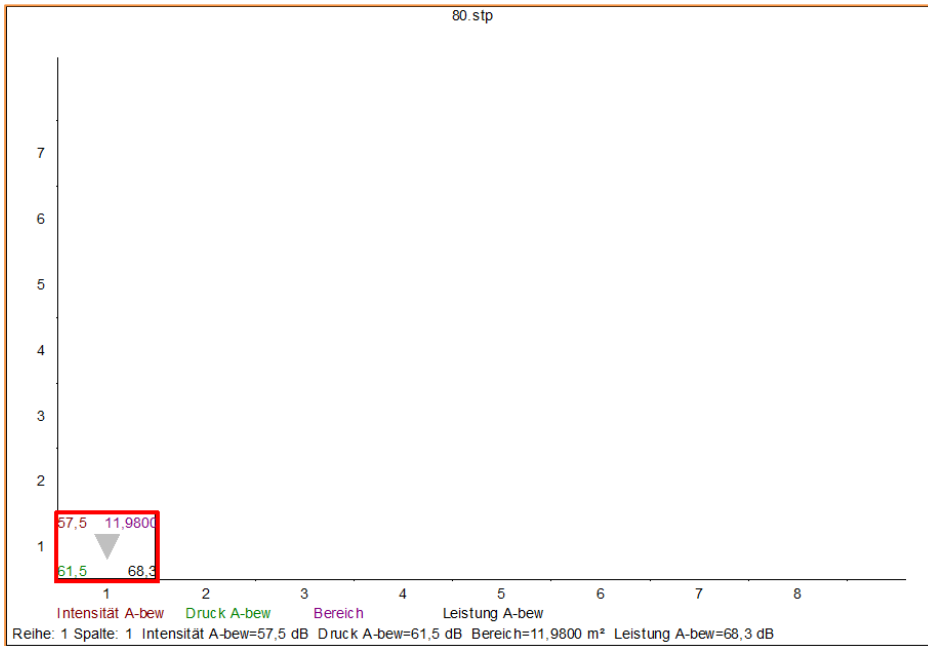


Figure 9 Fan Speed 80% - Closed doors\_1

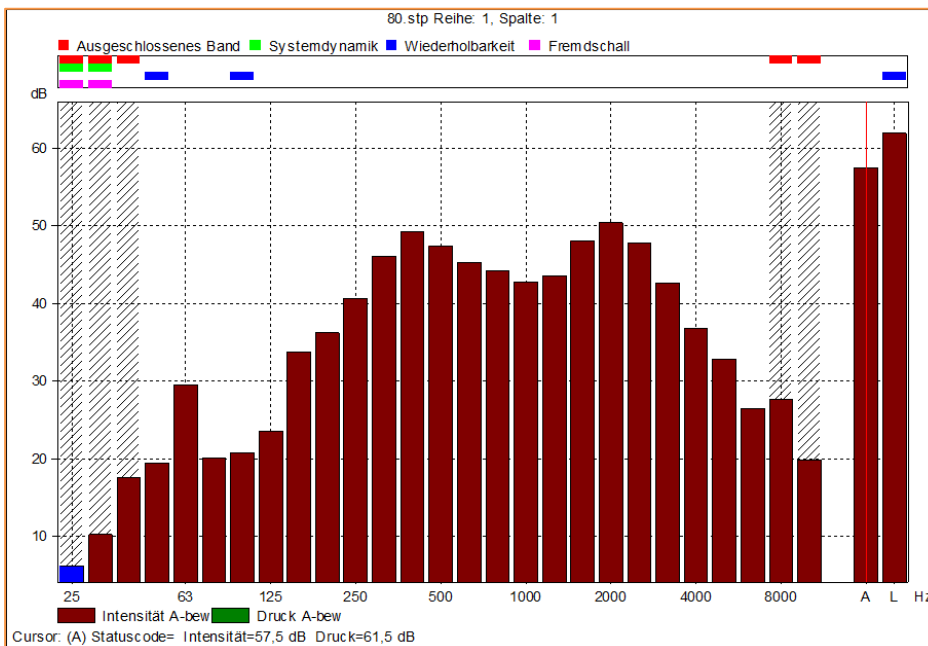


Figure 10 Fan Speed 80% - Closed doors\_2

**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

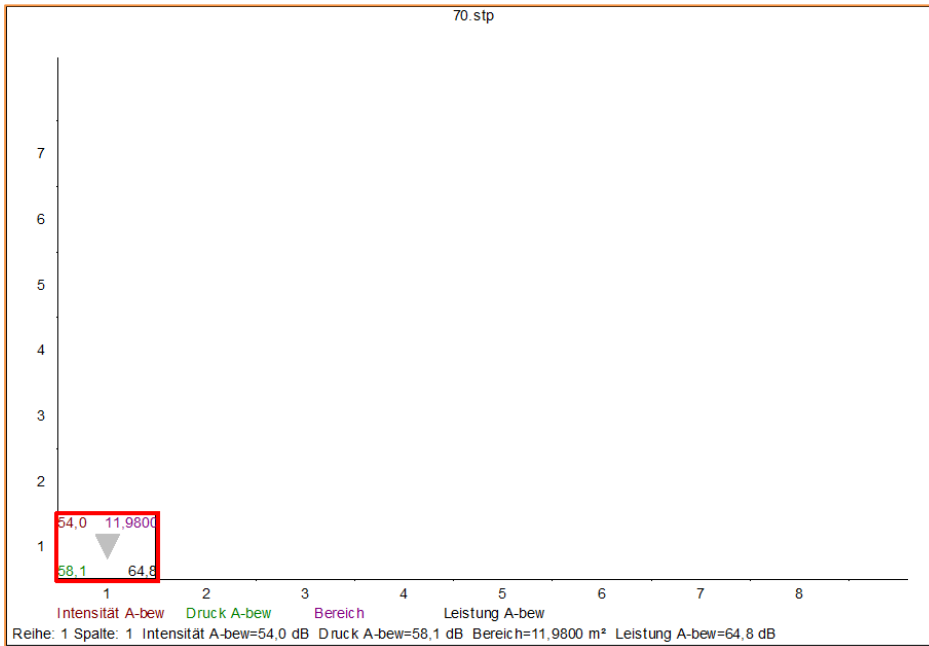


Figure 11 Fan Speed 70% - Closed doors\_1

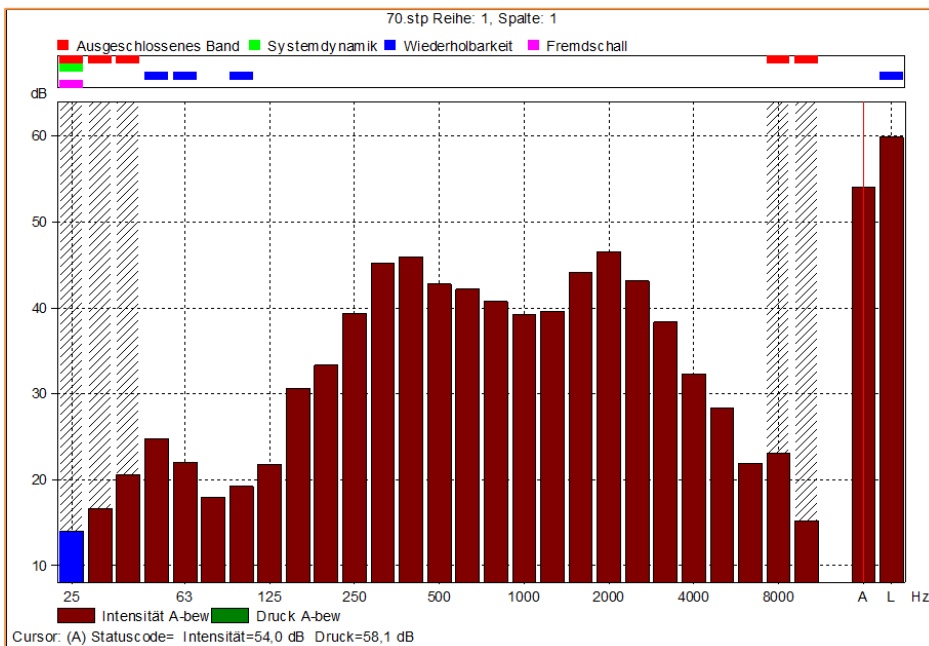


Figure 12 Fan Speed 70% - Closed doors\_2

**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

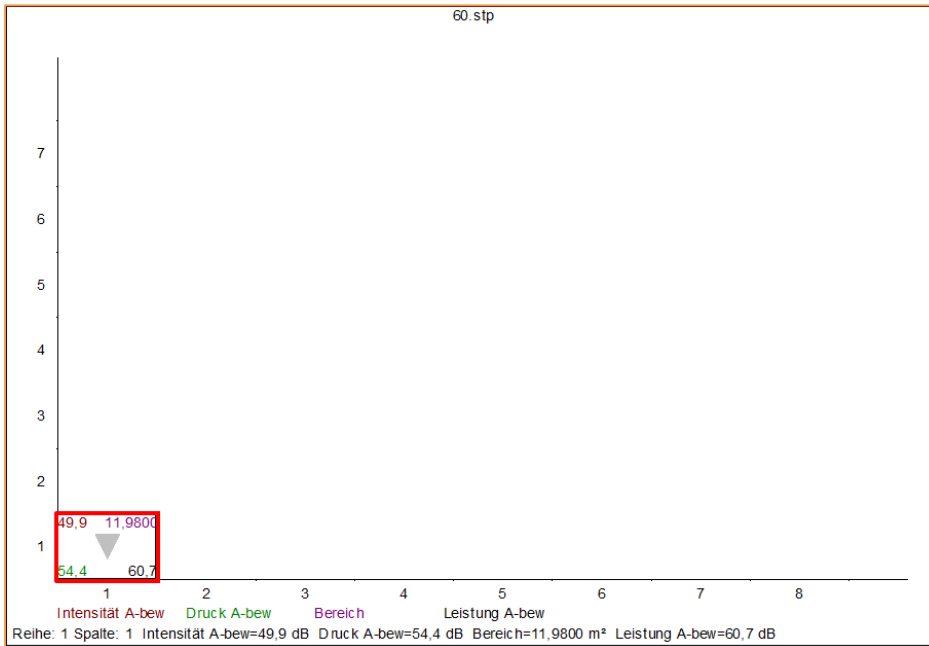


Figure 13 Fan Speed 60% - Closed doors\_1

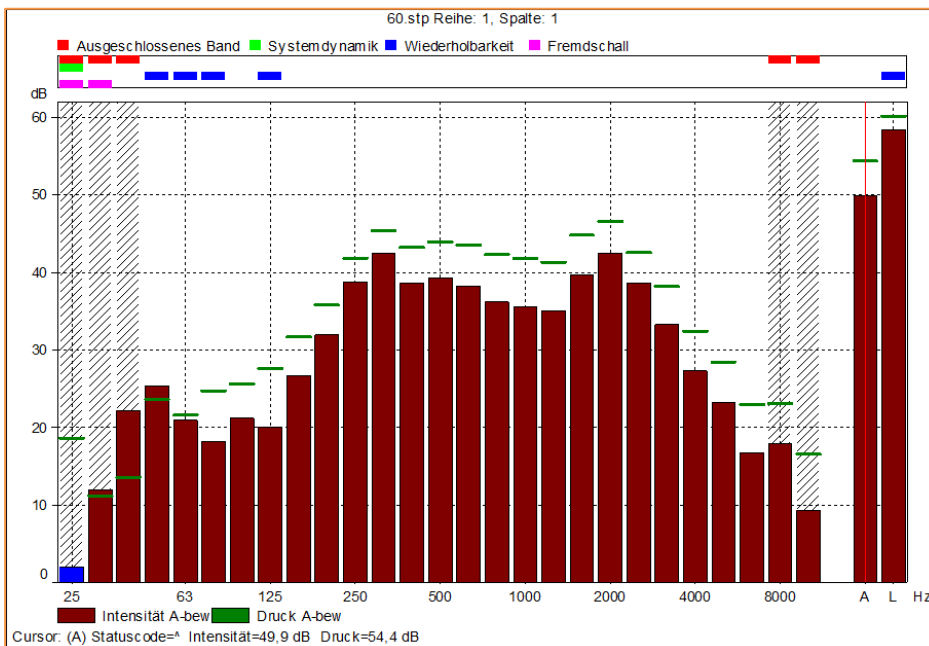


Figure 14 Fan Speed 60% - Closed doors\_2

**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

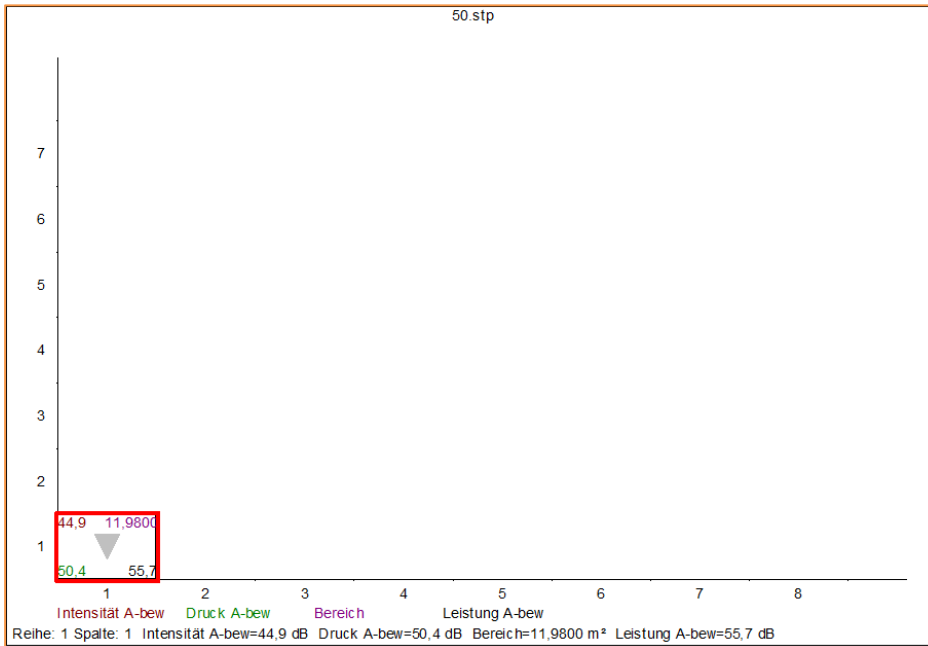


Figure 15 Fan Speed 50% - Closed doors\_1

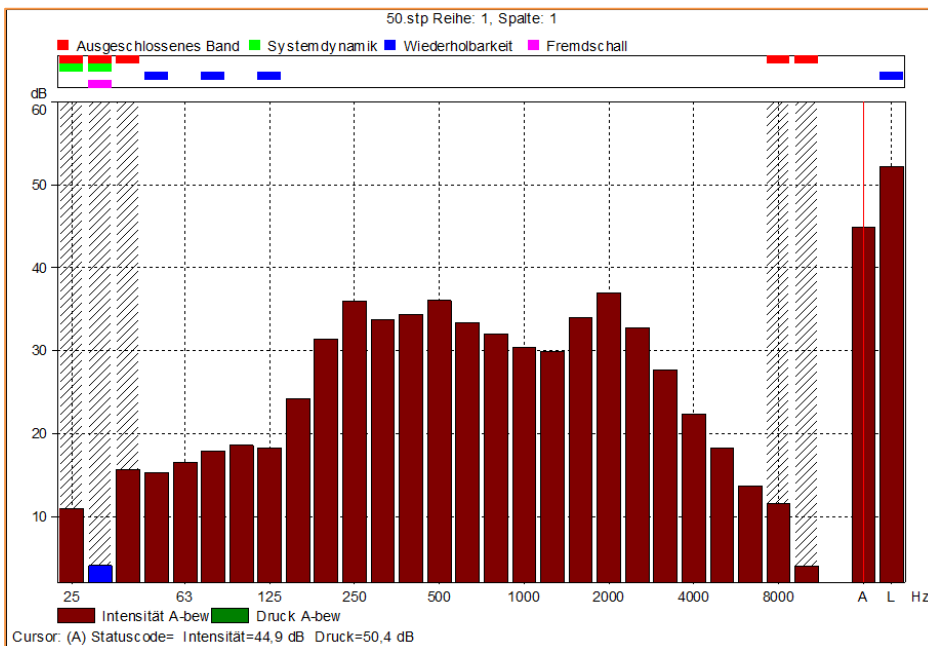


Figure 16 Fan Speed 50% - Closed doors\_2

**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

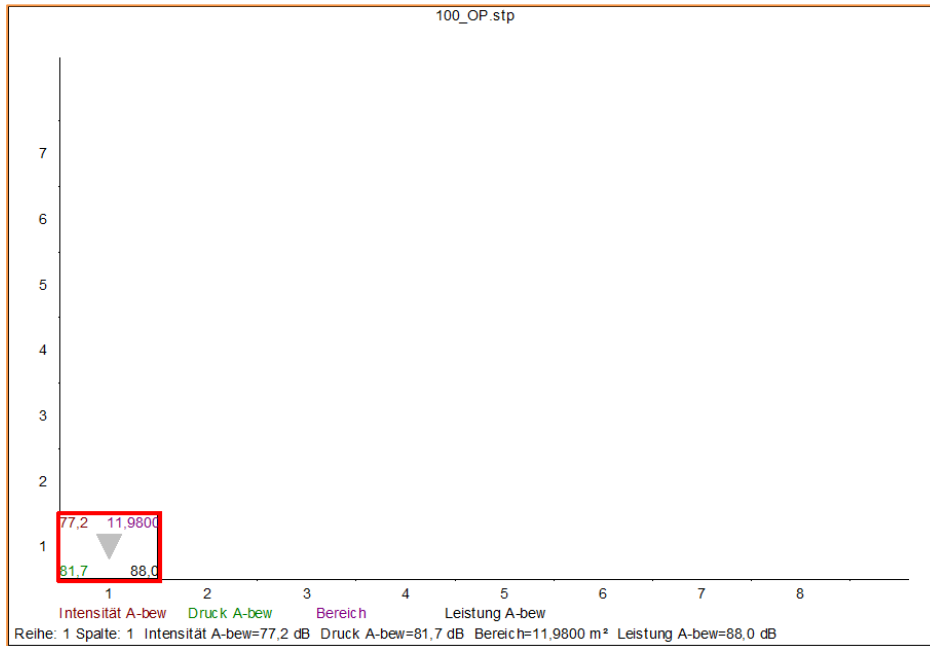


Figure 17 Fan Speed 100% - Open front door\_1

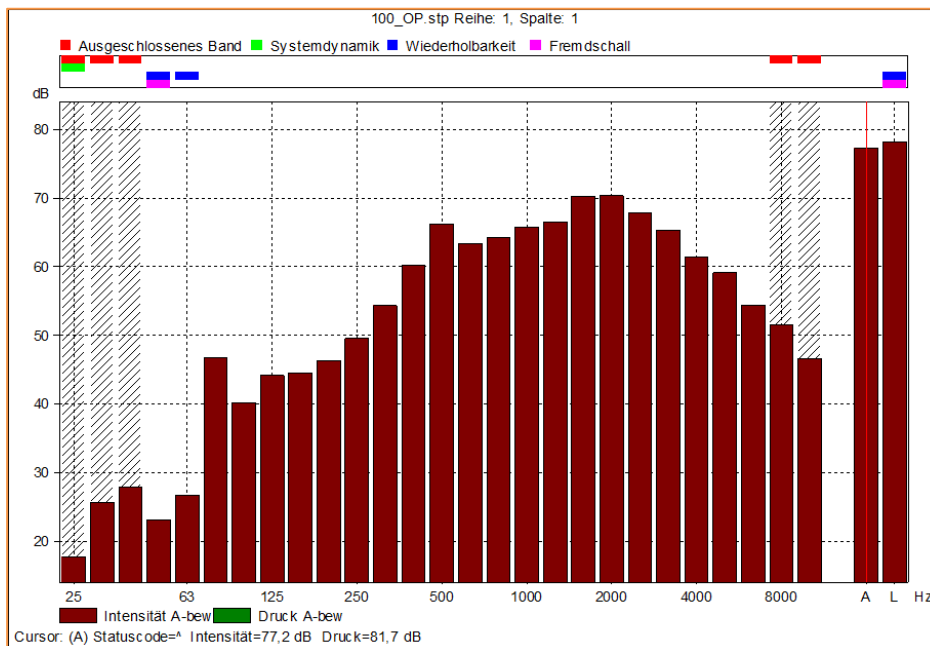


Figure 18 Fan Speed 100% - Open front door\_2



**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

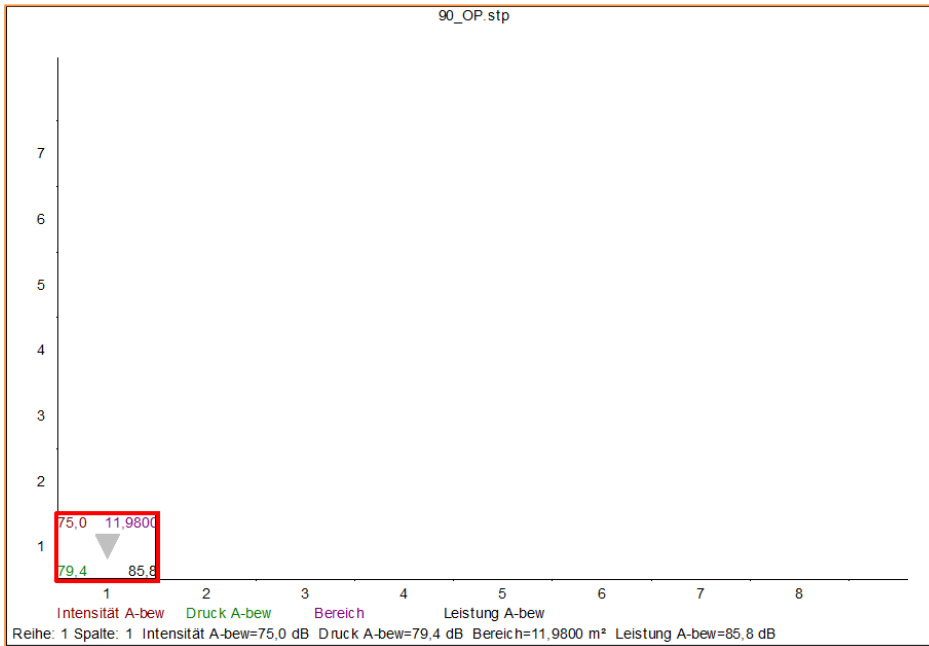


Figure 19 Fan Speed 90% - Open front door\_1

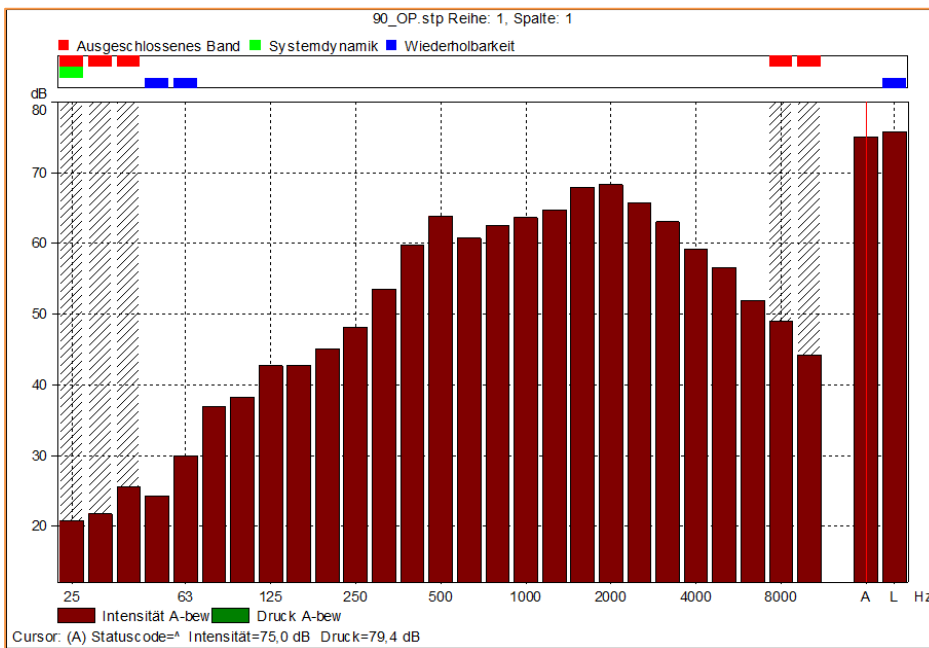


Figure 20 Fan Speed 90% - Open front door\_2

**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

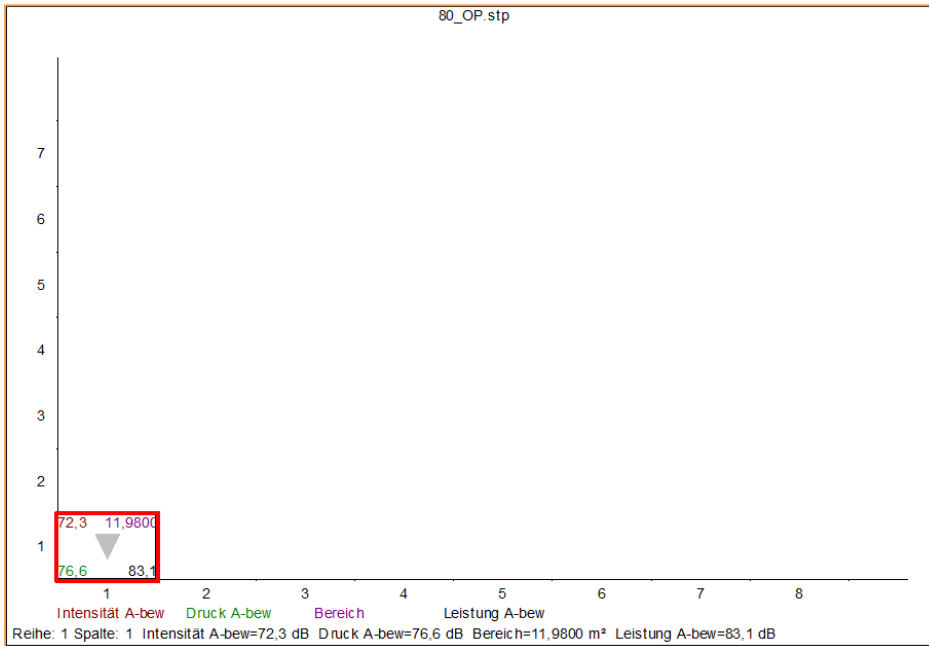


Figure 21 Fan Speed 80% - Open front door\_1

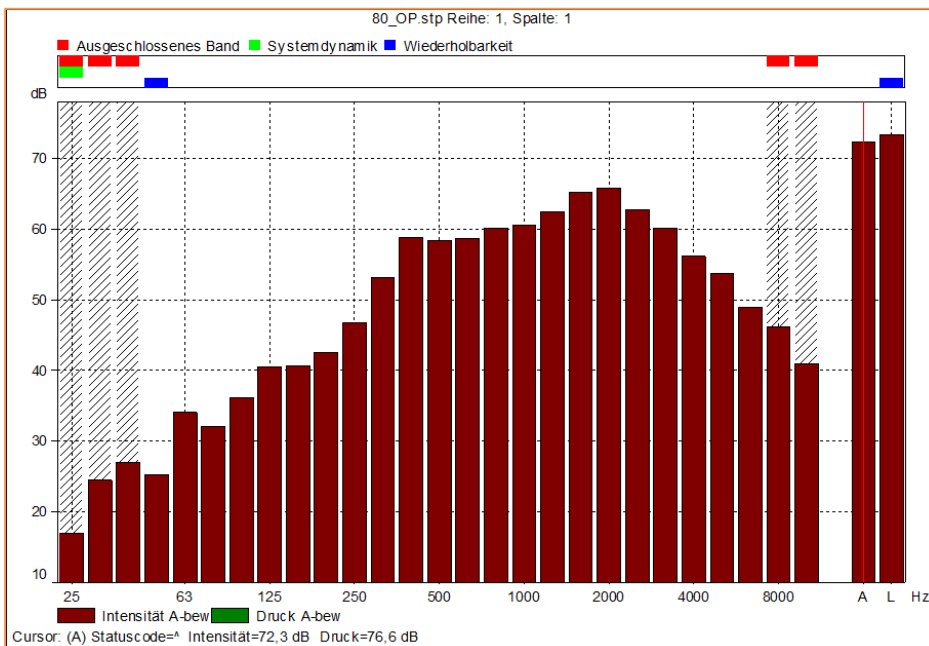


Figure 22 Fan Speed 80% - Open front door\_2

**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

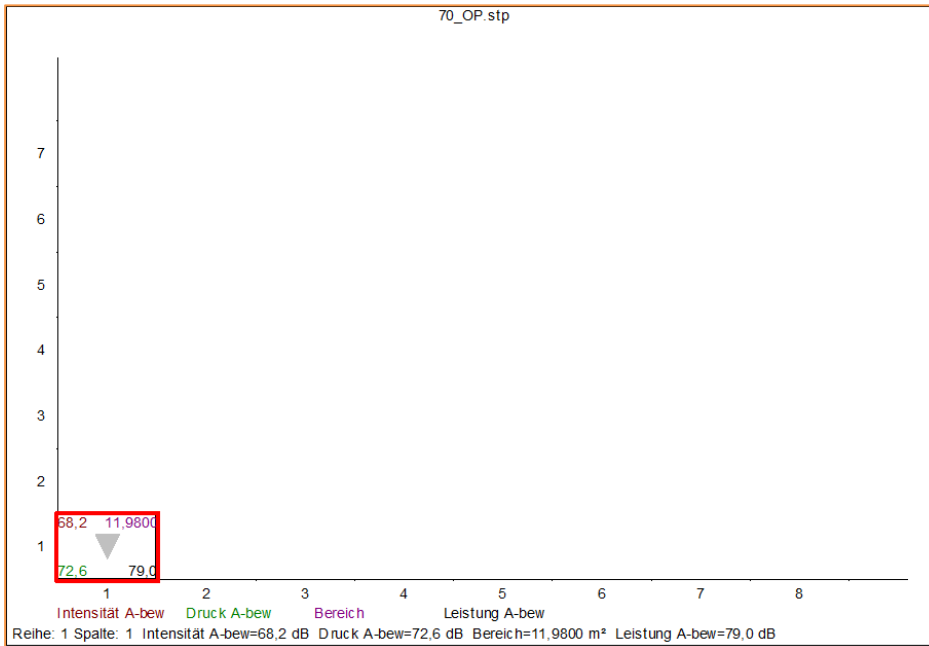


Figure 23 Fan Speed 70% - Open front door\_1

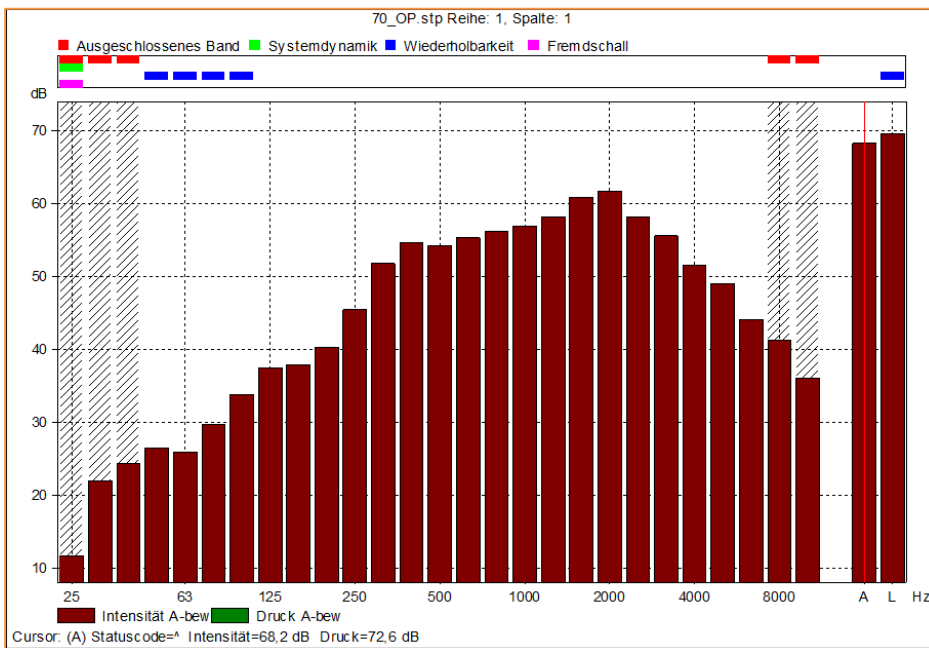


Figure 24 Fan Speed 70% - Open front door\_2

**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

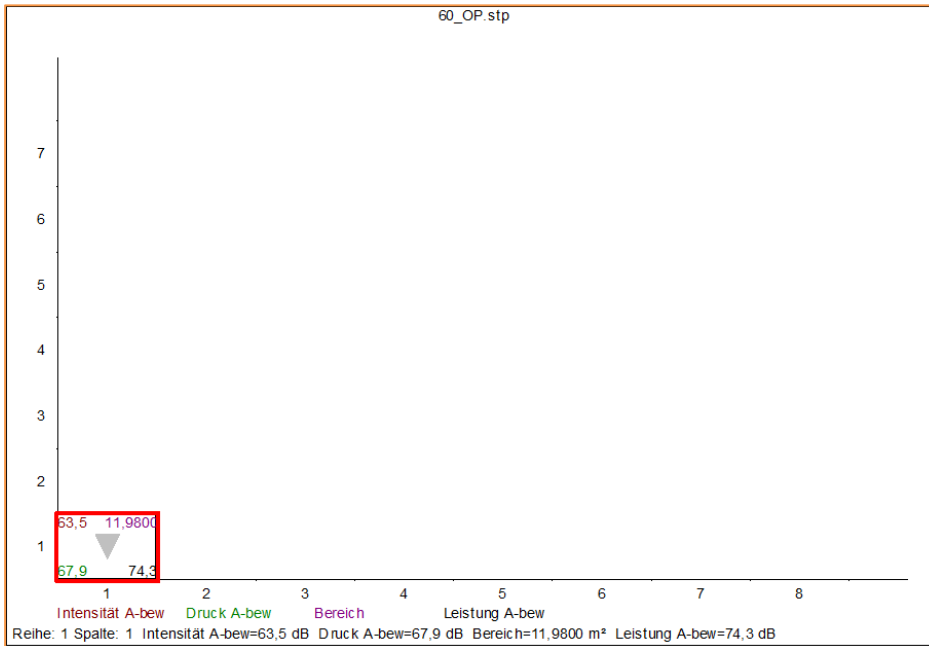


Figure 25 Fan Speed 60% - Open front door\_1

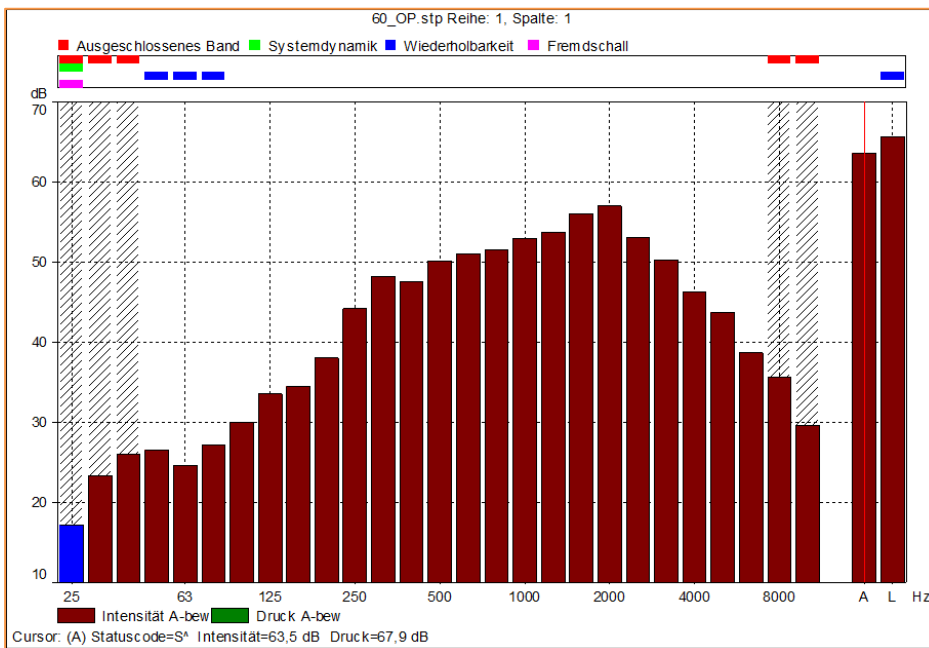


Figure 26 Fan Speed 60% - Open front door\_2

**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  $L_{PA}$  62,6 dB(A)**

Measurement distance 0,2m

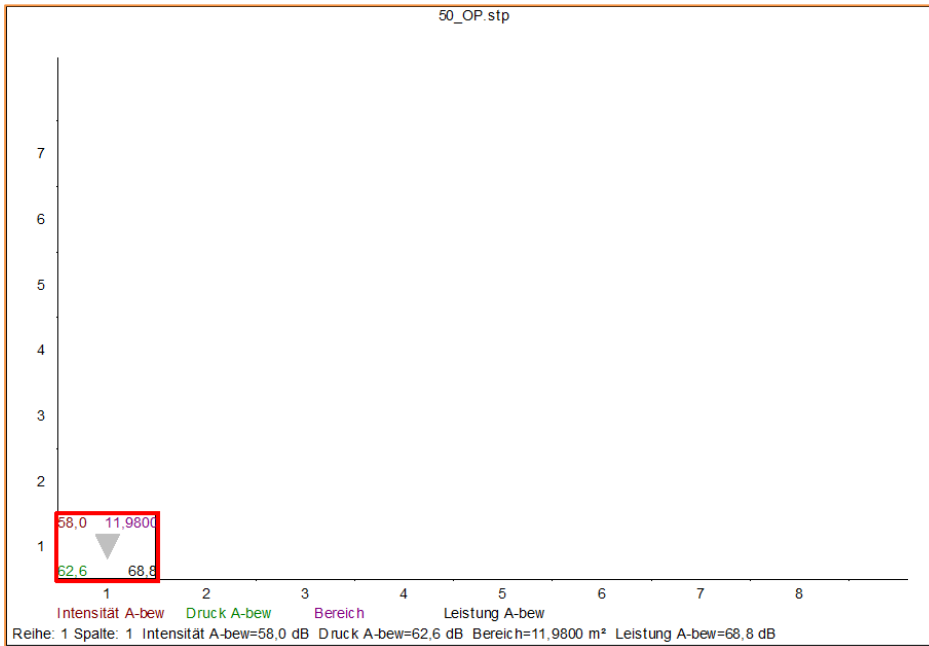


Figure 27 Fan Speed 50% - Open front door\_1

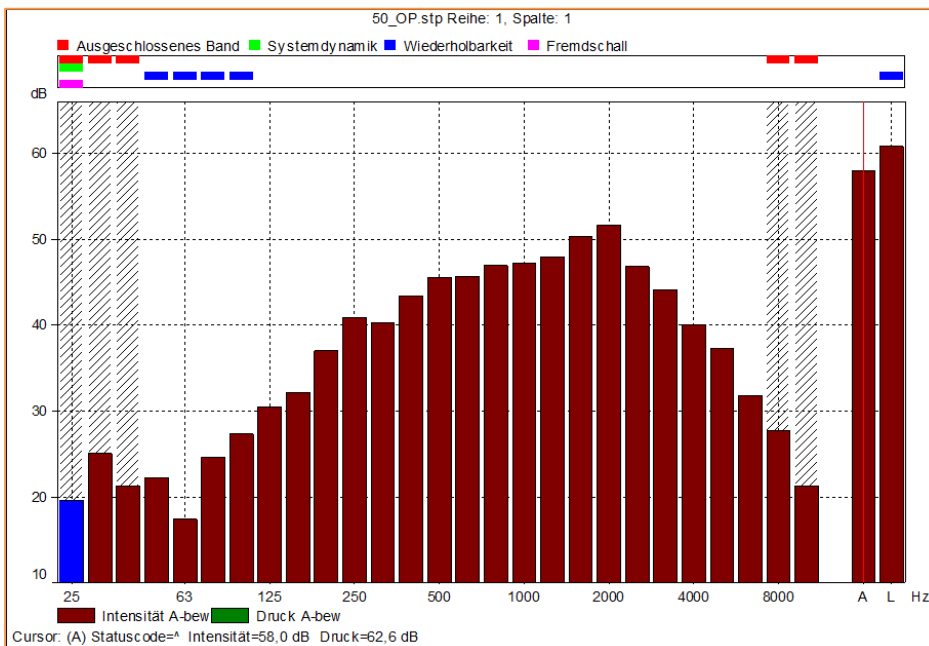


Figure 28 Fan Speed 50% - Open front door\_2

**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

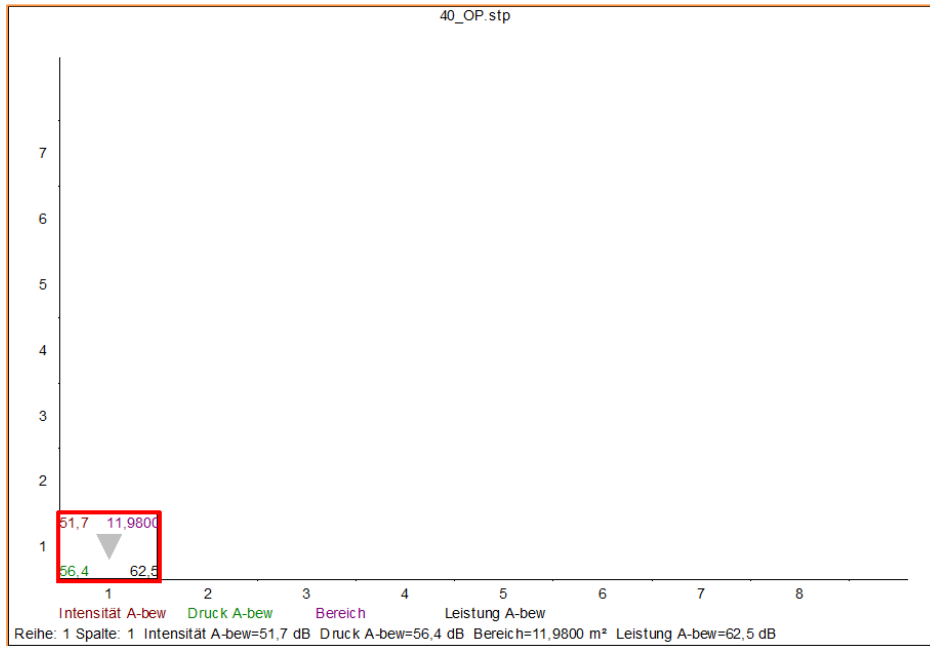


Figure 29 Fan Speed 40% - Open front door\_1

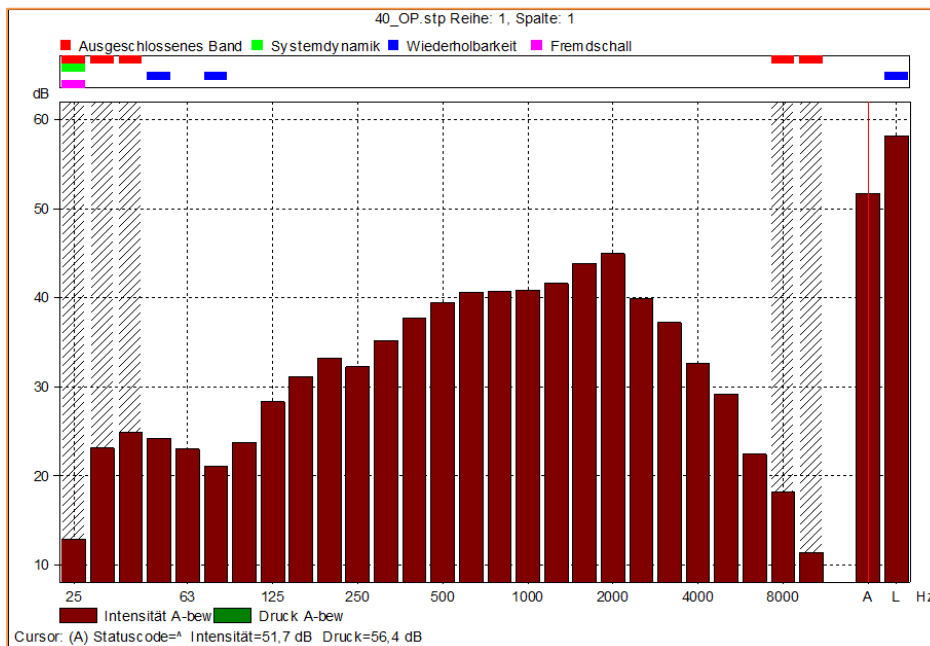


Figure 30 Fan Speed 40% - Open front door\_2

## 7 Summary

- **Noise measurement of the LHX+ 5kW performed**
- **The LHX+ 5kW was installed in a cabinet with defined ai 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