



DEWESoft®

C A S E S T U D I E S



SOUND POWER MEASUREMENT

INTRODUCTION

This application note shows how to perform a sound power measurement with Dewesoft.

The object under test was a standard notebook, the measurement was done according to ISO 3744 in a semi-anechoic chamber.

The following are our test categories:

IDLE

- Minimum: minimum noise emission while laptop is idle (Windows power plan: "Energy Saving")
- Medium: Average noise emission recorded while laptop is idle (Power Plan: "Energy Saving")
- Maximum: Highest noise emission measured while the laptop is idle (Power Plan: "High Performance")

HIGH SYSTEM USE

- Medium: Average noise emission while the computer is running at high level of system use. (3D Mark 2006, Power plan: Power Plan: "High Performance")
- Maximum: Highest possible noise emission while the system is under heavy load (Power Plan: "High Performance", 100% CPU and GPU usage - for the test tools such as Prime95 and Furmark load the CPU)

CONSIDERATIONS

In a quiet room, the human ear can hear background noise, which should amount to around 28 dB. A conversation at a normal volume ranges at 60 dB. All these values are dependent on the distance from the source of the noise. This is why we fix our gauge into place at a constant distance from our test models. This allows us to get clear results which can be compared with each other. The measurements are presented graphically and can be judged subjectively:

- **Under 30 dB:** Barely audible
- **Up to 35 dB:** Audible but not distracting.
Ideal level of noise emission for a laptop running office programs.
- **Up to 40 dB:** Clearly audible, and might be distracting after a while.
- **Up to 45 dB:** Might disturb the user if s/he is in a quiet room. Still acceptable while playing games.
- **Over 50 dB:** Notebook emissions over this level are uncomfortably loud

MEASUREMENT SETUP

DATA ACQUISITION SYSTEM

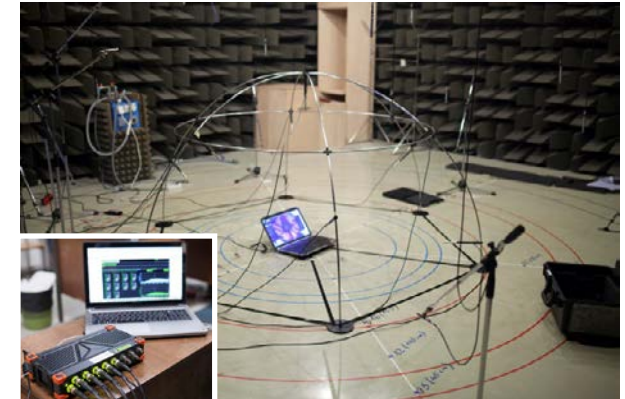
- SIRIUSI-HD-16xACC, USB-based 16 channel IEPE/Voltage unit

SENSORS

- 10 microphones G.R.A.S Type 26CA (scaling: -40/-55 mV/Pa)
- G.R.A.S. 67HA 1m CCP hemisphere kit (diagonal: 2716 mm, height: 1283 mm)
- 10 BNC cables (10 meters)

SOFTWARE

- DEWESoft X2
DSA package
Sound Power plugin



HEMISPHERE KIT SETUP

We used the hemisphere kit from G.R.A.S. with 10 microphones and a radius of 1.36 meters. The distance from the sound source to the microphones was 1 meter. The grid is very simple to assemble if you follow the attached instruction manual. It took us approximately 30 minutes to prepare everything.

First we had to put together the metal sticks and attached them together, to get a nice hemisphere structure. The next step was to put the microphones in the right positions according to the standards. The grid supports 10 or 20 microphones, so we had to select the right position for microphone mounting. The positions had to be the same as in standards and they are already predefined with small screws of different colors.

MICROPHONES

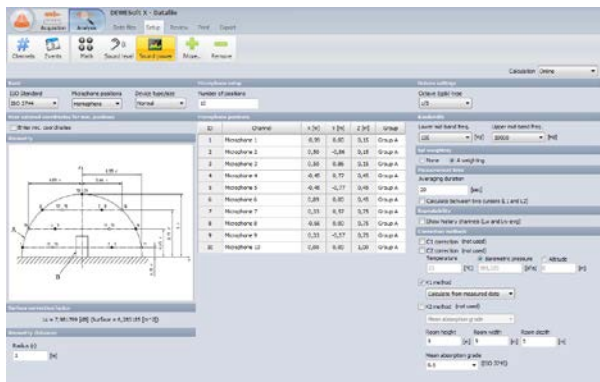
We used 10 BNC cables that were 10 meters long, so that the measurement equipment was outside of the semi-anechoic room. This is very important for reducing background noise to minimum. The microphones had TEDS chips, so the DEWESoft system automatically read the calibration factors after plugging in.

The whole data acquisition process took us approximately 10 minutes. We measured the laptop in three different states, the minimum measurement time for one measurement was 20 seconds (according to standard).

SOUND POWER MEASUREMENT

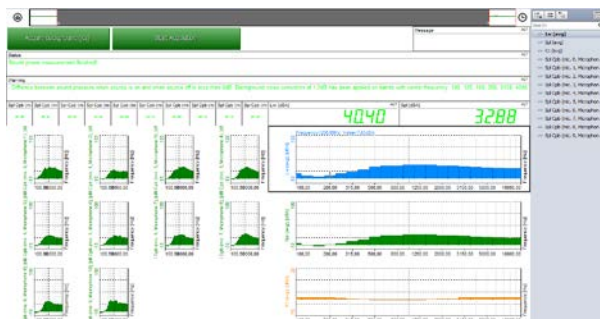
SOUND POWER SETUP

The according setup was chosen from the dropdown menu (ISO 3744, hemisphere), 10 microphones are mounted around the sound source in 1m radius, in the table you see the exact positions (x, y, z). Barometric pressure was measured and entered, the K1 (background measurement) correction method was additionally selected.



MEASUREMENT SCREEN

The SoundPower-Plugin in Dewesoft guides us through the procedure. At first the background noise measurement is done, with sound source (laptop) switched off. Then the laptop is switched on, configured to "idle mode" or "high system use", and the measurement is performed. According to the standard, data has to be collected for at least 20 seconds for each step. The green action buttons allow interaction (Acquire background, start acquisition). The text boxes below show status messages and warnings.



On the left side there are the 10 octave plots of all microphones, on the right you see the three graphs of the result: on top, most important: Sound Power, followed by Sound Level and the correction data.

RESULT AND REPORT

The noise levels of the 17-inch notebook are very good. It is always audible because the fan never stops spinning. The noise is very low during **idle** at **32 db(A)**. In this scenario, the fan speed is more or less constant and therefore very convenient for office use. The **hard drive** can be a bit disturbing with the clatter of the read/write heads, we measured **37.6 db (A)** during high activity.

When we demand the **highest performance** of the 17R, the noise rises up to **40.4 db (A)** (stress test CPU+GPU-FurMark). When we just play a game or run 3DMark 2006, we measured a moderate **36.4 db (A)**. In these cases the speed of the fan is also **constant** and there is no annoying pulsating.

Weather:	sunny
Temperature [°C]:	22
Pressure [kPa]:	1000
Relative humidity [%]:	45
Measurement duration [s]:	20
K1 [dB]:	1.30
K2 [dB]:	0.00
Sound Power Level [dB(A)]:	40.4

Frequency [Hz]	Lw (avg) [dBA]
100	11.4
125	6.14
160	4.81
200	7.65
250	11.18
315	15.58
400	20.47
500	26.84
630	30.07
800	29.52
1000	31.89
1250	32.22
1600	31.56
2000	29.73
2500	29.51
3150	27.51
4000	25.69
5000	24.95
6300	23.99
8000	23.28
10000	22.7

SOUND POWER LEVEL REPORT

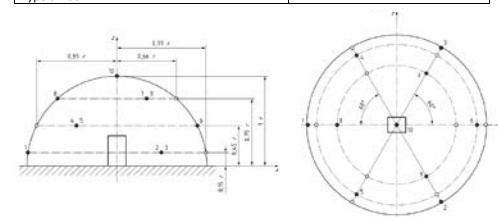
Project number:	000002
Project description:	SPL of laptop with power supply
Date of measurement:	14.7.2015
Company:	Dewesoft d.o.o.
Report version:	1.0

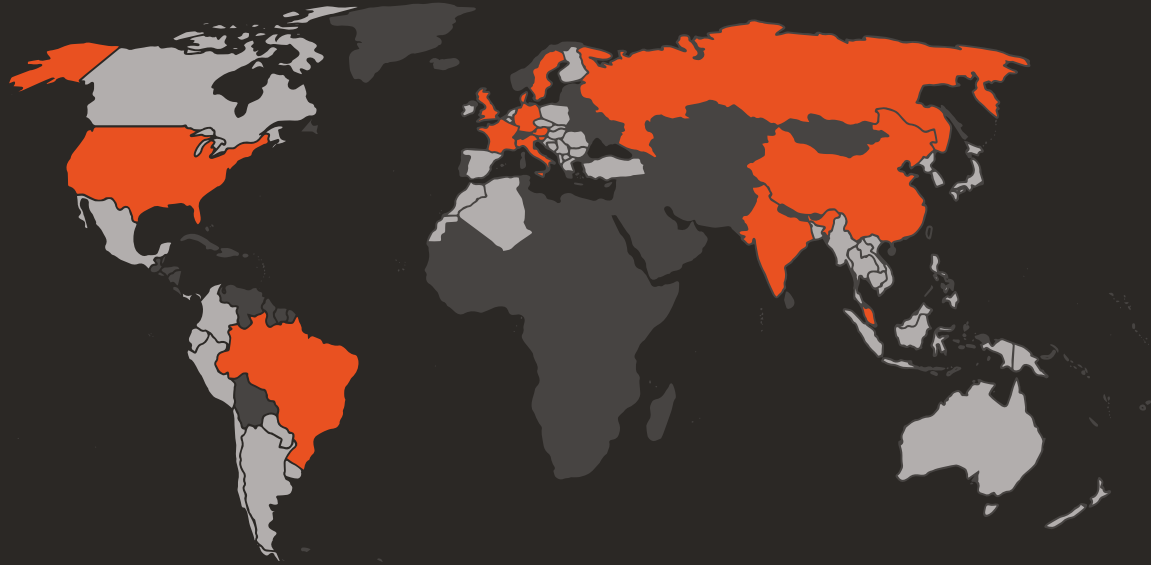
Standard:	ISO 3744
Location of measurement:	
Responsible person:	Dewesoft

Machine type:	Laptop
Machine description:	
Length [m]:	0.27
Width [m]:	0.028
Height [m]:	0.41
Fan speed [RPM]:	3963,00
Additional information:	Laptop was running under performance test FurMark 1.16.0.0 (same as in Appendix A)

High-precision sound power meter:	Dewesoft
Measuring amplifiers:	Sirius ACC
Hemisphere:	G.R.A.S (1 m)
Microphones:	G.R.A.S
Data recording and analysis software:	DEWESoft X2 SP3
Calibrator:	G.R.A.S calibrator

Microphone position:	hemisphere
Radius [m]:	1
Number of microphones:	10
Type of room:	semi-anechoic





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