

Summary

- Quiet operation is a critical feature for CPU coolers. A good design target for high-performance coolers is 33 dB-A, roughly the same volume as whispering
- Phononic reviewed and tested numerous fans to ensure noise and performance design goals were met
- The fan that ships with the Hex 2.0 achieves the air flow requirements for effective heat dissipation and creates <33 dB-A of noise even at maximum RPM

Introduction

An important requirement of for high-performance CPU coolers is low noise, especially when the system is not being stressed. Increasingly, users see obtrusive noise levels even under high stress as a reason to update or change their systems. Most noise comes from cooling fans on the case, GPU card or CPU cooler. For CPU coolers, both liquid and air coolers use fans for their final heat rejection to the ambient air, which makes fan selection, air flow and noise product- defining properties. For the HEX 2.0, we obsessed over finding the right fan that would maximize cooling performance with as low noise as possible.

Noise Levels

First, here’s a quick overview about noise levels and how our ears perceive them. Decibels (often abbreviated dB-A) are a unit of sound power and depend on how far away the noise is to the listener. Figure 1 shows a range of decibel values for typical sounds as a reference. Of course, we will be focusing on the quiet end of this spectrum (10-40 dB-A).

At Phononic we set the goal for the HEX 2.0 fan to get maximum heat rejection - especially with our [Active/Passive design](#) - with high pressure drop and air flow while limiting noise to 33 decibels or less. You can see that our goal of 33 decibels is about as loud as a whisper.. Based on direct market research with users and by canvassing the reviews of many coolers, the limit of 33 dB-A was aligned with coolers that were considered “quiet” by the CPU building community.

How loud is too loud?

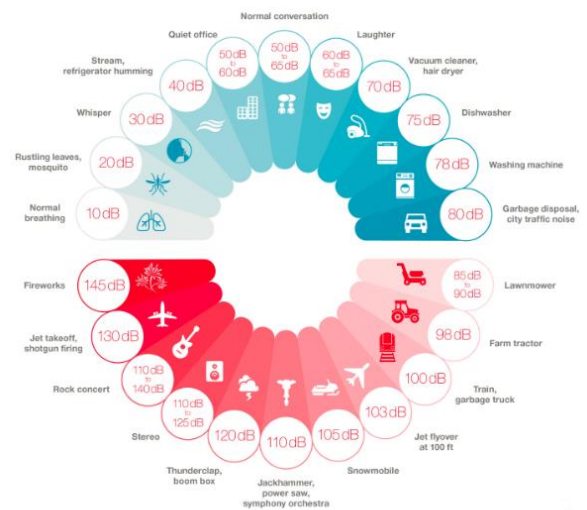



Figure 1 – Chart of typical decibel levels 
(Ref: earq.com/hearing-loss/decibels)

Fan Selection and Testing

We had to find a fan that met all these requirements – which led us to the SanAce 92mm fan that ships with the Hex 2.0. On paper, the fan checked all of the boxes on noise and air flow, but we had to be definitive on the noise levels. So, we tested the SanAce 92mm fan (and other fans) in an anechoic chamber for absolute certainty for dB-A level. An anechoic chamber is like a recording studio where all outside noise is blocked, but includes additional

sound baffling on the interior to remove any chance of reflected sound reaching the microphones for measurements. For the measurements, microphones are placed around the CPU cooler spaced at 1 meter away, as shown in Figure 2.

HEX2.0	RPM	Mic#1	Mic#2	Mic#3	Mic#4	Avg
Sanyo SanAce 92mm	2650	33.72	33.35	30.57	30.79	32.1
	2350	30.65	30.24	27.41	27.73	29.0
	2280	29.76	29.3	26.56	26.79	28.1
	1770	23.58	23.13	20.59	20.95	22.1
	1245	18.54	18.24	18.22	18.08	18.3
	920	17.12	17.02	17.78	17.55	17.4

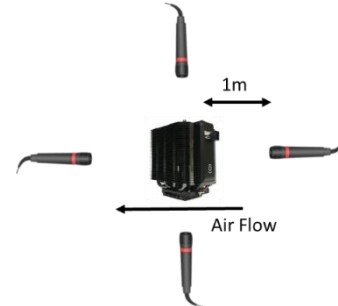


Figure 2 – Chart of anechoic chamber testing results for the HEX2.0 with the Sanyo SanAce92 fan at different fan rpm. Right – shows schematic of microphone set-up for sound measurements with microphones placed at 1m from HEX 2.0 along the path of air flow and perpendicular to air flow

The noise level of the HEX 2.0 was measured with the fan installed in the CPU cooler to mimic realistic performance. Fan RPM was controlled with a PWM power supply. The typical results for the noise levels at different fan RPM is shown in Figure 2. The data shows that the fan is only reaching 33-34 dB-A maximum noise level at full RPM with an average of only 32 dB-A. This fits in well with other CPU coolers that are considered quiet. Also, it should be noted that the anechoic chamber minimum background noise was measured to be 17 dB-A. So, at idle rpm (~1000 rpm), the HEX 2.0 noise is lower than the background noise in the chamber, meaning it is virtually silent at idle speeds.

Conclusion

The HEX 2.0 was designed to provide cooling performance on par with all-in-one liquid coolers and much larger air coolers without sacrificing sound comfort. The data shows that both design targets were met with our unique design of the heat exchanger fin sets, the selection of the correct fan and the integration of the high-performance thermoelectric heat pump. Please contact Phononic customer care if you have any questions and check out the other [technical briefs](#) on the HEX 2.0 if you have any other questions.