Introduction to the Soundskrit Dragonfly Kit

Figure 1: Soundskrit Dragonfly Kit

The Soundskrit Dragonfly kit is a tool to evaluate a shotgun microphone made using Soundskrit microphones. The Dragonfly uses Soundskrit microphones to create extremely narrow beam patterns. The kit includes our Dragonfly board, which is a PCB with three SKM1610 modules. Each SKM1610 holds a dipole and an omnidirectional MEMS microphone. The Dragonfly is connected to our PARDI board, which is a convenient interface to connect MEMS microphones over USB. The PARDI board runs an embedded linear beamforming algorithm using the Dragonfly board to demonstrate how linear array beamforming can be used to enhance directionality and reduce background noise.

What's In the Box	
Dragonfly Board	PCB with three SKM1610 modules, each with a dipole and an omnidirectional microphone
PARDI Board	MEMS microphone interface board running embedded beamforming algorithm
Molex Cable	Cable preconnected, linking the Dragonfly with the PARDI board
USB A to USB C Cable	Cable to connect PARDI board to your computer

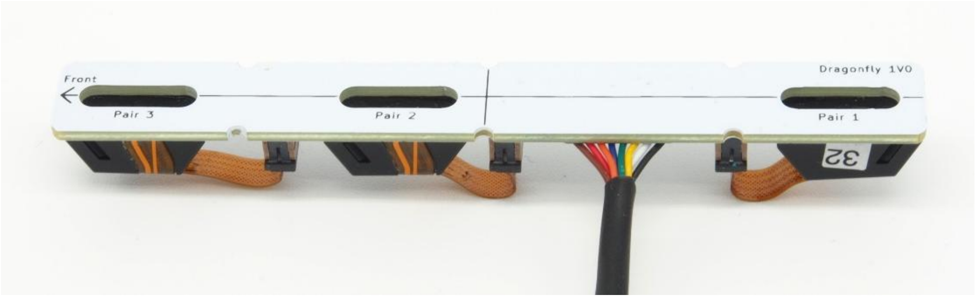

Figure 2: Dragonfly Board

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Board Overview and Pinouts

The PARDI board has a USB-C connector to connect it to a PC and a Molex connector to connect the Dragonfly board. The cable is preconnected and only needs reattachment if disconnected.

Figure 3: PARDI board

Dragonfly Board

The Dragonfly board is a PCB with three SKM1610 modules in a linear array. Each SKM1610 contains both a dipole and an omnidirectional MEMS microphone. The SKM1610 modules are spaced 30 mm and 50 mm apart, this asymmetric configuration allows optimization of the beam pattern for a wide frequency range.

The signals of the six microphones, three Soundskrit dipoles and three omnidirectional, are combined into a narrow unidirectional beam. This results in a beamforming pattern similar to that of a shotgun microphone. The direction this beam is pointing at is marked with “Front” on the PCB.

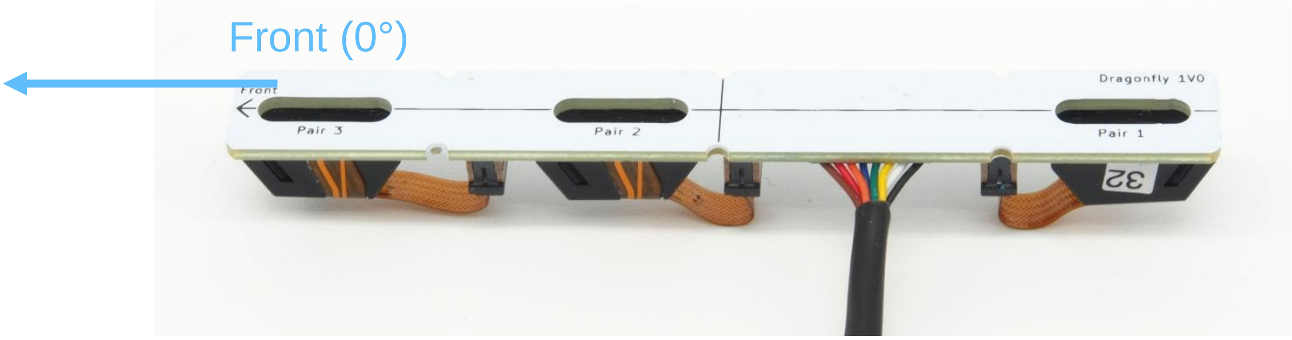


Figure 4: Dragonfly board and Molex cable

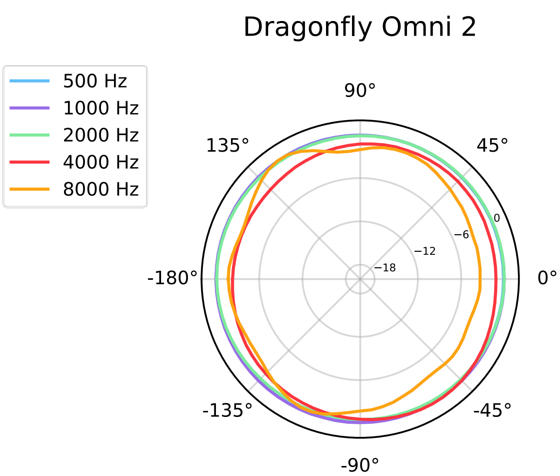
Included Beamforming

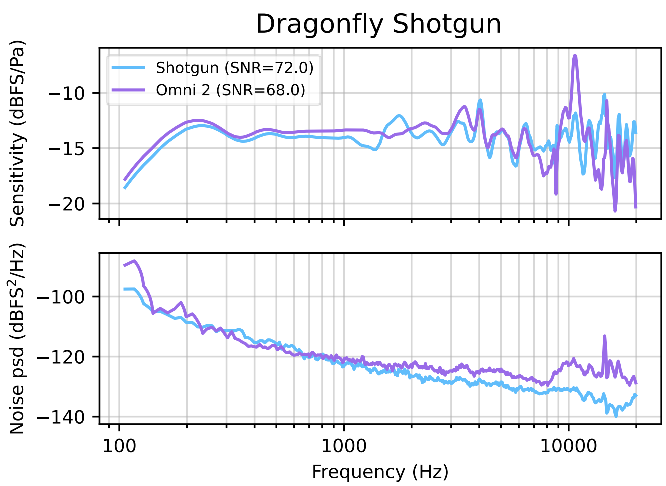
While recording the USB output, there will be three channels. The first channel is the omnidirectional microphone from the center SKM1610 module (labeled “Pair 2” in Figure 4), the second channel is a “shotgun beam” that is created via linear beamformers using all six microphones. Channel 3 is the same beam as on channel 2 with an additional AI denoising algorithm for additional noise reduction. The output configuration and measurements of each of the beamforming algorithms are below.

To learn more about combining an omnidirectional and dipole microphone to create adjustable polar patterns, check out our article Combining Microphone Polar Patterns.

Equalized Dragonfly omnidirectional microphone

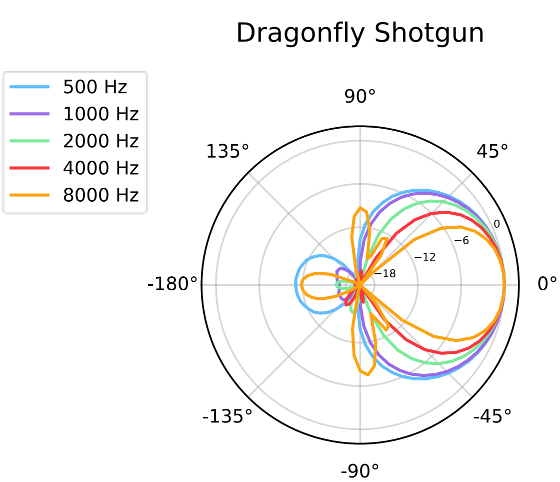
The omnidirectional microphone of the center SKM1610 of the Dragonfly board with an EQ applied to flatten the frequency response.

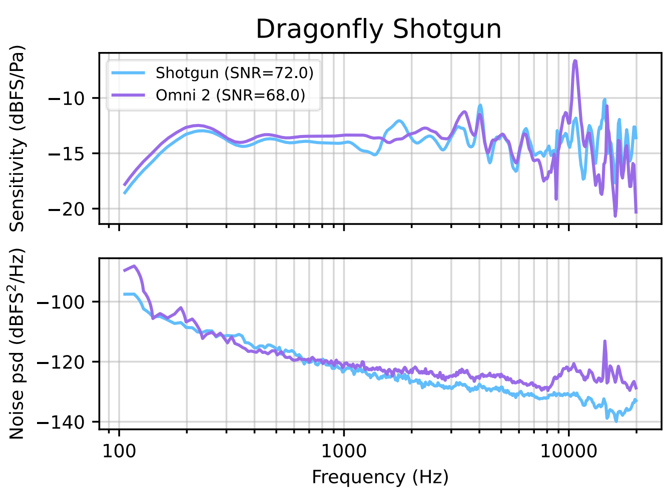




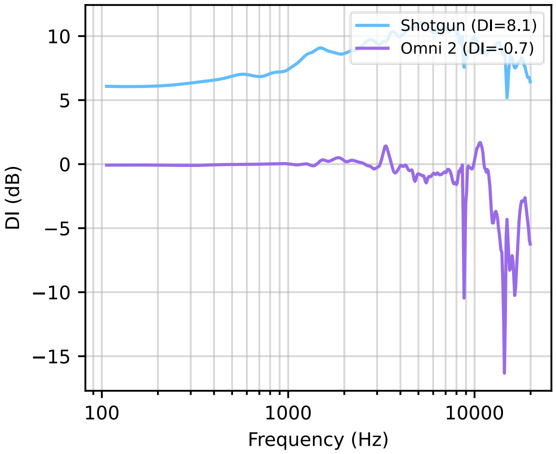
Shotgun beamformer

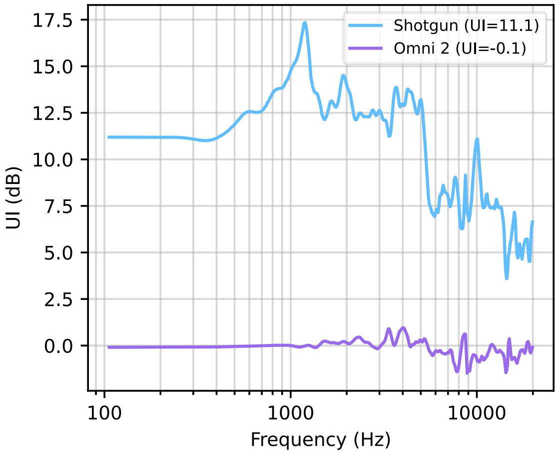
All six microphones are combined to form a narrow, unidirectional, linear beam. This is achieved by combining each of the SKM1610 to an SNR-optimized hypercardioid-like beam. These three beams are then combined by frequency dependent weighted sums. Sound coming from outside the beam is greatly attenuated while keeping sound from the front unaltered and natural.





The following plots show the directivity index (DI) and unidirectional index (UI) for the omnidirectional microphone and the shotgun beam (see the article linked on page 4 for details on DI and UI):





USB Output Channels		
Ch1	Equalized omnidirectional microphone	The equalized omnidirectional microphone of the center SKM1610
Ch2	Shotgun Beamformer	The Shotgun beam
Ch3	Shotgun Beamformer with AI denoiser	The Shotgun beam with additional AI noise reduction

The shotgun beamformer (Ch2) is routed to the analog output on our interface board.

Recording Audio with the PARDI Board

To record audio with the PARDI board, we recommend installing Audacity. Audacity is a trusted, free, multiplatform suite of tools for recording and working with audio files.

Once Audacity is installed, configure the software for use with the Soundskrit PARDI board. Configure the settings as listed below:

Audio Host	Windows WASAPI
Input	*Microphone (Soundskrit Dragonfly)*
Output	Your listening device
Channels	3 Recording Channels

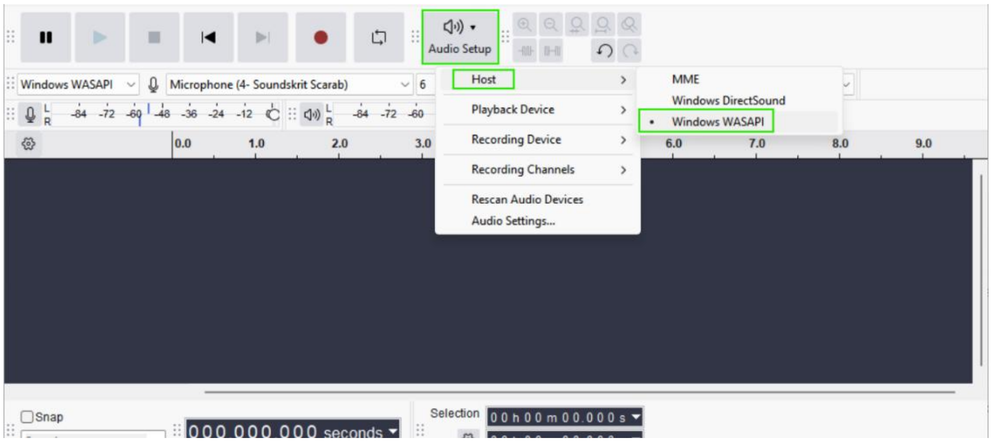


Figure 5: Audacity host selection

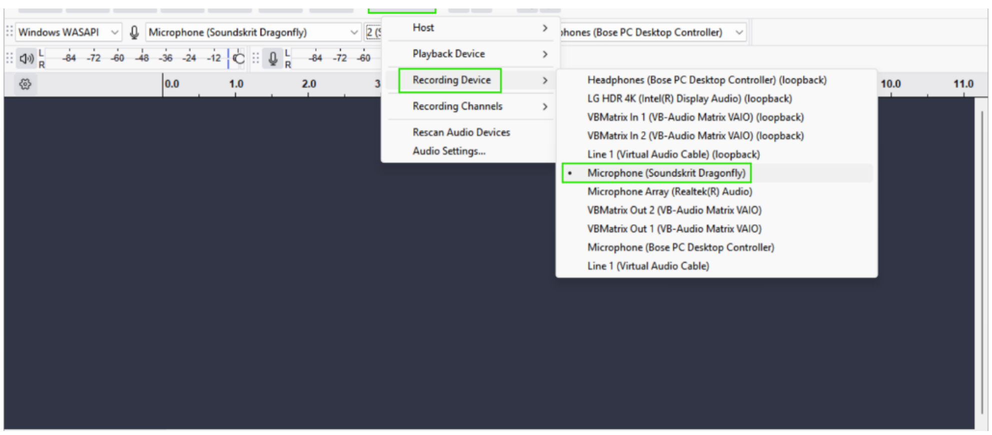


Figure 6: Audacity device selection

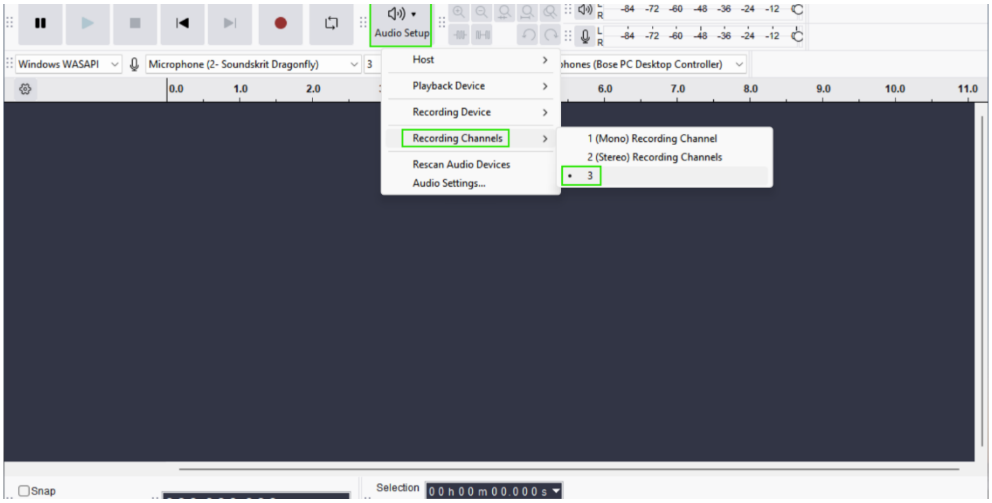


Figure 7: Audacity channel selection

When you take a recording, all 3 channels will be recorded simultaneously. The microphone gain might be initially very low, this is on purpose the default to avoid signal clipping. You can either increase the recording gain in Windows from the default 54% to a level better suited to your recording situation or amplify the signals in Audacity. To do so, select all tracks by pressing CTRL+A and apply the same gain value to them by selecting in the top menu Effect → Amplify. In the pop up, select a gain value below the clipping threshold, e.g. by setting the “New Peak Amplitude” to -3 dB.

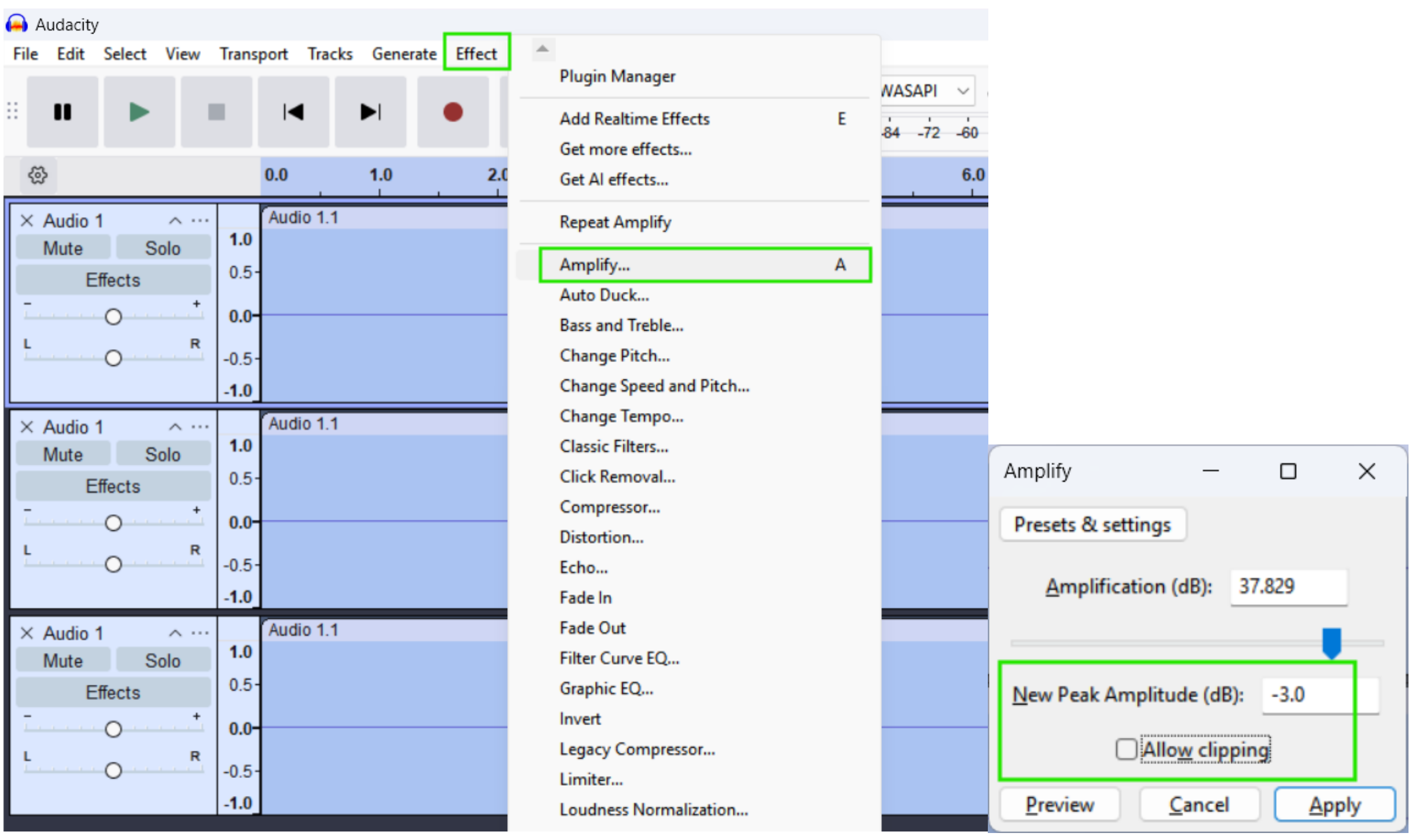


Figure 8: Applying gain to all recorded tracks.

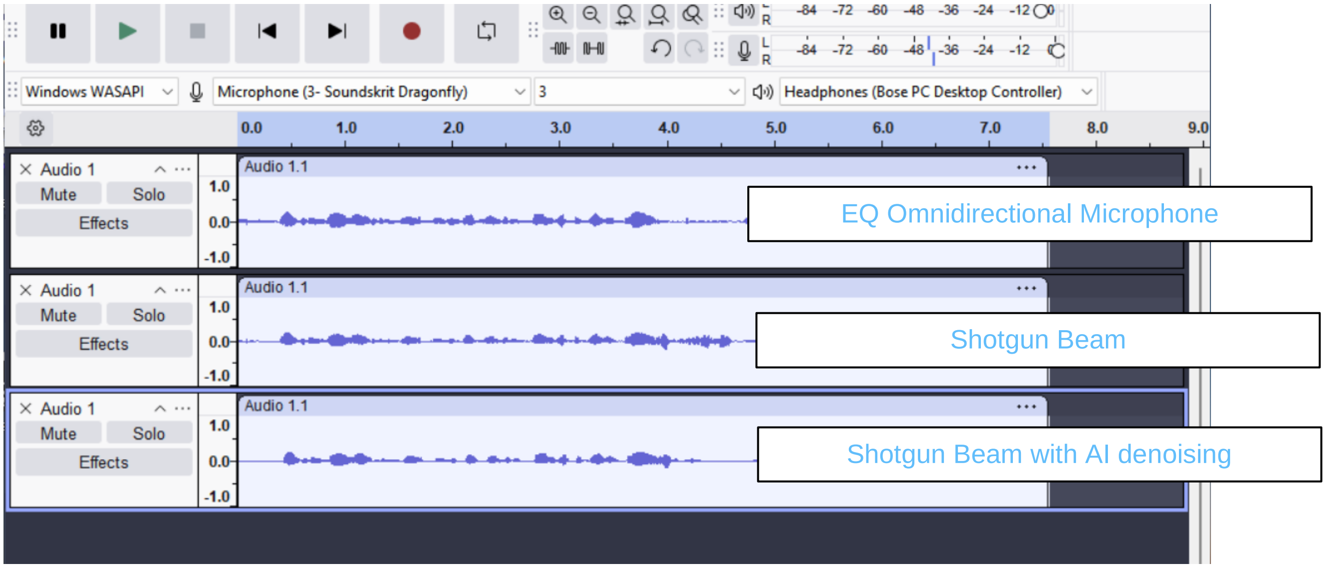


Figure 9: Output channels after 40 dB gain was applied.

Additional Support

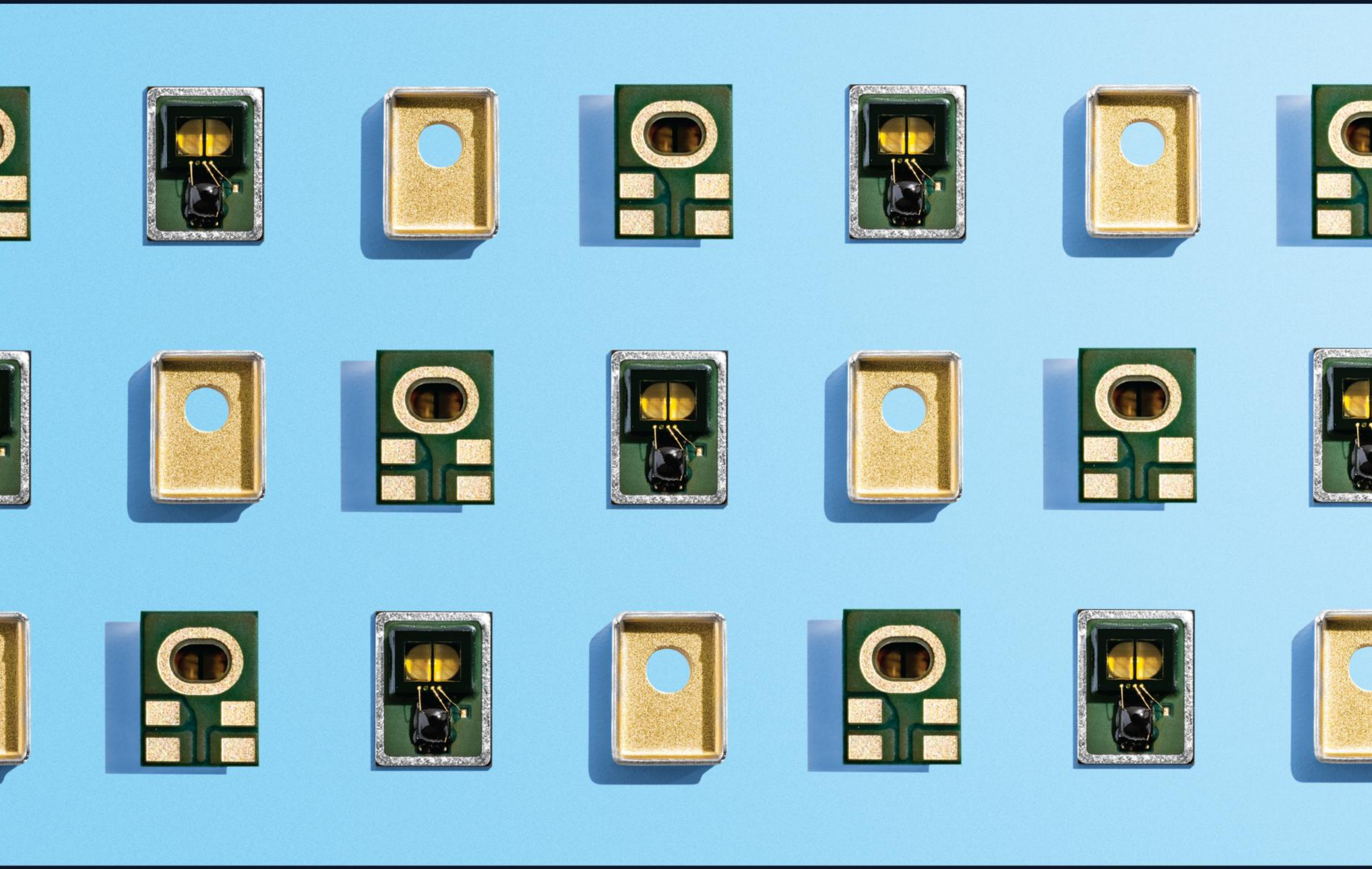
For further information on Soundskrit's products, visit our website at http://www.soundskrit.ca where you can find more application notes, datasheets, and purchasing information. If you have any questions or need technical support, please reach out to applications@soundskrit.ca.

Revision History

Revision Label	Revision Date	Sections Revised
-	November 2024	Initial release
Rev A	February 2025	Changes related to PardiV4 audio interface

Soundskrit developed the first high-performance directional MEMS microphone on the market, leveraging years of research in bio-inspired MEMS based on how spiders and other insects in nature hear. In combination with Soundskrit's in-house audio processing algorithms, directional microphones can be used to capture and isolate any sound in an environment with a fraction of the size, power, and computation of traditional omnidirectional-based microphone arrays.

Soundskrit was founded in 2019 and is headquartered in Montreal, Quebec with an R&D facility in Ann Arbor, Michigan.



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