Introduction to the Soundskrit Dragonfly Kit

Figure 1: Soundskrit Dragonfly Kit

The Soundskrit Dragonfly kit is a tool to evaluate how very narrow beam patterns can be achieved using Soundskrit microphones. The kit includes our Dragonfly board, which is a PCB with three SKM1600 modules. Each SKM1600 holds a dipole and an omnidirectional MEMS microphone. The Dragonfly is connected to our SPIDAR board, which is a convenient interface to connect MEMS microphones over USB. The SPIDAR 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 SKM1600 modules, each with a dipole and an omnidirectional microphone
SPIDAR Board	MEMS microphone interface board running embedded beamforming algorithm
Molex Cable	Cable preconnected, linking the Dragonfly with the SPIDAR board
USB A to USB C Cable	Cable to connect SPIDAR board to your computer

Figure 2: Dragonfly Board

Table of Contents

Contents

Board Overview and Pinouts

The SPIDAR board has a USB-C connector to connect it to a PC and a Molex connector to connect the Dragonfly board. The Molex cable is preconnected and needs only to get reconnected in case it gets loose.

Figure 3: SPIDAR Board

Dragonfly Board

The Dragonfly board is a PCB with three SKM1600 modules in a linear array. Each SKM1600 holds a dipole and an omnidirectional MEMS microphone. The SKM1600 modules are spaced 30 mm and 50 mm apart, this asymmetric configuration allows to optimize 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 creates a beamformer similar to those seen in shotgun microphones. The direction this beam is pointing at is marked with “Front” on the PCB.

Figure 4: Dragonfly board and Molex cable

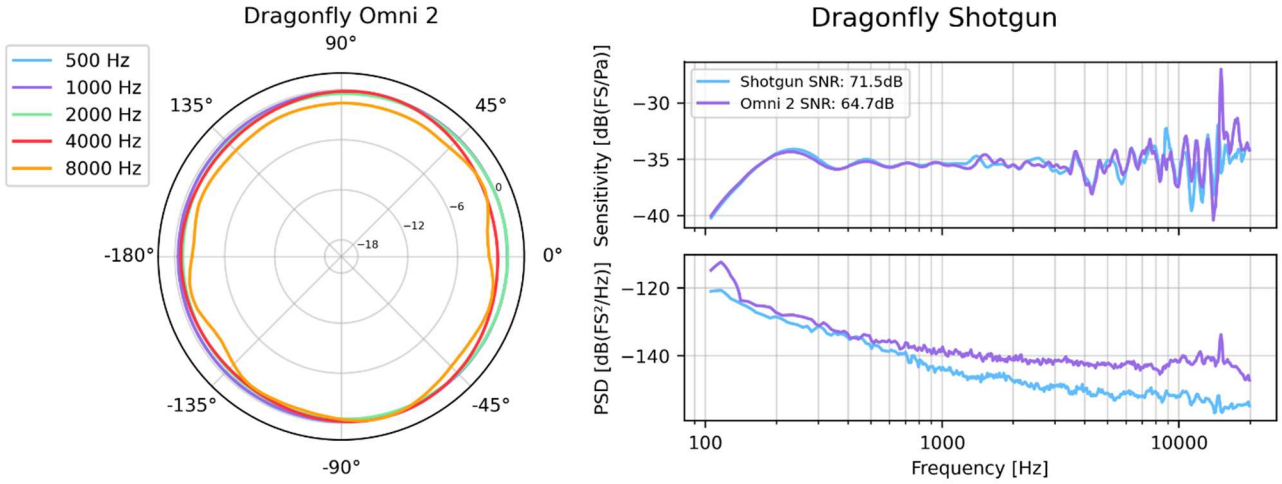
Included Beamforming

Once the Dragonfly board is connected, you can take a recording. The USB output will have six channels. The first channel is the omnidirectional microphone from the center SKM1600 module (labeled “Pair 2” in Figure 4) and the second channel is a “shotgun beam” that is created via linear beamformers using all six microphones. Channels 3 to 6 repeat these configurations but with different levels of gain to help mimic the appropriate gain settings for different recording distances (see the table on the next page). 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.

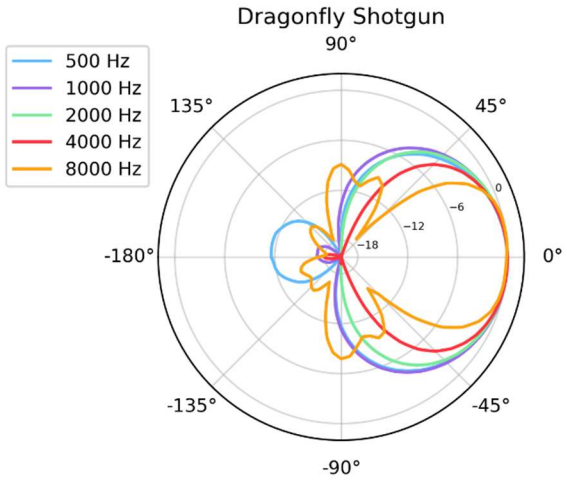
Equalized Dragonfly omnidirectional microphone

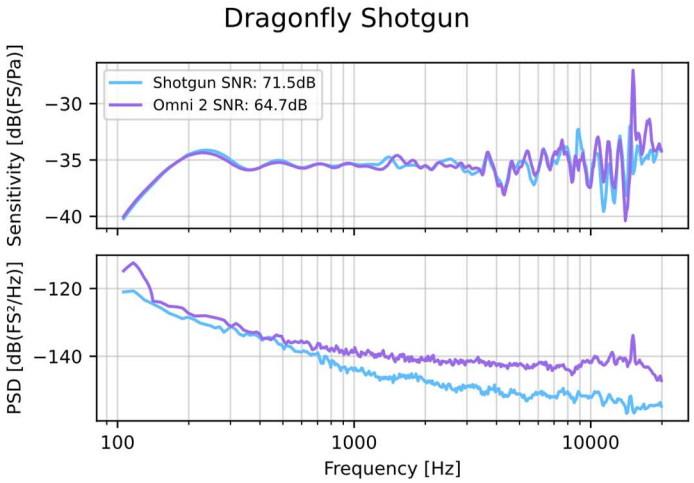
The omnidirectional microphone of the center SKM1600 of the Dragonfly board with an EQ applied to flatten the frequency response.



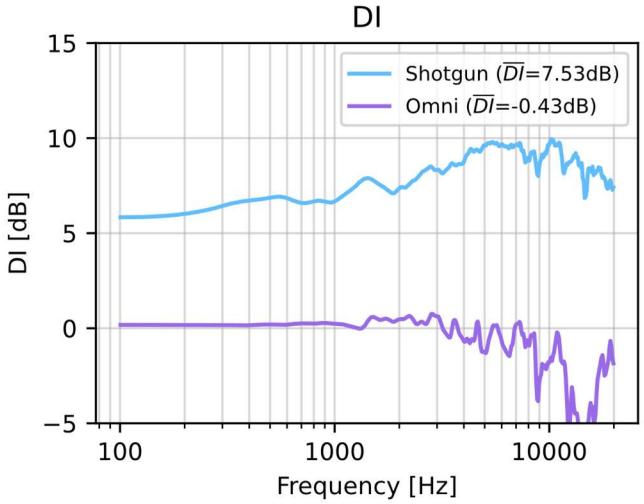
Shotgun beamformer

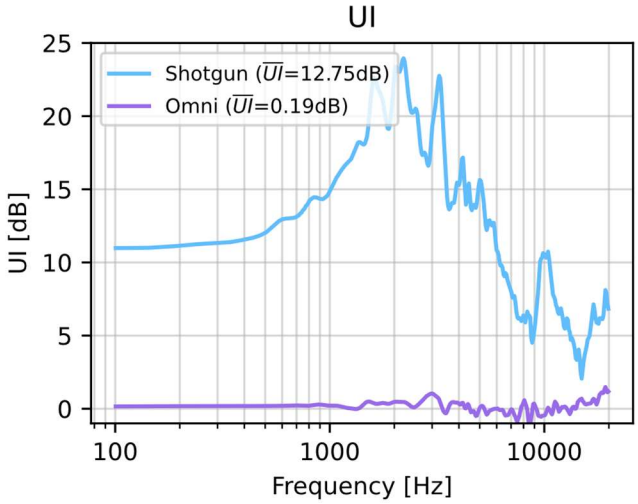
All six microphones are combined to form a narrow, unidirectional, linear beam. This is achieved by combining each of the SKM1600 to an SNR-optimized hypercardioid-like beam. These three beams are then combined by frequency dependent weighted sums. Sound coming from outside the beam is greatly attenuated 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, nearfield (30 cm)	The EQ'd omnidirectional microphone of the center SKM1600, with gain applied for testing at approx. 30 cm distance
Ch2	Shotgun Beamformer, nearfield (30 cm)	The Shotgun beam, with gain applied for testing at approx. 30 cm distance
Ch3	Equalized omnidirectional, midfield (1-2 m)	Same as channel 1 with gain applied for testing at 1-2 m distance
Ch4	Shotgun Beamformer, midfield (1-2 m)	Same as channel 2 with gain applied for testing at 1-2 m distance
Ch5	Equalized omnidirectional, farfield (3-5 m)	Same as channel 1 with gain applied for testing at 3-5 m distance
Ch6	Shotgun Beamformer, farfield (3-5 m)	Same as channel 2 with gain applied for testing at 3-5m distance

Recording Audio with the SPIDAR Board

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

Once you have installed Audacity, we need to configure the software for use with the Soundskrit SPIDAR board. Configure the settings as listed below:

Audio Host	Windows WASAPI
Input[1]	*Digital Audio Interface (Soundskrit 6Ch 24bit)* – Ensure the non-loopback version of the driver is selected
Output	Your listening device
Channels	6 Recording Channels

[1]WASAPI has two versions of each input option, the regular and the loopback, to record from all six channels the non-loopback mode must be selected. If this is configured correctly, there will be six recording channels listed, while the loopback will only allow two. Non-loopback is typically the second of the two versions.

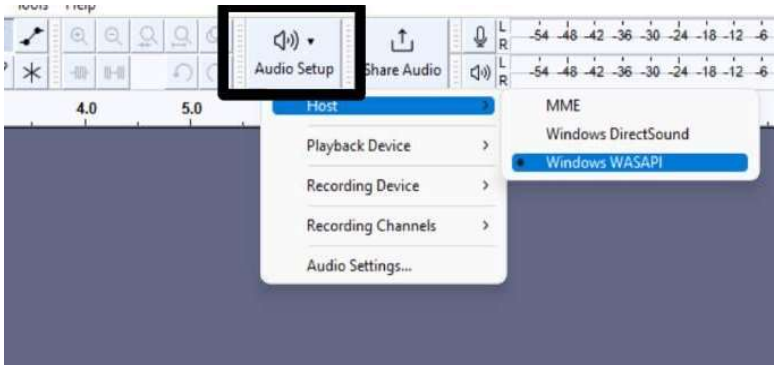


Figure 5: Audacity host selection

Figure 6: Audacity device selection

Figure 7: Audacity channel selection

When you take a recording, all 6 channels will be recorded whether there is a microphone connected or not.

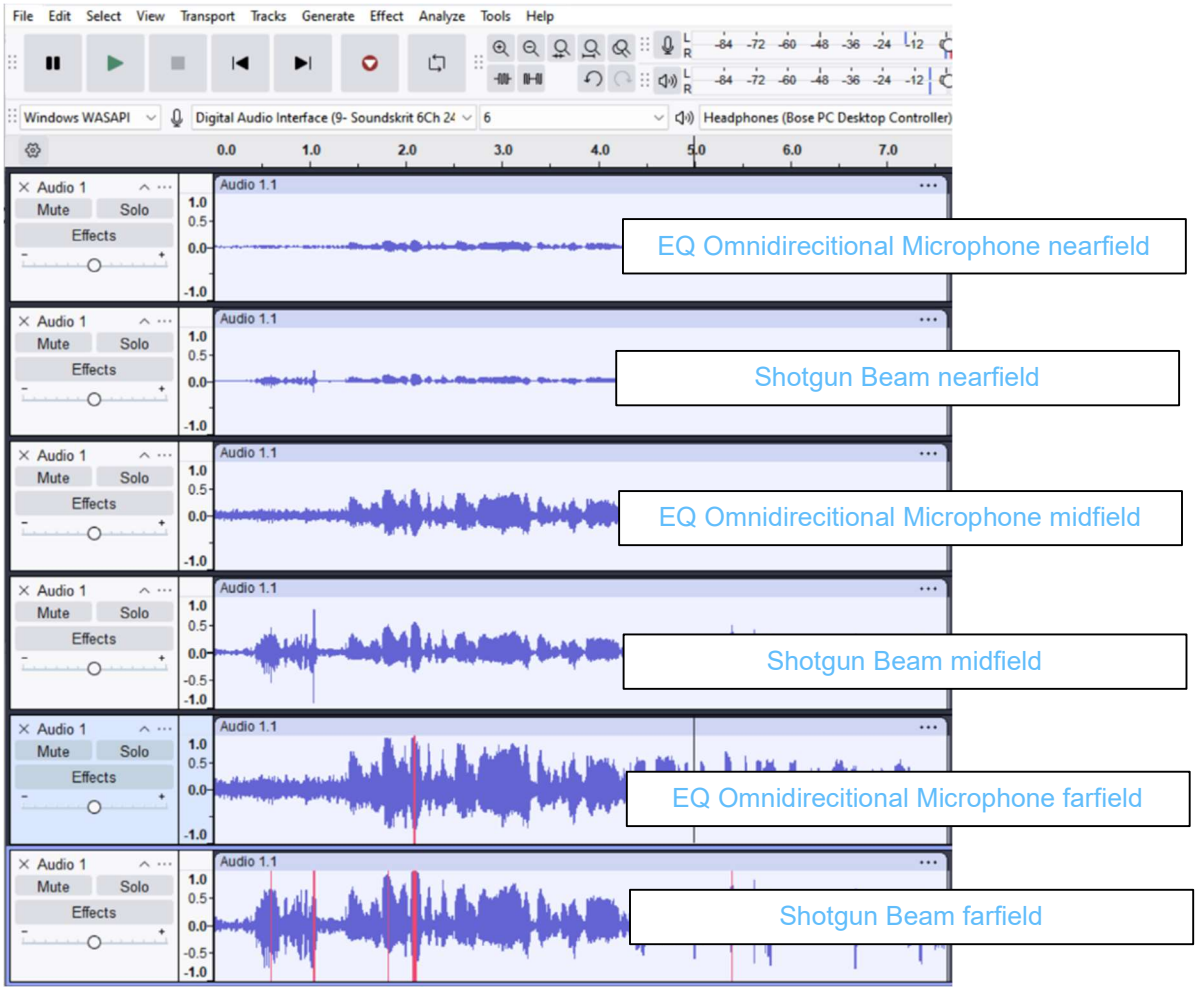


Figure 8: Output channels

Additional Support

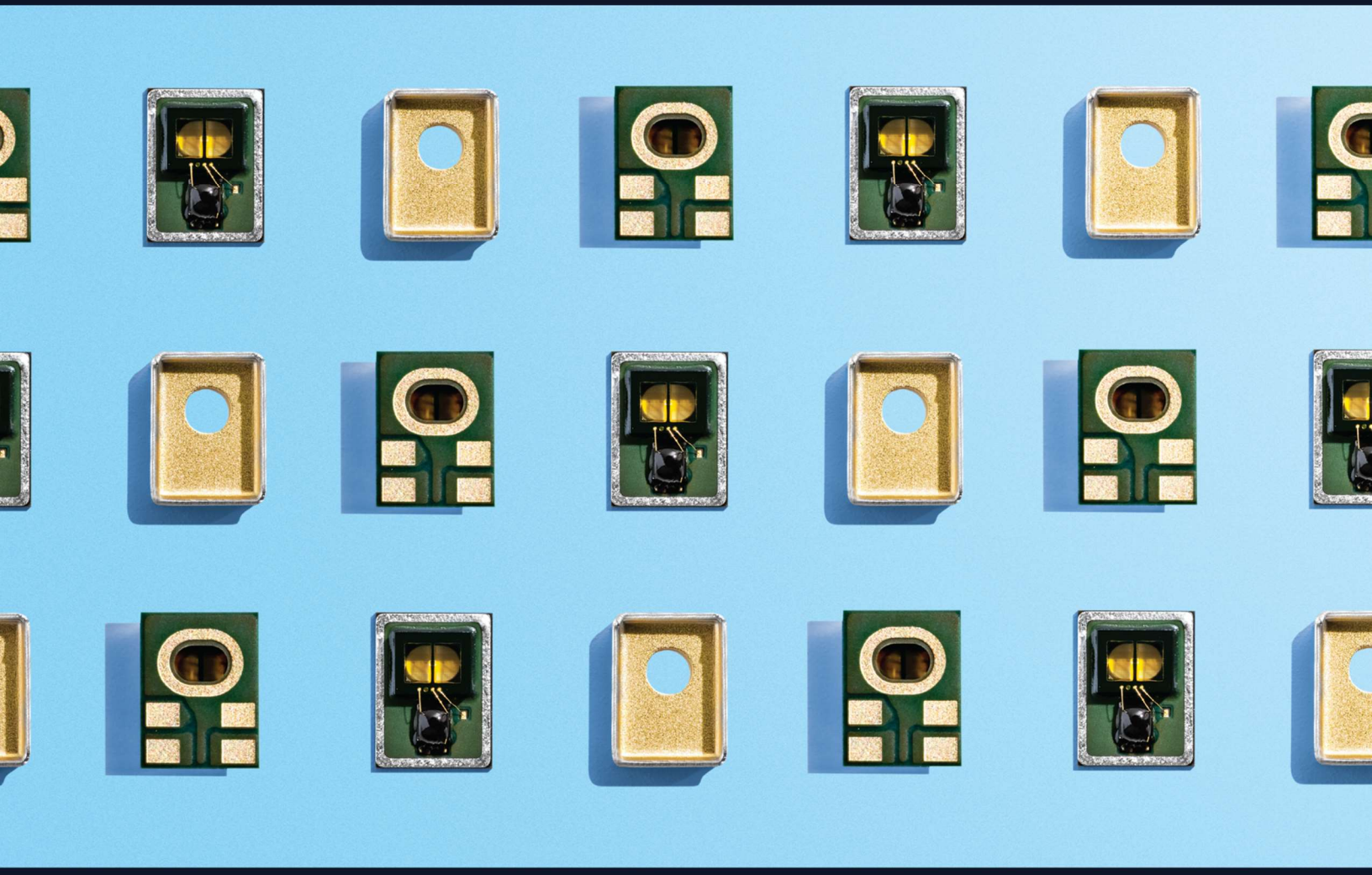
For further information on Soundskrit's products, visit our website at http://www.soundskrit.ca where you can find more application notes, datasheets, and purchasing information. If you have any questions or need technical support, please reach out to applications@soundskrit.ca.

Revision History

Revision Label	Revision Date	Sections Revised
-	November 2024	Initial release

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.



soundskrit
Hear the impossible.