1. Overview

Figure 1: Soundskrit Shotgun Microphone Demo Kit (Dragonfly)

The Soundskrit Shotgun Microphone Kit (Dragonfly) is a tool to evaluate a shotgun microphone made using Soundskrit microphones. It uses Soundskrit microphones to create extremely narrow beam patterns. The kit includes Soundskrit 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 Soundskrit PARDI board, which is a convenient interface to connect MEMS microphones over USB. The PARDI board provides multichannel raw audio signals to Soundskrit Demo Kit Interface for processing.

There are a variety of audio processing algorithms for the Dragonfly kit. These algorithms include Omni, Single Cardioid, and Linear Shotgun beamformers, as well as AI-based denoising models, all of which can be configured and evaluated using the Soundskrit Demo Kit Interface software, either with or without a connected Dragonfly demo kit. Through this, Dragonfly can demonstrate how linear array beamforming and AI denoiser can be used to enhance directionality, reduce background noise and eliminate the reverberation at long distance voice pickup.

What's In the Box	
Dragonfly Board	PCB with three SKM1610 modules, each with a dipole and an omnidirectional microphone
Soundskrit PARDI audio interface	Multichannel audio interface to connect microphones over USB
Molex cable	Cable preconnected, linking the Dragonfly with the PARDI board
USB-A to USB-C Cable	A cable to connect the board to your PC.

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2. Hardware Introduction

2.1 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.

You can check the detailed introduction for SKM16X0 module on our website [SKM1600 series].

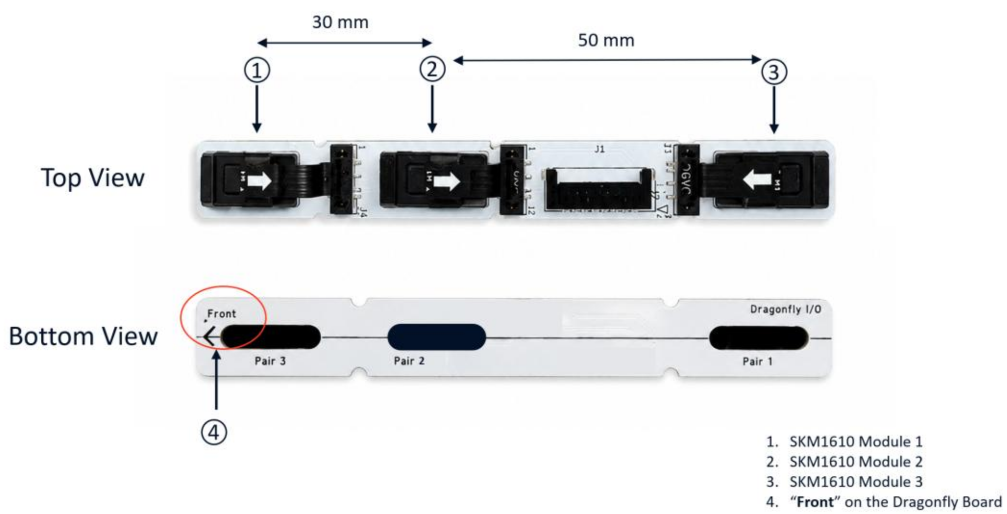


Figure 2: Top Views of the Dragonfly Board and SKM1610 Modules

2.2 PARDI Board Interface

The PARDI audio interface has a USB-C connector to connect it to a PC and a Molex connector to connect the Dragonfly board. The cable comes pre-connected and only needs to be reattached if it becomes disconnected.

Figure 3:Dragonfly PARDI Board Interface

3. Software Introduction

The Soundskrit Demo Kit Interface is a platform used for evaluating performance of the Dragonfly demo kit. It enables users to quickly test the different algorithms provided by Soundskrit.

Figure 4: Soundskrit Demo Kit Interface

The software allows users to capture a recording via Live Recording mode and process the raw signals through various algorithms. This mode lets users compare algorithm performance side by side through playback. To facilitate quick evaluations, sample audio files are also provided in the software, allowing users to test the algorithms even without connecting to the Dragonfly demo kit.

The Demo Kit Interface also provides relevant computational metrics across all algorithms, including CPU usage and RAM usage for various processor cores to help customers understand the algorithm requirements in embedded implementation.

For more detailed introduction of Soundskrit Demo Kit Interface, please refer to Downloads → **Soundskrit Demo Kit Interface User Manual.**

4. Dragonfly Algorithm Introduction

To help customers understand the performance differences between algorithms and identify the most suitable solution for processing audio signals in their projects, Soundskrit provides various algorithm families, including beamformers and AI-based models. These algorithms are optimized for isolating voice pickup and suppressing background noise. Below is a detailed overview of these algorithms.

4.1. Beamformers

Soundskrit provides several beamforming algorithms for users to compare the performance in terms of voice capture and noise suppression and further understand how linear array beamforming and AI denoiser could be used to enhance directionality and noise rejection. The table below shows the beamformers that can be evaluated with the Dragonfly.

Beamformer Descriptions*	
Omni	Outputs the equalized omnidirectional microphone signal, used as a reference for performance comparison.
Linear Shotgun	A highly directional beamformer that combines all six microphones to maximize front-facing sound pickup while reducing reverb and suppressing off-axis noise.

** Please refer to the computational requirement shown in the GUI.*

4.1.1. Equalized Omnidirectional Microphone

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

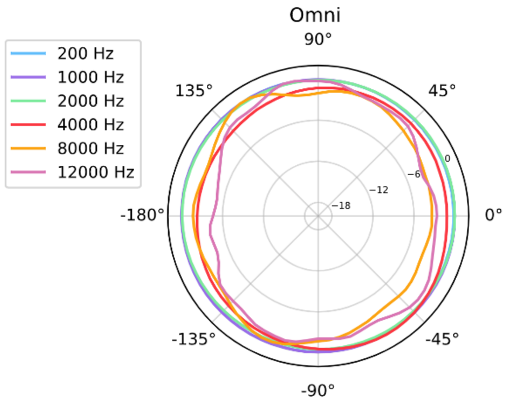


Figure 5: Polar Pattern Plot for Omnidirectional

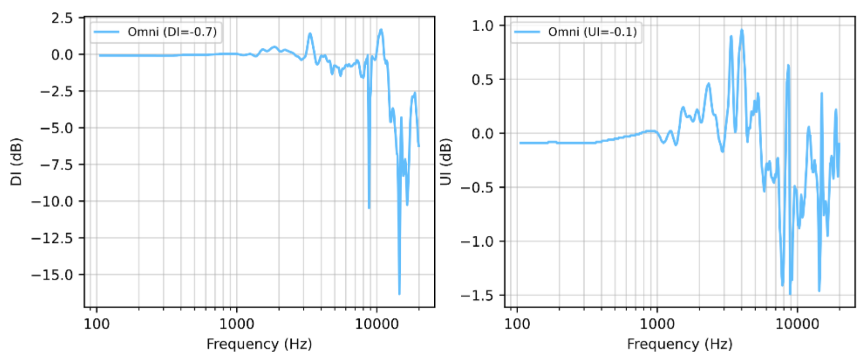


Figure 6: Directionality for Omnidirectional

4.1.2. Linear Shotgun

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.

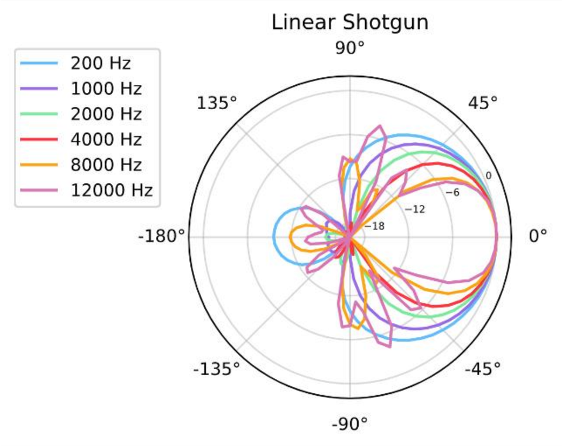


Figure 7: Polar Pattern Plot for Linear Shotgun

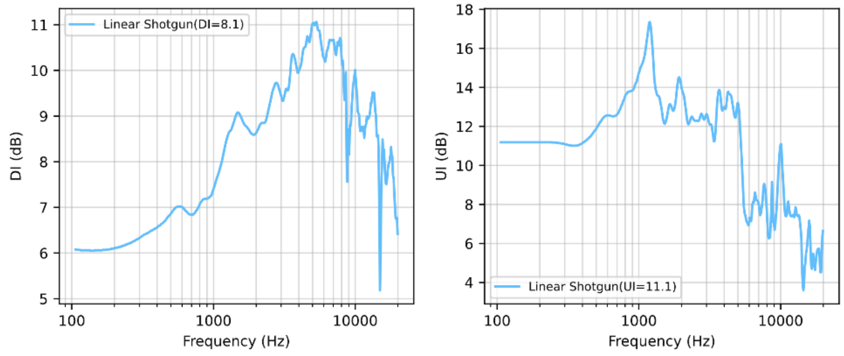


Figure 8: Directionality for Linear Shotgun

4.2. AI Denoising

The GUI comes equipped with AI denoising models that are divided into three categories: Small, Medium, and X-Large. These models can be cascaded on top of a chosen beamformer. The table below shows the detailed description for each AI model.

AI Denoiser Description*	
Small	Small AI model for noticeable background noise suppression, with some distortion and artifacts.
Medium	Medium AI model for enhanced background noise suppression, with less distortion and artifacts
X-Large	Extra-large AI model for premium background noise suppression, with minimal distortion and artifacts

** Please refer to the computational requirements shown in the GUI.*

5. Setup Guide

5.1 Installation

Download and launch the Soundskrit Demo Kit Interface installer file from Downloads on Soundskrit's website and follow the installation steps. A prompt may appear requiring approval for an unknown publisher.

Connect the Dragonfly to your PC using the included USB-C to USB-A cable.

To start the software, search from the Windows start menu for 'Soundskrit Demo Kit Interface' or use the desktop shortcut generated by the installer.

Make sure the Dragonfly is correctly connected to the PC and that the PARDI board is in **raw mode**. If the PARDI board is not in raw mode (this may apply to units shipped before June 2026), a window will appear, prompting you to change the PARDI board to raw mode.

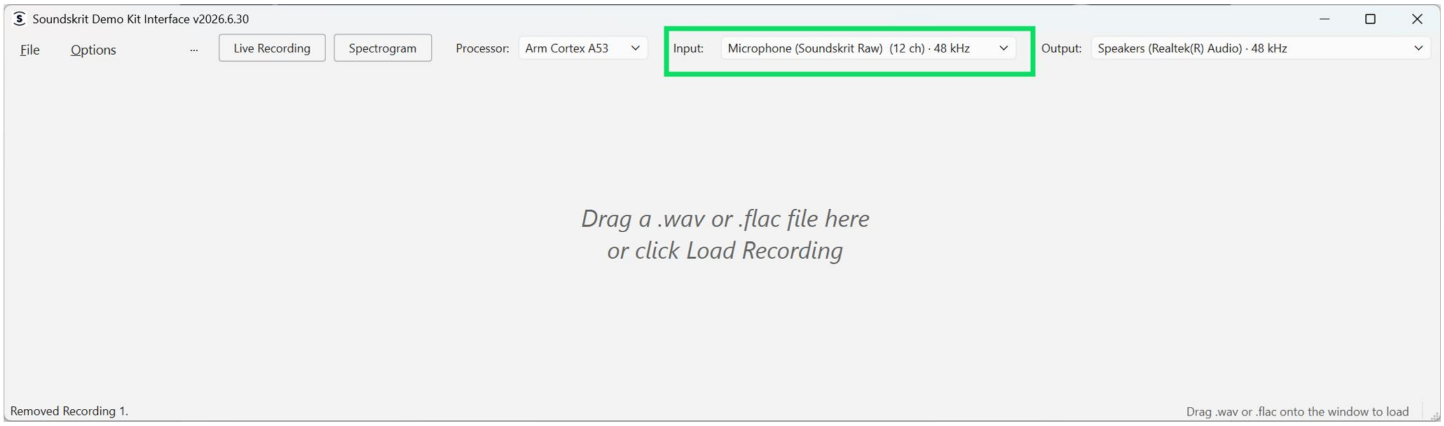


Figure 9: Raw Mode Detected

5.2 Audio Performance Evaluation

There are **three ways** to get audio for audio performance evaluation.

5.2.1 Option 1: Load built-in audio samples

Users can find pre-recorded audio samples and load them in the Soundskrit Demo Kit Interface for quick performance comparison without the Dragonfly kit connected. To find the audio samples, click **File** in the top-left corner, and choose **Samples**.

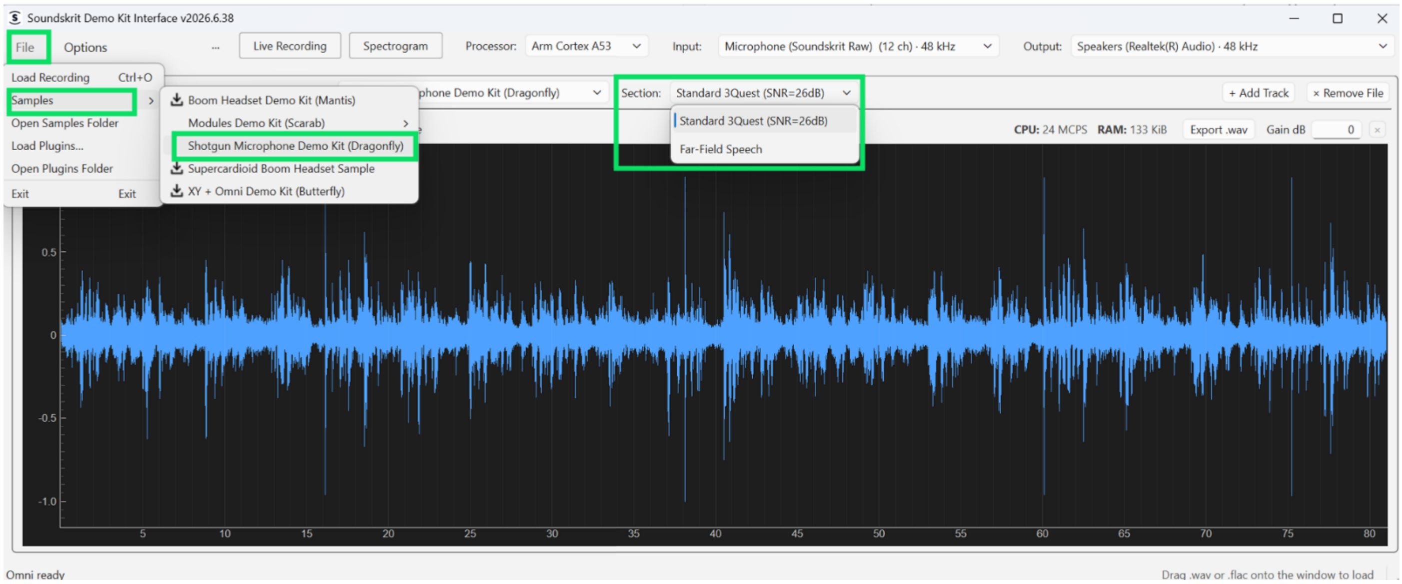


Figure 10: Audio Samples in Soundskrit Demo Kit Interface

3QUEST samples assess speech quality and noise suppression in typical noise. In a 3QUEST test, a talker speaks a set of standard sentences while realistic background noise is played around the device. The signal-to-noise ratios for speech level to background noise is 26dB (standard 3Quest setup. The SNR is computed at the HATS mouth reference point (25mm in front of the mouth).

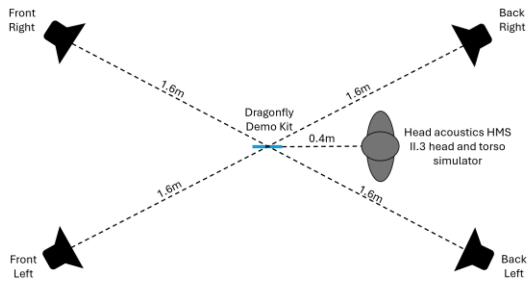


Figure 11: 3Quest Testing Setup

The **Far-Field Speech** sample shows how voice capture holds up as the talker moves farther from the device. In this test, a talker speaks from three fixed distances, at 1 meter, 3 meters, and 5 meters from the microphone, in a typical office environment with no added background noise. The sample plays the three distances back-to-back, so the recording captures the talker at increasing range. As the talker moves away, the direct voice level drops and room reflections become more prominent, making reverberation the main challenge.

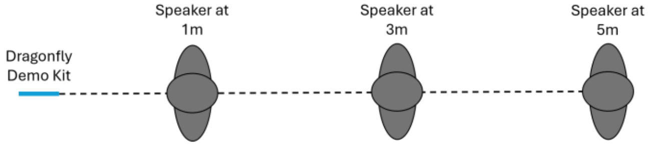


Figure 12: Far-Field Speech Testing Setup

5.2.2 Option 2: Load an External .wav File

Users can upload external .wav file for audio processing. The .wav file must be a raw signal recording captured from the Dragonfly demo kit.

Please note, if the external audio file is not recorded by Dragonfly demo kit, the audio file will only be marked as 'External', and no demo kit can be chosen for it. Under this circumstance, external audio file could be set as benchmark reference to compare the audio performance between Soundskrit Dragonfly Kit and other audio solutions.

5.2.3 Option 3: Record Live with the Dragonfly

Use Live Recording (see image below) to capture audio with the Dragonfly and process it in real-time.

1. Click **Live Recording** to open the recording window. By default, two tracks are configured to compare performance across the algorithms in parallel.
2. Click **Record** to start and **Stop** to end. The audio is distributed across the tracks with preset algorithms applied. All audio tracks are normalized to facilitate easy comparisons. Recording again replaces the previous take.
3. To compare the performance with AI algorithm combined, set the AI options in **Settings** for corresponding track.
4. Click **Export Raw Audio** to keep all three raw channels (re-loadable later for processing), or **Export .wav** to save a single processed track.

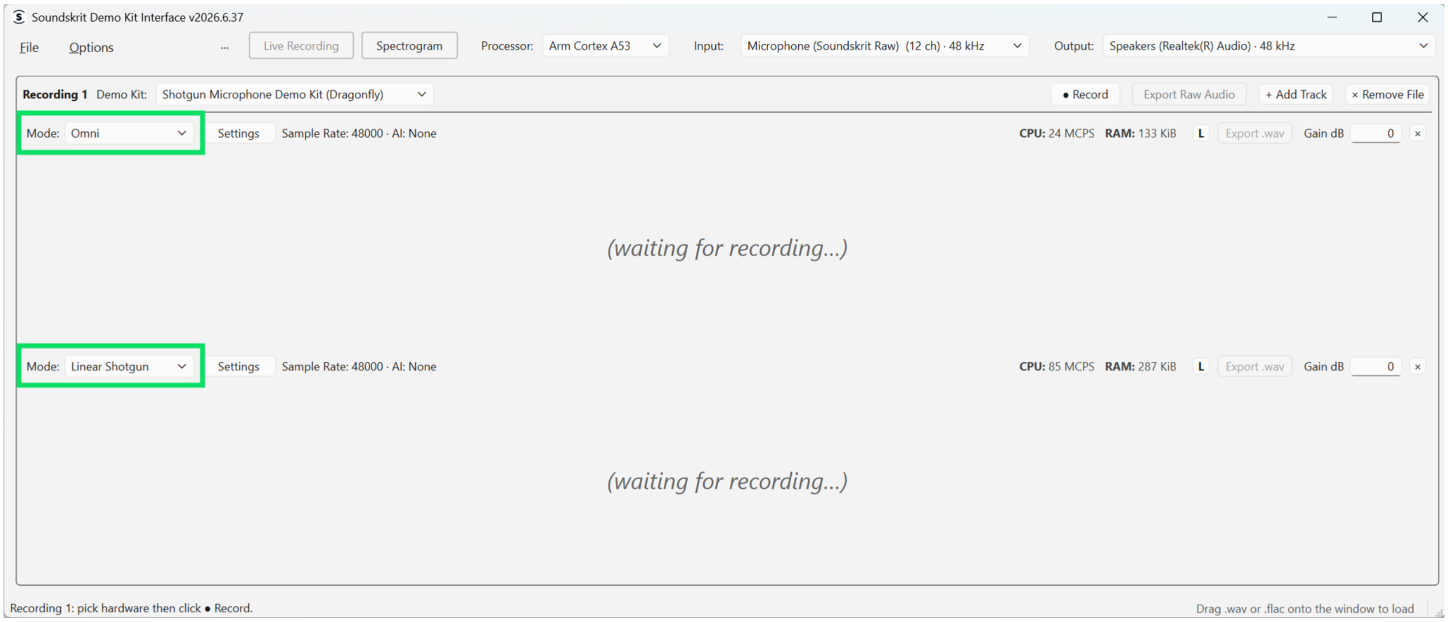


Figure 13: Automatic Tracks Setup in Live Recording

6. Troubleshooting

This section provides solutions to common issues encountered during installation and operation of the demo kit.

Problem	Possible Cause	Solution
Soundskrit Demo Kit Interface doesn't show **Microphone (Soundskrit Raw)** in the **Input**	Dragonfly is not correctly connected to PC	Verify the connection between PARDI board and mantis, as well as between PARDI board and PC. A green LED indicator on PARDI board should be flashing if the connection is correct.
Cannot get default tracks after loading external audio file recorded by Dragonfly	'Demo Kit' is not chosen as Dragonfly	Set Dragonfly as the demo kit.

7. 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.

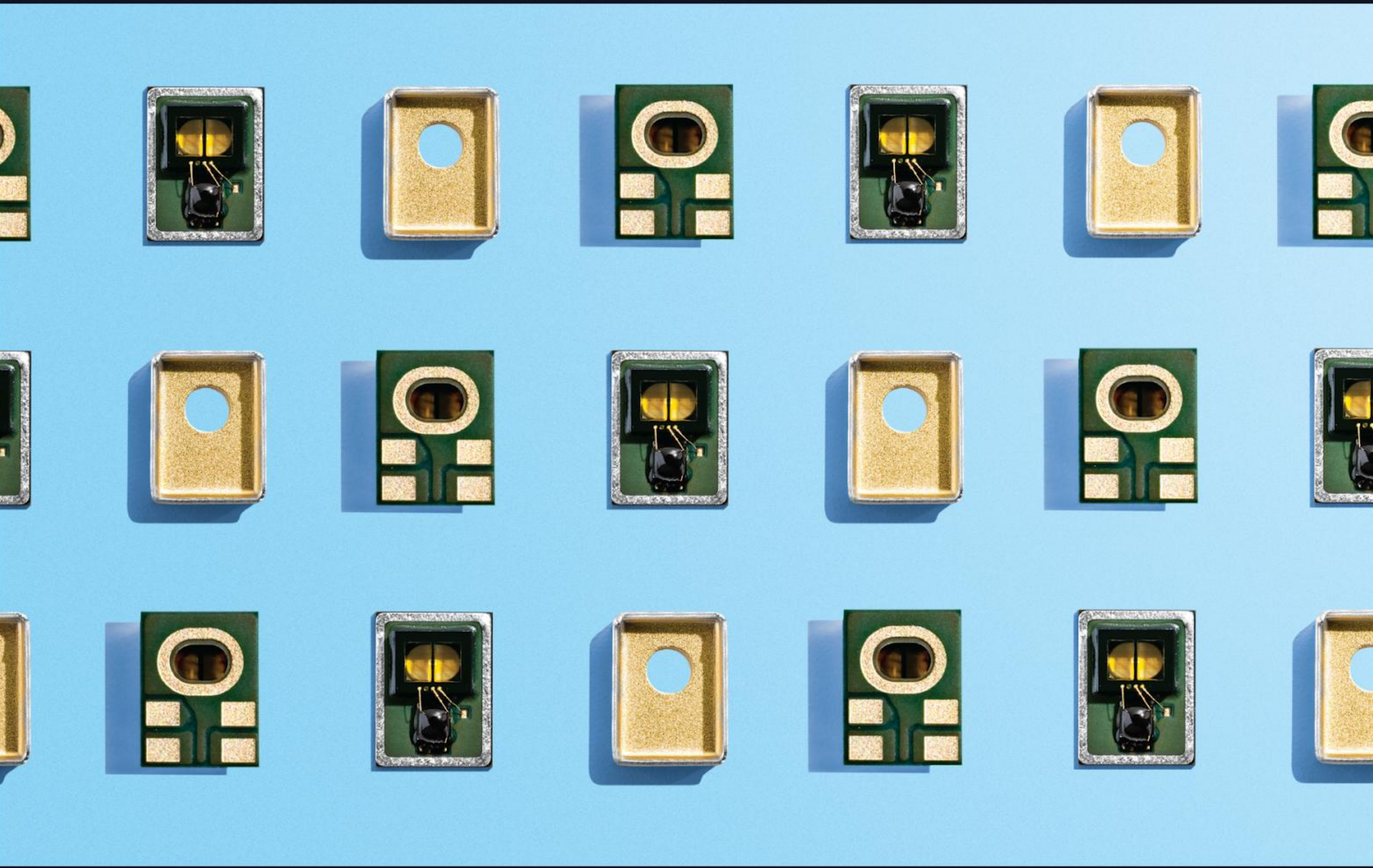
8. Revision History

Revision Label	Revision Date	Sections Revised
-	Jun 2026	Initial release

Figure 18: Add benchmark recording in Mantis GUI

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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