1. Characteristics

- Supercardioid polar pattern
  - 5.3 dB DI
  - 9.6 dB UI
- High 73 dBA SNR
- Ultra compact form factor
  - 7 mm diameter
  - 4.6 mm thickness
- Low power consumption

2. Description

This document describes how to design a state-of-the art boom microphone for headsets using the Soundskrit's directional MEMS microphones. When using Soundskrit's SKR06XX microphone series, an impressive 73 dBA SNR supercardioid boom microphone is achieved by adjusting the polar pattern with an acoustic mesh.

Due to the high SNR of the SKR06XX, the boom design can be made as small as 7mm in diameter and 4.6mm in thickness. This makes it ideal for applications in which small, sleek boom designs are required. The industrial design, including the outer shape and inner dimensions, is flexible as long as the key parameters are followed. Measurements are provided for a prototype of the design and samples of this prototype are available upon request.

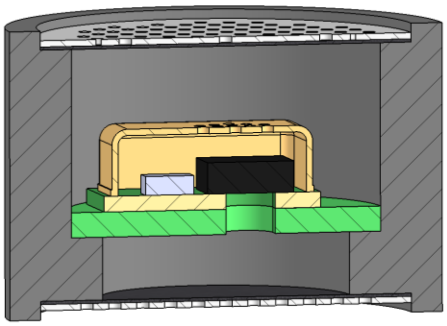

Figure 1: Cross-section of the SKR06XX supercardioid boom design

3. Performance Curves

Test conditions unless otherwise indicated: PCB port facing toward loudspeaker and defined as 0º, no EQ.

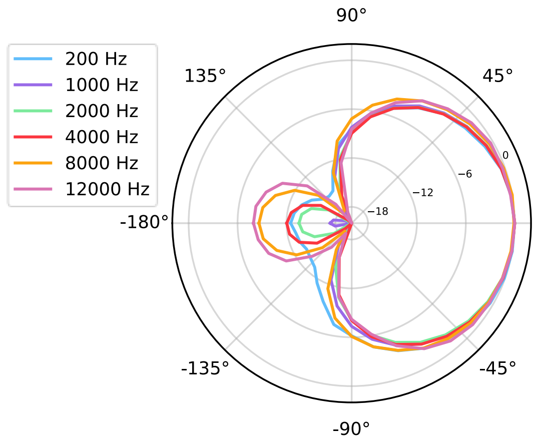

Figure 2.1: Pickup pattern vs frequency

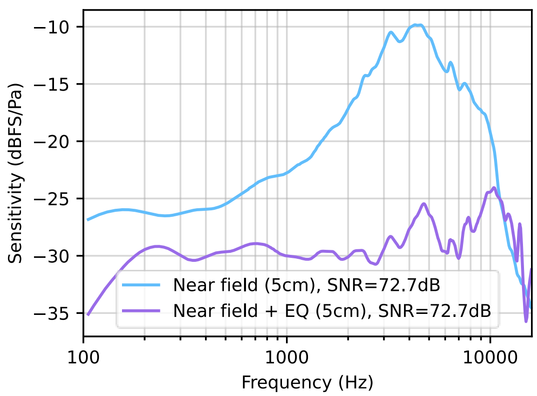

Figure 2.2: Sensitivity vs frequency

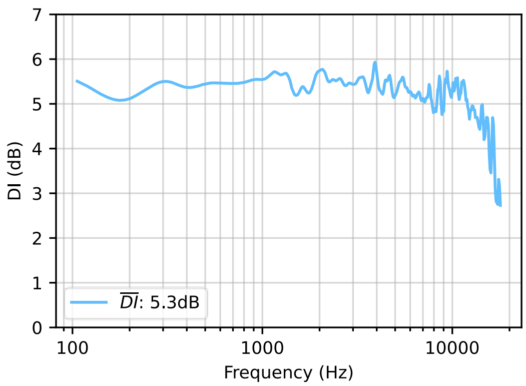

Figure 2.3: Directionality index vs frequency

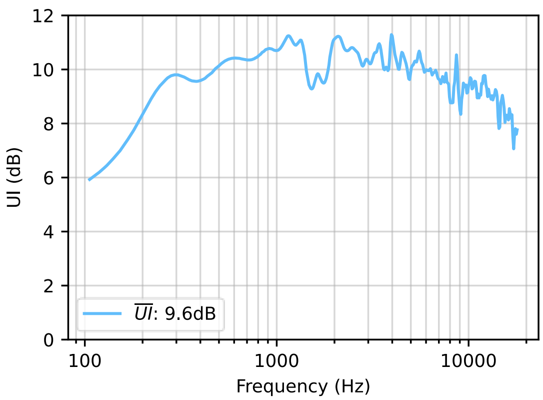

Figure 2.4: Unidirectional index vs frequency

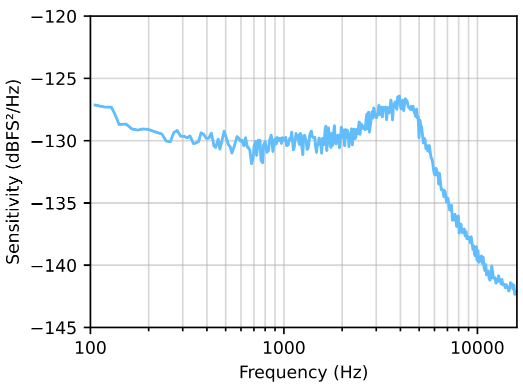

Figure 2.5: Noise floor

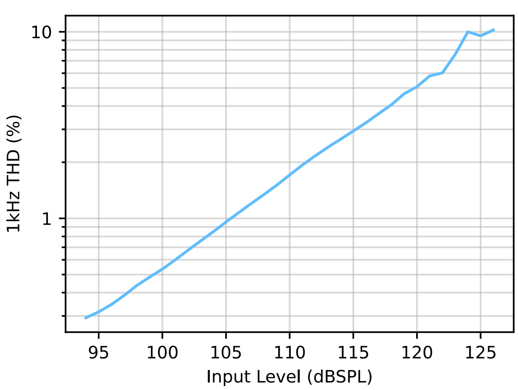

Figure 2.6: THD ratio at 1kHz, after EQ

4. Mechanical Overview

The following section shows an example integration of the SKR06XX microphone in a housing with acoustic meshes to achieve a supercardioid polar pattern.

4.1 Design Parameters (dimensions in mm)

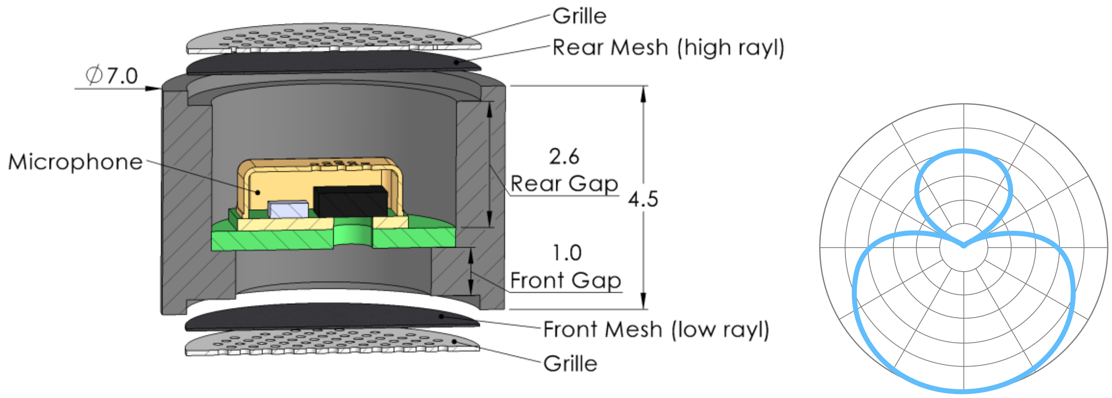

Figure 3: Cross section and polar pattern orientation

Parameter	Value	Notes
Outer diameter/width	7mm	The diameter or width of the boom casing. A larger diameter or width will increase SNR while a smaller diameter will decrease SNR. Changing the diameter will affect the frequency response and the shape of the polar pattern. It may require a re-tuning of the rear mesh impedance to achieve the desired polar pattern.
Front and rear gap	1 mm, 2.6 mm	The distance from the mesh to the PCB. This gap helps provide the ideal directivity pattern. Changing this distance will affect the shape of the polar pattern and may require a retuning of the rear mesh impedance to achieve the desired polar pattern.
Front/rear protective outer grills	N/A	A metal grille can be used to protect the meshes. The grille should be highly perforated to be as acoustically transparent as possible.
Front mesh impedance	≤42 Rayl	The front acoustic mesh is used for ingress protection. The Saati 042HY (with hydrophobic coating) is recommended for IP57.
Rear mesh impedance	~500 Rayl	The rear acoustic mesh is used to create an acoustic delay between the front and rear ports of the microphone and change the polar pattern from a dipole to a supercardioid. The Bopp AM500 with HC8 (hydrophobic coating) is recommended and will also provide IP57. The mesh resistance is approximate; it must be adjusted experimentally based on the specific mechanical design.

4.2 Sealing

For the functioning of the acoustic resistance of the mesh, it’s important that sound can’t leak around the mesh. The surfaces between parts must be sealed air tight, for example, by using adhesive between the parts.

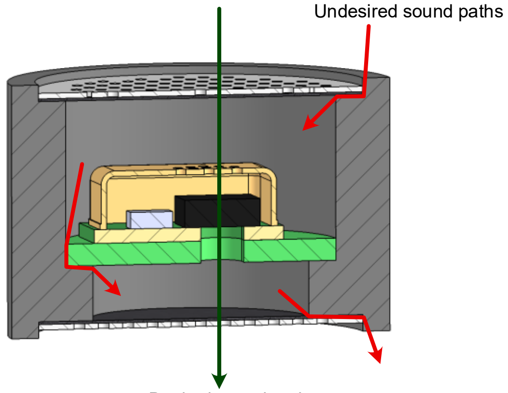

Figure 4: Possible sound leakage paths

Sometimes, the grill and mesh can be manufactured as pre-cut stickers with adhesive on the rim, which keeps them in place and creates an acoustic seal between the mesh and the surface of the housing.

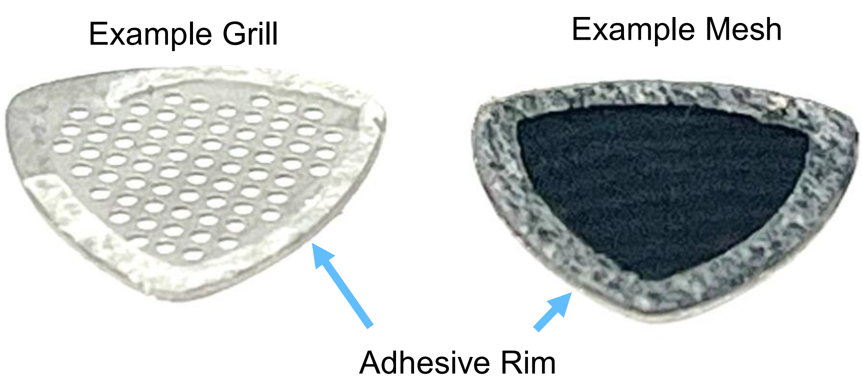

Figure 5: Example of a pre-cut grill and mesh sticker

5. Electrical Connection

Both the SKR0600 (analog) and the SKR0610 (PDM) can be used to build a single microphone supercardioid. It is **recommended to use PDM microphones**, as this avoids possible dynamic range issues that can occur with analog inputs of the headsets ADC/SoC, if they do not match the dynamic range of the microphone. This can lead to unwanted clipping of loud signals and additional noise on quiet signals.

See the microphone datasheet section “Typical Application Circuit” for electrical connection information.

PDM: To get the full performance of the microphone, the PDM signal should be down-converted to a 24-bit PCM signal.

Analog: When using an analog microphone, make sure that the clipping level of the ADC is higher than the highest expected signal level from the microphone and that the noise floor of the ADC is lower than the self noise of the microphone.

6. Signal Processing

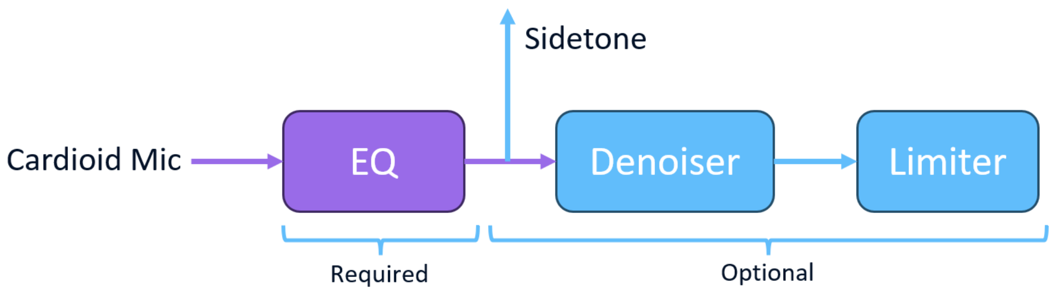

Figure 6: Typical signal flow

Equalizer: To achieve a flat frequency response over the full frequency range, an equalization filter (EQ) is needed on the microphone signal. This can be implemented using fixed function EQ blocks available in many SoCs / external ADCs.

The following curve is the response of the EQ following the inverse of the near field microphone response, leading to a flat frequency response at the output. This curve is an example – since the frequency response of the microphone will be affected by the mechanical integration and length of the boom, the EQ should be calibrated for the specific product using a frequency response measurement taken in the real microphone position.

The example EQ is implemented as 3 biquad sections (2 sections for flattening the microphone response and 1 section as a low-cut filter).

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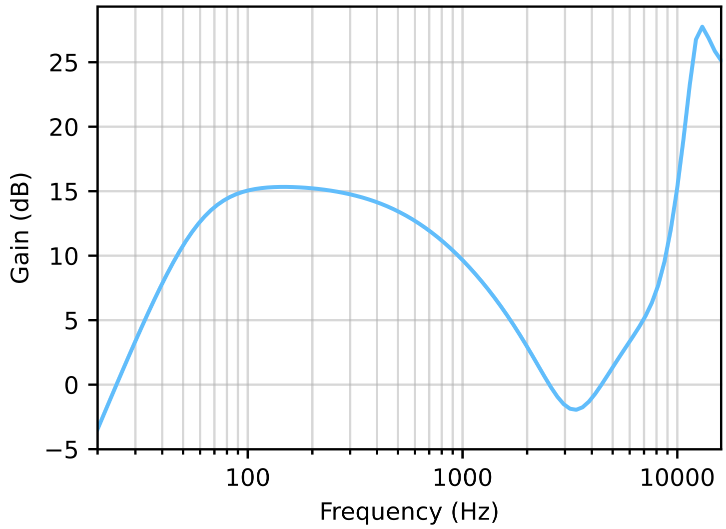


Figure 7: Typical EQ response curve

Denoisier: Some SoCs, e.g. from Qualcomm, offer an integrated denoiser. This can be applied after the EQ.

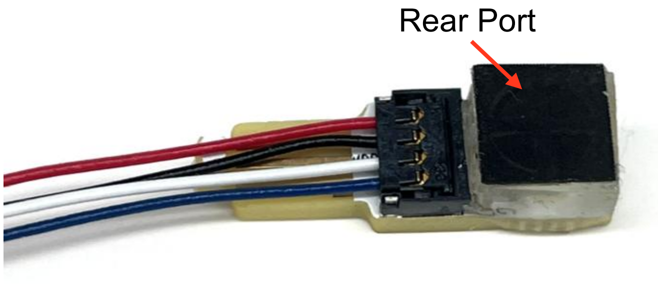
Limiter: A limiter (or compressor / DRC) at the end of the signal chain allows the gain to be set at a level appropriate for normal speech volume without risking clipping when the speech volume gets louder.

Sidetone: If the headset implements a sidetone (feedback of the users voice to the headphone speaker to avoid speaking unusually loud), the sidetone signal should usually bypass the denoiser and limiter to minimize the latency for the sidetone path.

7. Sample

Our sample demonstrates the creation of a supercardioid polar pattern in hardware using a higher acoustic resistance on the microphone rear port. It consists of a SKR0610 coupon board, a rubber spacer and a mesh sticker. The "Performance Curves" section shows measurements of this sample.

Pin	Color	Function
1	Red	VDD 1.8V
2	Black	GND
3	While	PDM DATA
4	Blue	PDM CLOCK



The sample comes with a cable connecting it to our PARDI audio interface board. The Soundskrit Demo Kit GUI includes the EQ curve calibrated for this sample.

To perform this, download the software through [Downloads] on Soundskrit's website and install the GUI. Once the installation is completed, open the software, click **Live Recording** on the top of the window, set **Demo Kit** as Supercardioid Boom Headset Sample, and click **Record**. There are two default tracks in live recording, each is configured as Supercardioid Raw and Supercardioid EQ.

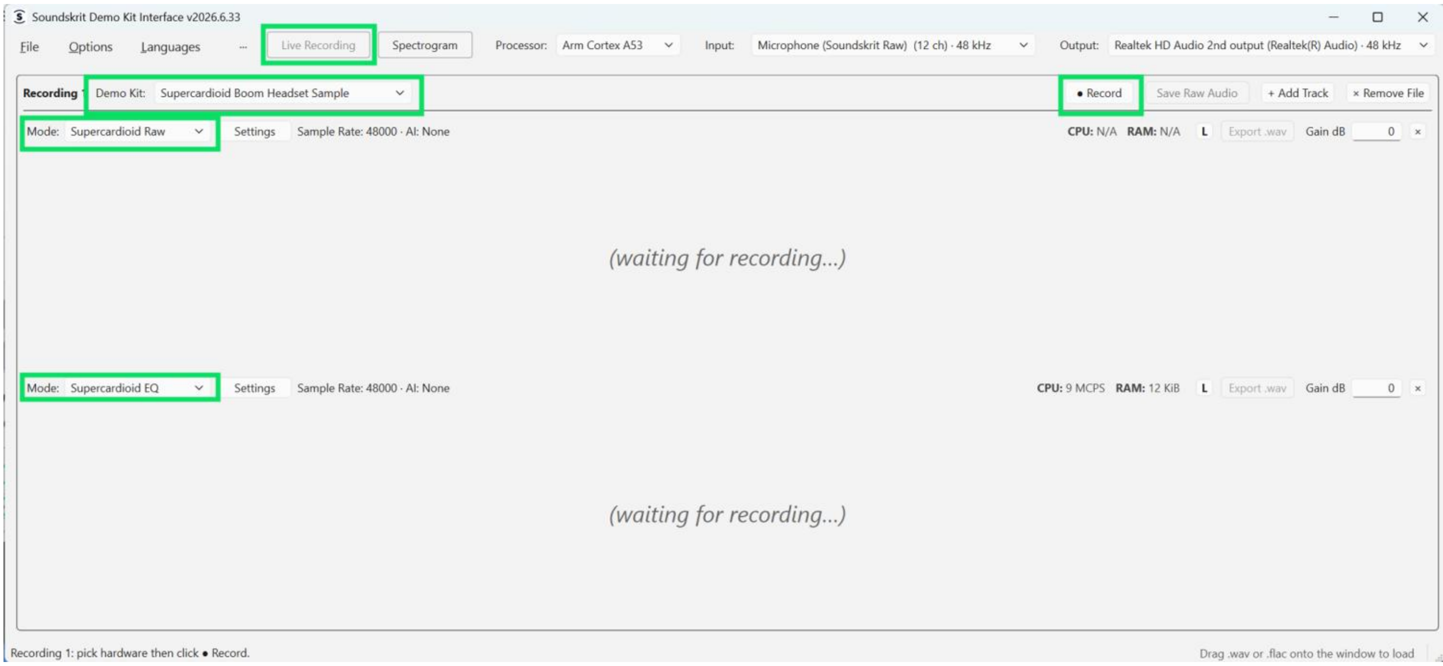


Figure 8: Soundskrit Demo Kit Interface for Supercardioid Boom Headset Sample

Additionally, users can add AI model in the track to compare the performance of AI denoiser. Click **Settings** and choose AI model that need to be tested.

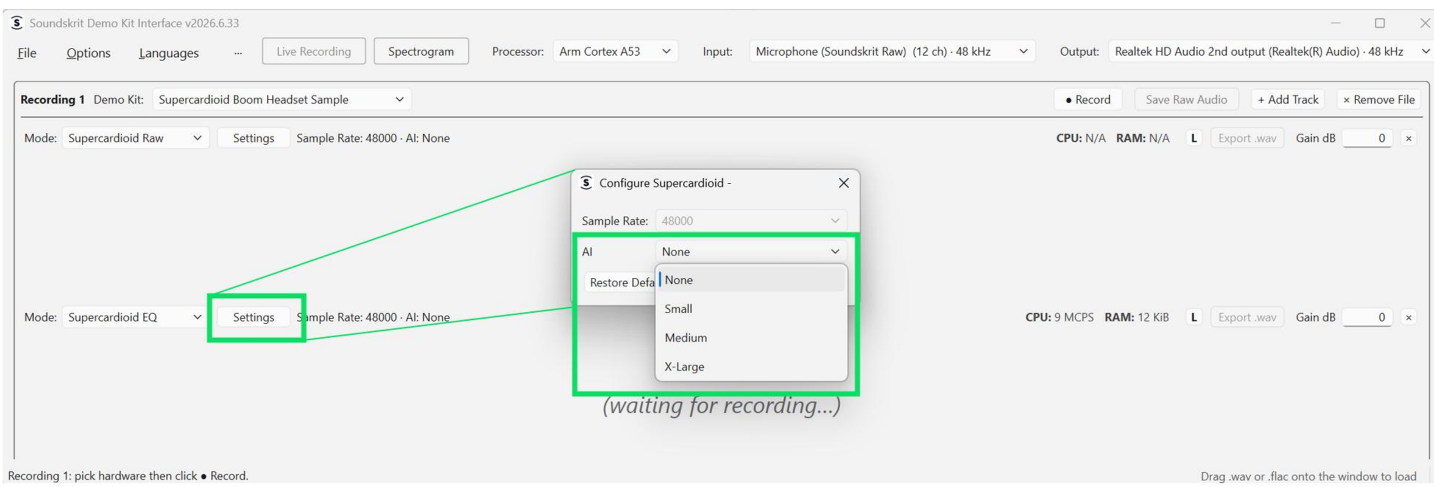


*Figure 9: Add AI Denoiser in **Settings***

8. Device and Documentation Support

8.1 Datasheets

[SKR06XX Datasheet]

8.2 Application Notes

Relevant application notes can be found on our application notes page:

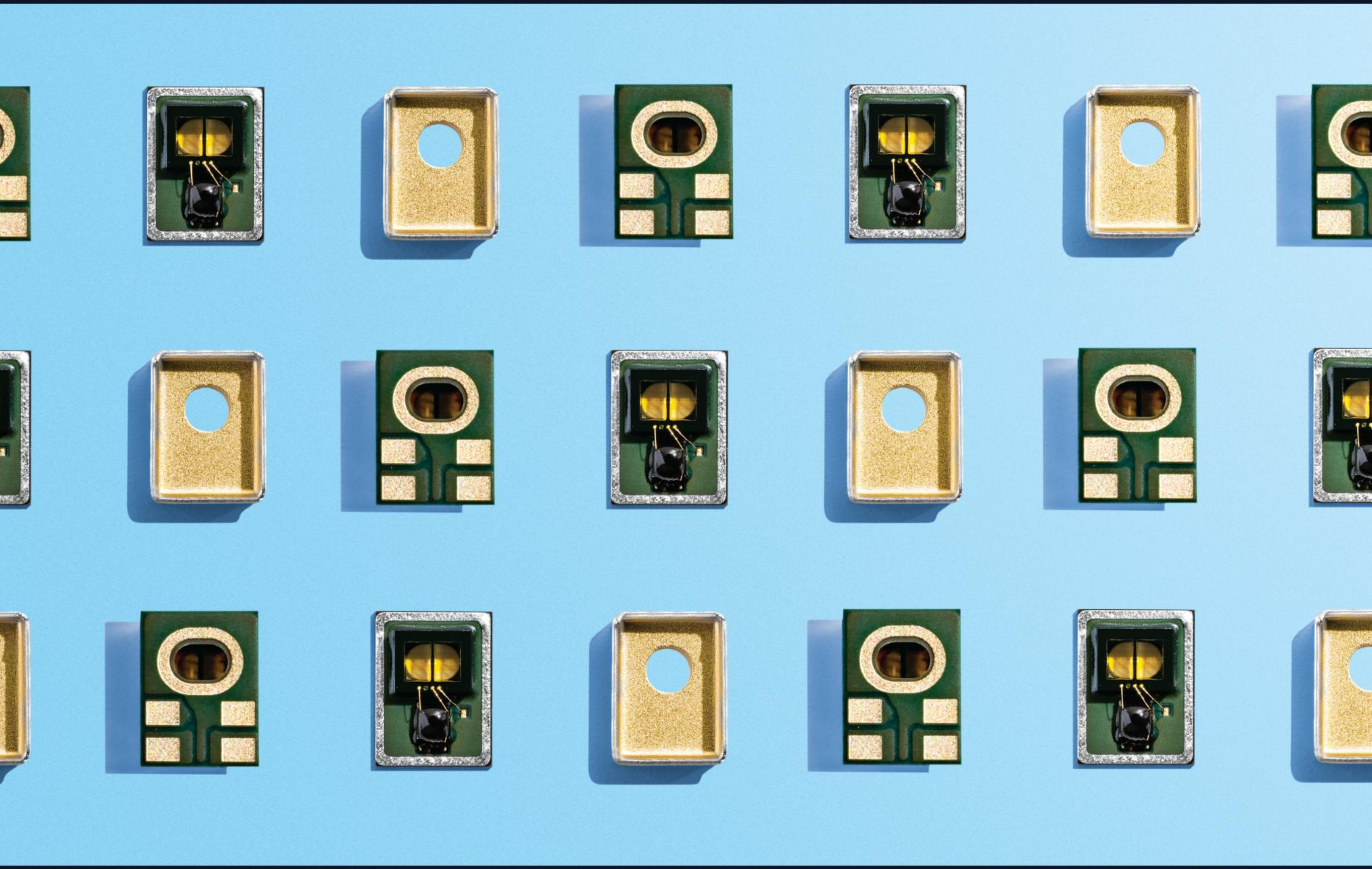
- AN-110: Attributes of Soundskrit Directional Microphones

9. Revision History

Revision Label	Revision Date	Sections Revised
-	May 2026	Initial release
A	July 2026	Soundskrit GUI instructions added to **Sample** section

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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Hear the impossible.