FROM PARTS TO PERFORMANCE:
THE DESIGN, CONSTRUCTION, EVALUATION, AND OPERATION OF A RIBBON MICROPHONE

ABSTRACT

The ribbon microphone has a long history of use in the sound recording industry. Its principle design consists of very few crucial components. Fundamentally, a ribbon microphone is made of a thin strip of conductive material suspended in a magnetic field and an output transformer. Even with relatively few components, the design principles are variable enough to allow for a wide array of commercial microphones with drastically different qualities, both objective and subjective. This research project will explore ribbon microphone design, identify the effects of variation within each component, construct a functional ribbon microphone utilizing the information gathered, and make use of the microphone for creative recordings. This project will result in a comprehensive analysis of ribbon microphone design, an operational microphone, comparisons, measurements, and recordings that demonstrate the functionality and quality of the product.

METHOD

1. **Research** the history of ribbon microphone design as well as the theories of operation and construction.
2. **Design** a ribbon microphone using the research as a guide.
3. **Construct** the entire microphone – including the ribbon/magnet assembly, output transformer, and body housing.
4. **Test** and measure the microphone to provide industry-standard specifications including frequency response, directional response, sensitivity, and output impedance.
5. **Utilize** the microphone in the making of creative recordings to demonstrate its practical function and sonic qualities.
6. **Analyze** the results, both objective (test and measurement) and subjective (creative recordings)

RESULTS

- A fully developed microphone design using the principles of electrodynamic ribbon transducers.
- Three microphones completely built from scratch - using no pre-constructed components.
- Measurements of frequency response, directional response, sensitivity, and output impedance.
- Recordings of three musical works that illustrate the sonic qualities of the microphone(s).

PRESENTER:
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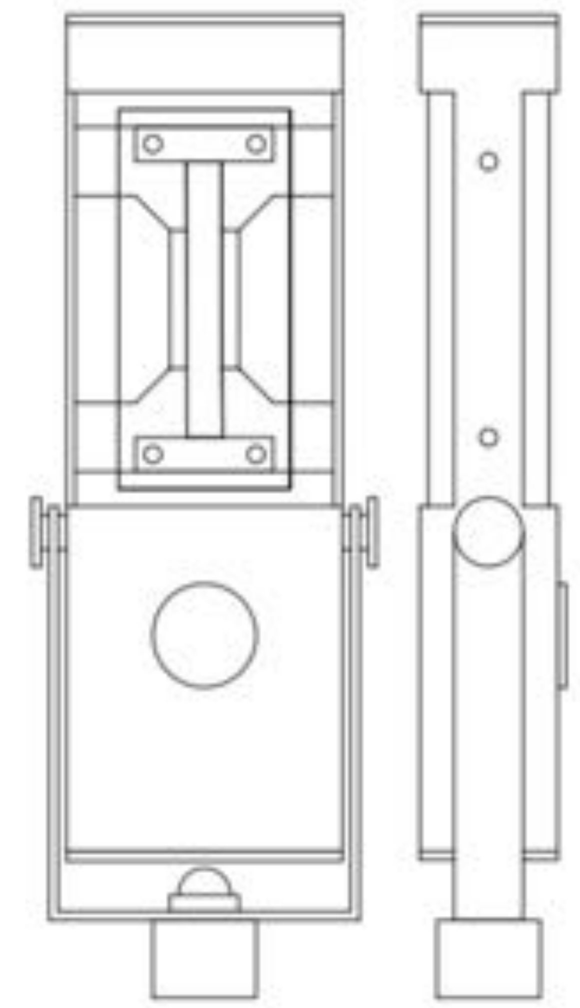
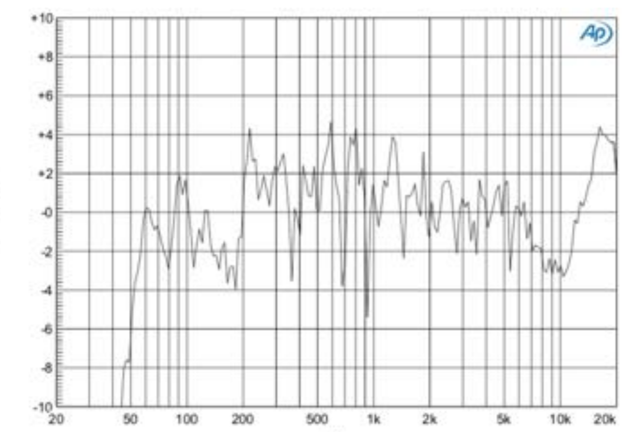
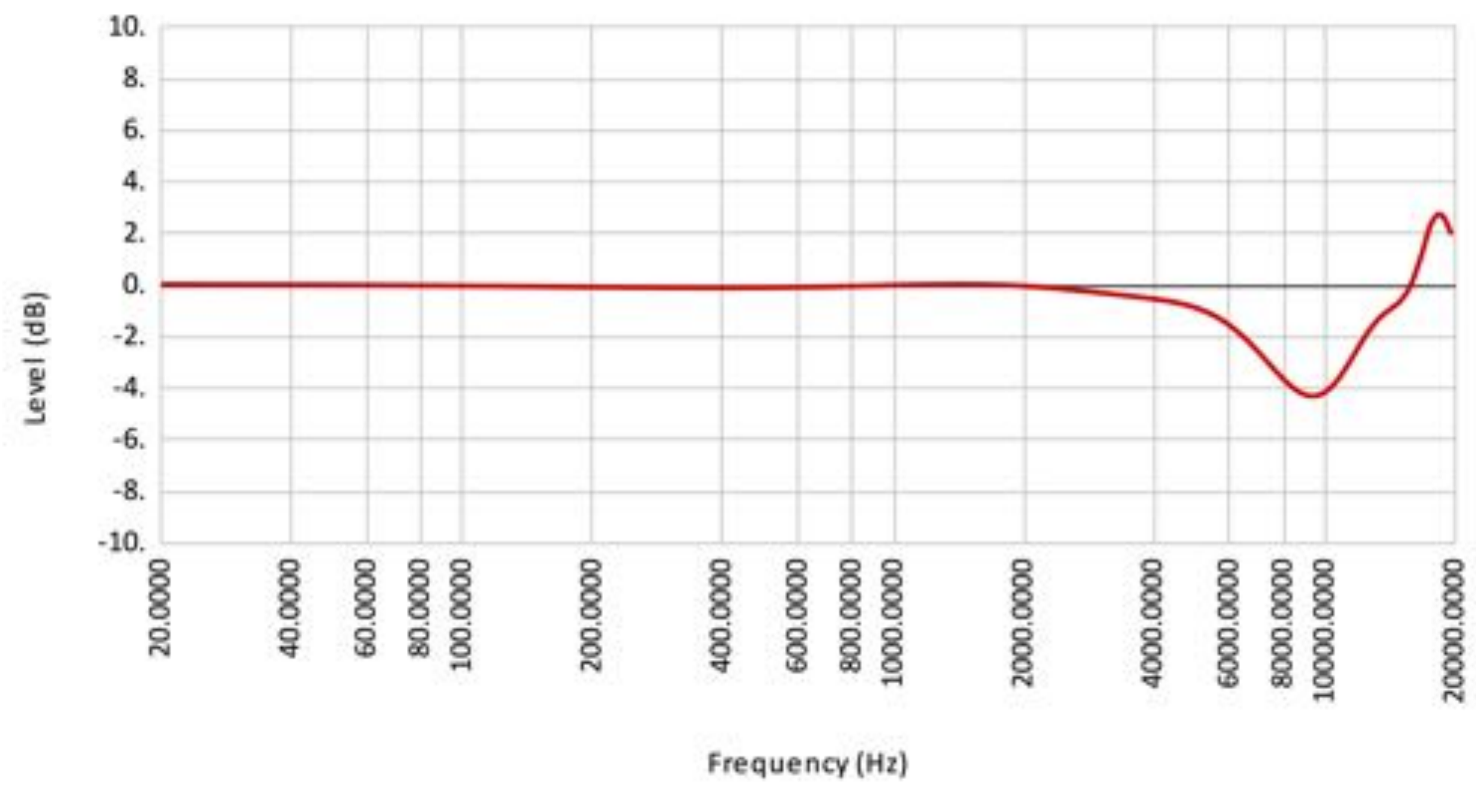
THIS MICROPHONE WAS BUILT **FROM SCRATCH**

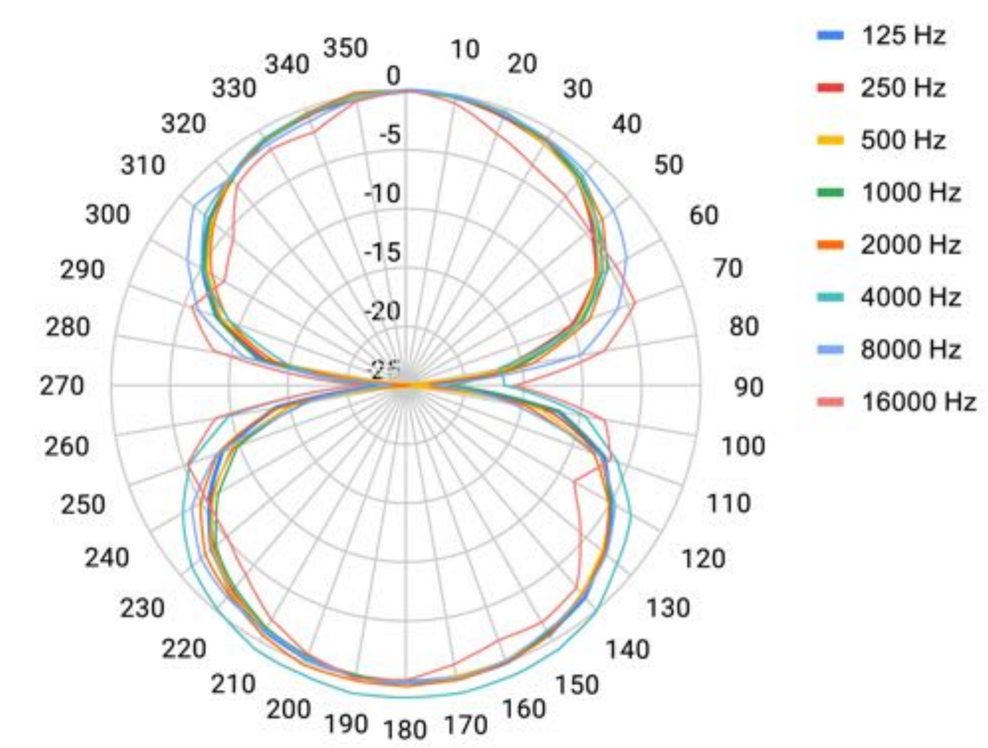




MEASURED MICROPHONE FREQUENCY RESPONSE - LEVEL (dB) v. FREQUENCY



MEASURED MICROPHONE DIRECTIONAL RESPONSE - LEVEL (dB) v. DEGREES



Frequency response is measured through the comparison method using a microphone of known response. A sinusoidal signal is used to sweep the audible frequency range (20 Hz – 20 kHz). The measured output of the reference microphone is adjusted to compensate for any fluctuations in frequency sensitivity. The measured output level of the microphone under test is then compared against this data set, resulting in a reasonable measure of frequency response.

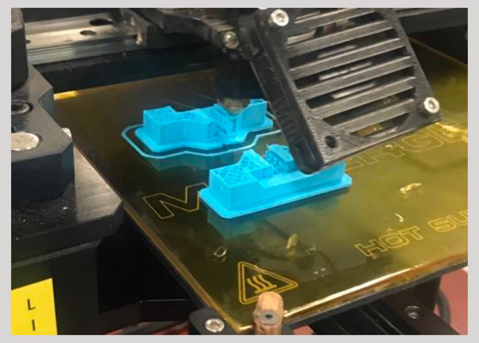
Directional response is measured by comparing the output level of the microphone when rotated to the level when facing a sound source on-axis. A steady-state sinusoidal signal is emitted from a loudspeaker and the microphone output level is recorded. The microphone is rotated 10 degrees and the level is recorded and compared against the on-axis response. This process is repeated until the microphone is fully rotated 360 degrees.

SCAN ME

FOR SOUND EXAMPLES SCAN THE QR CODE OR VISIT WWW.T-SONICS.COM

MICROPHONE SPECIFICATIONS

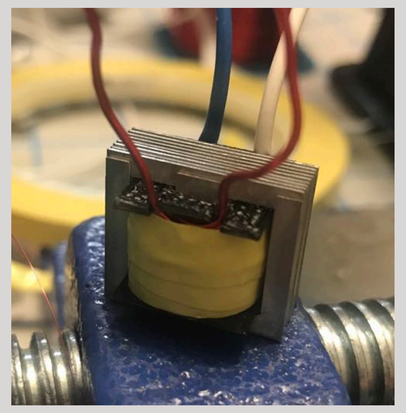
Operating Principle:	Pressure Gradient
Directional Pattern:	Figure 8
Frequency Range:	20 Hz – 20 kHz
Sensitivity:	-62dBV/Pa
Output Impedance:	250Ω
Finish:	Brass
Ribbon Material:	99% Aluminum
Ribbon Thickness:	1.8 micron
Ribbon Width:	0.2 inches
Ribbon Length:	2 inches
Microphone Length:	6 inches
Microphone Diameter:	2 inches
Microphone Weight:	469g (16.5oz)



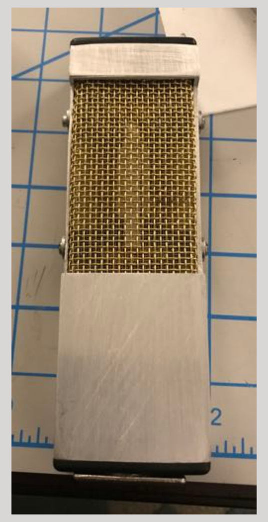
3D printing parts

3D printed parts molded and cast in a more durable plastic

Brass pieces prepped to make body



Finished output transformer



Initial prototype made with aluminum body

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