Knowles®

TB25

TECHNICAL BULLETIN

IMPROVED EM MICROPHONE

The Improved EM microphone was designed for higher sensitivity, lower input referred noise (ENP), and better power feedthrough attenuation (PFA) than our standard high quality EM microphone. This has been accomplished without sacrificing physical size or frequency response shape.

1.0 IMPROVED SENSITIVITY

The Improved EM microphone average 1kHz sensitivity is -52dB re 1V/microbar (see Figure 1 "response curve") which is 4 dB more sensitive than our standard EM product. This has been achieved while maintaining the same physical dimensions as our standard EM product (see Figure 2).

1.1 Benefits

- The increased sensitivity results in a reduced noise contribution from following amplifier/signal processing stages. In a typical application, using off–the–shelf amplifiers, the result can be a further 0.5dB reduction in ENP.
- The increased microphone sensitivity results in the hearing aid amplifier circuit needing less gain and using less battery current.
- The sensitivity of this microphone is within 1dB of our EK product, allowing the hearing aid designer the flexibility to use a smaller microphone without sacrificing sensitivity where space is at a premium.
- Since the sensitivity of the Improved EM is similar to the EK, hearing aid manufacturers will be able to use this microphone in place of the EK, reducing the number of microphone models and faceplate configurations in inventory.
- The added microphone sensitivity will increase the signal to supply voltage variation ratio for the following amplifier/signal processing stages, producing an overall clearer output signal to the receiver (see Section 3.0).

2.0 LOWER INPUT REFERRED NOISE

The Improved EM microphone average "A" weighted equivalent noise pressure (ENP) is 25.0dB SPL — 3.0 dB lower than the standard EM product.

2.1 Benefits

2.1.1 ENP

Lower ENP of the microphone has a direct impact on the ENP of the hearing aid.

Referring to ANSI Publication 3.22, which takes an average of the input referred noise at 1kHz, 1.6kHz, and 2.5kHz, the noise of a hearing aid using an EM-3346 will improve by approximately 3 dB over the same hearing aid equipped with a standard EM-3046.

2.1.2 ONE THIRD OCTAVE NOISE

A very descriptive way to study noise across the audio band is by looking at the spectral representation using 1/3 octave filters. A comparison of the input referred 1/3 octave noise measurements between our standard EM and the Improved EM (see Figure 3) reveals dramatic improvements in almost all of the 1/3 octave bandwidths across the audio spectrum.

Referring to IEC Publication 118-0, Section 7.14, which measures the input referred noise of a hearing aid at center bands between 200Hz and 5000Hz using 1/3 octave bands, the noise of a hearing aid using an EM-3346 could improve by as much as 8dB in the lower 1/3 octave bands over the same hearing aid equipped with a standard EM-3046.

Based on sections 2.1.1 and 2.1.2, noise is very dependent on how it is measured. For a further understanding on noise measurement and how it relates to Knowles microphones ask a Knowles Sales Representative for a copy of "Noise Notes" by Dr. Earl Geddes, Knowles Technical Director of Research & Development.

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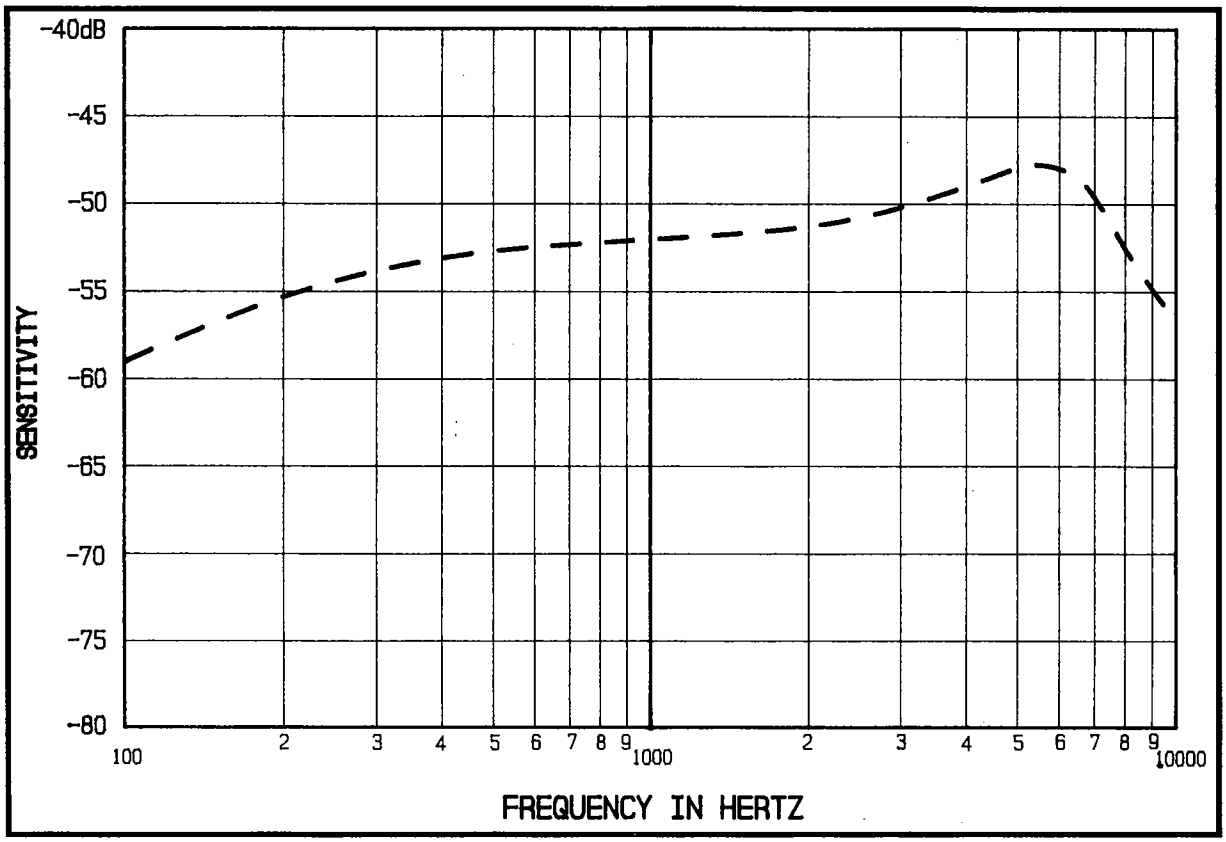
FIGURE 1. Typical Response Curve



3.0 IMPROVED POWER FEED-THROUGH ATTENUATION (PFA)

The amount of feedthrough that occurs on the hearing aid battery is a function of amplifier gain, receiver coil impedance, and battery resistance. Rejection, or attenuation, of this signal is necessary to ensure that the amplifier output remains stable under normal operating conditions.

A standard EM microphone has 11dB typical attenuation of battery voltage variation, as measured at the output terminal of the mic. For the Improved EM, this figure increases to 20dB. Taking into consideration the 4dB increase in sensitivity of the Improved EM, the apparent improvement in PFA is 13dB. This is easier understood by evaluating the following:

Standard EM
1kHz Equivalent SPL due to 10mV RMS variation of battery voltage: 79dB SPL

Improved EM
1kHz Equivalent SPL due to 10mV RMS variation of battery voltage: 66dB SPL

When using the Improved EM in a moderate gain Class A hearing instrument, it may not be necessary to include a battery filter or regulator. It is quite possible that up to 55dB peak gain with a 6dB gain margin could be achieved using the Improved EM with an EH–3050 receiver. Using a standard EM would result in only 42dB peak gain. Use of the Improved EM could result in a lower component count and therefore a lower cost hearing instrument.

The benefits seen in high gain and Class B/D instruments would be reduced value/size of regulator capacitors and lower second harmonic distortion, respectively.

FIGURE 2. Improved EM Microphone

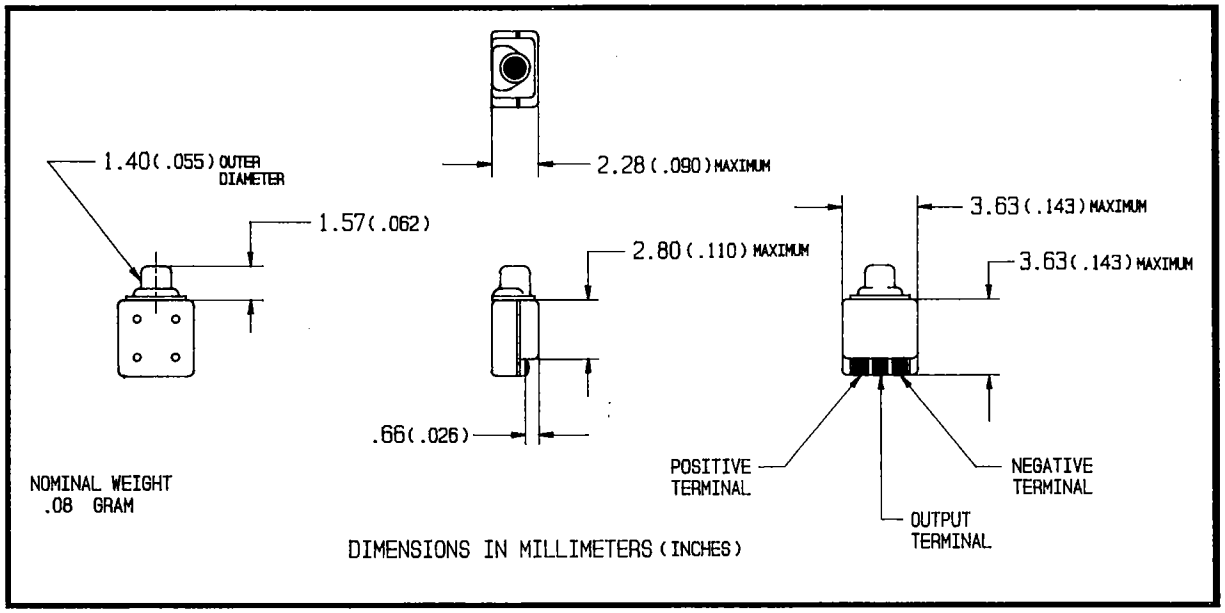


FIGURE 3. Comparison of Input Referred 1/3 Octave Noise Measurements Between Standard EM and Improved EM