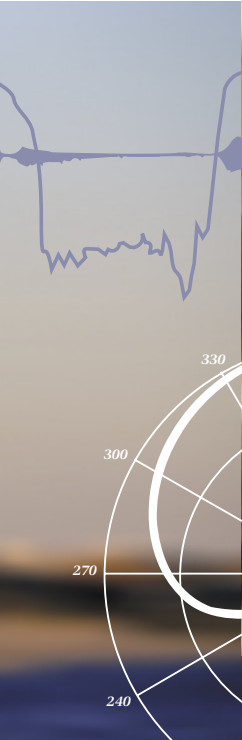


RESISTANCE TECHNOLOGY, INC.



directional

hearing technology just took a quantum leap



smaller.



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smaller.

Challenges affecting the hearing impaired

The vast majority of hearing aid products today employ omnidirectional microphones that amplify noise and speech equally from all directions. The resulting "surround sound" detection and amplification, without localized discrimination, can actually hinder the patient's ability to listen. Nor does the omnidirectional polar response model the human ear's physical discrimination of forward listening. Until recently, this limitation has been one of the more significant problems for hearing aid users.

Omnidirectional microphones

In some listening scenarios an omnidirectional microphone can provide reasonable listening comfort, but there are times when speech is not intelligible and background noise from undesirable sources competes with the speech in the front of the listener. A good example occurs when a hearing impaired person attempts to listen in a busy restaurant, where the speech in front and behind are at the same level. An omnidirectional hearing aid is not able to "sort" the speech, separating what the listener wants to hear from the speaker from competing sounds.

Unidirectional microphone technology

The unidirectional microphone offers a useful alternative to the omnidirectional microphone, providing a higher ratio of sound from a specific direction and pattern. With the recent emergence of unidirectional microphone technology, hearing aids today have a measurable technique to enhance the way patients listen to speech in noisy environments.

First, unidirectional microphones can maximize the sensitivity to sounds propagated in front of the listener and reduce the sensitivity to sounds behind the listener. They offer several polar response patterns that can be tailored to fit desired hearing levels. **Figure 1** shows three typical profiles that directional microphones can generate.

Current hearing aid directional microphone systems, utilize two microphones, hybrid electronics circuitry, an electro-mechanical switch, and - in some cases - a large molded package to hold all of these components.

IntelliMic™, the next generation in directional microphone technology

Resistance Technology is pleased to introduce the first selectable unidirectional and non-directional single microphone system for ITE half shells and some ITCs. The IntelliMic utilizes a patent pending acoustical valve technology. It will allow hearing aid manufactures to expand their market demographics by increasing the number of patients who can be fitted with directional hearing aids.

A breakthrough in miniature acoustic packaging and performance techniques, the IntelliMic establishes a new category for smaller, simpler directional hearing instruments that should improve sound discrimination for patients.

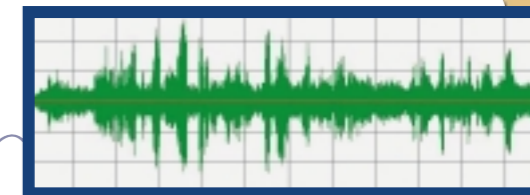
Figure 2 shows the volumetric size advantage of the RTI IntelliMic over other unidirectional microphone systems. Our comparison study confirmed that the IntelliMic is actually 3 times smaller in overall volume compared to one product type.



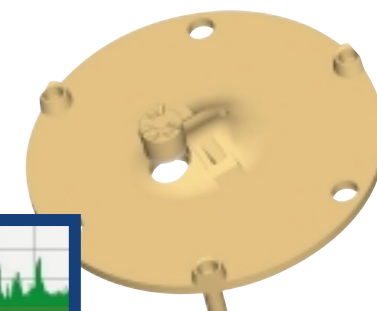
Figure 2



Figure 1



Actual speech pattern tested.



IntelliMic performance means improved clarity

The IntelliMic's acoustical performance was verified by Orfield Laboratories, an NVLAP/NIST certified acoustical laboratory known worldwide for its studies in the sound quality field. Orfield Labs verified the following key performance parameters:

- Signal to Noise Ratio (SNR)
- Frequency Response
- Directivity Index (DI)
- Noise Floor
- Speech Transmission Index (STI)
- Articulation Index (AI)

Individuals with hearing loss have a greater difficulty understanding speech in environments with significant background noise. A common way of rating the degrees of sound containing useful information such as speech as compared to the same sound containing only the degrading noise is call the signal-to-noise ratio (SNR).

Hearing impaired patients require a SNR of 5 to 15 decibels greater than people with normal hearing. The IntelliMic's performance confirms an overall SNR improvement of 6.4 dB in the unidirectional mode vs. the omnidirectional mode.

Table 1 shows the frequency bands critical for understanding speech and the SNR improvement for each band.

As shown in **Table 2**, the IntelliMic's noise floor is limited only to the microphone and does not contain the added noise generated by additional directional electronic circuits.

Octave Frequency Band (Hz)	Uni Vs. Omni SNR Improvement (dB)
125	5.3
250	8.4
500	5.8
1000	8.6
2000	6.0
4000	7.4
8000	3.4
Overall Score: 6.4	

Table 1

IntelliMic	Noise (dBA) A-weighted SPL
Omnidirectional	28.9
Unidirectional	34.4
RTI & Competitive Products (Overall Range)	
	28.9 (Low) up to 46.3 (High)

Table 2

In order to validate the performance of the IntelliMic, RTI has included another measurement tool to compare the speech transmission index (STI) of other directional microphone products (**see Table 3**). Independent testing confirms that the IntelliMic performs as well or better than other directional microphone products evaluated in this test. STI /RASTI is an IEC standard for the prediction of speech intelligibility. The method evaluates the temporal and frequency of the source signal (voice). As with articulation index (AI) measurement, the scale of STI ranges from no intelligibility (0) to perfect intelligibility (1).

Unidirectional Mode 0 Degrees	STI Overall (0=poor and 1=Perfect)	Subjective Impression
RTI IntelliMic™	0.67	Good
STI values (range of all products tested)	0.56 to 0.67	Fair to Good

Table 3





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(IntelliMic shown actual size).

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