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IntelliSonic™ Speech Enhancement Windows Vista

(HDAudio and USB Audio Solutions)

Data Sheet Version 1.3
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KNOWLES ACOUSTICS

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Introduction

Knowles' IntelliSonic™ Speech Enhancement[1] solutions customized to enhance the user experience for speech communications and activity like Voice over IP (VoIP), Speech Recognition on Windows Vista. These applications running on Tablet PCs, laptops/notebooks and Desktops benefit from using IntelliSonic software to improve the quality of speech by noise and interference suppression and acoustic echo cancellation. The IntelliSonic solution provides multiple configurations for real-time single or dual microphone speech enhancement. Knowles solution is available for HDAudio and USBAUDIO for Vista.

IntelliSonic is designed to provide robust performance based on:

1. Optimized noise reduction algorithms for rejecting background noise.
2. Dual microphone adaptive beam forming technology designed to enhance desired speech signals by rejecting directionally interfering sources.
3. Acoustic echo canceller is designed to eliminate unwanted acoustic echo from speakers for hands-free/headset-free telephony applications.

Solution	Number of microphones	Noise Reduction	Beam Forming	Acoustic echo cancellation
DXEC.01	1	Yes	No	Yes
DXEC.02	2	Yes	Yes	Yes

Applications

- VoIP / Telephony
- Dictation/Audio notes/ Voice annotation
- Speech transcription.
- Speech based command and control.
- Web-cam based real-time chat and tele-conferencing.
- Video mail.

Specifications

- HDAudio and USB support[2].
- Installation integrated with Codec INF files from Codec manufacturer and/or USB manufacturer.
- Minimum platform requirements:
  - OS: Microsoft Vista required.
  - CPU: Intel P4 at 1 GHz or more, 512 MB or more.
  - HDAudio codec with microphones[3] and speakers for HDAudio only solution.
  - USBAUDIO codec with microphones and HDAudio speakers for an Audio/Video solution using USB Web-cam with integrated microphones.
- APO SysFx[4] filters for WaveRT audio driver (Windows Vista).
- Microsoft Logo Certification is to be done by codec or USB manufacturer

[1] http://www.knowles.com/search/products/array_technologies.jsp
[2] Stereo input codec is required for beam-forming solutions (DXEC.02)
[3] One microphone can provide noise suppression and acoustic echo cancellation. Two microphones are required for beam-forming array.
[4] http://www.microsoft.com/whdc/device/audio/sysfx.mspx

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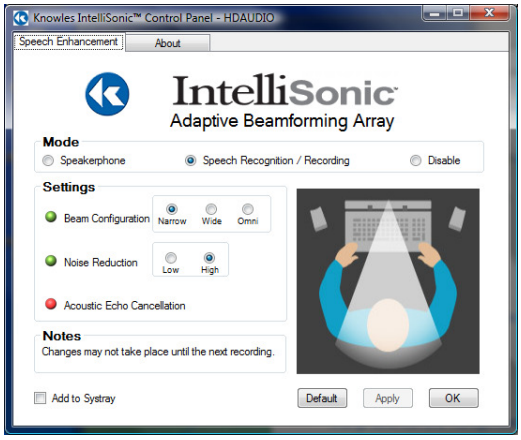
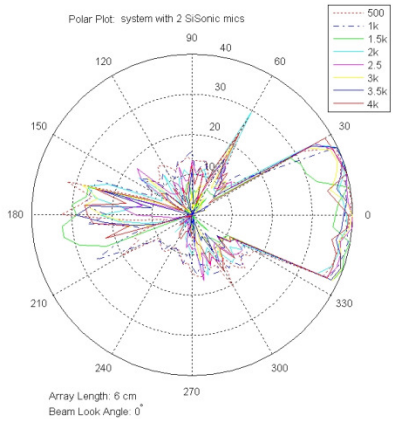
- Works with other APO Microsoft standard SysFX filters by APO chaining. Can also work with other SysFX APOs
- Fully featured control panel interface to software.
- Customizable settings for beam width and noise reduction levels



Algorithm Specifications

- Beam-Forming
  - Non-stationary noise & interference cancellation
  - 2 microphone broadside array adaptive algorithm
    - Large array algorithm:
      - Length: 50 mm - 270 mm
      - Adjustable beam-widths
    - Mini Array algorithm:
      - Length: 20 mm
      - Fixed Beam width
  - Off-beam attenuation > 25 dB
  - Signal bandwidth 8 kHz.
  - Optimized and tested with Knowles SiSonic[5] omni-directional microphones.
  - Other omni-directional and uni-directional microphones may also be used.



Typical IntelliSonic polar pattern for speech signals. Array Aperture: 60 mm Microphones: Omni-directional SiSonic MEMs

- Acoustic Echo Canceller:
  - Full-Duplex adaptive AEC based proprietary Knowles algorithm.
  - Maximum echo path delay 128 ms
  - Echo return loss enhancement (ERLE) > 20 dB
  - Signal bandwidth 8 kHz

- Noise reduction:
  - Optimized spectral subtraction algorithm with improved VAD for natural speech.
  - User configurable levels: 2
  - Noise rejection Levels: 12 dB, 15 dB
  - Signal bandwidth 8 kHz

[5] http://www.knowles.com/search/products/m_surface_mount.jsp

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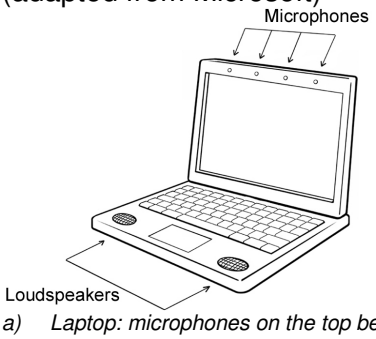
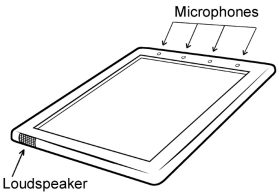
System Design Recommendations

- Microphone recording and speaker playback levels should be set so that speakers and microphones are operated in the linear region and codec A/D and D/A converters are not saturated.
- Microphones should also be located as far from the speakers as possible to avoid saturation of codec A/D converters by the echo signal. The figures below illustrate example microphone array and speaker placements suitable for good performance (adapted from Microsoft)



a) Laptop: microphones on the top bezel, speakers in front, away from them



b) Tablet: microphone array on the top, the speaker on the opposite side

- Suitable acoustic porting provided by well-designed boots is critical for robust beam-forming performance. Acoustic leakage can ruin algorithm estimations of signal direction. Knowles provides suitable design expertise in this area.
- Microphones should be used in broadside array configurations for Knowles beam-forming solutions.
- Microphone porting is required to be acoustically sealed for desired performance.
- If uni-directional microphones are used, microphones should also be accurately ported to the rear for optimal uni-directional performance and enhanced beam-forming performance.

Contact

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