# Adaptive Dual Microphone

Adaptive Dual Microphone (ADM) is a patent pending, digital signal processing technology creating directional or noise canceling microphone using only two omni-directional microphones. ADM automatically changes its directional characteristics to provide the best noise attenuation in varying environments while fully preserving the signal quality. The adaptation process is very fast and frequency selective so that multiple interferences may be cancelled simultaneously.

Besides its better directional characteristics, ADM is much less affected by wind than conventional, acoustic directional microphones. It has no proximity effect and it is easy to integrate into mobile voice communication and other devices.

ADM technology allows two types of microphones' configuration: "endfire" and "broadside". In the endfire configuration the sound of interest is supposed to be on the axis (line connecting the two microphones). In the broadside configuration it is supposed to be on the line transverse to the axis.

In the endfire configuration ADM has two modes of operation: "far-talk" and "close-talk". In the far-talk mode ADM works as the best possible directional microphone attenuating signals arriving from back and side directions while preserving the front signal. It is ideal for applications like conference, reporter and surveillance microphones, camcorders, hearing aids, assistive listening devices and mobile phones in "speakerphone mode". In the close-talk mode ADM works as the best possible noise canceling microphone creating a virtual "bubble of silence" around it effectively eliminating distant sounds without affecting the close sound. Relative freedom of acoustic design makes it ideal for mobile handsets with "soft" switch between speakerphone (far) and handset (close) modes of operation.
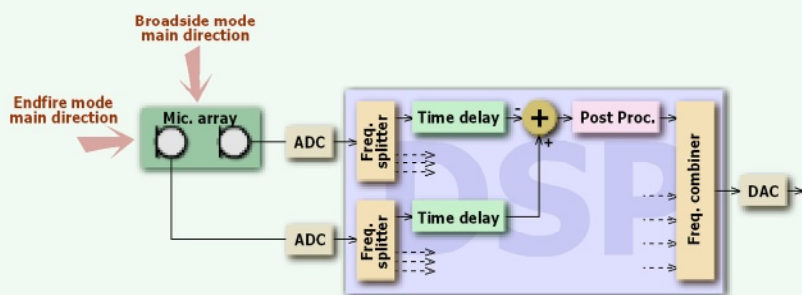
ADM principle of operation
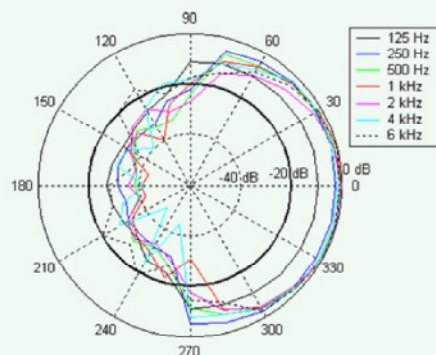
ADM polar pattern

The functionality of the processing blocks above depends on the operational mode.

In the far-talk mode the delays are chosen to attenuate all signals but the one coming from the main direction. For the endfire configuration the theoretical polar pattern of ADM microphone is described as half of figure eight. The figure above shows ADM polar pattern measured in an anechoic chamber. About 30dB attenuation is achieved for back sounds in the whole frequency range - close to the theoretical pattern.

In the close-talk mode ADM tries eliminate all sounds that create equal (with some specified tolerance) sound pressure level on its two sound pressure sensors. Thus all distant sounds coming from all directions are cancelled. At the same time close sounds that create enough sound pressure difference are preserved without any distortion.

Implementation (platforms)

ADM technology has low latency and it can be easily implemented on any low cost, 16 bit DSP. Currently ADM is available on Analog Devices BlackFin DSP family and Kalimba DSP integrated into CSR Bluetooth multimedia chips.

Appilcations

Mobile phones, Bluetooth headsets, hands-free kits, video/audio conferencing equipment, voice recorders, intercom systems, voice controlled devices and many others.