Increasing Sound Quality using Digital Signal Processing in a Surveillance system

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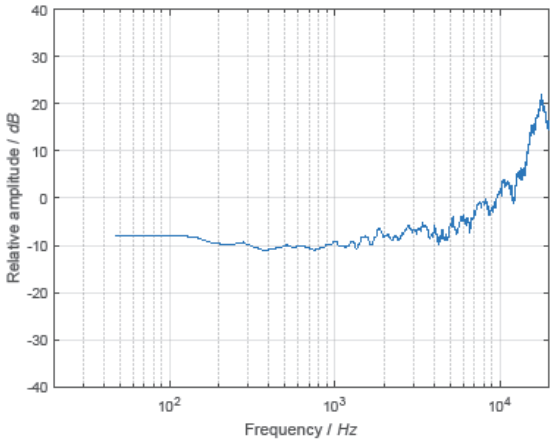
Hearing is our second most important sense. Good quality audio can have many advantages compared to video in surveillance applications. An obvious example is that audio can easily capture information from all directions while video often has a limited field of view.

Microphone

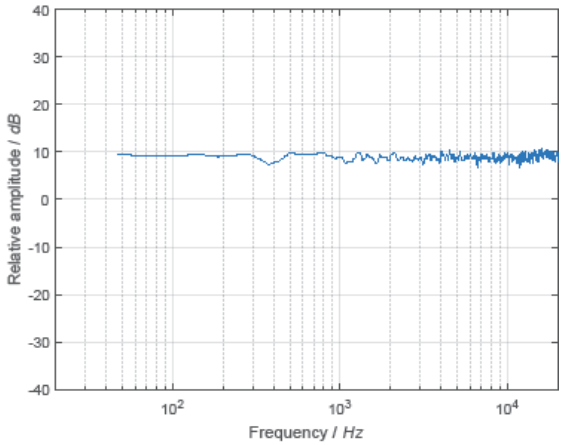
To cook a good meal you need to have good quality ingredients and it's the same with audio. Before we start "cooking", i.e. process the audio, we want to make sure that the incoming sound has good quality. Two new microphones were investigated based on their specifications. After our measurements we selected one of them. The new microphone can pick up the whole audible frequency range and has a much better signal-to-noise ratio.

Equalizer

When a microphone is placed inside a camera chassis the sound that it picks up will be greatly influenced by the chassis. This can be compared with speaking inside a metal jar. To compensate for this an equalizer was implemented to rectify the frequency response of the microphone after it was placed inside a camera chassis.



Frequency response for the camera without equalizer.



Frequency response for the camera with equalizer.

Noise Reduction

Noise is all around us, some common examples are ventilation, power supplies and distant noise from traffic. Surveillance cameras are often placed in environments with background noise that the operator needs to sit and listen to. This can be tiresome and important sounds can be hard to distinguish from the noise. We have implemented a noise reduction algorithm that can reduce all stationary noises by a considerably amount. It was determined that only stationary noises should be removed since all other sounds could be of potential interest in a surveillance application. The final implementation was obtained by making four variations that were tested and evaluated. We learned that it always was a tradeoff between how much the noise was reduced and how much the clean signal was distorted. In the final implementation we get a significant reduction of noise whilst only distorting the clean signal a small amount.