

## **IMPROVEMENT FEATURES OF ACTIVE SOUND REDUCTION**

An active sound reduction system (ASR) improved effectiveness due to the consideration of the difference in propagation velocities between acoustic and electric signals. This system has increased speed due to improved synchronization of the reduction signal with the sound source.

Further improvement of the active sound reduction method is possible by taking into account the acoustic characteristics of the room. If all the significant technical channels of acoustic information leakage are considered, as well as the acoustic characteristics of the room between the point of the sound source being reduced (speaker) and the points of acoustic information leakage channels at the boundaries of the controlled zone: time-based (time of acoustic wave propagation); amplitude-frequency characteristics (AFC) and phase-frequency characteristics (PFC); reverberation-based (reflection of sound waves from obstacles, echoes, etc.).

This makes it possible to dispense with the use of additional microphones near each channel of speech information leakage. This simplifies the hardware part of the system and the installation process. The above characteristics for each specific room can be taken in advance and entered into electronic control units, which will generate suppression signals. With this approach to protecting acoustic information, the following advantages can be achieved:

1. Each unit is prepared in advance to convert the electrical signal received from the microphone in order to produce the most effective suppression signal without significant time delays. This is provided by the action algorithm (program) entered in advance in the processor.

2. In such a system, only sounds that exist near the main microphone (acoustic information that needs to be protected) will be suppressed, without disrupting the rest of the non-critical part of the sound "picture" (ambient noise both within and beyond the controlled area). In addition, these ambient sounds will also complicate the task of capturing hidden information by intruders.

3. Since the natural sound background is not disturbed, the fact and location of the conversation will be disguised. Intruders will hear only natural sounds of the surrounding environment outside the controlled area. In other similar systems, ideally, there would be absolute silence. This would indicate the presence of secret conversations to some extent.

4. The system resources will not be wasted on suppressing these "extra" (non-relevant) sounds, which will allow the processor to be unloaded from unnecessary work, thus potentially increasing its speed and reliability (less heat generated).

5. The requirements for the maximum power of acoustic transducers can also be reduced since the sound vibrations that need to be suppressed at the boundaries of the controlled zone are often much lower in power (volume) than the extraneous sounds that other systems suppress unnecessarily. This reduces the cost of such hardware kits and reduces their weight and size. As a result, sound transducers (speakers) will have smaller dimensions and can be placed in information leakage channels (air ducts, conditioning systems, etc.) with smaller dimensions.

6. As a result of the above, power consumption will decrease. This property becomes particularly important when powering such systems from an autonomous energy source with limited energy resources (batteries, accumulators, etc.).

7. Since the system will only react to the speaker's speech (as stated in point 2 of this list), which naturally has pauses between words and phrases, the advantages mentioned in points 4-6 of this list will be more evident. During such pauses, the system "rests".

The procedure for setting up the system can be simplified by using automatic tuning with test signals.