

Overcoming Table Noise without Compromising Performance

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Paper shuffling, tapping and covering microphones create a constant annoyance for distant site of a group teleconference. To reduce table noise, ceiling microphones are often requested. The increased distance from the talker typically locates the microphones outside the Dc (Critical Distance) and compromises the transmit quality. In this paper the FC101 is applied to resolving table noise issues.

Analysis of the Problem

Boundary microphones (uni or omni directional) are popular low profile solutions widely available. A low profile microphone design helps to blend the technology into the table but can also be transparent to users. Since most users do not consider the sensitivity of the microphones, many unwanted table noises are transmitted to the distant end of an audio or videoconference. The basic theory behind this approach is that if users knew about the noise they were creating they would modify their behavior.

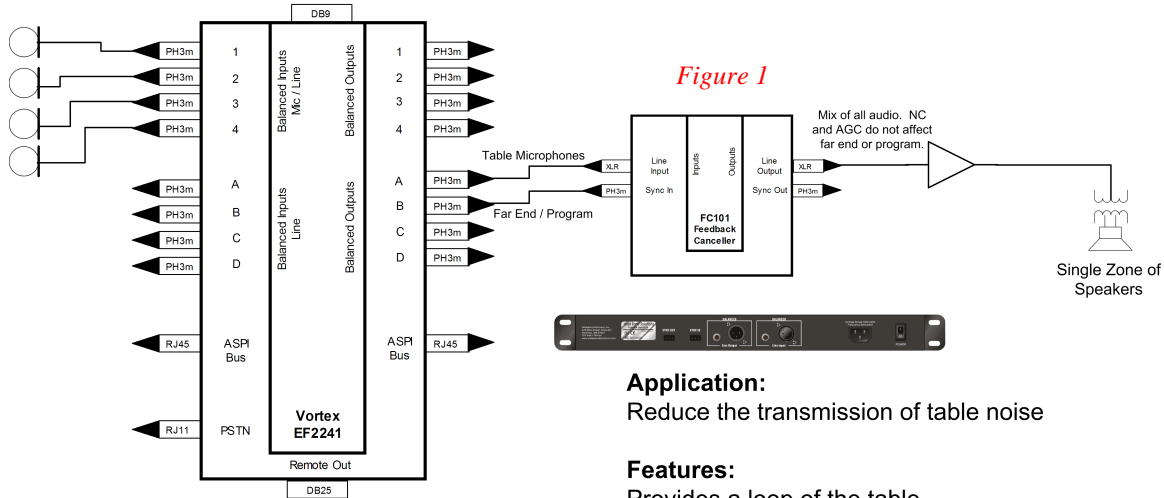
Audio Preview Monitor

The idea for this solution came from observing a videoconference. A teaching Doctor at a medical college complained about problems with a remote site's camera always being black. I visited the site with a dealer and found that the nurses would turn the camera to the wall before the class started. They wanted to avoid being seen on camera because they talked throughout the class and rarely paid attention. If there was no preview monitor they may not be aware that the Doctor could see them and would most likely be called to attention.

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Most users are unaware of the noise they are transmitting. Applying the preview monitor concept provides an audible cue of this noise. In 2004 WideBand monitored the installation of three sites: A corporate boardroom, law firm and University lecture hall. All had complained about table noise and wanted ceiling microphones. The three organizations agreed to try this concept.

A mix of the table microphones were routed to the FC101 (around -15dB to -20dB). The far end of the video and audio calls were routed to the "Sync In" of the FC101 to bypass the signal processing. This avoids acoustic echo cancellation and feedback cancellation from fighting each other. The output of the FC101 is a mix of the Line Input and Sync In and was connected to the amplifier. (see figure 1)



Typical Flow
Biamp Audia Flex, Polycom Vortex, ClearOne XAP400, 800

Note: Do not reference microphones in the Mixer (only far end and program).

Sync switch should be in the down position on the FC101.

All three installations had positive results. The Fortune 500 Company would usually cover their microphones. This solution was an immediate fix to the problem.

The lawyers were the worst table noise offenders. Their facial expressions were priceless when they first heard the noise they were generating. They have a heightened awareness of the microphones, and the noise was dramatically reduced. They also requested that the level be increased so they can hear themselves. Even though this room does not require speech reinforcement, their request was accommodated (not recommended).

The school used boundary table microphones for the students but did not have adequate coverage. To compensate the integrator set the microphones at a fairly high level. The FC101 prevented the microphones from being covered (which happened all the time). The system was left on at all times to prevent tampering with the microphones.

Challenges Resolved by the FC101

Boundary microphones used for teleconferencing often need to transmit participants speaking soft or speaking off axis. Higher gain or AGC is used to compensate for a wide variance in speaking levels. Creating a local loop with boundary microphones and speakers overhead will typically cause the system to become unstable even at lower levels. The FC101 applies Feedback Cancellation (FC) to maintain stability. The FC algorithm is adaptive so climate changes and even disconnecting or moving microphones will not cause the system to feedback. An overview of Feedback Cancellation technology is available on WideBand's website:

www.widebandsolutions.com/docs/FC%20White%20Paper.pdf

Why not use Acoustic Echo Cancellation to achieve the same affect?

AEC is designed to cancel acoustic echoes that are a result of a full duplex system (open microphones and speakers). The ITU (International Telecommunications Union) specifies that an echo canceller should provide 45dB of cancellation. In order to achieve this result, an echo canceller uses a combination of linear and non-linear processing. A robust algorithm may achieve 30dB of cancellation by the linear component when the signal to noise ratio \geq 30dB. As the signal to noise ratio decreases, so will the amount of linear processing that is possible. Non-linear processing will remove residual echo to achieve the desired results. The non-linear processor suppresses or (cuts off) the residual echo.

The Bottom Line - Acoustic echo cancellation is designed for echo, not feedback control. Attempting to calibrate an echo canceller for feedback control will result in compromises in the teleconference component of the system and vice-versa.

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