

Motorola's Advanced Noise Shield Capabilities Prove to be a Sound Investment in Safety



"When the high ambient background noise interference issue came into the spotlight, we wanted to know if there was an impact on analog and digital communications. We asked Motorola if we could test its Noise Shield software to see if the benefits would warrant upgrading our units."

- Rob Ross, Deputy Chief, Akron Fire Department

Situation: Significant ambient background noise in radio communications

Reports from the International Association of Fire Chiefs, NTIA and other professional associations have discussed the problem of excessive background noise and its impact on fire department radio communications. Akron Fire Department professionals had been hearing a difference in audio quality and intelligibility between their digital and analog talkgroups. To address the question, Deputy Chief Rob Ross decided to test the benefits and feasibility of upgrading the department's radios with Motorola's Noise Shield software.

Solution: Motorola's Noise Shield noise reduction software

"Tests were conducted using two radios not equipped with Noise Shield and two radios with it," notes Deputy Chief Ross. "A variety of typical noisy situations were recreated and transmissions were attempted with the radios." Tests were conducted in two of the department's busiest fire stations spanning three separate shifts and involving a relatively large cross section of fire professionals.

Result: Noticeable improvement in both analog and digital channels

"All testing groups agreed that there were improvements in most noisy situations," reports Deputy Chief Ross, "and most found (the improvement) more pronounced on the digital talkgroups." In summary, Deputy Chief Ross concludes, "My hope is to equip all of our existing handheld radios with the Noise Shield upgrade and any replacements would certainly be specified with the software."



Motorola XTS® 5000
Digital Portable Radio

Akron Fire Department, Akron, OH

- Full-service emergency services agency
- 400 career firefighters
- 13 fire stations
- 33,000 EMS responses in 2008
- 7,500 fire calls in 2008

Motorola Solution:

- 5-site 800 MHz SmartZone system
- 318 radios
- Portable radios: XTS 5000 models
- Motorola Noise Shield software

Results:

- Noticeable difference in analog and digital intelligibility
- Improved communications clarity under extreme test conditions
- Higher quality voice communications when wearing SCBA equipment
- Plans to upgrade all radios to Noise Shield software



“Since transitioning to our 800 MHz system in 1995 Akron Fire has operated almost exclusively on digital talkgroups. Although we at times had high levels of background-noise-causing problems with voice intelligibility...we just accepted the problems as ‘the way it is.’”

- Rob Ross, Deputy Chief, Akron Fire Department

The Akron, Ohio, Fire Department is an all-paid department with an authorized strength of 400 and a support staff of 30 members. “We are a full-service emergency services agency providing fire suppression, EMS, HazMat, technical rescue, dive rescue, code enforcement and life safety education,” notes Deputy Chief Rob Ross. “Akron has an area of approximately 62.5 square miles (our primary response responsibility) but we also have automatic aid agreements with several border communities.” It is an active department, making approximately 33,000 EMS responses and 7,500 fire calls in 2008.

“We have a five-site 800 MHz Motorola SmartZone system used by many public safety and public service entities here in our county. Once it was exclusively used by Akron Fire and Akron Police, but it is so much more than that today,” Deputy Chief Ross explains. Akron Fire has 318 radios assigned; all portables are XTS 5000 models. Most portables are ruggedized.

Audio intelligibility issues

“Since transitioning to 800 MHz service in 1995, the department has utilized digital talkgroups almost exclusively, having little analog experience,” states Chief Ross. “We never really knew there was a possible ‘difference’ between analog and digital talkgroups with regard to background noise. We started hearing about the issue through our professional associations and as we began working more closely with some of our neighboring fire departments. They had used analog exclusively and were now transitioning to digital as they joined our radio system. Once we began to compare the systems, we did start to notice a difference between analog and digital communications.”

Commenting on the effect of background noise problems, the chief says, “We do not believe anyone has ever been injured due to a ‘missed’ conversation, but there are times people had to (and still have to) repeat themselves to be understood.” In addition, the Deputy Chief adds, “When firefighters are wearing SCBA face masks, they sometimes have to take the masks off to be understood. That’s not safe!” When Deputy Chief Ross heard about the Motorola Noise Shield capabilities, he asked Motorola if he could conduct testing to determine if the department’s radios should be upgraded.

Noise Shield technology

Trying to communicate in high ambient background noise situations on the fireground is well known to public safety and other government agencies. In fact, Motorola introduced a new software upgrade to help address this issue. Motorola’s Noise Shield software is a complementary solution that enhances/improves voice clarity and intelligibility on the fireground.



Motorola's Noise Shield noise suppression capabilities are unique in the industry because they work in both analog and digital modes and, they help suppress noise outside the vocoder, either in new radios or in legacy models. For agencies like Akron Fire with hundreds of legacy radios, Noise Shield is a simple, affordable solution for addressing high ambient background noise issues without the expense of having to replace all of the radios.

Noise Shield was developed to complement and improve vocoder technology. For example, the time it takes the software to sort out background noise from voice, is significantly shorter. Where it might take a vocoder about six seconds to begin working, Noise Shield can begin suppressing noise in less than one second.

When conversations are fast and terse, such as on fire scenes, split seconds are critical. Noise Shield also reduces breathing noise and garbled speech that often occur when firefighters are wearing SCBA facemasks. In addition, the XTS portables offer adjustable radio parameters — such as treble and gain control — and offers exclusive channel announcements to ensure a firefighter knows which channel he is communicating on.

Akron Testing Scenarios

"We received two loaner XTS 5000 portable radios from Motorola," says Deputy Chief Ross. "I initially gave one radio each to two of our busier fire stations. They were instructed to do side-by-side comparisons using our regular radios (also XTS 5000 units) and the Motorola loaners under a variety of situations likely to cause us problems."

"Scenarios were recreated and transmissions were attempted with the two radios," the deputy chief



notes, "and with and without SCBA masks." As a remote listener used another XTS 5000 radio in a quiet area of the station, the department set up tests that approximated four 'worst-case' scenarios for background noise problems. Explains Deputy Chief Ross, "These included transmissions in the immediate vicinity of operating rescue and chain saws, gasoline positive-pressure ventilation fans, a PASS device in full alarm mode, and standing right next to trucks with their engines operating under load. We also connected the radios to our SCBAs and repeated the exercises while transmitting from inside the facepiece." The tests were conducted on both the Akron Fire Department's digital talkgroups and the Summit County Mutual Aid Channels (MAC) analog talkgroups.

Results were very positive. "The overall opinion from our testing groups is that there was an improvement in voice intelligibility from the upgraded radios in most noisy situations," says Deputy Chief Ross.



A vocoder with an integrated noise reduction algorithm takes around six seconds to begin suppressing background noise.

Noise Shield can begin suppressing noise in less than one second.



MOTOROLA'S NOISE SHIELD SUPPRESSION TECHNOLOGY

Noise Shield technology uses a series of algorithms in the digital signal processor to accurately filter out the caller's voice from background noise. The noise is then attenuated before the voice signal reaches the vocoder. In most environments this provides users with more intelligible audio and significantly reduces the cycle time for noise suppression to activate. Adaptable programming also allows users to configure radios to fit their environments. Noise Shield technology is available on the XTS 5000/2500/1500 portables and XTL 5000/2500/1550 mobiles.

BEST PRACTICES

Motorola and the City of Akron fully support the use of Best Practices as defined by the International Association of Fire Chiefs (IAFC). These can be found at www.iafc.org.

SCBA Communications

"The most noticeable difference according to our people was while wearing their SCBA facepiece and connected up to the noise-cancelling radio. They said the transmissions were much "crisper" and less obscured from the "breathing noise." Elaborating, Deputy Chief Ross says, "In years past while wearing SCBA we had to try to place a radio microphone near the speaking diaphragm and hope that the transmission was intelligible. Most often it was not. With our SCBA system now a speaker hovers right over the top of your ear and we transmit from a microphone located inside the facepiece. It is much better but still was sometimes obscured by outside noise and the "Darth Vader" effect."

"Breathing noise can still cause intelligibility problems, especially if someone is breathing at a high rate. When this occurred during the tests, however, the Noise Shield did seem to kick in and make that situation better according to the subjective tests," says Deputy Chief Ross. The tests were repeated on analog and digital talkgroups as well as on Akron Fire's simplex (analog) channel.

No differences between digital and analog

The Akron Fire testing groups also indicated that Noise Shield improvements were perceptible on both digital and analog talkgroups. "Testers did not document any significant difference in audio quality



between analog and digital talkgroups. Although this is where considerable concern has focused, in our case we were not able to recreate any situation where our digital transmissions were significantly worse than analog ones in the noisy environments," says Deputy Chief Ross.

Plans for the Future

In conclusion, Deputy Chief Ross says, "Based on the results I have received, I do plan on requesting this upgrade early next year. The communications and safety benefits certainly add up for us. The fact is, I have already recommended the Motorola Noise Shield feature to other fire departments."



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