



Now is a good time to revisit the use of P25 technologies on the Fire ground.

Summary Benefits of P25 for fire ground operations

Benefits of using P25 mission critical radio equipment include:

- Improved performance in background noise. P25 equipment can achieve 10 to as much as 25 dB improvements in background noise reduction.
- Tone Signaling – DTMF, Knox and single tone is now supported.
- Paging – P25 Paging receivers are now available.
- Improved Coverage – P25 Phase 1 technology is about +7dB better than 25 KHz Analog.
- Enhanced Signaling – Talking Party ID, Group Calls, Unit-to-Unit Calls, All Calls, Emergency Alerts, Emergency Calls, Call Alerts, Radio Check, Radio Unit Monitoring and others.
- Location Services – Integrated GPS receivers provide location information.

Background

Early deployments of P25 radio products highlighted the challenges of digital voice compression in high background noise. Equipment noise including fire apparatus, PASS alarms, and SCBA presented unique challenges for the P25 Vocoder.

Another limitation of early P25 radio products was compatibility with current paging and tone signaling systems which are widely deployed. The lack of availability of P25 paging receivers was of primary concern with volunteer departments. Given the original P25 vocoder is optimized for voice, many tone signals such as DTMF, Knox Box or paging tones were highly distorted over P25 radios.

Coverage was another area of concern. While the P25 Common Air Interface was designed to provide equivalent or better radio coverage footprints to analog, differences in real world operation were noted. The digital air interface maintained excellent intelligibility almost all the way to the limits of coverage, but then dropped off rapidly. Analog maintained some level of intelligibility even beyond the edge of coverage and the gradual degradation was noticeable

Testing conducted by the National Telecommunications and Information Administration (NTIA) in 2008 reinforced the anecdotal reports of public safety practitioners with respect to performance in high background noise and reported range issues.

Industry and government team to address the issues

Digital Voice Systems Incorporated (DVSI), working with NTIA and P25 equipment manufacturers went to work to develop methods to test vocoder and air interface performance, determine baseline performance and then set out to implement critical improvements. This effort was conducted under the standards development process of the Telecommunications Industry Association (TIA).

New Developments improve performance on the fire ground

Technology Improvements within the P25 vocoder, including noise reduction, automatic gain control, and advanced error correction coding, were developed, explored, and tested to verify that the changes would translate to improvements in real world fire ground scenarios.

The P25 vocoder was also modified to detect most tone signaling common to public safety systems including: DTMF, Knox Box and paging tones. These signals are now detected and encoded by the vocoder for transmission. At the receiver, the subsequent tones are then regenerated to preserve fidelity of the original tone.

The P25 Standard now includes a Vocoder Performance Test which measures noise reduction for 15 noises including vehicles (car, boat, helicopter, firetruck), sirens, alarms (PASS and Low Air), crowds, saws, water pumps, fog nozzle, and pink noise.

In parallel, half rate vocoder technology was developed to support P25 Phase 2 operation which would deliver double the spectrum efficiency of P25 Phase 1 systems. To support interoperability of Phase 1 and Phase 2 systems, a half rate/full rate conversion capability is also available.

P25 Products Today

These vocoder improvements, along with other technology to improve performance in high noise environments typical to public safety communications such as enhanced noise cancellation methods, are now available in products using both the full rate vocoder (P25 Phase 1) and half rate vocoder (P25 Phase 2).

In addition to vocoder improvements to two-way radio products, a P25 paging receiver has been introduced allowing many public safety agencies the ability to use existing P25 infrastructure for paging services.

Integration of GPS receivers into handheld subscriber radio equipment coupled with updates to the P25 Location Services Standards provide opportunity to obtain location data during critical incidents. This provides robust operation for units operating outdoors, for example during wildland fire incidents.

2013 Narrow banding requirements reduce range for existing analog technologies

One additional development affecting radio users in VHF and UHF spectrum was the requirement to narrowband by January 2013. Analog systems are now required to operate on 12.5 KHz channels. Testing has shown that narrow banding can have pronounced effects when RF channel impairments and background noise are considered.

P25 offers better range for the fire ground in the required narrowband world. P25 Phase 1 technology is about +7dB better than 25 KHz Analog and close to +10dB better than the newly required 12.5 kHz analog for the same Delivered Audio Quality (DAQ). Although P25 has improved coverage over analog, and significantly over narrowband analog, concerns with the difference in real world operation cannot be ignored. In general, a digital receiver will provide a good quality signal to a greater range than an analog receiver and then effectively stop receiving once the range limits are reached. Typically in these conditions the corresponding analog audio is still detectable but is virtually incomprehensible due to the poor signal-to-noise ratio and thus it is of little practical use. Technically the analog signal may have greater range, but may have a significantly smaller useful range. When considering a possible conversion to using P25 for the fire ground, it is strongly encouraged to do a detailed evaluation of RF coverage performance on your system to ensure that buildings will be properly covered, especially on the fringe of your system's operational area.

PTIG presented information on P25 vocoder and range improvements at the IWCE College of Technology in 2015. A link to this presentation is below. Please refer to slide 21-32

http://www.project25.org/images/stories/ptig/IWCE_2015/IWCE_2015_P25_Foundations_Part_2_150308.pdf

Conclusion

P25 radios are just one of many communication technologies available to meet the demanding needs for fire ground communications.

Today, P25 radios are well equipped to address mission critical communication challenges for fire ground operations.

If you have not evaluated P25 technology for use on the fire ground in the past few years, now may be a good time to take a comprehensive look and see if the performance and features of current P25 equipment are an improvement over your current solution.