Evaluation of Portable Radios for a rural EMS squad

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By: *Halifax EMS, Halifax, Vermont*

Executive Summary

Halifax EMS is a new squad, formed during the spring of 2008 by members of the Halifax, Vermont community. We are a not-for-profit volunteer corporation that has adopted the following mission: "To provide emergency medical services to the Town of Halifax, delivering neighbors definitive care safely, with dignity and compassion."

Our goal with portable radios was to have a good portable radio that can serve both as a pager and a two-way radio. The paging had to be reliable, loud, clear and easy to use. It also had to be flexible. Given, our community is within 10 miles of a nuclear power plant, first responders have to be alerted for both local and regional emergencies. Many of our members are also on multiple services. Therefore, a radio had to be able to accommodate a minimum five two-tone page groups.

During an elapsed period of six months of research, several vendors and four manufacturers we have found a radio that meets our needs. This radio is the Vertex 924 (929 with DTMF dial pad). The other radios evaluated included the Tekk XT-800, ICOMM F-14, and the Kenwood TK2170.

Geographic Issues

Our town is has approximately 700 properties and 540 year-round residents. There are apartment buildings in New York that have more people; even some high schools have larger graduating classes. Our community is spread out over 40 square miles on the eastern edge of the Green Mountains in Southern, Vermont. Homes are connected by narrow dirt roads. The nearest hospitals are 30 miles away. The standard travel time to a hospital is 45 minutes.

We are dispatched on VHF frequencies through a regional service located in Keene, NH thirty-five miles away. This service supports seventy-seven towns in Vermont and New Hampshire. We are at the south western corner of this dispatch service area.

We do not have a local ambulance service. Ambulances must travel from neighboring towns. Often the elapsed time between someone dialing 911 and the ambulance arriving on scene is 45 minutes or more.

Our first responders must be able to communicate with our dispatch service, mutual aid services, helicopter services, and local fire ground. Most events such as a car accident result in a multi-agency response: fire, EMS, transport ambulance, and police. Additionally, first responders may have to contact medical control while on scene. Although distance and the mountainous terrain are often barriers, there are some locations in Halifax where we can reach a hospital via two-way radio. Cell phone coverage in Halifax is poor or non-existent.

Halifax is fortunate to have a radio tower in town that has a trunk to our dispatch service. Although tactical and medical control frequencies are not relayed, our primary dispatch channel is reliable throughout Halifax.

Requirements

1) Mimic the paging features of a Motorola Minitar V
    a. Narrow-band and wide-band reciever
    b. Quiet unless tone pattern is matched
    c. Alert loudly when tone pattern is matched
    d. Monitor frequency, alert loudly when tone pattern is matched
    e. Small enough to wear comfortably
2) Programmable two-way radio with a minimum of 16 VHF channels
3) Durable, reliable
4) 5 watt portable

Radios Tested

1) Tekk XT-800
2) ICOMM F-14
3) Kenwood TK2170
4) Vertex 924

Setup

1) Channel 1
    a. Transmit inhibit
    b. Monitor for five sets of two-tone pattern on dispatch frequency
    c. Alert when there is a tone pattern match
    d. Note: This setup mimics a Minitar
2) Channel 2
    a. Transmit permitted
    b. Set to dispatch frequency
    c. Note: this setup is a standard two-way radio

It was decided not to allow transmitting from Channel 1, the “Pager” channel for several reasons. First, it avoids that awkward moment when you discovers that you are accidentally transmitting to 76 other towns. Second, this allows for the closest approximation of a Minitar’s setup. In the rare times that one must transmit, a first responder must change to Channel 2.

The remaining channels are used for tactical frequencies, VCOMM, and VTAC channels and various mutual aid requirements.

Findings

Narrative: Tekk XT-800

The Tekk XT-800 radio is a light-weight radio with a simple interface. We purchased a Tekk radio with Lithium Ion battery, rapid charger. Within four weeks, the batteries failed. The batteries and charger were replaced. Within another couple of weeks, the radio lost all of its programming. It got reprogrammed. Shortly there after, the radio was replaced. Upon the second complete failure of the radio, we decided to abandon the Tekk XT-800.

Acknowledging that the sample size was small: one purchase of one radio, we rejected the Tekk radios outright. We did have that one radio fail twice and get replaced once. That second radio failed as well.

Our local vendor was extremely supportive of the effort and accommodated our request for credit on the purchase.

Narrative: Kenwood TK2170

Our squad did not do the direct research on the Kenwood TK2170, instead we relied on the efforts of the folks at Clark Communication Electronics of Milton, Vermont. At the outset, this radio advertised the featured required, but upon subsequent programming efforts it failed to meet our requirements.

Although the TK2170 supports two-tone encode/decode (two-tone signaling, quick call) this radio cannot support five sets of two-tone patterns on one frequency on one channel.

In summary, although the advertising literature describes the desired features, in reality the features are not robust enough to accommodate a small squad with our limited requirements with separate fire, EMS and regional alert tone patterns.

Narrative: ICOM F14

The ICOMM F14 (F-14) radio is a slightly more feature-rich radio than the Tekk. The brand is better known and with the increased features, it has more knobs and buttons. Our squad has three ICOMM F-14 radios operating now (May 2008). The F14 met many of our requirements, but the paging feature was inconsistent and therefore unreliable. The radio did prove to be more reliable than the Tekk. It weighed little more than the Tekk. The two-tone (quick call, fire call) roughly met the requirements.

We were disappointed that the alert tones that sounded after there was a tone-pattern match. First, the alert tones were quiet. They were not as loud as a Minitar. They could be muted easily by having the radio speaker-side down on a table, car seat, or in a pocket. The alert tones could not be heard over equipment such as a farm tractor, lawn mower, or loud engine. Second, the alert tones did NOT sound if the radio were "open" or monitoring the dispatch frequency. Often, our officers would set the radio to "monitor" and to "scan" while they worked at other duties. In this situation, the alert tones do not sound. Additionally, our dispatch service will transmit the tones and message twice. This will typically cause a Minitar V to alert twice and broadcast the message twice. With the ICOMM F14 radio, the alert maybe heard the first time, but not the second time. The tones would not trip the alert because the radio was already "monitoring" the frequency.

The key struggle for several of us came from the Push-to-Talk button (PTT). As described above, we set Channel 1 to behave like a Minitar: Quiet unless tones are matched, then alert, open and monitor the frequency until reset. Because we programmed Channel 1 to prohibit transmissions, when we hit the PTT button the radio would "error" and open to monitor the frequency. Once the frequency was monitoring, the alerts would not sound. This means that if you dropped your radio to a car seat, dashboard, or rest it in the tractor's cup holder and inadvertently tapped the PTT button while doing so, your radio would not give alert tones. With one simple accident, the radio no longer performed as a Minitar but like a one-frequency scanner.

All of us carrying an ICOMM F14 radio learned to rely on the Minitar pagers for alerts. Therefore the "Minitar-like" paging feature that we expected to use on the ICOMM F14 proved unreliable.

In conclusion, we will continue to use these radios because they are reliable two-way radios. As we cycle them through the squad, we will likely make sure that the users understand the short comings and that the user also has a Minitar V to carry. Our goal was to limit the investment so that members didn't have both a Minitar and a portable radio. Eventually, as we build inventory we will either present them to the fire company (who have different requirements) or we will sell them on the open market.

Narrative: Vertex 924 / Vertex 929

This radio was tested extensively by Clark Communication Electronics of Milton, Vermont. At the conclusion of their testing, it was shown that the Vertex 924 and the Vertex 929 would meet our requirements.

Additionally, this radio has a few features that resolve problems on other radios. For example, the team programmed an “On Duty” / “Off Duty” toggle button. When “On Duty”, the radio will monitor frequencies and scan. If there is a two-tone pattern match, a very loud alert will sound, a bright LED will flash. The alert will sound each time a pattern is matched. This is the best match to the features of a Minitar V when “open” or monitoring of any radio that we have tested.

When the radio is set to “Off Duty”, the radio will remain quiet until there is a two-tone pattern match. Upon a match, the radio will alert loudly and flash the LED brightly.

This radio has the following features that we were not looking for, but will provide value to our squad, these include:

- Very Loud Audio and Alert Tones – controlled with the volume knob
- 7 individual Alert Sounds and 7 LED colors to differentiate squad alerts
- Programmable Key Hold Time before it's sensed as activated
- On Duty (hears everything) and Off Duty (quiet until paged) modes for paging alerts
- 12 character back lighted display and back lighted keys
- Ability to add a UHF receiver board later
- Ability to add 2 minute voice storage board later
- DTMF memory speed dials on 16 Key version
- Radio and lapel mic are rated as submersible
- Module for 2 minutes of voice storage available

The DTMF (dial pad) feature can be important when reaching a hospital via the HEAR network. Many hospitals require a dial-up access. With this feature and being present in the few locations where Halifax can reach the hospital by radio, we can gain direct access to medical control.

Conclusion

The Vertex 924 radio will continue to be field tested by Halifax EMS. At present, we will work to standardize on this radio with the expectation that we can continue to purchase this radio and phase out the ICOMM F14 radios. The Vertex 924 radio’s alert has proven itself to be loud. The backlight display is helpful while managing multiple frequencies. Although the radio is slightly larger and heavier than our original goal, the features override other concerns.

For members who are working in an office or can not comfortably carry a full-sized portable radio while ‘on-duty’, a Minitar pager may still be required because it can be carried more discreetly when in public.

