



Motorola FSA4000™

How to Achieve Near 100% Fire Station Alerting Reliability



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Abstract

When lives and property are at risk, every second of the emergency response cycle counts. However, the emergency alert process faces several challenges that decrease communication link reliability and jeopardize rapid response. While most approaches to improving alerting reliability fall short, dual link communications technology offers the optimal solution. Dual link communications implement RF and wired/wireless IP on separate links—providing a level of redundancy that single link systems cannot match.

“The nationwide 90th percentile response time to structure fires is less than 11 minutes².”

Introduction

Quick response means more than just the time it takes to get from the fire station to the scene. Each step of the incident reporting, dispatching, and alerting process costs valuable time. The Department of Homeland Security defines total response time as the moment from when the emergency communications center receives the call to the arrival of the first unit at the incident scene¹. Turn out time begins from the instant the dispatcher sends the alert to when the first responder returns the acknowledgment and leaves the station en route to the incident scene.

In the world of first response, the alerting process faces several challenges:

- Reliability of the communication link to the station
- Receiving the acknowledgement from the station
- Ensuring “heart saver” pre-alert tones initiate at the appropriate fire stations
- Executing the voice alert process after the tonal alert

To reduce turn out time and thus total emergency cycle time, dispatchers and first responders demand a solution that provides reliable alert delivery and streamlines the emergency response process. Specifically, dispatchers must have a way to transmit the alert datagram and voice commands through systems that leverage redundant communication links.

Rapid Response Depends on Reliable Dispatch and Alerting Systems

Many fire departments rely on RF (Radio Frequency) and or wired/wireless IP (Internet Protocol) alerting systems. When used individually, these systems suffer from a lack of redundancy, reducing their reliability—ultimately affecting the emergency response cycle.

Looking at the problem from a technical perspective, alert systems that communicate strictly over RF or wired IP cannot provide a 100% guarantee of alert delivery. In fact, RF transmissions are susceptible to signal interference and noise. In the RF world, channel interference, signal fading, and intermodulation distortion can adversely affect communication reliability and message integrity.

On the other hand, wired IP such as DSL (Digital Subscriber Line), dial-up modem, and cable depend on uninterrupted hard-link connections. If a cable or phone line breaks due to a backhoe tearing up the street, or routing switches managed by the telecom provider fail due to storms, the fire station alert connection goes down. Unable to connect, dispatchers must follow their standard operating procedures for backup alerting, causing delays in the alerting process. As a result, response time increases—potentially risking lives and property.

Shaving precious time from the emergency response process requires a reliable dispatch and alerting system that contains built-in redundancy with both front and back-end intelligence.

¹Department of Homeland Security, U.S. Fire Administration/National Fire Data Center, Structure Fire Response Times, Rev. August 2006

²Ibid

Most Approaches for Improving Alert System Reliability Fail

Several approaches exist that attempt to achieve high alerting system reliability, though most fall short.

Primary Link With Backup

One method implements a primary RF or wired IP transmit link with a secondary link for backup. When an alert occurs, the system transmits alert data on the primary link, but uses the secondary link for retries. In practice, this solution increases response time because the system wastes precious seconds while performing the retry on the backup link.

Multiple Links With One-Way Messaging

Sending an alert on one link, then retrying on an alternate system does improve source to destination alert reliability. Many of these systems use one-way messaging for sending the alert data. However, one-way messaging lacks a feedback mechanism for station polling or acknowledgment of alert data receipt.

Sequential Alerting Over Narrowband Analog Systems

Other solutions place the burden on the dispatcher. Some alerting systems use narrowband analog communications to sequentially alert fire stations. While this approach may be acceptable in small jurisdictions with one fire station, the approach fails in scenarios with multiple fire stations. Specifically, the more stations that are alerted, the longer the dispatcher must wait before proceeding with the voice announcement. Any alerting system that requires additional intervention from the dispatcher costs valuable response time and becomes subject to errors.

Dual Link Communications Helps Solve the Reliability Challenge

With any multi-tiered system, adding redundant layers boosts overall solution reliability. The same approach also applies to public safety communication technologies. Carrying this concept forward, the first step for implementing reliable fire station alerting is to leverage the concept of “dual link” communications.

True dual link functionality uses the following methods to achieve redundancy and high reliability:

- Public safety systems that support RF data communication on one link and wired/wireless IP data on the other link
- Implements full two-way messaging with acknowledgments on both links
- Alerting systems from the dispatch center regularly poll links at the fire stations to ensure consistent connectivity
- Loss of any communications on either link to each fire station display as an alarm on the dispatch alerting system terminal
- The system sends alerts simultaneously on both links

Dual Link Reliability Benefits Fire Departments of all Sizes

By combining RF and wired/wireless IP technologies, reliable alerting becomes reality. Once in place, dual link alerting systems have the potential to:

- Speed up response times – Alerting systems that use dual link communications can help shave off valuable seconds in response time by transmitting the alert on two separate links. This approach ensures the delivery of the alert data, thus enabling the immediate routing of audio to sleeping quarters. In addition, the system can automatically open doors, turn off appliances, and activate fire equipment exhaust systems—further improving turn out time.
- Help reduce operating and maintenance costs – Alerting systems that use dual links for polling and two-way messaging automatically keep track of the dispatch to fire station connection, significantly improving the reliability of two-way communications. This approach makes possible the efficient use of equipment, personal, and infrastructure.
- Increase station safety and environmental controls – Enables monitoring and management of equipment at fire stations from within the dispatch center to help secure the building and restrict unauthorized access.

Improve Response with the Motorola FSA4000 Fire Station Alerting System

With over 65 years of experience in the public safety market, Motorola understands the unique needs of fire departments and first responders.

When critical events happen, quick response is vital, as is the way dispatch and alerting systems manage the entire emergency cycle. From first alert to final dispatch and acknowledgement, Motorola's FSA4000 Fire Station Alerting system helps seamlessly manage the turn out process of the response cycle. With one system, fire departments can improve the speed, efficiency, and safety of their teams, equipment, and critical infrastructure.

Quickly detect problems – With automated fire station monitoring, dispatchers and battalion chiefs can quickly determine equipment problems within the fire station such as failed communication hardware and backup power system operation.

Enable National Fire Protection Association (NFPA) 1221 compliance – Dual link technology helps satisfy fundamental NFPA requirements for two transmitters, redundant dispatch circuits, switchover operation, and supervision/accountability.

Realizing the Key Benefits of FSA4000

Built upon Motorola's proven FSA3000/MOSCAD system, the FSA4000 is next generation technology built around the new ACE3600 Remote Terminal Unit (RTU). The FSA4000 fully leverages dual link redundancy and reliability for data alerting, trunked radio for voice command, and intelligent automation. Motorola's unique approach improves the way that fire departments respond to incidents while helping to automate the end-to-end, dispatch through alert processes of emergency response.

Dual-Network Links Assures High Reliability

FSA4000 operates on analog and digital RF systems and IP (wired or wireless) data networks at each fire /EMS station, providing redundant networking capabilities that allow alerts to reach their destination reliably. The system transmits commands over both links to enable delivery of the data message. For IP access, fire departments can use existing IP connections or leverage Motorola's highly reliable Canopy™ wireless broadband infrastructure.

Some of the key aspects of FSA4000's dual link communications include:

- Ability to reach any fire station location regardless of storms, floods or construction
- Scalable for easy system expansion, relocation, and infrastructure reuse
- Supported on existing public safety ASTRO 6.x/7.x Integrated Voice and Data (IV&D) infrastructure
- Provides analog voice broadcast alerting, and rapid sequential alerting over IV&D to multiple fire stations—regardless of the number of alert stations. Rapid alerting allows dispatch of units to multiple incidents, improving response time and boosting departmental efficiency even further.
- Reliable fire station alerting depends on crucial alerts reaching their destination. With the FSA4000, alert acknowledgements and polling can occur while the dispatcher executes the voice alert.

Leverages Existing Dispatch Consoles and Helps Maintain Security

The FSA4000 Fire Station Alerting application maintains full co-habitation with Motorola Gold Elite and MCC7500 dispatch consoles, saving space and reducing operational costs. Because the FSA4000 application resides on the same client system as the console software, dispatchers can easily utilize both systems with a single pointing device for station alerting and live voice alerting.

Reliability and compatibility are not the only challenges facing the emergency alerting process. Network security issues remain a top priority for Public Safety CIOs (Chief Information Officers). To ensure high network security and the privacy of sensitive information, the FSA4000 system provides full box-level authentication, password hardening, and centralized logging.

Supports NFPA 1221 Compliance

NFPA 1221 contains multiple recommendations for fire station radio systems including:

- Redundant dispatch circuits - NFPA 1221, 2007, Section 9.3.2.2 & 9.3.2.3(2)
- Switch-over operation - NFPA 1221, 2007, Section 9.1.1.4(2)(b)
- Self Monitoring - NFPA 1221, 2007, Section 9.1.1.4(2)(a) & 9.1.2.2
- Dual power sources - NFPA 1221, 2007, Section 6.4
- Back up time during power loss - NFPA 1221, 2007, Section 6.4
- Alert tones - NFPA 1221, 2007, Section 9.1.1.6 & 9.3.2.1
- Automatic recording of system activity - NFPA 1221, 2007, Section 9.1.1.8 & 7.6.3
- Alarm alert acknowledgment from the fire station to the dispatcher – NFPA 1221, 2007, Section 9.1.1.11
- Manual GUI alerting backup to Computer Aided Dispatch (CAD) for added level of redundancy – NFPA 1221, 2007, Section 10.2

The FSA4000 Fire Station Alerting system conforms to the stringent requirements of NFPA 1221, thus increasing system reliability, reducing operational expenses, and lowering fire department insurance costs.

Save Time and Resources with Automated Fire Station Monitoring

The ability to manage fire stations remotely stands as one of the most powerful ways to ensure infrastructure security. Through two-way messaging, the FSA4000 system empowers dispatchers with complete monitoring and control of the fire station environment.

When deployed, the FSA4000 system contains intelligence within both the front-end application installed on the dispatch console, and within remote units installed at the fire station.

Through regular polling and exception reporting, the FSA4000 system provides:

- Monitoring of intrusion and fire alarms
- Status of back up power systems, response equipment status, and bay door positions
- Automatic routing of audio to sleeping quarters, opens doors, turns off appliances, and activates bay exhaust systems
- Improved alerting system accountability through time-stamped event logging and automatic recording of dispatch and response-related events
- Remote control of fire station access to prevent theft and vandalism

Visualizing the FSA4000 in Action

When a 911 center receives a fire emergency call, the dispatcher determines the level of severity and enters the information into the CAD system. The CAD communicates to the FSA4000 system, which manages the remote data messaging over dual link communication links on behalf of the CAD. FSA4000 sends out a command alert to the appropriate stations using the dual link interface.

To speed the dispatch process, the FSA4000 system initiates a single data burst command to every fire station, followed by an interrogation to verify the station received the alert. The FSA4000 system reports to the dispatcher if the alert did not get through.

At the receiving station, a heart saver pre-alert tone sounds informing the first responders of the incoming voice message, while lights and exhaust fans turn on in the appropriate zones. Departments can setup separate alert tones to inform the fire-fighters of the alert type. When the tone completes, the dispatch console acknowledges the receipt of alert from the FSA4000 system. The dispatcher then starts speaking, and the FSA4000 system transmits the voice message to all alerted fire stations and zones.

When first responders leave the station, the FSA4000 system allows a dispatcher to close the bay doors (with authorization) and secure the building while continuously monitoring for intrusion, fire, smoke, electrical power, and FSA4000 equipment operation.

FSA4000 Helps Manage and Streamline the Emergency Response Process

The Motorola FSA4000 Fire Station Alerting system provides more than just dual link reliability, fire station monitoring, and control. The system serves as a cornerstone for the operation of the public safety dispatch process. FSA4000 helps manage resources with proven hardware and software that can lead to a reduction in emergency cycle time—while streamlining the alerting process and improving departmental efficiency.



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Motorola, Inc. • 1301 East Algonquin Road • Schaumburg, IL 60196 U.S.A. • www.motorola.com/governmentandenterprise

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