

Emergency Alarm: Project 25 Inter-RF Subsystem Interface and Console Subsystem Interface Features and Functions

This document is part of a series of Project 25 (P25) Inter-Radio Frequency (RF) Subsystem Interface (ISSI) and Console Subsystem Interface (CSSI) Features and Functions write-ups designed to increase awareness of P25 features, terminology, and implementation considerations learned during ongoing discussions within the Federal Partnership for Interoperable Communications (FPIC) ISSI/CSSI Focus Group. This document uses vendor neutral P25 Standards terminology, but the reader should be aware that different manufacturers and user communities often use different terms to describe these features.

FEATURE OVERVIEW

Problem Statement

P25 users and the FPIC ISSI/CSSI Focus Group have identified operability and interoperability concerns when using the *emergency alarm*, *emergency call*, *emergency alarm cancel*, and *emergency call cancel* features across the ISSI/CSSI, especially in a multi-vendor environment.

What are these features?

The *emergency alarm* feature alerts other users and dispatchers of an emergency condition, and the *emergency call* feature grants a responder in peril the highest-priority access to P25 system(s) resources via mobile or portable radio. The *emergency alarm cancel* and *emergency call cancel* features resolve *emergency alarms* and *calls*, respectively. These are primarily trunking features within the context of the ISSI/CSSI; however, they are also available on many conventional systems.

Why is this feature important?

The ability to alert telecommunicators and other first responder personnel of an emergency condition and its resolution in a timely manner can be the difference between life and death. Conversely, the inability to confidently establish or cancel an emergency condition – whether for a trapped firefighter, a law enforcement officer under duress, or an injured transportation or utility worker – is a risk that most agencies are unwilling to accept. The user expectation is that these features work seamlessly across the ISSI/CSSI even with multiple manufacturers involved; however, the operational and functional reality does not always match this expectation.

What are the primary ISSI/CSSI concerns?

With ISSI/CSSI connections, voice and data messages related to these features are sometimes routed between multiple P25 systems (i.e., RF subsystems, including console subsystems). As such, differences in configurations, implementation, and how each manufacturer's system handles these messages may result in the emergency alarm, emergency call, emergency alarm cancel, or emergency call cancel messages not working across the ISSI/CSSI. These issues have led to tough decisions to disable these features in situations where problems may occur.

What is being done about this?

For prospective users, it is important to be aware of potential interoperability concerns that may occur across the ISSI/CSSI. Robust features testing can identify emergency alarm, call, and cancel issues across different manufacturer systems, software revisions, and configurations.¹

SECTION 1: INTRODUCTION

Features related to the declaration and resolution of user emergencies – referred to as “emergency condition” or “emergency status” in the P25 Standards – represent a critical and lifesaving P25 user need. Emergency conditions constitute the highest priority voice and data communications transmissions (typically for the affected talkgroup and/or user). Whether the emergency is a trapped firefighter, a law enforcement officer under duress, an injured transportation or utility worker, or another life-safety situation, the ability to alert dispatch and other first responder personnel in a timely manner can be the difference between life and death. In these situations, a typical emergency condition unfolds in the following steps:

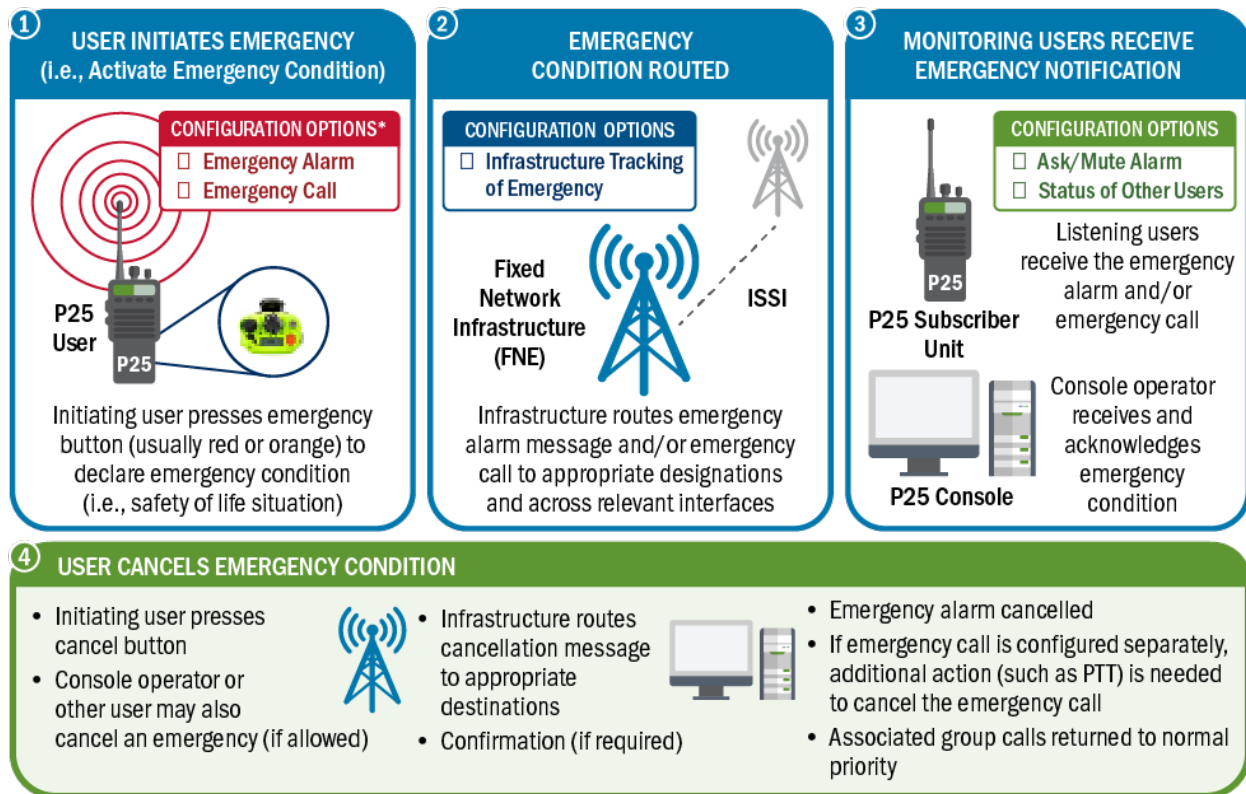


Figure 1 - Emergency Condition Overview

*Emergency Alarm and Emergency Call are explained in the next section. These are distinct services, handled differently by the P25 Standards and implemented uniquely by the manufacturers.

¹ Interoperability testing of P25 features and functions is on the Project 25 Compliance Assessment Program (CAP) roadmap. Currently, interoperability testing is conducted by manufacturers as either a part of their product development or during system implementation.

Defining the Terms

When an end user activates an emergency (i.e., presses the emergency button on his or her subscriber unit [SU]), it does not matter to him or her how an emergency condition is conveyed across the system infrastructure or ISSI/CSSI interfaces. Operationally, terms such as “emergency alarm,” “emergency alert,” “emergency call,” and “group emergency” are often used interchangeably to describe the ability for an end user to declare an emergency condition. As such, these terms are commonly misconstrued as a single feature.

However, within the context of P25 Standards and cross-manufacturer interoperability, these terms represent complementary yet distinct features that are handled differently by P25 systems. When addressing interoperability and operability challenges, it is important to understand the differences among these terms. When initiating an emergency condition, the two primary terms used by the P25 Standards are:

- **Emergency Alarm (Emergency Alert)** – the supplementary data feature for transmitting an alarm/alert message to a dispatcher (or infrastructure) indicating an emergency status for a user or talkgroup
- **Emergency Call (Group Emergency Call, or Emergency Group Call)** – a voice transmission intended for a group of users in a radio system during an emergency condition. In an emergency group call, a talkgroup is granted the highest priority (including ruthless preemption if enabled) on the P25 system, but otherwise follows standard group call procedures

Similarly, terms such as “emergency alarm cancel” or “group emergency cancel” may be used to describe the cancellation, “clearing,” or “knock down” of an emergency condition:

- **Emergency Alarm Cancel** – clears the emergency alarm/alert notification of the SU and/or associated group. There is a separate feature called the “*group emergency cancel*” that applies to trunked systems; however, in most situations, this feature is synonymous with *emergency alarm cancel*
- **Emergency Call Cancel** – clears the emergency status of group calls. The *emergency call cancel* is often tied to the *emergency alarm cancel*, but this is not always the case because emergency calls and emergency alarms are separate features

SECTION 2: EMERGENCY CONDITION BEHAVIORS AND IMPLEMENTATION VARIABLES

The P25 Standards define general procedures and messaging formats for each of these features. However, the standard allows implementation variations that result in different behaviors of standard services between manufacturers. If what the standard allows and how equipment from different manufacturers operates is unknown or unclear to the system operator/users, this could lead to interoperability challenges in a multi-manufacturer ISSI/CSSI environment. As such, it is up to system administrators to understand and configure those options. This section describes general emergency alarm behaviors and identifies areas where system and SU configurations and manufacturer design decisions could lead to different behaviors (i.e., implementation variables). **Due to these variations, regular testing is needed to establish and maintain functionality of desired P25 features and functions across ISSI/CSSI connections.**

condition for all talkgroup 1 SUs, whereas System A may not. The systems may also differ in how they trigger and treat *emergency calls* and their associated talkgroups.

Differences in implementation may lead to missed *emergency alarms* or *emergency calls* and *emergency alarm cancels* where some users are not granted system priority. For example, users have experienced issues where an emergency acknowledgement on a CSSI-connected console is not passed back to the home core. Additional complexities arise when audio patching, encryption, roaming, multiple ISSI/CSSI connections, and/or non-P25 systems are introduced.

To ensure true interoperability across the ISSI, connected systems must test each feature across all permutations of home, registered, and talkgroup RFSSs to understand expected behaviors across the ISSI.

Table 1 - ISSI Testing Permutations

Note: This is not a real test plan, but a list of permutations meant to show the complexity of ISSI/CSSI testing.

Initiating SU	Home RFSS	Registered RFSS	Talkgroup Home	Destination SU
Radio and Console	RFSS A and B	RFSS A and B	RFSS A and B	Radio and Console (on RFSS A and B)

Summary of Implementation Variables

In summary, while the P25 Standards address some implementation variables, they do not dictate how *emergency alarm*, *emergency call*, *emergency alarm cancel*, or *emergency call cancel* messages should be addressed within each manufacturer’s P25 infrastructure or RFSS. Additionally, legacy preferences and differing user expectations can lead to variations in how these features are implemented. Table 2 provides a breakdown of elements found in the P25 Standards and elements where implementation differences can exist.

Table 2 - Emergency Alarm and Call in the P25 Standards (includes both ISSI and non-ISSI Standards)

In Standard	In Standard, but with Optionality	Not in Standard
Emergency Alarm messages and procedures	What happens when resources are limited. Ruthless preemption vs. top of queue for emergency calls	End user (and device) ergonomics to trigger and cancel an emergency condition
Emergency Call procedures	Whether the system infrastructure should track the emergency status of a group call	Method for dispatch operators (or other users) to acknowledge or cancel an emergency condition
Mechanisms (emergency bit, control message formats) for alerting the FNE of an emergency condition	If the emergency condition applies to subsequent group call transmissions	How an emergency condition is displayed on listening SUs (and consoles)
Mechanism for auto-triggering of emergency alarms	Whether the emergency condition applies to all members of a group	
Emergency alarm cancellation messages and procedures	Ability to register SU on previously non-approved systems/sites	
Emergency call cancellation procedures		

Other Considerations

The rising popularity of long-term evolution (LTE) and land mobile radio (LMR) interconnections necessitates an extension of the *emergency alarm* and *emergency call* features to LTE users connected to an LMR system. A joint Alliance for Telecommunications Industry Solutions (ATIS) and the Telecommunications Industry Association (TIA) working group is currently defining an interworking function (IWF) between LMR and LTE systems.

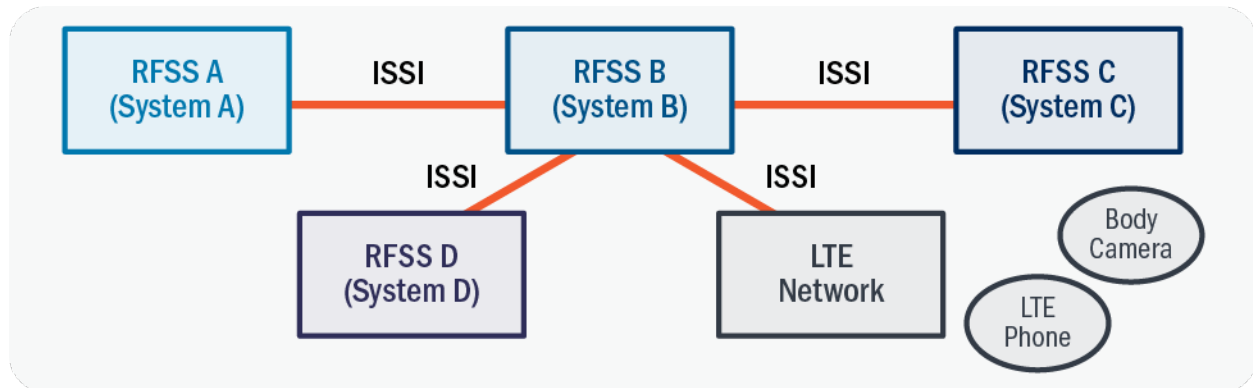


Figure 3 - Complex ISSI/CSSI and LMR/LTE Considerations

Addressing Emergency Challenges

Various efforts have been taken or are underway to address this topic:

- **P25 Standards: P25 Trunking Procedures updated** to include more detailed procedures for *emergency alarm*, *emergency alarm cancel*, *emergency call*, and *emergency call cancel*
- **Compliance Assessment Program (CAP): ISSI/CSSI conformance testing** for *emergency call* and supplementary data features, such as *emergency alarm*, over an ISSI/CSSI. The CAP does not currently perform interoperability testing of these features, but that could be a next step if P25 interoperability testing procedures are developed
- **FPIC: ISSI/CSSI Focus Group activities** to discuss and share ISSI/CSSI implementation best practices³

Conclusion

The public safety user community views these well-established features as critical to life safety and have expressed their concerns to the manufacturer community. Because these concerns occur only in specific combinations of manufacturers and in specific conditions, they are difficult to identify and resolve due to their level of complexity and the number of permutations that exist. Additionally, existing implementations conform with P25 standards; as such, issues can only be identified through extensive interoperability testing and/or during live operations.

³ Through these efforts, FPIC has developed ISSI/CSSI documents such as ISSI/CSSI Best Practices Volume 1 and Volume 2. These documents can be found at cisa.gov/safecom/fpic

From the user perspective, it is important to communicate ISSI/CSSI user needs to all involved manufacturers and be aware of potential interoperability challenges. For example, a user looking to implement these features and functions will need to work with their manufacturers to understand if the *emergency alarm* and/or *emergency call* (depending on implementation) is able to pass through the ISSI and be acknowledged, and that the *emergency alarm* can be seamlessly cleared across all systems, regardless of manufacturer.

Additional Resources⁴

- TIA-102.BACA-B, Inter-RF Subsystem Interface Messages and Procedures for Voice Services, Mobility Management, and RFSS Capability Polling Services
- TIA-102.AABD-B, Trunking Procedures
- TIA-102.AABB-B, Trunking Control Channel Format
- TIA-102.AABC-E, Trunking Control Channel Messages
- TIA-102.BAAD-B, Conventional Procedures and TIA-102.AABG, Conventional Control Messages

⁴ P25 Standards are published by TIA and can be found at standards.tiaonline.org/standards/technology/project_25/index.cfm