

Improving Interoperability Through Shared Channels



**Homeland
Security**



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Executive Summary

Communications interoperability refers to the ability of emergency response agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice or data with one another on demand, in real time, when needed, and as authorized. This guide, *Improving Interoperability Through Shared Channels*, is designed for emergency response officials at all levels of government who have an interest in improving communications interoperability in their community or region, yet face the challenge of determining the technical solutions that best meet their needs. Such a challenge can seem overwhelming, as there is a variety of technical options for improving interoperability. To complicate matters further, a combination of technical solutions is required.

Furthermore, it is important to understand that technology is only a piece of the interoperability solution. For a technical solution to be successful, areas of governance (often the most difficult challenge of all), standard operating procedures (SOPs), training and exercises, and the promotion of routine usage must also be addressed.

This guide is intended to create an awareness of one type of technical solution—shared channels, commonly referred to as interoperability channels—that can help communities or regions achieve an improved level of interoperability through existing systems and resources. The guide will help the emergency response community understand the level of effort, resources, and key actions to implement a shared channel solution. Ultimately, it will provide officials with the information to help decide whether a shared channel solution makes sense for their region. The guide does this by:

- Providing an overview of the technical options available for improving interoperability
- Defining the shared channel solution
- Highlighting key questions that should be asked when considering implementation of a shared channel solution
- Describing the technology considerations that may affect a shared channel solution
- Outlining the key actions in implementing a shared channel solution

This document, *Improving Interoperability Through Shared Channels*, is a living document subject to periodic revisions. Future versions will provide greater detail on the actions involved in implementing a shared channel solution, essentially providing “how to” guides for responsible officials.

Communications interoperability
refers to the ability of emergency response agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand, in real time, when needed, and as authorized.

Why Is It Difficult To Identify the Technical Solutions that Best Meet Your Needs?

Each agency, community, and region has unique communications interoperability needs and requirements. However, no “one size fits all” technical solution exists that simultaneously meets this diverse range of needs. As a result, localities and regions must employ multiple technical solutions to meet their interoperability requirements. Officials charged with improving interoperability face a difficult challenge in determining not only which solutions are best, but which ones are also affordable given limited funding. This task can seem overwhelming. A range of technical solutions exists. A wider range of solutions, manufacturers, and products exist. A brief overview of the broad technical solutions available to improve interoperability, as outlined in the Technology Lane of the Interoperability Continuum, is in Figure 1.

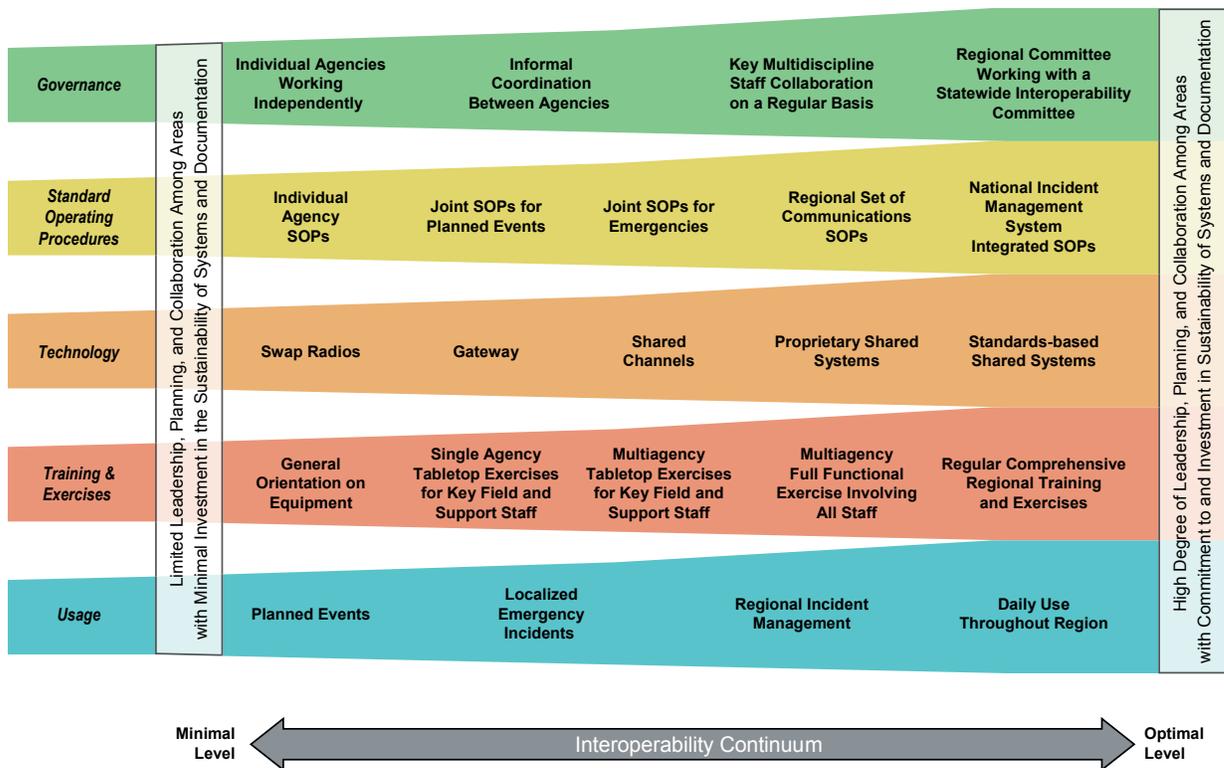


Figure 1

The Interoperability Continuum framework depicts the five critical elements of interoperability success—governance, standard operating procedures, technology, training/exercises, and usage. All of these are necessary to successfully establish effective interoperable communications. Emergency response organizations can use this tool to assess their current level of interoperability and to determine what elements are lacking or need further development.

[2]

planning guide

The specific technological solutions that the Interoperability Continuum identifies are outlined in the section that follows.

Swap Radios

Swapping radios can either involve emergency responders using radios from a compatible set of radios, called a radio cache, where available, or an agency providing one of its radios to a responder from another agency. The solution of swapping radios can achieve a basic level of interoperability; however, it can be time-consuming, management-intensive, and may only provide limited results. In addition, it is often best suited for command and control activities, unless a radio is available for every emergency responder.

Gateways

Gateway systems offer improved interoperability by connecting two or more radio networks. This allows users on one network to communicate with users of another network. This solution is limited by: (1) Gateways can be inefficient because, for each common talk path, they require one channel per interconnected network; (2) A gateway's effective geographic coverage may be limited to the area common to all systems participating in that link, unless the network uses designated common interoperability channels not inclusive to an individual participant or response agency; and (3) They often require significant time to set up or turn on; an emergency incident may be over before a supporting link can be established.

Shared Channels

Channels consist of frequencies, or pairs of frequencies for repeaters, licensed by the Federal Communications Commission (FCC). Shared channels, commonly referred to as interoperability channels, achieve an improved level of interoperability by establishing common channels over which multiple jurisdictions or disciplines can communicate. This solution can be achieved using existing systems and resources, as long as these channels are programmed into each piece of conventional, non-trunked radio equipment, and as long as radios operate in the same frequency band. Trunked systems must also be in the same band and be from the same, or compatible manufacturer, for shared talkgroups to be effective. Limited availability of spectrum and channel/talkgroup congestion can limit the effectiveness of this solution.

Proprietary Shared Systems and Standards-Based Shared Systems

Shared systems refer to the use of a single radio system infrastructure to provide service to most agencies within a region. With the proper planning, standards-based, regionally shared systems can provide optimal interoperability in functionality for users of the system in the region. However, this type of solution can be costly to construct. Proprietary shared systems force users to procure one manufacturer's product and eschew any open competition.

These technical solutions each have benefits and limitations. None can solely provide the highest interoperability. A combination of these solutions is required to best accommodate the communications needs of a region or community. However, this guide highlights the shared channel solution, because it can be achieved using existing systems and limited resources.

[3]

What Are Shared Channels?

Shared channels are common radio channels or talkgroups that are established and programmed into radios prior to an incident to provide a conduit for interoperable communications among agencies. This solution can be achieved using existing systems and resources as long as these channels are programmed into each piece of conventional, non-trunked radio equipment, and the radios operate in the same frequency band. Trunked systems must also be in the same band and be from the same or compatible manufacturer for shared talkgroups to be effective.



Figure 2

The above definition refers to shared channels and talkgroups synonymously, which is not always the common practice. “Shared channels” are generally identified as a solution for conventional radio systems—systems in which specific channels are assigned to specific groups of users. “Shared talkgroups,” on the other hand, are often defined as a solution between different, compatible trunked radio systems—systems in which channels are pooled among all users under an automated, priority-based system of channel resource sharing. In both cases, shared channels and talkgroups must operate in the same frequency band. This document uses the terms “shared channels” and “shared talkgroups” interchangeably, except where specifically distinguished.

The development and execution of a shared channel solution requires understanding the effort, resources, and key actions involved—which are outlined in the remainder of the document. However, a number of key questions and technology considerations should be addressed first to decide whether a shared channel solution should be considered at all.

Deciding To Share Channels Regionally: Key Questions

A shared channel solution should be considered when a region can answer the following questions affirmatively.

1. ***Does your region have, or have the ability to establish, a governance structure that can oversee an emergency response interoperable communications effort?***

Governance means establishing a shared vision and an effective organizational structure to support a project or initiative. The proper governance structure is important to the success of any interoperability solution. Establishing a common governance structure will improve communication, coordination, and cooperation across the region and across disciplines that are essential to achieving a shared channel solution for interoperability. A governing body should consist of local, tribal, state, and Federal organizations as well as representatives from all pertinent emergency response disciplines within an identified region. Typically, an overarching governance group will identify operational and technical working groups to handle the finer details of a shared channel solution.

2. ***Does your region have the ability to assess its current communications capabilities?***

To fully understand the level of effort needed to implement a shared channel solution, a region must have, or be able to develop, an understanding of its current communications technology, gained through a comprehensive assessment. A state or local emergency response community often has the technical elements to become interoperable, yet has not fully assessed its capabilities or engaged in the coordination needed to make capabilities operational. Further, when conducting an assessment, regions should determine whether they have enough channels available to allow offering a channel for shared use without reducing the effectiveness of other operations. Finally, regions should assess whether they are using available national interoperability channels. Existing

national interoperability channels can be used as part of a region's shared channel solution. The Association of Public-Safety Communications Officials—International provides a draft list of all public safety-designated interoperability channels, in all bands, at: <http://www.apco911.org/frequency/siec/documents/documents.htm>.

3. *Are the agencies in your region open to sharing resources such as spectrum?*

Development and implementation of a shared channel solution requires, above all, coordination and cooperation. If agencies in a region are open to sharing resources and working cooperatively to achieve an improved level of interoperability, a shared channel solution can prove feasible and extremely effective. However, conflicts between agencies, resulting from competing values, objectives, and authorities, can often obstruct working together for a solution. A community or region must determine whether the differing agencies are capable of cooperating and sharing. Development and execution of a shared channel solution may be achieved inexpensively compared to other technology solutions, such as a regionally based, shared system, which can cost tens of millions of dollars. For regions lacking the resources for a solution requiring substantial funding, a shared channel solution is a potential option—if agencies within the region operate in the same frequency band and are open to sharing resources.

4. *Can your region dedicate the required resources?*

While development of a channel plan can be very cost-effective, it does not come without expense. The resources and costs for the successful development and implementation of shared channels can include:

- o **Time and Commitment.** Above all, this effort requires considerable time from and the commitment of the identified stakeholders and leadership to properly plan for, develop, implement, manage, and use the shared channel solution.
- o **Radio Programming.** Once shared channels/talkgroups are agreed on, all radios must be programmed to include these resources. If a community or region does not have the ability to program its radios, it may have to locate a qualified service center to do so.
- o **Technology Procurement.** In some cases, agencies will have to purchase technologies (such as gateways) to provide connectivity among disparate systems in a region.
- o **Channels/Talkgroups.** Some disciplines and jurisdictions may need to share one or more channels in order to help the region identify and designate shared interoperability resources. A willingness to dedicate channels/talkgroups to the region will enhance the safety of the emergency response community and the citizenry it serves.

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Technology Considerations

A shared channel/talkgroup solution can improve the level of interoperability for a region if the member systems are compatible and operate in the same frequency band. When evaluating the potential use of a shared channel solution, system planners will consider the following:

- o System mode: conventional or trunked
- o System type: digital or analog
- o Manufacturer: vendor, trunking technology, and proprietary or non-proprietary components

- o Frequency band: VHF, UHF, 700 MHz¹, or 800 MHz

To make a shared channel/talk group solution possible, the groups of users who plan to share a channel or talkgroup must operate on compatible systems. This means all systems must be able to operate in an analog mode or support compatible digital and trunking standards. For example, a shared channel solution could be possible if all users operate conventional analog systems in the VHF band. Another solution might include users from multiple jurisdictions operating on shared talkgroups with compatible, 800 MHz digital trunked systems.

In some cases users will operate on different bands or use incompatible digital technology. For example, if one group of users operates on an 800 MHz, digital trunked system and another operates on a conventional analog system in the VHF band, then shared channels/talk groups would not be possible. Interoperability would have to be accomplished using a different solution, such as a gateway.

A gateway solution, like a shared channel/talkgroup solution, can achieve interoperability by creating connectivity among groups of users operating on disparate systems and frequency bands. However, a gateway solution is less efficient than shared channels because it requires the use of two or more frequencies, as opposed to the sharing of one. Still, when disparate systems preclude a shared channel/talkgroup solution, the use of a gateway to patch systems offers a practical solution.

In addition to system compatibility, a shared channel/talkgroup solution must have frequencies available for shared use. When identifying frequencies available for shared use, regions should consider whether national interoperability channels are available for use. Without the ability to obtain or identify frequencies for shared use, this solution will not work.

Finally, regions should be aware of three significant FCC mandates and actions that will affect operations in the VHF, UHF, and 800 MHz bands.

- **Narrowbanding:** The FCC has mandated that the emergency response community operating on wideband (25 kHz) channels operating below 512 MHz move to narrowband (12.5 kHz) channels by January 1, 2013. The aim is to promote more efficient use of spectrum resources.
- **Rebanding:** The FCC has mandated the rebanding of the 800 MHz band to separate commercial wireless provider channels from public safety channels and to prevent interference. The FCC has established a schedule, and plans to migrate to the new channels by 2008.
- **700 MHz:** 24 MHz of the 700 MHz spectrum band will be released in February of 2009 for use by the emergency response community. The FCC has designated approximately ten percent of the 700 MHz public safety spectrum for nationwide interoperable communications.

These mandates may affect channels shared in the bands mentioned. Regions will need to plan accordingly to prevent disruption of their channel sharing. Further information about these issues can be found in the Additional Resources—Spectrum Information section at the end of this guide.

¹ As specified in the Deficit Reduction Act of 2005 (Pub. L. No. 109-171), 24 MHz of the 700 MHz spectrum band will be released for use by the emergency response community in February of 2009. The Federal Communications Commission (FCC) has designated approximately 10 percent of the 700 MHz public safety spectrum for nationwide interoperable communications.

Key Actions for Developing and Implementing Shared Channels

Technology, while only one piece of a robust interoperability solution, is critical. The development and implementation of a shared channel solution involves a number of technical considerations. As the Interoperability Continuum indicates, success in each of the elements of the Continuum is necessary to develop a successful solution and to ensure its proper use and implementation. The following are the key actions, which incorporate all elements of the Interoperability Continuum, to take when developing a shared channel solution to improve interoperability.

Action

1

Establish a Governance Structure and Gain the Proper Leadership Commitment

A number of challenges² can affect any effort to improve interoperability through shared channels. A proper governance structure, however, can address and overcome these challenges. To develop the proper governance structure to lead the development and implementation of shared channels, the following actions should be taken:

- Establish key relationships with high-level representatives who have decision-making authority and who represent agencies that need to be included in the shared channel plan—including multi-disciplinary and multi-jurisdictional agencies across all levels of government (local, tribal, state, and Federal).
- Develop a locally-driven governance structure that incorporates key stakeholder organizations and ensures an appropriate level of local practitioner membership and input.
- Elect a leader who is familiar with the communication needs and technology capabilities in the region, and has the ability to identify potential funding resources.
- Establish a working group made up of representatives from each agency sharing channels to ensure each agency is a part of the entire decision-making process.

In addition to forming a governance structure to lead the effort, it is important to gain support and commitment from political leadership across the region. The governing body should:

- Establish relationships with local administrators and elected officials (e.g. mayors, council members, and county executives) to gain policy and resource support. Long-term support for maintenance, upgrades, and eventual replacement is essential to overall success. If possible, the use of legislation to gain authority and funding for the governance structure overseeing interoperability efforts is desirable.

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² The National Task Force on Interoperability identifies five key challenges to interoperability—incompatible and aging communications equipment, limited and fragmented funding, limited and fragmented planning, lack of coordination and cooperation, and limited and fragmented spectrum. Each of these challenges can affect an effort to improve interoperability through shared channels.

Action

2

Conduct an Assessment of Operational Needs

Gather information from the entire user community on operational needs that will be included in the shared channel/talkgroup solution. The information should include:

- Mission objectives
- Interoperability needs (who needs to talk to whom and under what circumstances). Should include multi-disciplinary and multi-jurisdictional needs.
- User expectations
- Organizational structure and operations (which should incorporate the National Incident Management System structure)
- Any existing communications problems
- Identify specific types of emergencies that have historically required or will likely require interoperable capabilities

Action

3

Conduct a Technical Assessment of the Communications Systems and Resources of the Region

To develop a shared channel/talk group solution, a region must first understand its communications capabilities, resources, system capacity, and limitations. Such a baseline will help a region identify what channels/talkgroups it may have available for interoperability, and whether changes or upgrades to existing systems are needed. A technical assessment should include:

- Identification of all regional communications systems currently in use, including type (analog or digital), mode (conventional or trunked), frequency band, and manufacturer (if proprietary)
- A database of all FCC radio licenses in the region
- Identification of all channels/talkgroups in use and purposes of use (including national interoperability channels)
- Identification of capabilities by site, including the identification of site users
- Coverage, or the system footprint of all areas covered
- Capacity, or the number of channels/talkgroups that radios in the existing systems can handle and frequency capacity of the radios
- Current interoperability capabilities with other systems

Action

4

Agree Upon Channels To Be Shared and the Policies and Procedures To Govern Use

Once a region has conducted a full operational and technical assessment, the participating agencies can identify resources that may be shared, provided that sharing is agreed to by the licensee. In some circumstances, agencies may need to share some of their own resources to help the region identify and designate interoperability channels/talkgroups. In addition, the region should ensure it has an awareness of all available national interoperability calling and tactical channels.

Policies and procedures must be established to govern the use of the agreed upon shared channels. These policies and procedures should determine when the use of shared channels is needed and authorized. These policies and procedures should incorporate the following principles:

- **Flexibility.** Regions can conduct extensive planning efforts to prepare for the range of variables that may affect a response effort. However, unforeseen circumstances will undoubtedly occur. It is important that the established policies and procedures allow for flexibility so the emergency response community can adjust to unforeseen circumstances accordingly.
- **Autonomy.** Individual agencies should be allowed to maintain a level of autonomy as long as it does not affect interoperability across the region. Agencies should know their communications needs best and should have authority to pursue those needs.
- **Standard Channel Nomenclature.** When differing agencies have programmed different names for the same channel into their radios, operational confusion during incident response can result. This confusion can delay response and hinder interoperability at an incident, endangering life and property. Potential confusion can be prevented by agreeing upon standard channel naming conventions across a region and by programming radios accordingly. The FCC's 700MHz National Coordinating Committee has developed a common interoperability channel nomenclature scheme. It encompasses all nationally designated interoperability channels in all bands, and has been implemented in many areas. This scheme is a recommended best practice for regions.
- **Plain Language.** When using shared interoperability channels, it is important to use plain language, as opposed to signals and codes. Not all jurisdictions recognize the same signals and codes. Misunderstood codes endanger lives. Plain English removes potential confusion and increases safety.
- **Discipline.** Because many users have access to shared channels, it is easy for radio discipline to break down. Overcrowding can occur, causing interference among transmissions. Protocols must be established to manage the volume of radio traffic on shared channels during an incident. Policies and procedures should incorporate communications features of the Incident Command System included in the National Incident Management System. These policies must be reinforced through regular and frequent training and exercises.

Action
4
cont'd

Agree Upon Channels to be Shared and the Policies and Procedures to Govern Use

- **Licensing Options.** When implementing a shared channel solution across a region³, it is important to understand the applicable rules and regulations from the FCC (and National Telecommunications Information Administration for Federal users). For example, channels such as 154.280 MHz (fire response) and 155.475 MHz (law enforcement) are limited to interagency use only.

Action
5

Create a Regional Channel/Talkgroup Plan Incorporating the Agreed Upon Shared Channels and Policies and Procedures

A channel/talkgroup plan is a tool for organizing a region’s available emergency response interoperability resources. It can help ensure that all end users know the purpose of the channels/talkgroups, how to access them, who should be allowed access, and how and when authorization for access and use should occur. Ideally, a plan serves as a tool for identifying and managing the use and sharing of spectrum resources for improved interoperability through shared channels. For trunked systems, the planning document for shared talkgroups (a “talkgroup plan”) will be built around each agency’s “fleet map.” Tables 1 and 2 provide templates for identifying and documenting shared channels and shared talkgroups within a channel/talkgroup plan.

[10]

Primary Use	Frequency	Channel Name	Description	License Holder

Table 1

Primary Use	System ID	Talkgroup ID	Talkgroup Name	Description

Table 2

³ 47 C.F.R. Part 90 contains the rules and regulations for Private Land Mobile Radio Services, which provides for the internal communications needs of emergency response organizations and other non-commercial users of two way radio services. Information on 47 C.F.R. Part 90 can be found at: <http://wireless.fcc.gov/rules.html>.

Action 6

Develop a Regional Memorandum of Understanding (MOU)

Develop a regional Memorandum of Understanding (MOU), agreed upon by all agencies incorporated in the regional channel plan. The MOU should include:

- **Governance Structure.** The governing body should have the proper authority to successfully develop, lead, and implement the interoperability solution.
- **Roles and Responsibilities.** Establish the roles and responsibilities of the governing body tasked with implementing a shared channel solution.
- **Support.** The MOU should establish the necessary support—leadership, people, and funding—to ensure the effort has the resources necessary for success.
- **Cost-Sharing Plan.** The availability of resources varies greatly from agency to agency and community to community. Where funding is needed to provide connectivity between agencies and jurisdictions, communities may need to develop a cost-sharing plan.
- **Designated Shared Channels.** It is important to document the channels/talkgroups designated for use, and to ensure that all rules and regulations are followed.
- **Policies and Procedures for Use of Shared Channels.** Policies and procedures must govern the use of shared channels/talkgroups.
- **Regional Channel Plan (or Talkgroup Plan).** The plan should provide users with a quick reference guide of available shared channels and purposes of channel use.
- **Enforcement.** A mechanism for monitoring and enforcing adherence to the MOU by participating agencies must be in place.

[11]

Action Program Radios

7

All user radios in the region must be programmed with the shared channels/talkgroups. This will require:

- **Radio Technicians.** If a region does not have technicians on staff, then it will need to procure services from their local vendor.
- **Process and Schedule.** To implement a shared channel solution, users must give up their radios for a time, for the purpose of programming the radios. Regions should plan to minimize the impact of such programming to ongoing emergency response operations.

Action

8

Train and Exercise on the Use of Shared Channels/Talkgroups

Proper training and regular exercises are critical to the implementation and maintenance of any interoperability solution, including shared channels/talkgroups. An interoperability solution fails to be a true solution if the end users do not know how to use it. Despite the fact that radio communications are a critical resource for the emergency response community, training on the use of communications equipment is often overlooked. To successfully implement a shared channel/talkgroup solution, a community or region should consider the following actions:

- Commit resources to manage a program, providing training and exercises on the use of shared channels/talkgroups.
- Identify and deliver guidelines and requirements for regional training and exercise.
- Ensure regular training—should occur at least twice per year.

Success will be assured by regular and comprehensive exercises that address realistic shared channels/talkgroups scenarios.

Action

9

Regularly Use Shared Channels/Talkgroups

It is important that shared channels/talkgroups are regularly used so that the emergency response community becomes familiar and comfortable with their use. Ideally, communities will use interoperability equipment and procedures daily. However, problems can often preclude regular use. Common problems include:

- Emergency responders do not regularly use interoperability solutions.
- Day-to-day operations do not always use interoperability equipment.
- First responders from different jurisdictions and disciplines may not interact daily.

To encourage regular use of shared channels/talkgroups, the solution should:

- Reflect operational needs.
- Institutionalize regular use and review of shared channel/talkgroup policies and procedures.
- Train and exercise regularly on the use of shared channels.

Optimal usage, as defined by the Interoperability Continuum, includes regular use of interoperability systems for managing routine and emergency incidents, user familiarity with the operation of the interoperability solution, and routine coordination with multiple disciplines and jurisdictions.

Future Versions

Future versions of this guide are under development. They will provide further detail on key actions to implement a shared channel solution. These versions will provide, among other items, a roadmap to guide regions.

Additional Resources—Spectrum Information

A shared channel solution for interoperability depends on the use, sharing, and management of spectrum resources. Because spectrum is a finite resource in great demand, its use and availability are highly regulated. The FCC regulates spectrum designated for use by state, local, and non-Federal entities engaged in emergency response activities. The National Telecommunications and Information Administration (NTIA) regulates use of spectrum by Federal Government agencies. Evolving rules, regulations, and policies established by these bodies govern the use of spectrum. These mandates can affect interoperability in general, as well as the interoperability specifically achieved through shared channels. Table 3 displays public safety spectrum by band and range. The resources in the sections that follow provide other spectrum related information—including information on rules, regulations, and policies.

Frequency Band	Frequency Range
High HF	25-29.99 MHz
Low VHF	30-50 MHz
High VHF	150-174 MHz
Low UHF	450-470 MHz
UHFTV Sharing	470-512 MHz
700 MHz	764-776/794-806 MHz
800 MHz	806-869 MHz

Table 3

FCC Spectrum Information

FCC General Public Safety

The following link provides information on the spectrum used by the public safety community:

<http://wireless.fcc.gov/publicsafety/>

FCC Narrowbanding/Refarming

Narrowbanding, also known as “refarming,” refers to rules developed by the FCC to ensure more efficient use of spectrum. Information on the rulemaking related to this can be found at:

http://wireless.fcc.gov/services/index.htm?job=operations&id=private_land_radio

FCC 700 MHz Spectrum

The following site provides information on the 700 MHz public safety spectrum and the rules governing its use:

<http://wireless.fcc.gov/publicsafety/700MHz/>

FCC 800 MHz Band Reconfiguration

The following sites contain information on the 800 MHz public safety spectrum, including rules of use and guidelines for reconfiguration:

<http://wireless.fcc.gov/publicsafety/800MHz/bandreconfiguration/index2.html>

<http://wireless.fcc.gov/publicsafety/800MHz/>

FCC National Coordination Committee (NCC)

The FCC established the NCC to address and advise the commission on the operational and technical parameters for use of the 700 MHz band. The NCC's charter expired on July 25, 2003. Information about the NCC and its work can be found at:

<http://wireless.fcc.gov/publicsafety/ncc/>

FCC Rules and Regulations

FCC rules and regulations can be found at the site below. The site includes 47 C.F.R. Part 90, containing the rules and regulations for private land mobile radio services, which provide for the internal communications needs of emergency response organizations and other non-commercial users of two way radio services:

<http://wireless.fcc.gov/rules.html>

FCC Frequency Coordination

The FCC has certified specific associations to perform the coordination process for those applying for spectrum licenses. A list of certified associations is at:

<http://wireless.fcc.gov/publicsafety/coord.html>

NTIA Spectrum Information

NTIA Office of Spectrum Management (OSM)

The NTIA's Office of Spectrum Management (OSM) manages Federal Government use of the radio frequency spectrum:

<http://www.ntia.doc.gov/osmhome/osmhome.html>

NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook)

This manual includes narrowband requirements for land mobile spectrum allocated to the Federal Government:

<http://www.ntia.doc.gov/osmhome/redbook/redbook.html>

Other Spectrum Information

Association of Public-Safety Communications Officials (APCO)-International Spectrum Issues Page

APCO-International was established to enhance public safety communications. The following page provides information related to public safety spectrum issues:

<http://www.apcointl.org/frequency/issues.htm>

APCO-International Draft List of All Standardized Public Safety Designated Interoperability Channels

Currently, there exist national interoperability channels that can be used as part of a region's shared channel solution. APCO-International provides a draft list of all public safety designated interoperability channels in all bands:

<http://www.apco911.org/frequency/siec/documents/documents.htm>

Computer Assisted Pre-Coordination Resource and Database System (CAPRAD)

The CAPRAD tool provides automated features to assist in management, assignment, and application for interoperability channels:

<http://caprad.nlectc.du.edu/cp/index.jsp>

National Public Safety Telecommunications Council (NPSTC)

NPSTC is responsible for implementing the recommendations of the FCC's NCC. Spectrum related information can be found on its site:

<http://www.npstc.org/index.jsp>

The Department of Homeland Security (DHS) established the Office for Interoperability and Compatibility (OIC) in 2004 to strengthen and integrate interoperability and compatibility efforts in order to improve local, tribal, state, and Federal emergency response and preparedness. Managed by the Science and Technology Directorate, OIC is assisting in the coordination of interoperability efforts across DHS. OIC programs and initiatives address critical interoperability and compatibility issues. Priority areas include communications, equipment, and training. As communication programs of OIC, SAFECOM and DM, with its Federal partners, provides research, development, testing and evaluation, guidance, tools, and templates on communications-related issues to local, tribal, state, and Federal emergency response agencies.



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