



Technical Solutions

Common Frequencies

THIS COMMON FREQUENCIES ANALYSIS HIGHLIGHTS THE FOLLOWING

- Technical description and conceptual drawings
- Appropriate uses
- Advantages and disadvantages
- Costs
- Spectrum requirements
- Management issues
- Security and standards issues
- Implementations

PUBLIC SAFETY AGENCIES CAN ACHIEVE INTEROPERABILITY BY SHARING COMMON FREQUENCIES THAT ARE PREPROGRAMMED INTO THEIR SUBSCRIBER EQUIPMENT

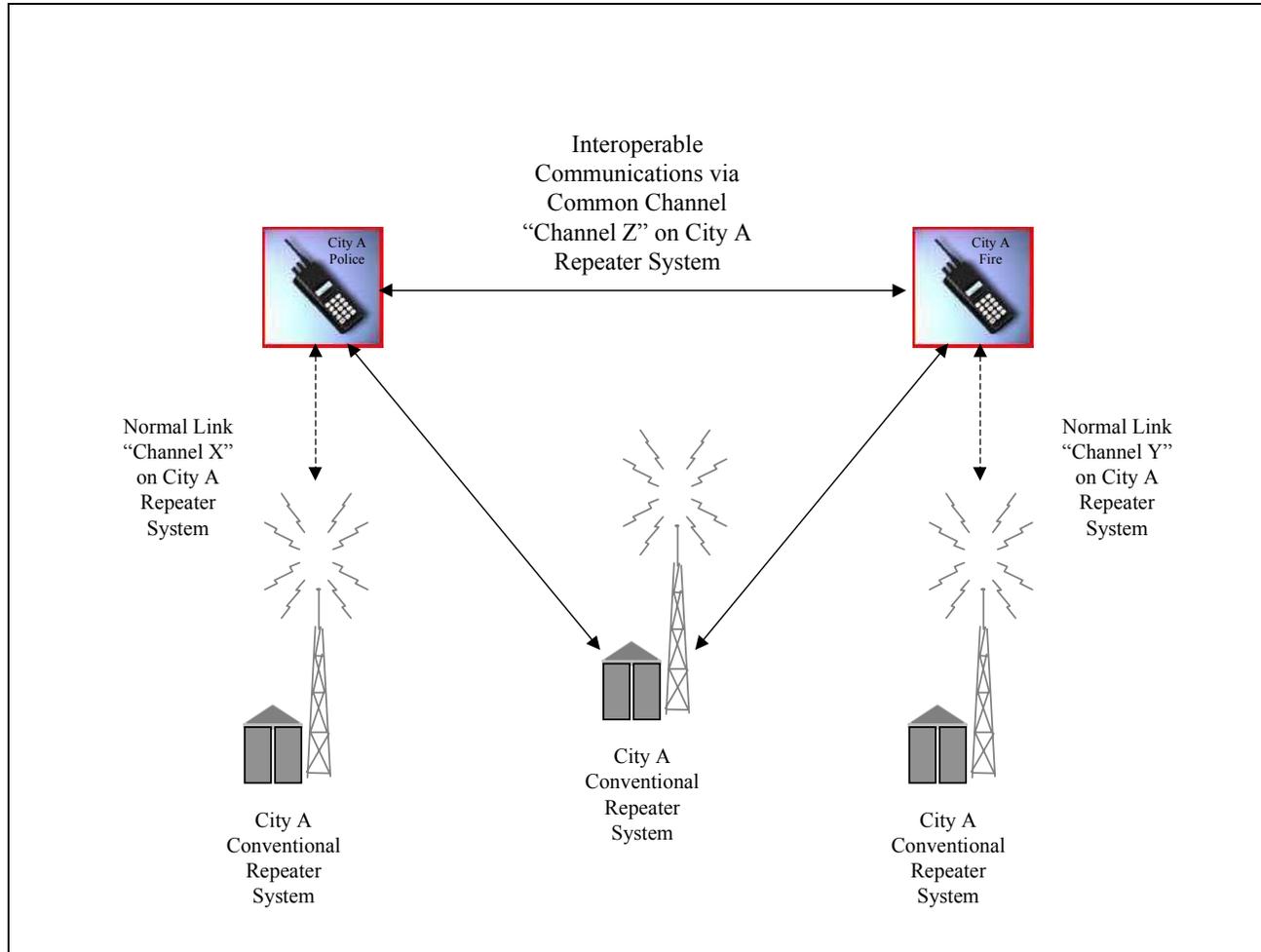
- Agencies that use common frequencies for interoperability must share one of the following
 - Common conventional system infrastructure
 - Infrastructure in different conventional systems
 - Infrastructure in incompatible trunked systems
- When agencies share conventional system infrastructure, they can switch to a common channel programmed into their radios and designated for interoperability
 - For example, a city's police department and fire department may share an ultrahigh frequency (UHF) repeater
- When agencies share infrastructure on different conventional systems, they can use a "reserved" channel on each system or an existing operational channel on each system that enables the subscriber unit needing interoperability to be added to the existing talk group
 - For example, if a police officer is in "hot pursuit" of a vehicle approaching the county line, he or she may need to request permission from an officer in the next jurisdiction to continue the pursuit

PUBLIC SAFETY AGENCIES CAN ACHIEVE INTEROPERABILITY BY SHARING COMMON FREQUENCIES THAT ARE PREPROGRAMMED INTO THEIR SUBSCRIBER EQUIPMENT (CONTINUED)

- When agencies operate trunked systems and use the same frequency band, they can achieve interoperability by using common conventional repeater channels if these are installed as part of each system's infrastructure
 - For example, the police chief in a city with a trunked system from one manufacturer may want a direct radio link to the police chief in another city with a trunked system built to a different protocol by a second manufacturer. Although the chiefs cannot communicate directly in the trunking mode, they can communicate by switching to a conventional repeater channel, such as a National Public Safety Planning Advisory Committee (NPSPAC) calling or tactical channel

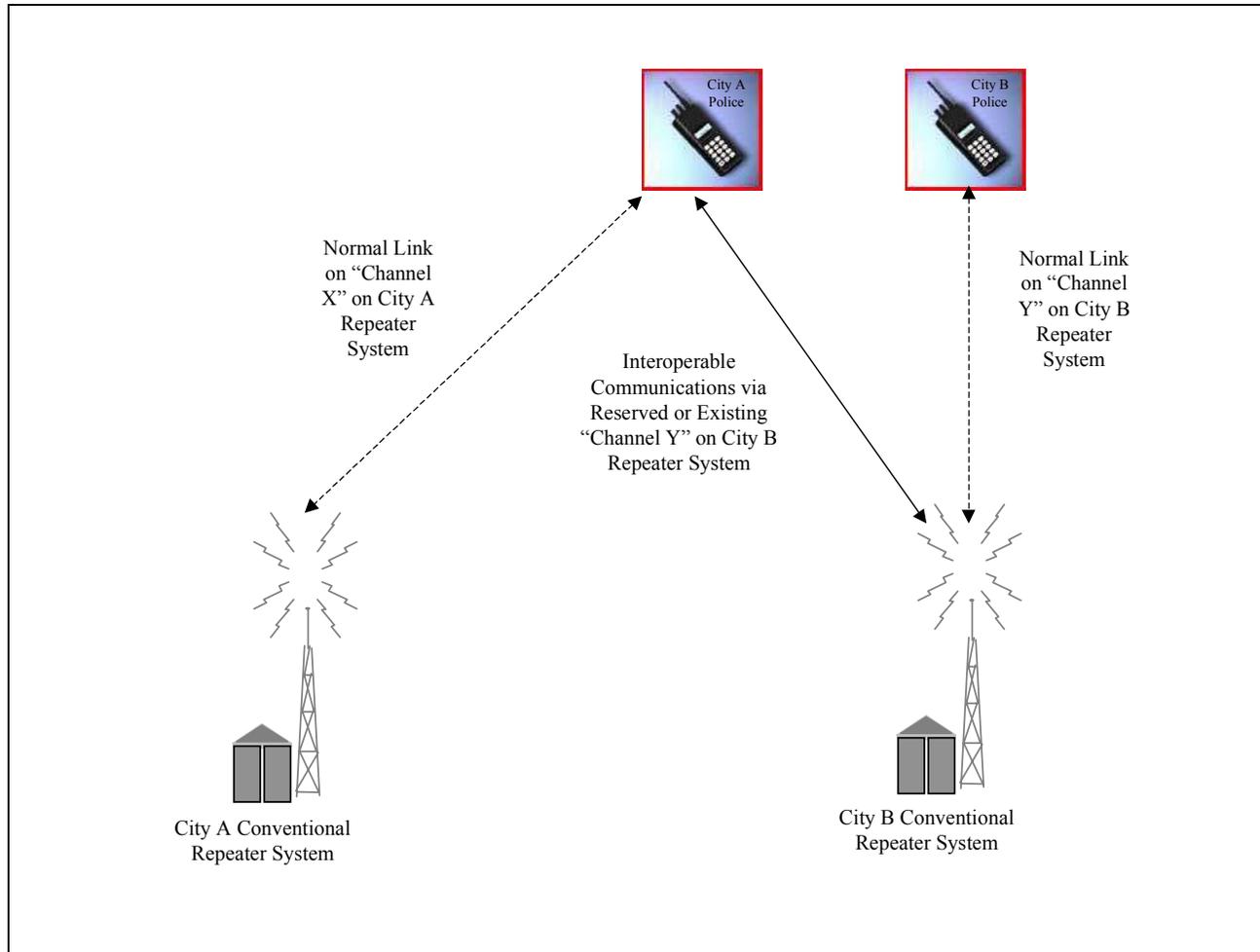
Common Frequencies Solution...Conceptual Drawings...

THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF COMMON FREQUENCIES WHEN SHARING A COMMON CONVENTIONAL SYSTEM INFRASTRUCTURE



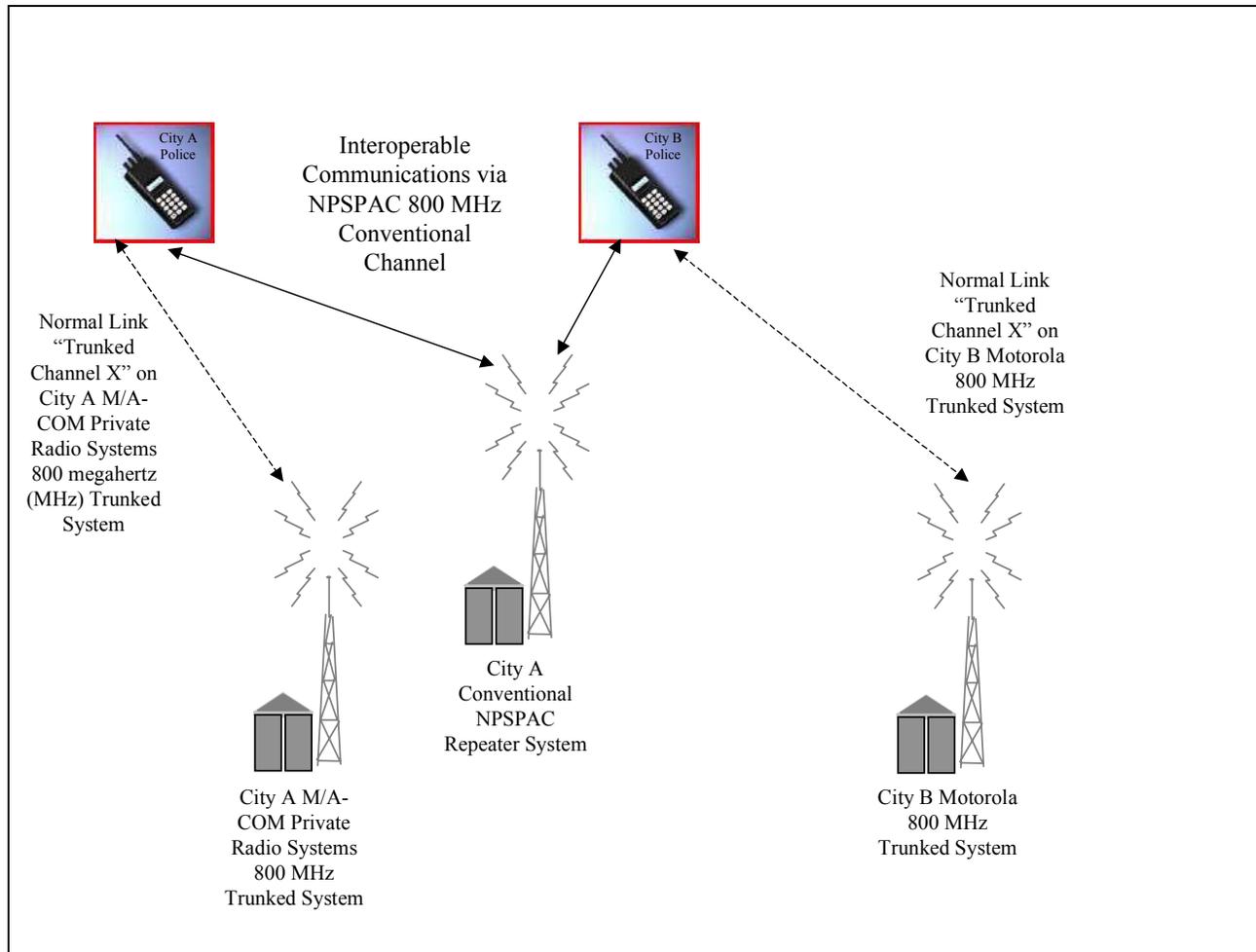
Common Frequencies Solution...Conceptual Drawings...

THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF COMMON FREQUENCIES WHEN SHARING INFRASTRUCTURE IN DIFFERENT CONVENTIONAL SYSTEMS



Common Frequencies Solution...Conceptual Drawings...

THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF COMMON FREQUENCIES WHEN SHARING INFRASTRUCTURE IN INCOMPATIBLE TRUNKED SYSTEMS



Common Frequencies Solution...Appropriate Uses...

USE OF COMMON FREQUENCIES IS A VIABLE SOLUTION WHEN THE PUBLIC SAFETY AGENCIES THAT NEED TO INTEROPERATE USE—

- The same frequency band
- A common system or different compatible systems, either conventional or trunked. If trunked systems use incompatible protocols, common conventional repeater channels must be installed as part of the infrastructure

Common Frequencies Solution...Advantages...

EACH COMMON FREQUENCIES SOLUTION HAS SEVERAL ADVANTAGES

Advantage	Common Conventional System Infrastructure	Different Conventional System Infrastructure	Incompatible Trunked System Infrastructure
Solution is easily accomplished by programming a common channel into each subscriber unit needing interoperability	✓	✓	
Cost is minimal or moderate	Minimal	Minimal	Moderate
User training (i.e., to change the selector switch) is minimal	✓	✓	✓
No dispatcher is required because the infrastructure equipment configuration remains unchanged	✓	✓	✓
No additional field equipment is required to set up a "patch" or crossband link to accommodate the interoperability requirements; no patch or crossband link must be removed when interoperability is no longer required	✓	✓	✓
Each agency can use its own subscriber equipment; it need not buy, trade, or reprogram radios to work on another system	✓	✓	✓
Subscriber equipment may have only basic features; switching frequency bands or operating modes is unnecessary	✓	✓	
The subscriber equipment must be capable of switching from trunked operation to conventional repeater operation if only one radio unit is to be used for both normal trunked operation and conventional interoperability channel access			✓

EACH TYPE OF COMMON FREQUENCIES SOLUTION ALSO HAS SEVERAL DISADVANTAGES

Disadvantage	Common Conventional System Infrastructure	Different Conventional System Infrastructure	Incompatible Trunked System Infrastructure
Solution may add loading to either trunked radio system			✓
Solution is limited to agencies using the same frequency band	✓	✓	✓ ¹
Each subscriber unit probably has to be reprogrammed initially to include an interoperability channel. Potentially time consuming (depending on number of units) and costly (if reprogramming performed by an outside vendor)	✓	✓	✓
Subscriber units must have room to add an interoperability (or operational) channel; if not, solution is not feasible	✓	✓	✓
Fixed equipment infrastructure must have sufficient capacity to allow designation of an interoperability channel. Although another channel can be added, doing so can be time consuming and expensive to coordinate and license the channel (especially in metropolitan areas) and to acquire and implement additional infrastructure	✓	✓ ²	

¹ Typically, trunked systems use the 800 MHz public safety band.

² Allowing subscriber units to use an appropriate operational channel on the adjacent system may avoid this disadvantage.

EACH TYPE OF COMMON FREQUENCIES SOLUTION ALSO HAS SEVERAL DISADVANTAGES (CONTINUED)

Disadvantage	Common Conventional System Infrastructure	Different Conventional System Infrastructure	Incompatible Trunked System Infrastructure
Adjacent systems have different coverage "footprints," so users must be aware of their location in relation to the coverage areas of the systems they wish to access. A unit outside a given system's footprint will be unable to communicate with the desired agency		✓	✓
The fixed equipment infrastructure must include one or more conventional repeaters configured to operate on the interoperability channel(s) (e.g., NPSPAC calling or tactical channels). Repeater(s) could be relatively expensive and time-consuming to purchase and implement			✓
The subscriber equipment must be capable of switching from normal trunked operation to conventional repeater operation to access the conventional interoperability repeater. When a subscriber unit is in the conventional mode, it is out of contact with the system dispatcher, because the dispatcher is still operating on the trunked radio system. The dispatcher may need to talk to the switched subscriber unit, and that unit does not receive ongoing communications in its normal trunked talk group			✓

COSTS VARY, DEPENDING ON HOW THE COMMON FREQUENCIES SOLUTION IS IMPLEMENTED

- The cost of sharing conventional system infrastructure is minimal because no additional equipment is usually required, provided—
 - Subscriber units have room for another channel position
 - The fixed infrastructure has a channel that can be spared for interoperability use
- The cost of sharing infrastructure in different conventional systems is minimal because no additional equipment is usually required, provided—
 - Subscriber units have room for another channel position
 - The adjacent fixed infrastructures have a channel that can be spared for interoperability use (or use of operational channels is acceptable)
- Sharing infrastructure in incompatible trunked systems requires some additional costs
 - They include installation of the conventional repeater(s) for the interoperability link
 - Repeater(s) could be relatively expensive and time-consuming to purchase and implement
 - This one-time expense should include programming the appropriate mobile and portable radio units to allow access to the conventional repeater channel

COMMON FREQUENCIES SOLUTIONS GENERALLY REQUIRES NO ADDITIONAL SPECTRUM

- These solutions typically use previously licensed spectrum, regardless of system (conventional or trunked)
 - If an agency is planning to use an NPSPAC channel, the agency must use the licensed channel in accordance with the regional plan for that region
- If an interoperability channel is unavailable, however, additional spectrum may be required

THE COMMON FREQUENCIES SOLUTION REQUIRES MANAGEMENT BY THE PUBLIC SAFETY AGENCIES INVOLVED

- Subscriber units may require reprogramming to include the interoperability channel
- Any expansion of fixed infrastructure capacity to add a channel increases management requirements sharply, both to coordinate and license the new channel (especially in metropolitan areas) and to acquire and implement the additional infrastructure
- The system's coverage footprint must be available to all users
- Coordination can also require substantial effort. Formal interoperability procedures should be developed to ensure that users follow established procedures in communicating with other departments or systems

USE OF COMMON FREQUENCIES FOR INTEROPERABILITY CAN AFFECT COMMUNICATIONS SYSTEMS' SECURITY

- Security may be addressed through the use of
 - Encryption in the field units
 - Encryption/decryption equipment at the consoles
- Use of conventional channels can circumvent problems created by lack of common standards (e.g., trunked systems built by different manufacturers)

COMMON FREQUENCIES HAVE BEEN IMPLEMENTED IN LOCAL PUBLIC SAFETY ENVIRONMENTS

- Many public safety agencies across the United States achieve interoperability by using common frequencies and shared conventional system infrastructure
- The El Paso County Sheriff's Office and the Dona Ana County Sheriff's Office are both on VHF conventional systems. They can interoperate by using predetermined common VHF channels that are programmed into their respective subscriber units
- NPSPAC calling and tactical channels are being used in many areas of the country to link trunked systems. For example, the police chiefs in El Paso, Texas, and Las Cruces, New Mexico, can communicate directly with each other by switching to a conventional repeater channel (a NPSPAC tactical channel) when in the coverage area of the Las Cruces NPSPAC repeater. Use of the conventional repeater channel allows the two cities to overcome the incompatibility between their trunked systems (Motorola in El Paso and M/A-COM Private Radio Systems in Las Cruces)