



Technical Solutions

Radio Reprogramming

THIS RADIO REPROGRAMMING ANALYSIS HIGHLIGHTS THE FOLLOWING

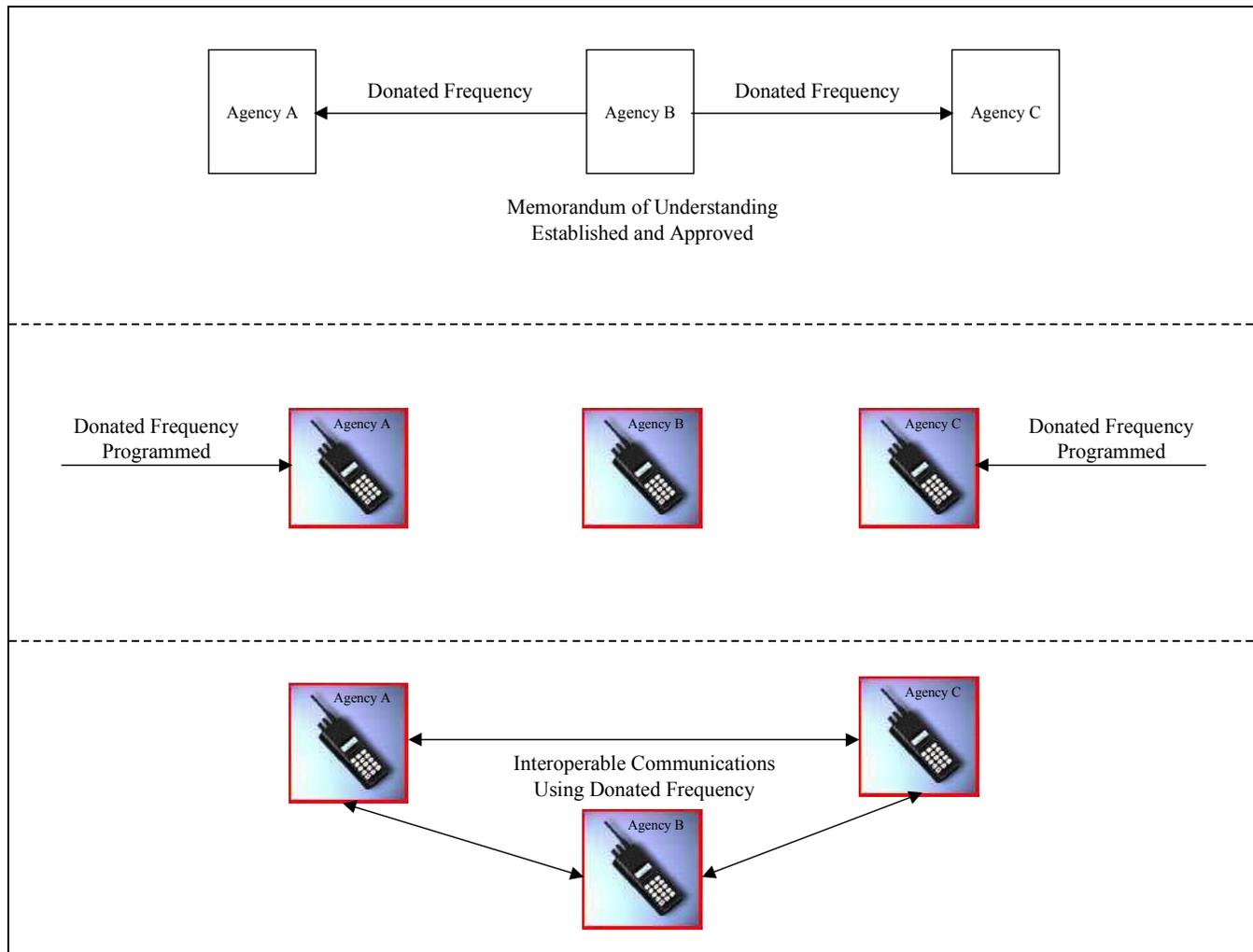
- Technical description and conceptual drawing
- Appropriate uses
- Advantages and disadvantages
- Costs
- Spectrum requirements
- Management issues
- Security and standards issues
- Implementations

TECHNICALLY, RADIO REPROGRAMMING IS A SIMPLE TYPE OF INTEROPERABILITY

- Radio reprogramming occurs between agencies operating in the same frequency band that wish to interoperate with each other
- Participating agencies must develop a memorandum of understanding (MOU)
 - The MOU establishes which agency will donate frequencies in different situations
 - It defines the agreed scenarios in which frequency sharing will occur
 - If more than one agency donates frequency, the MOU specifies the arrangements so that all agencies understand which frequency will be shared and in what areas of the region
- Radio programming with the new donated frequency depends on the radio's age and model
 - Frequency Modulation (FM) analog radios more than 20 years old require a quartz crystal specifically cut for the primary frequency for which the radio's oscillator was designed
 - Next-generation radios require "dip switch" changes to program a phase-lock-loop (PLL) circuit to create the proper over-the-air frequencies for transmit or receive
 - State-of-the-art radios are programmed using a central processing unit input/output (CPU I/O) port—an RS-232, typically, or some other bus technology. A service computer is plugged into the "flash programming" port and the radio's memory is updated with the new frequency set
- Reprogrammed radios will implement the new frequencies to provide interoperability between participating agencies

Radio Reprogramming Solution...Conceptual Drawing...

THE DRAWING BELOW ILLUSTRATES THE CONCEPT OF RADIO REPROGRAMMING



Radio Reprogramming Solution...Appropriate Uses...

RADIO REPROGRAMMING IS A VIABLE SOLUTION WHEN THE PUBLIC SAFETY AGENCIES THAT NEED TO INTEROPERATE—

- Establish an MOU
- Use the same frequency band (for either conventional or trunked communications)
- Use a common system or different compatible systems, either conventional or trunked

Radio Reprogramming Solution...Advantages...

THE RADIO REPROGRAMMING SOLUTION HAS SEVERAL ADVANTAGES

- It costs less than other interoperability solutions
- It does not require additional infrastructure
- It does not require coordinating and licensing of additional frequencies
- It can provide interoperability on very short notice

Radio Reprogramming Solution...Disadvantages...

RADIO REPROGRAMMING ALSO HAS SEVERAL DISADVANTAGES

- It requires participating agencies to establish an MOU in advance
- Coordination is difficult if more than two agencies are involved
- Reprogrammed radios lose an internal frequency slot
- Programming tools and technical personnel must be available to reprogram the radios
- All radios sharing frequencies must operate in the same mode as the default to clear audio FM

Radio Reprogramming Solution...Costs...

RADIO REPROGRAMMING COSTS ARE MINIMAL

- Radio reprogramming is the least expensive interoperability solution
- The number of units reprogrammed determines the cost

Radio Reprogramming Solution...Spectrum Requirements...

RADIO REPROGRAMMING GENERALLY REQUIRES NO ADDITIONAL SPECTRUM

Radio reprogramming typically uses previously licensed spectrum

RADIO REPROGRAMMING REQUIRES SIGNIFICANT MANAGEMENT BY THE PUBLIC SAFETY AGENCIES INVOLVED

- Participating agencies must establish an MOU in advance detailing—
 - The agency or agencies to donate frequency
 - The frequency or frequencies to be shared
 - Scenarios for use
 - Areas of use
 - Formal interoperability procedures ensuring that users follow established procedures on interoperability channel(s)
 - Same Common Air Interface (CAI)

- Radio reprogramming requires significant coordination when more than two agencies are involved

RADIO REPROGRAMMING CAN AFFECT COMMUNICATIONS SYSTEM SECURITY

Radio reprogramming raises a physical security issue

- The agency that donates the shared frequency no longer maintains sole control of the frequency
- In this situation, encryption creates a special concern because acquisition of a participating agency's radio may enable unauthorized users to intercept or spoof secure communications

Radio Reprogramming Solution...Implementations...

RADIO REPROGRAMMING HAS BEEN IMPLEMENTED IN LOCAL, STATE, AND FEDERAL PUBLIC SAFETY ENVIRONMENTS

Radio reprogramming is widely used for interoperability by public safety agencies across the United States