NATIONAL REGIONAL PLAN GUIDELINES

An outline for regional plans utilizing public safety 4940-4990 MHz

Provided by the National Public Safety Telecommunications Council

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Introduction

On May 2, 2003, the Federal Communications Commission released a Memorandum Opinion and Order and Third Report and Order (FCC 03-99) on FCC Docket 00-32, which allocates spectrum from 4940-4990 MHz to the public safety community and outlines operational and technical parameters for its usage. This guide is to be used as a tool to assist Regional Planning Committees (RPC) in the ongoing implementation of the band and offers suggestions and recommendations for usage.

As all regions differ in demographics and population, the suggestions addressed in this regional planning template are to be reviewed and implemented at the discretion of the regional planning committee. Regional planning committees are strongly urged to review the many filed comments contained in Docket 00-32, as well as orders issued by the FCC on the public safety allocation of 4940-4990 MHz to provide Regional Planning Committee's with as much information as possible while implementing the band.

The issues to be addressed include the following:

An introduction to FCC Docket 00-32, including:
Channel Band plan
Regional planning authority and responsibilities
Recommendations for inclusion in submitted FCC regional 4.9 GHz plans

Jurisdictional characteristics outlined in the Order that will be required in the implementation of the band and suggestions for effective and efficient public safety use, including the sharing of 4.9 GHz public safety spectrum with the Critical Infrastructure community.

A review of the anticipated public safety applications anticipated in the 4940-4990 MHz band along with suggestions that promote cost effective connectivity and improve access to spectrum in the adjacent unlicensed 5 GHz band and the public safety spectrum in the Dedicated Short Range Communications (DSRC) band between 5850-5925 MHz.

The use of Incident Command in 4.9GHz implementation will improve the bands effectiveness.

The CAPRAD (Computer Assisted Pre-coordination Resource And Database system) database and how it can assist regional planning committees in day-day 4.9 GHz Broadband management.

APPENDIX A

Band Plan options utilizing 50 MHz of public safety spectrum in 4940-4990 MHz

Three Scenarios will be provided that will provide ideas and potential applications that, with the use of 4.9 GHz spectrum to implement broadband public safety usage and effective regional management, will enable public safety first responders to more effectively complete their mission and better serve the public they strive to protect.

A map of radio quiet zones is provided that will allow regional planning personnel to identify radio telescope operations in their area and to ensure proper steps are taken in the band implementation that promotes effective operation without interference.

Section 1
4940-4990 MHz Band Allocation-Structure of band plan

Band Plan (Additional Band Plan scenarios, see Appendix A)

The following channel center frequencies are permitted, per FCC rules, to be aggregated to channel bandwidth of 5, 10, 15, or 20 MHz. Channel numbers 1-5 (yellow) and 14-18 (blue) are 1 MHz channels and channels numbers 6-14 (green) are 5 MHz channels. See APPENDIX A for additional examples of band configurations. Different band configurations will be appropriate for different regions, or parts of regions, to achieve maximum efficiency.

Center Frequency (MHz)	Channel Nos.
4940.5	1
4941.5	2
4942.5	3
4943.5	4
4944.5	5
4947.5	6
4952.5	7
4957.5	8
4962.5	9
4967.5	10
4972.5	11
4977.5	12
4982.5	13
4985.5	14

4986.5	15
4987.5	16
4988.5	17
4989.5	18

Section 2
Regional Planning Authority

Per FCC 03-99, Regional Planning Committees (RPC) are authorized to manage the implementation of 4.9 GHz spectrum within their region. Per the Order, the RPC is required to have held a regional planning meeting for the expressed purpose of addressing 4.9 GHz implementation issues within their respective region by January 2004. In addition, the RPC is also required to submit a plan on their anticipated use of public safety 4.9 GHz by July 2004. In the absence of products that are type accepted for use in the band, it is anticipated initial plans filed with the FCC by the July date will provide the commission with preliminary findings identified in the Regional Planning Committee meetings. It is anticipated that updated plans will be filed with the Commission to better reflect the 4.9 GHz cooperative environments within regions.

It should also be noted the FCC required all users of the spectrum to be bound by Rule Section 90.173(b), which will require 4.9 GHz applicants and licensees to cooperate in the selection and use of frequencies so as to reduce interference and maximize effective use of authorized facilities. The success of 4.9 GHz public safety implementation relies largely on the adherence to this one point; that the "public safety commons" environment, where no one user or licensee has any more expectation of an interference free environment than any other, is accepted by the public safety community.

It is anticipated that community based public safety broadband development, utilizing the 4940-4990 MHz band, will be fostered and embellished by agencies working closely together by sharing hardware and spectrum in their respective communities.

Section 3
Applications in the 4940-4990 MHz Band

- **Personal Area Networks (PLAN)**
  - **Will enable Blue tooth type applications in a vehicle, thereby removing wiring that can restrict end users.**
  - **Will change mobile unit design in public safety, as 4.9 GHz Spectrum will enable broadband environments for the user.**

Scenarios showing examples of Personal Local Area Networks and some of their potential in public safety applications are found in Appendix A.

- **Vehicular Local Area Networks (VLAN)**
  - **An area around the vehicle where broadband access is brought out of the vehicle, think Blue-tooth, short range type applications.**
  - **Within 50 ft of a vehicle, a LAN will be deployed to manage/monitor life critical functions, such as pulse, heartbeat, blood pressure, oxygen level in First Responders and connect the end user to his vehicle.**

Scenarios showing examples of Vehicular Local Area Networks and some of their potential in public safety applications are found in Appendix A.

- **Hotspots**
  - **The most commonly assumed public safety application. Nodes will be placed in strategic areas in a community, shared by multiple agencies/disciplines, which will enable seamless high capacity download of video and other large files.**
  - **Many communities will develop single site areas and begin to connect them together to develop seamless wider area broadband environments where necessary.**
  - **Hardware will be COTS based (Commercial Off The Shelf) and expected technology is tolerant to adjacent/co-channel interference as throughput reduction occurs as a result of adjacent channel interference, rather than the entire operation becoming ineffective.**

Scenarios showing examples of Hotspot technology and some of its potential in public safety applications can be found in Appendix A.

- **Fixed Point-Point**

  - **Permanent fixed point-point @ 4.9 GHz has to be licensed site by site. Band not intended for dedicated point-point use. Permanent is in the ground for over 1 year. Permanent fixed point-point is secondary to the previously mentioned primary uses of the band.**
  - **Fixed point-point temporary @ 4.9 GHz is primary in the band for up to one year. Command post/emergency response usage is assumed for periods of up to one year. Longer than that, must license site-site and it will become secondary to other applications. Permanent fixed operations must be licensed separately.**

Examples of Fixed Point-Point operations, both secondary and primary, are listed in the scenarios in Appendix A

Section 4
Recommendations for Inclusion in 4.9 GHz plans

ITEM 3. DESCRIPTION OF THE REGION AND ITS USERS

A section of the plan shall include the following information:

- **Definition of the region and its boundaries, a list of the counties and cities within the boundaries.**
- **Description of relationships between eligible/licensed entities for the use of 4940-4990 MHz in communities throughout the region.**
- **Description of applications anticipated within the region utilizing 4940-4990 MHz.**
- **Overview of public safety entities/eligible users that have jurisdiction within or over any or all portions of the region (Local, County and State agencies, Federal agencies, Critical Infrastructure users etc.). Also include areas where multiple agencies have jurisdiction and how the region has conveyed the method of cooperative use between all eligible parties.**
- **Description of the types of public safety, law enforcement, government, public service, or other entities (town, city, county, regional, federal) that are included in the region.**

ITEM 4. NOTIFICATION PROCESS

A section shall contain a complete description of the process used by the Regional Planning Committee to notify the eligible entities within the region and the steps taken to promote interaction necessary that can lead to efficient and effective use of the spectrum. This section shall contain at a minimum:

- **The dates and publications in which the meetings were announced**
- **The dates and websites on which the meetings were announced**
- **A description of the process by which comments were solicited from all eligible parties**
- **Copies of all notices, comments and submissions obtained through the process**
- **A description of the process used to consider the comments submitted by concerned parties,**

ITEM 5. REGIONAL PLAN RECOMMENDATIONS

A section shall include:

- **The guidelines and procedures for operation of the RPC**
- **The procedures for in the region for communicating with the regional planning committee with regard to local channel usage and associated contacts for additional information.**
- **The procedures for frequency coordination, or cooperation, within different communities in a region.**
- **Guidelines and procedures for protection of incumbent Radio Telescope stations within the Region or near the Region's border, when applicable.**
- **4.9 GHz Spectrum Utilization agreements with adjacent regions.**
- **Description of the pre-coordination allocation/cooperation method used at adjacent region's borders.**
- **Regions should indicate how they plan on using the CAPRAD database http://caprad.nlectc.du.edu/login/home to help provide and document regional coordination of 4940-4990 MHz use in the band to promote efficient operation. An overview of the NLECTC 700 MHz Pre-coordination Database and its development tools and how they will improve coordination in your region is recommended.**
- **Information on how your region is planning on working with the Critical Infrastructure community in the effective deployment of 4.9 GHz.**

ITEM 6. REGIONAL PLAN REQUIREMENTS

Per FCC Rule 90.1211, the following items must be included in regional plans submitted to the FCC:

1 Identification of the document as a plan for sharing the 4.9 GHz band with the region specified along with the names, business addresses, business telephone numbers and organizational affiliations of the Chairperson(s) and all members of the planning committee.

2 A summary of the major elements of the plan and an explanation of how all eligible entities within the region were given an opportunity to participate in the planning process and to have their positions heard and considered fairly.

3 An explanation of how the plan was coordinated with adjacent regions.

4 A description of the coordination procedures for both temporary fixed and mobile operations including but not limited to, mechanisms for incident management protocols, interference avoidance and interoperability.

Appendix A

Public Safety Broadband Wireless Communications Scenarios

Introduction

This section includes several scenarios of typical public safety operations to provide a view of *future* public safety communications. These scenarios describe credible, realistic incidents, activities, and responses that involve public safety agencies and personnel. While these scenarios do not cover all possible activities and situations, this collection provides a comprehensive vision of the future of public safety communications. Additional scenarios that depict increasingly complex events and their associated communications requirements are included in the Appendix. These scenarios provide descriptions of the voice and data communications used in routine, day-to-day operations and include a traffic stop, a structure fire, and a medical emergency. In the Appendix, two scenarios—a pre-planned event, represented by a college football game, and a terrorist car bomb—reflect the interaction of multiple services in a local area, and, finally, two scenarios—a hurricane and an earthquake—represent large-scale regional events.

There are several common elements in the following scenarios defined below.

Public Safety Communications Devices—Public safety personnel in these scenarios communicate using a device that is portable (handheld or wearable), unless specifically noted for Command Post or other in-vehicle use. Throughout this document, these devices will be referred to as Public Safety Communications Devices (PSCD). These devices perform the communications functionality as defined in the scenario. Because the emphasis of these scenarios is on communications capabilities, other important considerations for technology development, such as form (e.g., how text data is input to the device via keyboard, stylus, or spoken language) are not discussed. The scenarios also do not distinguish as to whether a public safety individual is carrying one or more such devices; however, it is noted that minimizing the number of separate devices required to provide the described functionality is preferred, consistent with other requirements, such as affordability and maintainability.

Public Safety Communications User Group—Public safety personnel and resources that are recognized by the system to share communications and information. This implies that traffic related to this user group only traverses the portion of the network necessary to reach all members of particular user group. Each user group can be a permanent unit or a temporary unit created by an authorized user for a particular task.

System of Systems—The communications devices are associated with systems or networks that range in size from small to large. Whether large or small, the systems work with each other to pass information and communications back and forth seamlessly. In other words, all systems together become a system of systems.

Personal Area Network (PAN)—On the small scale, the communications device interacts with other devices that belong with the public safety individual. A first responder is equipped with wireless devices used to monitor the first responder's physical location, pulse rate, breathing rate, oxygen tank status, as well as devices for hazardous gas detection and voice communications**.** The devices are all linked wirelessly on a personal area network (PAN) controlled by the first responder's communications device**.**

Incident Area Network (IAN) – An incident area network (IAN) is a network created for a specific incident. This network is temporary in nature.

Jurisdiction Area Network (JAN) – The JAN is the main communications network for first responders. It is responsible for all non-IAN voice and data traffic. It handles any IAN traffic that needs access to the general network, as well as providing the connectivity to the EAN.

Extended Area Network (EAN)—The city systems are in turn linked with county, regional, state, and national systems or extended area networks (EAN).

Permanent and Temporary Networks—JANs and EANs are networks that exist at all times whereas the LANs are created on temporary basis to serve a particular purpose, such as an incident and then are dissolved. The nature of the IAN is such that it may not reach all areas of an incident. In such cases, the user would either connect to the JAN, or create a temporary network to extend the IAN to the area not covered.

Public Safety Communications User Registration and Authorization—The PAN is created every time a public safety individual begins a work shift and turns on his communications device. The individual needs to provide a positive identification, such as through a biometric scan, to his communications device, which then registers the individual on the network. From that moment on, all voice or data communications from that communications device are associated with only that individual. All the pieces of equipment that can monitor the environment, monitor the health of the individual, locate his exact position, etc. register with the individual's identification on the systems so that every time a monitor provides a measurement, the measured value is associated with that public safety individual. Each individual also has privileges, permissions, and authorities to communicate with others and to access databases and systems to complete the individual's work assignments. The systems will allow communications and system access based upon the user's profile and authorizations.

Temporary Network Creation and Growth—An emergency event or incident can happen anywhere, and those responding to the incident must have communications on-scene as well as away from the scene for command, control, and information to complete their missions. As public safety individuals and resources, such as ambulances and fire engines, come into an incident, the incident communications system or IAN will automatically recognize the new entry, register and authorize the resource, and allow an authorized user to assign the resource to user groups for communications and information exchange. Additionally, in the absence of a network, such as an IAN or JAN, the communications system is designed to allow continued operation in the absence of this infrastructure**.**

The following scenarios include three that relate future communications capabilities for the first responder disciplines and one that describes future command, control, communications, and information sharing for a large incident.

3.2 EMS—Heart Attack Scenario

Initial Work Shift Tasks

At 3:00 p.m., two paramedics report for their shift with the Brookside ambulance service. After being assigned to ambulance A-34 and receiving the day's situation updates from the shift supervisor, they go to their ambulance and begin their system initialization tasks. Both paramedics turn on the Public Safety Communications Devices (PSCDs) that are integrated with the medical equipment and the ambulance's wireless incident area network (IAN), which allows them to have contact with the network when they operate outside the ambulance. At power up, all medical devices, including the video cameras, go through their self tests and report their status to the local command and control system on board the ambulance; the PSCDs go through their network registrations and the ambulance wireless network links to the hospital network to register and download the latest information from the county public health center, emergency procedures from sources, such as the poison center and instructional aids with the latest EMS training packages.

Both paramedics must go through a biometric identity check with their PSCDs. After authenticating each paramedic, the ambulance system sets up the profiles of the two paramedics on the medical equipment and the PSCDs, establishes the level of authorized data access for each paramedic across available databases, and initiates personal tracking of each paramedic so that a record can be made of all instructions given to each paramedic, and the treatment each paramedic provides.

Before formally alerting dispatch that A-34 is in an active status and available for calls, one paramedic goes through a training exercise (using a life-like mannequin) that simulates a situation in which parents have reported their child has stopped breathing. The other paramedic runs the "Required Inventory" program that identifies all the medical supplies needed on board, locates the inventory present via radio frequency identification (RF ID) tags, and restocks the supplies that the system identifies as insufficient.

At 3:25 p.m., A-34 reports to the dispatcher via its on-board data system that it is active and available for calls, and follows up with a radio voice call corroborating the same message. The dispatcher acknowledges that A-34 is active and that dispatch is properly receiving location data from the unit. He assigns the unit to patrol a prescribed grid in the Brookside area.

EMS Response to Heart Attack Call

At 4:19 p.m., the Brookside Public Safety Answering Point (PSAP) receives a 9-1-1 call from the relative of a man who has returned home from playing tennis and is reporting chest pains. From the PSAP's computer aided dispatch (CAD) display, the dispatcher knows that the A-17 team is available and is close to the address but will require 7 minutes to reach the address because of heavy rush hour traffic near several factories. The CAD shows that A-34 is farther away from the address, but has little traffic in its path, and is therefore only 4 minutes away. The dispatcher notifies A-34 and simultaneously sends a digital message providing the patient's name and address. A-34 leaves its location and the ambulance driver notifies the dispatcher who in turn relays the information to the relative stating that paramedics are on their way.

The ambulance driver views the patient's address on the cab monitor display, which also maps the route for the driver; a computer-activated voice directs the driver to the appropriate lanes and where to turn. As the ambulance approaches traffic lights along the route, the on-board signaling system adjusts the traffic light sequence to allow the ambulance to travel through quickly and the on-board system also interrogates the county's transportation system for road closures, blockages, train conflicts, or slow traffic conditions to route the ambulance around impediments and provide the fastest route to the patient. At the same time, the geo-location system provides information on the ambulance location and progress on the dispatcher's CAD display.

A-34 arrives at the patient's house at 4:23 p.m. and the paramedics enter the home to find the patient barely conscious on the living room couch. While one paramedic begins a preliminary medical assessment, the second paramedic acquires personal information about the patient through the other person present. The patient's information is entered by the attending paramedic who uses the ambulance's on-board facilities to capture the data─patient's name, address, gender, age, etc., through a voice recognition system. One paramedic checks the most recent list of available hospitals and confirms that the Brookside Hospital's Emergency Room (ER) will be able to accept the patient. The paramedics discover the patient is wearing a medic alert RF ID bracelet; the paramedics scan the RF ID tag and find that the patient has a severe allergy to penicillin-based medicines.

The paramedics attach a wireless 12-lead electrocardiogram (EKG) unit to the patient and the unit begins transferring its digital information to the PSCD. The Brookside Hospital's ER staff pulls the EKG information from A-34's database. The staff route the information directly to the hospital's emergency physician, who views information from all 12 leads of the EKG simultaneously, zeroing in and enlarging the waveforms for specific leads as required.

The cardiologist quickly determines the patient needs a cardiac catheterization and orders the paramedic team to bring the patient directly to the hospital's catheterization lab. The same order activates the hospital's teams to staff the lab and prepare for the patient's arrival.

The patient is transported from the house to the ambulance with all medical monitors wirelessly attached to him, including the EKG unit, a respirator monitor, and a blood pressure monitor. The attending paramedic rides in the ambulance's patient module and communicates to the driver via their hands-free PSCDs. As the ambulance approaches the hospital, the catheterization lab staff retrieves the patient's information and vital statistics from the ambulance's database.

When the ambulance arrives at the hospital from the house 19 minutes later, the catheterization lab is ready for the patient. After another 33 minutes, the cardiologist and the catheterization lab team successfully establish good blood flow to the affected coronary artery.

EMS Communications Summary

Throughout the scenario, the ambulance, the paramedic team, and the patient are tracked by the network providing geo-location information in real time. All patient information and vitals are recorded through wireless monitors and voice recognition systems with no reliance on paper reports and notes. All EMS hospital staff orders as well as paramedic treatments are recorded by the hospital and ambulance databases. All monitors and devices used with the patient are wireless to allow easy patient transport and mobility. All conversations between dispatcher and paramedics and between paramedics and hospital staff are conference call, simultaneous discussions.

Fire—Residential Fire Scenario

Initial Work Shift Tasks

Three firefighters begin their shift at the Brookside Fire District Station BFD-7. After completing their administrative check-in, they complete their biometric identity check with their Public Safety Communications Devices (PSCD). After authenticating each firefighter, the system sets up their profiles on their PSCDs and the network, establishes the level of data access that each is authorized to have across available databases, and initiates personal tracking of each firefighter so that a record can be made of all instructions that are given to each, and the actions and responses provided by each firefighter. The firefighters initiate the equipment self-tests of the vests they will wear during a fire situation. The vests measure each firefighter's pulse rate, breathing rate, body temperature, outside temperature, and three-axis gyro and accelerometer data. Each vest also provides geo-location information for each firefighter and measures the available air supply in the firefighter's oxygen tank. The vests have a self-contained wireless personal area network (PAN) that interrogates each of the sensors and monitors. The vests code their information with the firefighter's ID and then conduct their registration/authorization steps and report their status to the wireless network.

The firefighters begin their check-out of the fire equipment, the fire engine, E7, and fire ladder, L7, at the station. Each apparatus has sensors to measure water pressure, water flow, water supply, fuel supply, and geo-location. Each apparatus also has its own PAN for interrogating all apparatus monitors. The apparatus codes the apparatus ID with the measured values and geo-location information for routing to the network. After successfully completing all the self tests, the firefighters provide a digital status to the network that they have completed all initial set-ups and they are ready. The fire station network reports to the dispatcher, via the station's and on-board data systems, which personnel and equipment are active and available for calls. The station battalion chief follows up with a PSCD voice call with the same message. The dispatcher acknowledges that BFD-7 is active and that dispatch's Geographical Information System (GIS)/CAD systems are properly receiving location and status data from the units.

Fire Response to a Residential Fire Call

At 3:17 a.m., the Brookside PSAP receives a 9-1-1 call from a cab driver that the apartment building at 725 Pine is smoking and appears to be on fire. From the CAD display, the dispatcher finds that the BFD-7 station is available and close to the address. The dispatcher notifies BFD-7 to send E7 and L7, and to send BFD-7 battalion chief as the fire's incident commander (IC). As E7 is leaving the fire station, firefighter F788 jumps onto the back of the vehicle. The vehicle registers that F788 has become part of the E7 crew for accountability and tracking. The dispatcher simultaneously sends a digital message providing the apartment building's address. The dispatcher notifies another Brookside Fire Department, BFD-12, to also send an engine to the fire. By 3:19 a.m., E7, L7, and the incident commander leave BFD-7 and report their status to the dispatcher. As the incident commander's command vehicle leaves the station, a nearby wireless PSCD sends the apartment's building plans and the locations of nearby fire hydrants, the building's water connections, the elevator, and the stairwells to the command vehicle's GIS. The dispatcher sends a reverse 9-1-1 call message to all residents of the building, which has eight apartments on each of three floors. The nearest ambulance is alerted by the dispatcher to proceed to the scene. The local utility is alerted to stand-by for communications with the IC at 725 Pine.

The E7, L7, and IC drivers view the apartment's address on the cab monitor displays, which also maps the route for the drivers; a computer-activated voice tells the drivers what lane to be in and which turns to make. As the fire vehicles approach traffic lights along the route, the on-board signaling system changes the lights to the emergency vehicles' favor and the geo-location system provides the vehicles' location and progress on the dispatcher's CAD display. The on-board system also interrogates the county's transportation system for road closures, blockages, train conflicts, or slow traffic conditions to route the vehicles around impediments and provide the fastest route to the fire.

The IC arrives on scene at 3:22 a.m., assesses the situation, noting that smoke and fire are visible, and alerts dispatch that 725 Pine is a working fire. The IC directs the local utility to shut off the gas to 725 Pine. As L7 and E7 arrive and get into position, all fire personnel and equipment are shown on the IC's GIS display. The system automatically sets up the tactical communications channels for the IC and the fire crews. The fire crews are able to talk continuously with each other, reporting conditions and warning of hazards. Because the apartment building is not large enough to require a built-in wireless incident area network (IAN) for emergency services, the first fire crew into the apartment drops self-organizing wireless IAN pods on each of the floors at they progress through the building. Soon E12 and the assigned EMS unit arrive on site. The new personnel and equipment are automatically registered with the IC command post network and their PSCDs are automatically reprogrammed to operate on the incident's PSCD radio channels and protocols.

Several families have already evacuated the building. As firefighters ask for their names and apartment numbers, they use the voice recognition capabilities of their PSCDs to capture the information, applying an RF ID wrist strap to each resident to track their status and location. Other firefighters enter the building to guide survivors out and to rescue those who are trapped. The IR cameras on the firefighter's helmets provide the IC a view of fire conditions within the building and where the hot spots are located. Additionally, the firefighters monitor the temperature of the surrounding air in their location; this information is directly available to the firefighter, as well as the IC and EMS unit on-scene. Other passive sensors, such as hazardous gas detectors, are also operating in the firefighter's PAN. With the IC's guidance, the firefighters search each apartment for survivors and the source of the fire. The IC is able to monitor the location of each firefighter and is aware of which apartments have been searched by the information provided on the GIS displays.

The EMS unit outside the apartment monitors the vital signs of all the firefighters in and around the fire scene. The unit alerts the IC that firefighter F725 is showing signs of distress and the IC orders F725 and his partner F734 out of the building for a check-up with the EMS team.

Firefighter F765 pushes his emergency button when he becomes disoriented in the smoke. The IC immediately directs firefighter F788 to his aid by providing F765's location relative to F788.

While the firefighters check every apartment for victims, the main fire is discovered in a second floor apartment kitchen where an electric range is burning. Two adults and two children are discovered in the apartment suffering from smoke inhalation. RF IDs are attached to their arms and each is given an oxygen tank and mask to help their breathing. They are carried outside the building where the EMS unit is ready to take over medical aid.

While the firefighters put out the fire in apartment 202, the IC checks the GIS display, which shows where the fire personnel are and where all the survivors and rescued individuals live in the apartment building. Two top-floor apartments have not been searched and the IC moves fire personnel to those apartments. The apartment database indicates an invalid may be living in apartment 321. The firefighters break down the doors of both apartments and in 321 find a bedridden individual, who is in good condition, and a pet dog in the other apartment. Both are outfitted with RF ID devices and taken from the building.

The fire is brought under control. The IC releases E12 and the IC network controller reconfigures E12's PSCDs for return to the fire station. E7 and L7 wrap their fire operations and A34 has to transport one fire victim to the hospital. The IC releases all remaining equipment and gives control to dispatch.

Fire Communications Summary

Throughout the scenario, the fire personnel and equipment, EMS support personnel, and the fire victims are tracked by the network providing geo-location information in real time, providing the Incident Commander with current accountability of public safety personnel and of the fire's victims. All victim information and vitals are recorded through wireless monitors and voice recognition systems with no reliance on paper reports and notes. All fire personnel and equipment have monitors to measure vital conditions and status that are reported by the wireless PAN and IAN systems to the IC's GIS. The GIS also has access to city building department databases, which are searched and queried for building information and plans, fire hydrant locations, etc.

3.4 Law Enforcement—Traffic Stop Scenario

Initial Work Shift Tasks

A police officer enters his 10-hour shift at the Brookside jurisdiction. After completing his administrative check-in, the officer takes his duty equipment to the squad car assigned to him for the shift. In the vehicle, the officer initiates his biometric identity check with his Public Safety Communications Device (PSCD). After authenticating the officer, the system sets up a profile of the officer on the PSCD and the network, establishes the level of data access the officer is authorized to have across available databases, and initiates tracking of the officer's activities. The officer initiates the equipment self-test of the devices he will be using within the vehicle. The data terminals, status monitors, video cameras, displays, three-dimensional location sensor, etc., are integrated into a wireless personal area network (PAN). All of the devices code their information with the officer's ID and then conduct their registration/authorization steps and report their status to the wireless network. Each device will be associated with the officer and will provide the officer with capabilities based upon the officer's profile. When the officer starts the vehicle, a wireless hub recognizes the officer's PAN and uploads the pertinent database files, the latest law enforcement alerts, and the current road and weather conditions to the PAN.

After successfully completing all the self tests and receiving all the updates from the wireless hub, the officer provides a digital status to the network indicating that he has completed all initial set-ups and is ready. The Police Center network reports to the dispatcher, via the center's and on-vehicle data systems, which personnel and equipment are active and available for calls. The officer follows up with a PSCD voice call with the same message. The dispatcher acknowledges that the officer is active and that dispatch's GIS and CAD systems are properly receiving location and status data from the officer's vehicle and monitor units.

Law Enforcement Response to a High-Risk Traffic Stop

While on routine traffic patrol, the officer observes a car that runs through a red light at an intersection. The officer presses the "Vehicle Stop" button on his vehicle's PSCD. The PSCD issues a message to dispatch, noting the operation underway, the officer's ID, and the location information of the officer's car. As the officer drives his squad car, the license number of the vehicle is captured by license plate recognition software and queried back to the Motor Vehicle Department. The video camera on the officer's vehicle dashboard begins recording video of the vehicle stop onto a RAM buffer video storage device on the vehicle's network; the video can be accessed at any time, on-demand, by the dispatcher and other authorized viewers. Other units in the area are alerted to the vehicle stop.

Shortly, the State Motor Vehicle Registration, Stolen Vehicle, and Wants/Warrants systems return their information to the officer's PSCD. The officer also receives a picture of and information about the registered owner; the information indicates (both on the PSCD screen and with an audio signal) that there are no Wants/Warrants.

The vehicle pulls over and stops. The video feed will be available to dispatchers and supervisors on demand, or automatically displayed in the case of an emergency. When the officer leaves his squad car, he has access to all of his communications and data devices as the devices continue to communicate between his PAN and the vehicle's network. The officer approaches the car and notes that there is a single occupant, the driver. The officer requests the driver's license and registration, but the driver does not provide documentation.

While obtaining the information from the driver, the officer observes what he believes to be the remains of marijuana cigarettes in the ashtray. The officer decides to search the suspect's vehicle and contacts dispatch to request a backup unit. The dispatcher enters the "Dispatch backup" command for the incident on her dispatch terminal and the CAD system recommends the dispatch of the closest unit based upon automatic vehicle location (AVL) information provided by the vehicles on patrol and known road and traffic conditions. The dispatcher glances at the console map to confirm the recommendation and presses the key to confirm the CAD recommendation. The dispatch of the backup unit is transmitted electronically to terminals in that vehicle, as well as to other nearby units and the area supervisor's car for informational purposes. A user group is created on the network between the original and backup officer to share information. The backup officer acknowledges dispatch and asks the on-scene officer to confirm location and circumstances.

The supervisor brings up the real-time video of the event in her vehicle and briefly observes the situation. All appears under control and she releases the video link. The backup unit arrives on-scene. The responding officer orders the suspect to get out of his car. The backup officer watches the driver while the original officer searches the car. The original officer finds a number of bags of a white substance that appears to be cocaine. The original officer then places the driver under arrest and restrains him with handcuffs equipped with an RF ID tag. The RF ID tag is later loaded with the officer's identity code, the nature of the crime, and a case number. The original officer radios dispatch to request a transport vehicle. The unit is dispatched and is linked to the original officer to communicate and obtain information as needed.

After the arrest, the officer takes the driver's biometric sample with his PSCD. The PSCD submits the scan data to the biometric ID database for identification. Soon after, the PSCD returns an image, name, date of birth, and physical characteristics of the individual from the biometric sample that matches the name and DOB of one of the aliases returned by the license plate check, and matches the driver's license picture. This indicates that the driver is the registered owner of the vehicle. The officer queries the criminal history database for information about the driver and receives a response that the individual has previously been arrested for drug possession.

When the transport unit arrives on scene, its PAN and vehicle network is automatically linked with the original officer's network. Based on the incident and location, the system establishes a single user group so that the officers can exchange appropriate case information. The transport unit takes control of the arrested driver and transports him to the jail. The backup unit departs the scene and resumes patrol.

The original officer takes photo images of the suspect's car and the suspected drugs and collects the evidence. He conducts field tests of the substances and confirms that the suspected drugs are cocaine. He places RF ID tags on all evidence bags.

The original officer radios dispatch to request a tow truck to impound the vehicle. Dispatch notifies the tow company and the original officer communicates directly with the tow truck operator to confirm location and status. While waiting for the tow truck, the original officer completes preliminary suspect and vehicle information on the crime to automatically populate the electronic Tow Report and Inventory Form and the Jail Booking Form. This information is transmitted electronically to the Sheriff's Central Records System.

The transport officers arrive at the jail located in Central City. The officers bring the suspect in for booking. The booking officer queries the suspect's RF ID tag on the handcuffs to begin the booking record, which is automatically populated from the information previously sent to the Central Records System. Information

on the handcuff RF ID tag is cloned to a wristband that is then affixed to the suspect after the handcuffs are removed.

As the tow truck arrives, the truck's network is recognized on the incident area network (IAN) at the scene. The tow truck and driver are registered and authorized to exchange information on the network. The tow truck company information automatically populates the tow report. The tow truck driver reviews the tow report with the associated officer code and case number and adds his electronic signature. The officer then continues to work on the arrest report, adding a narrative section describing the events, along with descriptions of the confiscated property and associated arrest information. The officer also updates the State Motor Vehicle database to show the vehicle status as "towed/stored."

The officer completes the arrest report in electronic form. The report is transmitted to the officer's supervisor. The supervisor notes one deficiency in the report and she issues it back to the officer. The officer corrects the report and re-transmits it to the supervisor. She electronically signs off on the report and forwards it to the Central Records System and to the District Attorney's office.

The officer clears the incident on his PSCD, which automatically shuts off the video camera, and resumes patrol.

Law Enforcement Communications Summary

Throughout the scenario, the law enforcement personnel and equipment as well as the arrested suspect are tracked by the network providing geo-location information in real time to provide the field supervisor as well as dispatch with current accountability of all personnel. All suspect information and evidence are recorded through wireless monitors and voice recognition systems with no reliance on paper reports and notes. All information is tagged with the original officer's identity code. All evidence is tracked with RF IDs to provide an audit trail. All law enforcement personnel and equipment have monitors to measure vital conditions and status that are reported by the wireless PAN and IAN systems to the IC's GIS. National and state criminal justice records and state civilian records are searched and queried for information relating to the traffic stop, etc.

3.5 Multi-Discipline/Multi-Jurisdiction—Explosion Scenario

This scenario focuses on the command and control, asset status and tracking, and major communications interoperability aspects of an incident involving first responders. The scenario occurs from the perspective of the Incident Commander and Emergency Commander, and does not include first person, first responder perspectives. The communications capabilities described in the three first responder scenarios are implied (but not described) in this scenario. The italicized text indicates actions or responses of the Emergency Manager.

Explosion

A large explosion occurs at a chemical plant in Barberville, a suburb of Brookside. There is the potential for hazardous chemical leaks as well as toxic smoke from the chemicals burning.

Incident Command (IC) arrives on-scene and assesses the situation. After briefly surveying the area, the IC team initiates their mobile command center and begins to receive information from the temporary network created by the on-site first responder vehicles and personnel.

The Emergency Manager (EM) is alerted that a major incident has occurred and brings up the command terminal in the Emergency Operations Center (EOC) to monitor the regional situation. All of the region's assets are available for query by the EM.

The mobile command center's display registers all of the assets that are currently on-scene, including EMS, Law Enforcement (LE), and Fire. The status of each asset is also available, but is displayed on demand.

IC shifts the display to a GIS overlay of the explosion, with the location of all assets shown. Areas are marked to display casualties, fires, evidence, the incident perimeter, etc. The information for the GIS displays comes from a site survey already underway by LE, Fire, and EMS personnel.

Information is available on the EM's system as the information is gathered by IC. This information is shown both in a GIS-map format as well as a textual set of data. On demand, the EM can call up the information on the incident as if the EM were on site in the capacity of IC.

As new units arrive on-scene, they are authenticated into the incident and added to the list of assets available to IC.

The on-scene Fire Branch monitors the status, location, and current duties of the Fire assets on their command screen, and reassigns them as necessary. Any data that is pertinent to the other Branches and IC is automatically forwarded onto their command systems. This same situation is repeated for both the LE Branch as well as the EMS Branch.

After completing all of the pre-defined tasks for this particular type of incident, IC begins coordinating with the LE, EMS, and Fire command posts. As IC begins directing the assets in the field, the Fire Branch informs IC that the incident is too large to be handled by the assets on hand. IC then puts in a request to the EM for the acquisition of more fire units.

As the request for more fire assets comes into the EM, the EM initiates the Mutual Aid agreements in place, and units are dispatched from the Brookside Metro area to Barberville.

The EMS Branch sets up a triage/treatment area and begins to direct the resources available to identify and handle casualties. The location of the triage/treatment area is disseminated to all first responders on-scene, and the area medical facilities are alerted as to the status of the triage/treatment area.

The Fire Branch is notified of an emergency on their command screen as one of the firefighters in the field has a passive sensor triggered by the detection of a hazardous chemical. The sensor determines that the hazardous chemical would not be ignited by a radio transmission, allowing the network to notify all first responders within 100 feet of the particular firefighter along with LE, EMS, and IC. The Fire Branch designates this area as a Hot Zone that alerts any personnel entering the designated area as to its status.

> Because of the potential for the release of hazardous chemicals, the EM directs all available Hazardous Materials (Haz-Mat) teams to the location, and puts these assets under the control of IC.

IC sets up a secondary perimeter five blocks back from the incident.

The EM notes the perimeter change and initiates a Reverse 9-1-1 warning call that is sent to all fixed and cellular telephones inside the secondary perimeter. This call instructs the people inside the perimeter to find shelter in the area quickly and to close off all outside ventilation.

The LE Branch is directed by IC to coordinate with the Department of Transportation (DOT) to configure traffic management assets, such as traffic lights and electronic signs, to divert traffic away from the incident.

The LE Branch has enough assets to establish a perimeter, but needs more assets to maintain the security of the incident. IC puts in a request for LE assets to the EM.

The EM begins to coordinate with the public utilities and other pertinent private organizations for the appropriate responses, such as shutting down gas lines to the area, and dispatching electrical crews to handle situations, such as downed power lines. The EM also directs additional LE assets into the area upon receiving the request from IC.

Upon further investigation by LE and Fire assets, IC determines that this explosion was not an accident, directs LE to treat the area as a crime scene, and assigns Detectives to begin an investigation of the crime scene in coordination with Fire Investigators. This information is also available to the EM.

After determining that the probable cause of the situation is a bomb, IC directs the LE Branch to begin directing traffic away from the scene and to initiate a secondary explosive device search by the Explosive Ordinance Disposal (EOD) team.

The EMS Branch continues to coordinate the efforts of EMS assets. As casualty information comes onto the command screen via the RF ID tags used by personnel in the field, the most critical cases are selected for transport to the nearest available hospitals. The EMS Branch believes that the on-scene casualties will overburden the medical facilities selected to handle them. The transportation officer is directed to query the local medical facilities as to their status, and their capacity for casualties and what types of casualties can be taken. Casualty statistics are available on demand by IC and the EM. Additionally, the local medical centers coordinate among themselves regarding resource availability.

The EM begins to monitor the status of the casualties, as well as the status of the responding medical facilities. Seeing the casualties from the incident will overburden the nearby facilities, the EM puts a neighboring medical facility on alert for incoming casualties. The EM also directs additional EMS crews to respond to the incident.

As EMS assets arrive on-scene, the assets are registered and their capabilities are authorized for placement into the EMS asset pool for assignments given by the EMS Branch.

The Unit Commander of the EOD team notifies the LE Branch that no secondary devices have been found. The LE Branch pushes this information to IC. IC then automatically forwards this information to the EM.

The Fire Branch alerts IC that all of the fires have been identified and are marginally contained. Additionally, the hazardous chemical spill has been contained and eliminated by the HazMat teams dispatched by the EM. All but one HazMat team is released back into the asset pool.

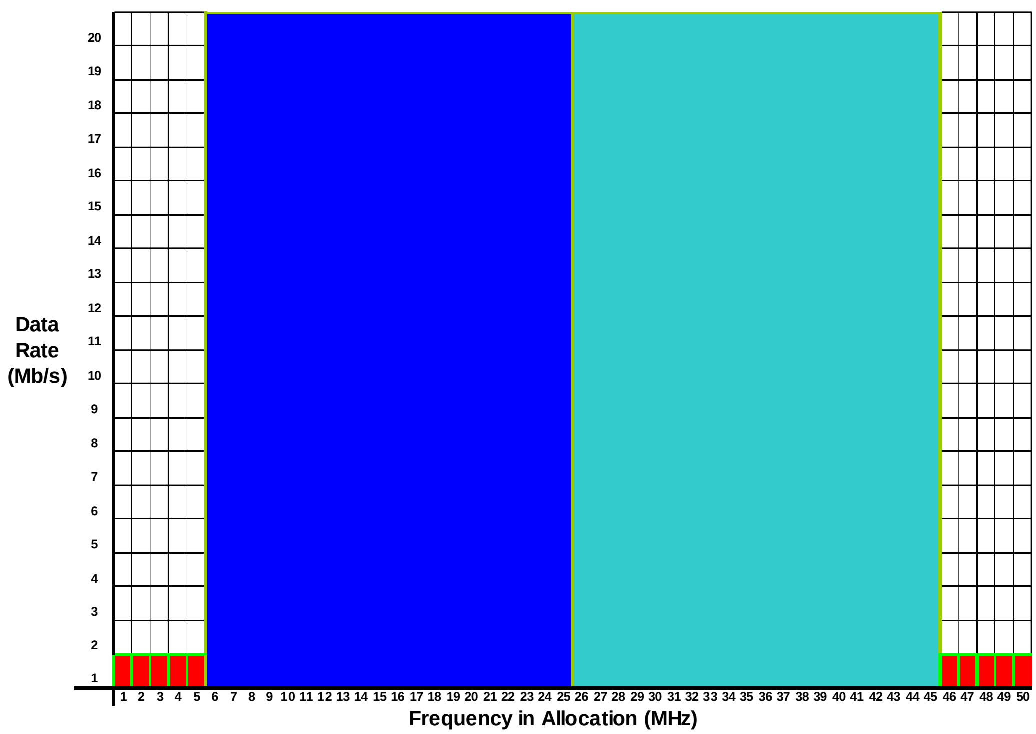
The Fire Branch alerts IC that all of the fires have been eliminated, and that all but one Fire Crew has been released back into the asset pool.

The EMS Branch alerts IC that all of the casualties have been evacuated to appropriate medical facilities. The coroner has been contacted to begin removal of the corpses.

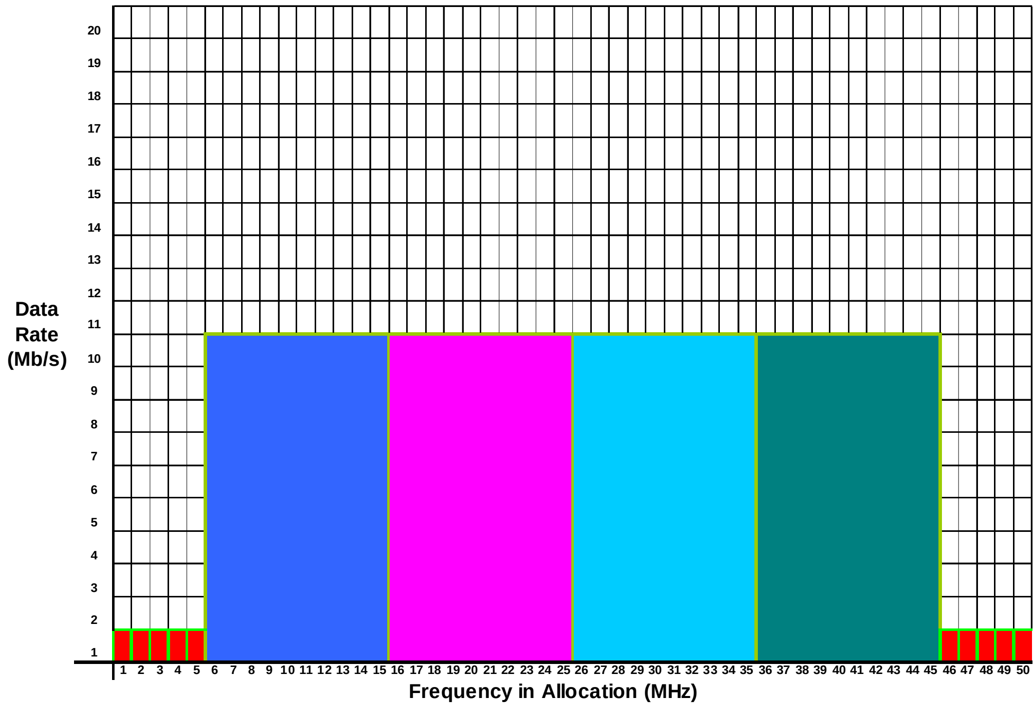
Multi-Discipline/Multi-Jurisdiction Communications Summary

The abstracted view of Incident Command is very different than that of a first responder reacting to a situation in the field. As such, their communications needs and capabilities are tailored to meet those differences. While the communications and actions depicted in the scenario are oversimplified versions of what would actually have occurred in real life, what has been captured is the general nature of the communications, the command and control functionality, and examples of access to a wide variety of information on an on-demand basis. The command and control of Incident Command on-scene and the Emergency Manager provides for the safety and accountability of all the assets at the incident and provides information on additional resources that could be brought to the incident. The networks for communications and information exchange are created on an ad hoc and/or temporary basis at the scenes. They overlay on one another to provide interoperability and integrate with the larger jurisdiction area networks to form a system of systems for command and control.

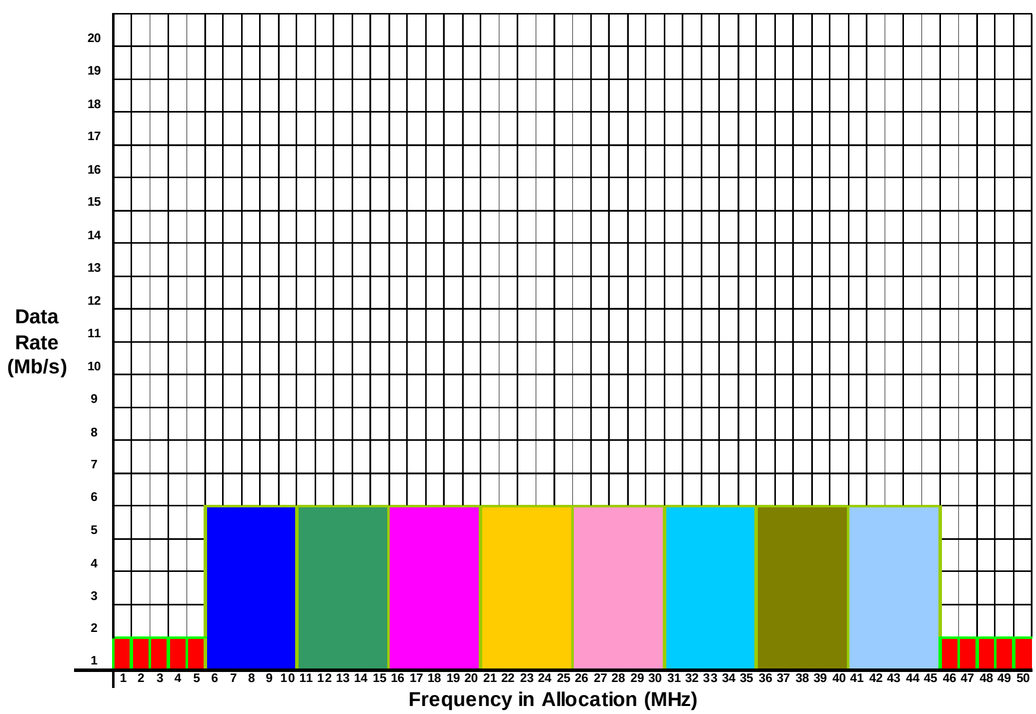
4940-4990 Channel potential channel designations



Two twenty MHz channels utilizing 40 of the available 50 MHz



Four ten MHz channels utilizing 40 of the available 50 MHz



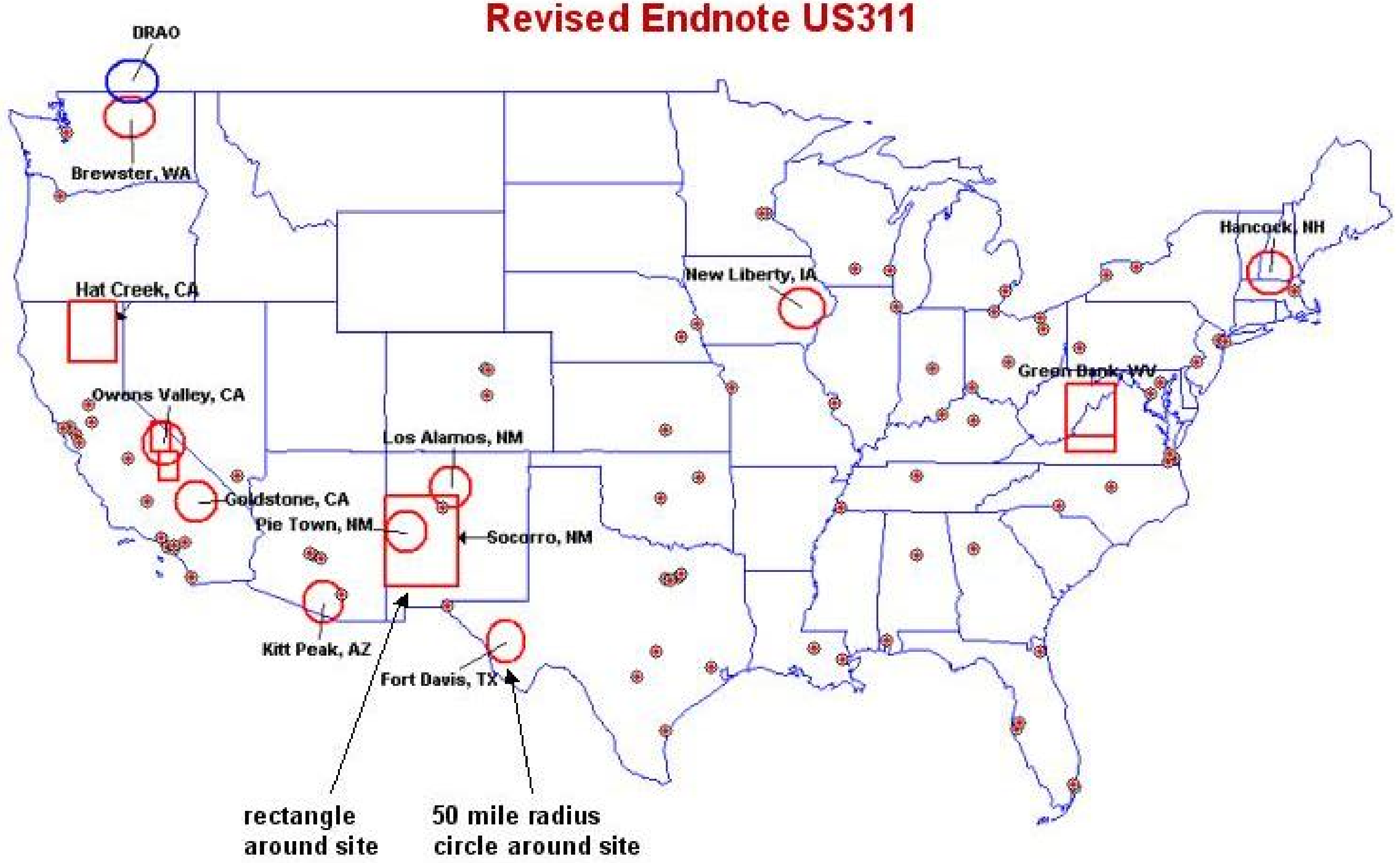
Two twenty MHz channels utilizing 40 of the available 50 MHz

Possible Region 4.9 GHz Channel Designation Example

4940 4945 MHz 5 MHz block for multiple or aggregate 1 MHz app's Air Video Link PLAN/ VLAN	4945 4955 MHz 10 MHz block Might be useful in secondary Or Primary fixed operations in region or Hotspots	4955 4965 MHz 10 MHz network block for node type application or hotspot	4965 4975 MHz 10 MHz network block for node type application or hotspot	4975 4985 MHz 10 MHz network block for node type application or hotspot	4985 4990 MHz 5 MHz block for multiple or aggregate 1 MHz app's Air Video Link PLAN/ VLAN

A regions individual interpretation of channel implementation, which matches channel bandwidth with the number of channels needed for the implementation of specific identified applications within each region or sub-region, should be consistent with regional conclusions. It is anticipated a region will determine the best solution for broadband public safety access in their community. Regions may have multiple channel assignments in different areas of the region to best provide for end user applications in the 4940-4990 MHz band.

4940-4990 GHz
Radio Astronomy Sites
Revised Endnote US311

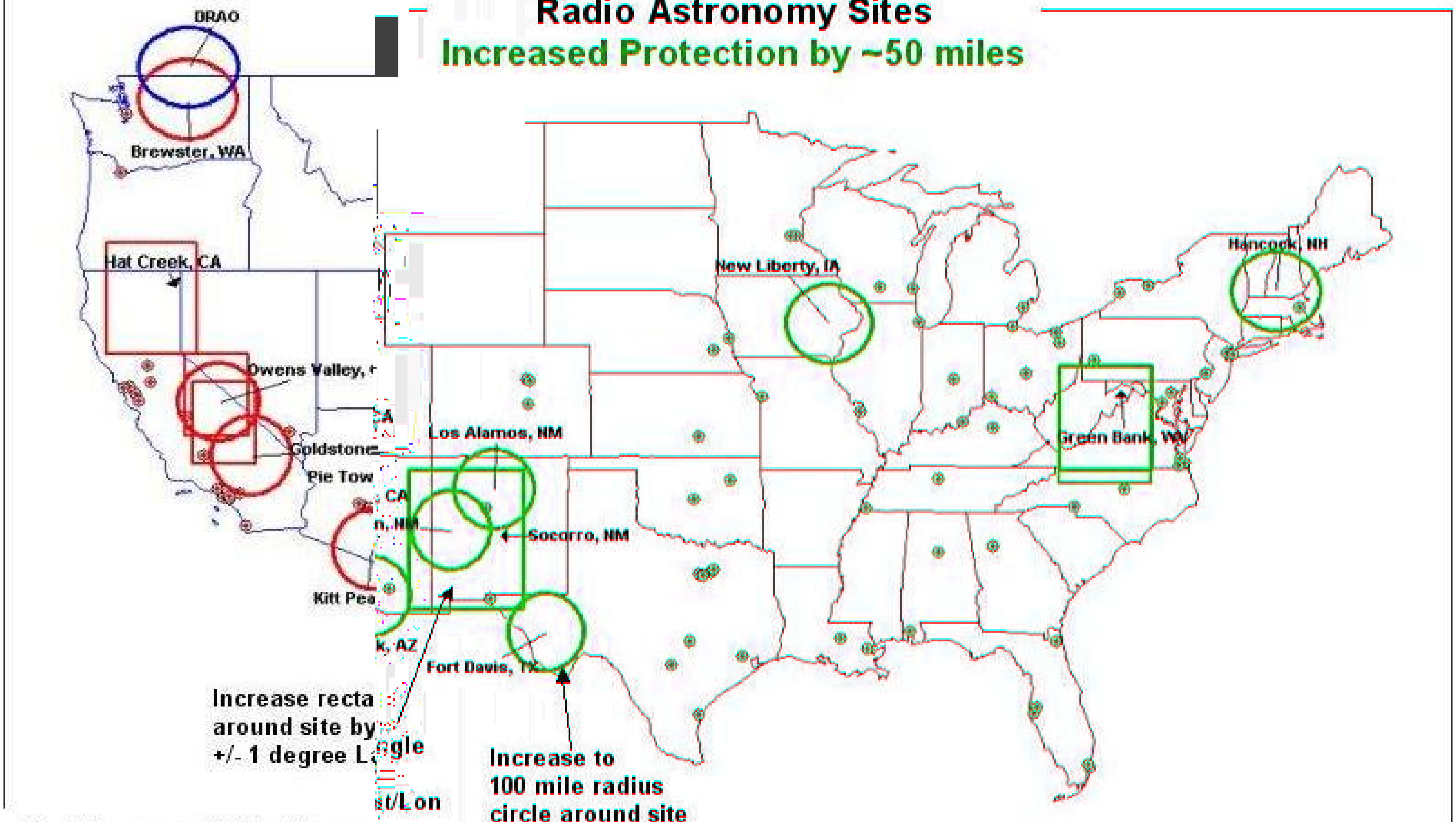


Problems w/ 84 cities:
Albuquerque, NM
Tucson, AZ

4940-4990 GHz

Radio Astronomy Sites

Increased Protection by ~50 miles



Problems w/ 84 cities:
Albuquerque, NM
Tucson, AZ
Fresno, CA
Bakersfield, CA
El Paso, TX
Boston, MA