

4.9 GHz Public Safety Broadband Spectrum

Overview of Technical Rules And Licensing Instructions

By

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Motorola Spectrum Strategy

Eligibility

Public Safety services as defined under Part 90 rule section 90.523 are eligible to hold a 4.9 GHz license. All state or local governmental entities (including municipal transit authorities and municipal utilities qualifying for public safety service) are eligible to hold 4.9 GHz licenses. Entities not eligible to hold a license, but which perform operations in support of public safety, (such as private critical infrastructure industries) can negotiate sharing agreements with 4.9 GHz public safety licensees. The federal government is not eligible to hold 4.9 GHz licenses but can share state and local public safety systems. Sharing of systems must be by written agreement between the licensee and the party sharing the system and all communications by the non-licensee must be in support of public safety, related to the protection of life, health or property.

Types of Uses

The 4.9 GHz band has been allocated to public safety for broadband technologies. Communications must be related to the protection of life, health or property. Examples of types of uses are:

- Wireless LANS for incident scene management
- Mobile data
- Video security
- VoIP
- PDA connectivity
- Hotspots
- T1 line replacement (permanent fixed point-to-point operations are secondary to base mobile and temporary fixed operations)

4.9 GHz Band Plan

The following channel center frequencies are permitted, per FCC rules (90.1213), to be aggregated to channel bandwidths of 5, 10, 15, or 20 MHz. The maximum bandwidth of a 4.9 GHz channel is 20 MHz.

Center Frequency (MHz)	Channel Nos.	Channel Bandwidth
4940.5	1	1 MHz
4941.5	2	1 MHz
4942.5	3	1 MHz
4943.5	4	1 MHz
4944.5	5	1 MHz
4947.5	6	5 MHz
4952.5	7	5 MHz
4957.5	8	5 MHz
4962.5	9	5 MHz
4967.5	10	5 MHz
4972.5	11	5 MHz
4977.5	12	5 MHz
4982.5	13	5 MHz
4985.5	14	1 MHz
4986.5	15	1 MHz
4987.5	16	1 MHz
4988.5	17	1 MHz
4989.5	18	1 MHz

Technical Requirements

Emission Mask

The emission masks for 4.9 GHz are listed in 90.210. In November 2004, the FCC defined two masks for use in the 4.9 GHz band: the DSRC-A mask (identical to the mask defined in the 802.11 standards) for a low power devices, and the DSRC-C mask, with better adjacent channel protection, for higher power devices. The low-to-high power breakpoint varies by channel bandwidth: 20 dBm (100 milliwatts) for 20 MHz channels, 17 dBm for 10 MHz channels, 14 dBm for 5 MHz channels and 7 dBm for 1 MHz channels. Public Safety users requested the looser mask for low power devices such that existing 5 GHz commercial-off-the-shelf (COTS) equipment could be easily modified to operate in the 4.9 GHz band, thereby bringing down the costs and reducing initial time to market.

The power limits of stations operating in the 4.9 GHz band are outlined in Rule Section 90.1215. Maximum transmitter power increases according to the amount of bandwidth used. High power devices are limited to a peak power spectral density of 21 dBm within any 1 MHz of bandwidth as long as they do not exceed the peak transmit power over the

entire channel bandwidth defined in table 90.1215(a). Likewise, low power devices are limited to a peak power spectral density of 8 dBm within any 1 MHz of bandwidth.

The peak transmit power should not exceed:

Channel Bandwidth (MHz)	Low power peak transmitter power (dBm)	High power peak transmitter power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

All devices can use omni or directional antenna gains up to 9 dBi at maximum transmit power output. Directional antenna gain may exceed 9 dBi, if both power transmit power and power spectral density are reduced dB-per-dB by the amount that directional antenna gain exceeds 9 dBi.

High power devices used for point-to-point or point-to-multipoint operation (fixed or temporary) may use transmit antennas with a directional gain up to 26 dBi at maximum transmit power output. Directional antenna gain may exceed 26 dBi, if both power transmit power and power spectral density are reduced dB-per-dB by the amount that directional antenna gain exceeds 26 dBi.

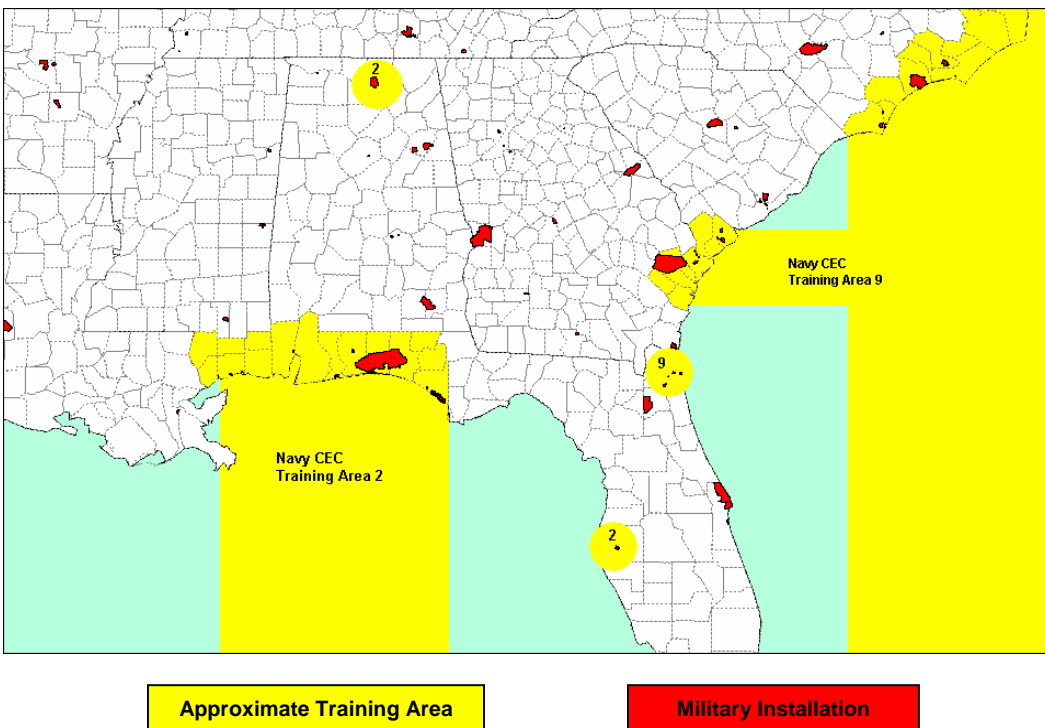
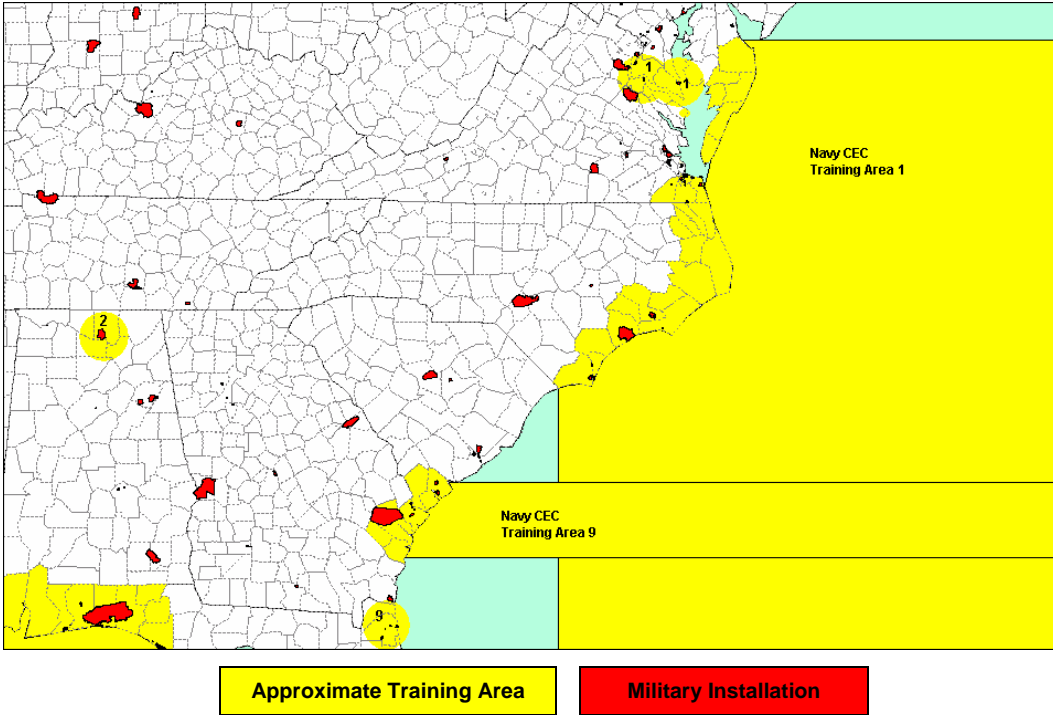
Protection of Incumbent Adjacent and Co-Channel Users

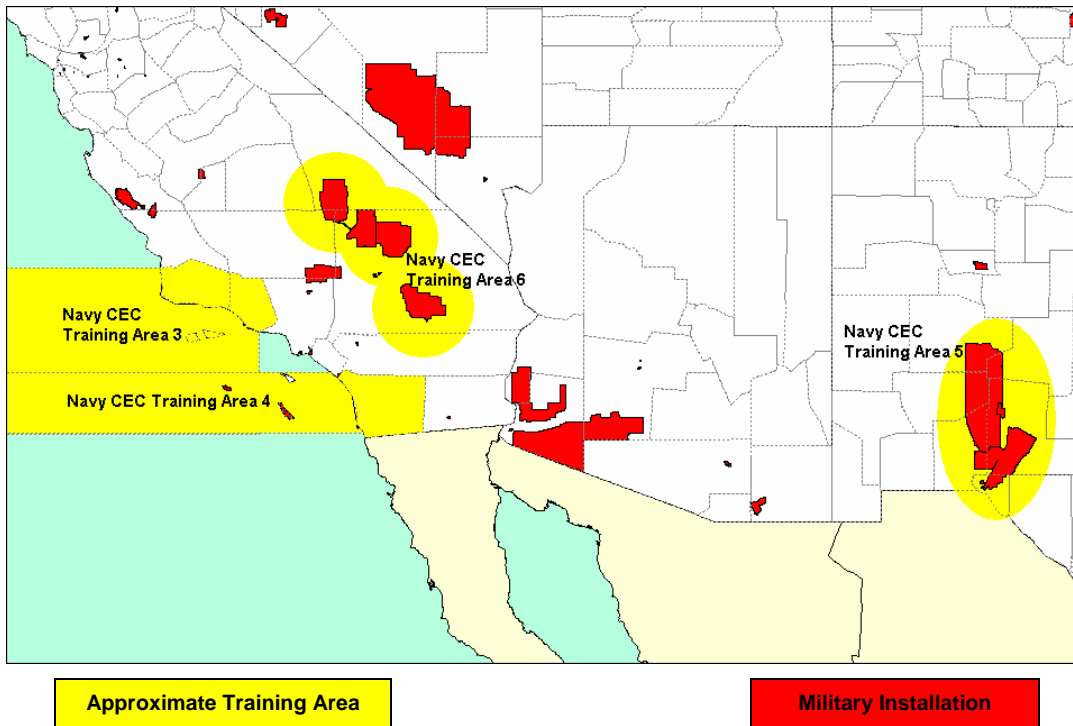
US Navy

The US Navy uses spectrum in the band just below 4.9 GHz to conduct Cooperative Engagement Capability (CEC) operations in nine training areas located along the East, West and Gulf Coasts, the entire state of Hawaii, plus military reservations in southern California and New Mexico. Licensees in the lower half of the 4.9 GHz band might receive interference from high power CEC operations within these training areas or, worst case, as far as 245 miles away from high power airborne CEC operations within these training areas. The Navy has the right to expand the training areas. The FCC has not established any specific interference mitigation procedures between 4.9 GHz and Navy CEC operations. As the 4.9 GHz band begins to be deployed, licensees and the FCC may establish approaches to address concerns about CEC interference to 4.9 GHz

operations. Appendix C of the Report & Order in WT Docket 00-32 lists the parameters of the nine CEC stations. Maps of the protected areas in affected states follow:

MAPS OF NAVY CEC TRAINING AREAS





Radio Astronomy

Radio Astronomy operates in the 4990-5000 MHz band on a primary basis and in 4950-4990 MHz at 14 specific locations on a secondary basis. 4.9 GHz licensees must protect those operations as required in Part 2, Table of Frequency Allocations, footnote US311. Because public safety transmitters will primarily be operating close to the ground, no interference to radio astronomy observatories is anticipated. The need to protect radio astronomy is the reason behind the prohibition on aeronautical use of the 4.9 GHz on a routine basis. The radio astronomy sites that must be protected and the coordination zones are shown on the US map in the Appendices of this document.

Primary Uses

Primary uses of the 4.9 GHz band are for hot spots, point-to-multi-point, base/mobile/portable operations, temporary fixed point-to-point. Communications must be related to the protection of life, health or property. Unattended and continuous operation is permitted; voice, data and video operations are permitted. Operation on-board aircraft is prohibited; although the FCC will entertain waivers for such operations (see section on “Uses Requiring Waiver.”)

Secondary Uses

Permanent fixed point-to-point operations are permitted, but are secondary to the primary uses of the band. Fixed point-to-point operations are considered permanent if they are

constructed and in place for more than one year. Secondary operations must not cause interference to primary operations and must accept interference from primary operations in the band. Secondary operations must mitigate any interference caused to primary operations up to and including ceasing operations.

Uses Requiring Waiver

Operation on-board aircraft – helicopter video downlinks for example – is not generally permitted in the 4.9 GHz band because of concern about interference from such operations to radio astronomy operations. Agencies wishing to use the band for airborne operations can seek a waiver to do so. All waiver requests for airborne operations must include the following information:

- All technical parameters of the proposed airborne operation
- Technical showings, using ‘established criteria’ (interference threshold levels contained in ITU-R Recommendation RA. 769-1) demonstrating the proposed operation will not cause interference to any radio astronomy operations.
- Demonstrate how the airborne operations will protect other 4.9 GHz band operations.

The FCC will coordinate with the National Telecommunications and Information Administration (NTIA) before acting on any waivers requesting airborne operations.

Licensing

Licenses in the 4.9 GHz band have been available since July 31, 2003. (See Appendix A for a “How To” Guide on filing 4.9 GHz license applications). Primary operations are licensed on a geographic basis over the applicant’s legal jurisdiction – e.g. city, county, state, etc. The 4.9 GHz band is a shared band; there are no exclusive assignments; all licensees are granted for all 50 MHz available and must coordinate use with other granted licensees within their jurisdiction. Transmitters can be deployed anywhere within the licensed area of operation (entity’s legal jurisdiction) without any additional licensing required, except under certain conditions. Individual licenses are required if:

- International coordination is required
- An environmental assessment is required under Part 1 OR
- The station would affect the radio quiet zones

Any antenna structure requiring notification to and approval from the Federal Aviation Administration (FAA) must be registered with the FCC.

Secondary, permanent fixed point-to-point operations must license each transmitter site and provide coordinates, ground elevation, HAAT, antenna height, etc. Six transmitter sites can be accommodated per Form 601/call sign.

Licenses are granted for a term of 10 years.

Construction Requirements

There is no construction deadline for primary licensees.

Secondary, permanent fixed point-to-point systems must be constructed within 18 months of license grant.

Regional Planning

The FCC delegated the authority for developing 4.9 GHz Regional Plans to the existing 700 MHz Regional Planning Committees. However, there is no requirement for the Regions to write and file a 4.9 GHz Regional Plan with the FCC. If a Region chooses to develop a 4.9 GHz Regional Plan, it must be filed with the FCC on May 12, 2005.

Required elements of a 4.9 GHz Regional Plan can be found in Rule Section 90.1211:

- Identification of the document as a plan for sharing the 4.9 GHz band in the Region specified
- Names, business addresses, business telephone numbers, and organizational affiliations of the chairperson(s) and all members of the Committee
- Summary of the major elements of the Plan
- Explanation of how all eligible entities within the Region were given an opportunity to participate in the planning process
- Explanation of how the Plan was coordinated with adjacent Regions
- Description of the coordination procedures for both temporary fixed and mobile operations

Lack of a Regional Plan does not prevent eligible entities within a Region from filing license applications and receiving granted authorizations in the 4.9 GHz band.

If a Region fails to form a 4.9 GHz Planning Committee or develop a 4.9 GHz Regional Plan, the FCC gives licensees the option to establish a local ad hoc planning committee or appoint a band manager or frequency coordinator to assist them in effectively coordinating the use of the band. The FCC stresses that licensees must cooperate in the selection and use of channels to reduce interference and make efficient use of the band.

Effective Date of the New Technical Rules

The new technical rules are effective as of July 18, 2005.

Filing for a 4.9 GHz License

Frequency coordination is not required at 4.9 GHz, so eligible entities can apply for a 4.9 GHz license using the FCC's on-line application system, the Universal Licensing System (ULS).

Eligible entities interested in obtaining 4.9 GHz licenses can either use the filing guide provided in Appendix A of this document, or contact one of the many FCC licensing preparation firms for assistance.

APPENDIX A

How to File for a 4.9 GHz License

Eligibility for a 4.9 GHz license is limited to public safety entities and communications on the band must be limited to the protection of life, health or property. Cities, towns, counties, states, municipal utilities are all eligible to hold 4.9 GHz licenses.

Each 4.9 GHz license is granted for the entire 50 MHz available in the band and all primary licensees share the band equally – there are no exclusive assignments. Licenses in the 4.9 GHz band are granted to cover the licensee’s legal jurisdiction – e.g. citywide, countywide, statewide. Each transmitter site need not be licensed **unless** it affects an Environmentally Protected Area, is within a Quiet Zone or would require international coordination. Then the site must be licensed separately.

If the applicant is licensing a **permanent** fixed point-to-point system (which operations are secondary to other operations in the band). Then each permanent fixed site must be listed individually on the license application giving complete information about the site.

License applications for operations at 4.9 GHz are filed using the FCC’s Universal Licensing System (ULS). At any time during the electronic filing process, if you do something wrong, or fail to complete a required field, an error message will appear explaining what was completed incorrectly or what information is missing. The system will not let you advance to a new screen until the current screen is completed successfully.

Log onto the FCC’s Universal Licensing System at <http://wireless.fcc.gov/uls/>.

- Click on “Log In” to the right of the “On-Line Filing” option.
- Enter your FCC Registration Number (FRN) and your password¹
- Click ‘Submit’
- A screen will appear that says “My Applications”
- Click on the “Apply for New License” link on the left hand side of this page
- A screen will appear entitled “License Manager” asking you to “Select Service”
- Use the drop-down box to select the radio service code “PA”
- Click “Continue”
- The system will begin to download the Form 601. If your system has a firewall, a Java Plug-In Security Warning will appear asking if you want to ‘install and run signed applet distributed by the Federal Communications Commission?’ Click on ‘grant this session.’
- The Form 601 will appear

¹ If you do not have an FCC Registration Number (FRN) you will have to register your Taxpayer Identification Number (TIN) with the FCC following the on-screen prompts using “CORES”. CORES is available on-line on the ULS homepage.

- When filling out a Form 601 on-line, certain fields will not require completion – these fields appear faint or faded on the screen. Certain items have already been filled in by the system.
- First item you will need to respond to is “Will this application require a waiver of the Commission’s rules?”
- Select ‘No’²
- Click ‘No’³ to the question ‘Are attachments filed with this application?’
- Regulatory Status – Private, internal communications has already been selected
- Type of Radio Service – “Mobile” has already been selected. If your application is for permanent fixed links, you must select ‘fixed’ and de-select ‘mobile.’
- Next question is: “Interconnected Service?”
- Answer yes or no
- Next field is “Fee Status”
- Governmental entities are exempt from fees. Answer “yes” to both fee questions.
- Click “Next page.”
- On the drop down screen in the field “Legal Entity Type” select ‘Governmental Entity’
- Fill in “Entity Name” (e.g. County of, Town of, etc.)
- Complete all the blank fields (attention to, address, phone number, email address, etc.)
- You must include a Contact Name and Address
- The Demographic Section is optional
- Click “Next Page.”
- Ownership Questions/Qualifications
- Answer each of the questions using the drop-down boxes
- Click “Next Page.”
- Type the name of the party authorized to sign the application in the signature box
- Type the authorized signatory’s title in the title section
- Click “Next Page”
- The control point section comes up
- Click on “Add.” Fill in the control point information, address, telephone number.
- Click on ‘Save’
- Click on “Next Page.”
- The Eligibility screen will appear. Enter rule section 90.1203. Describe your activity just as always – e.g. applicant is a governmental entity, etc.
- Click on “Next Page.”
- Click “Yes” if the system asks you if you want to save changes.
- The Location Page is next
- Click on “Add.”
- Using the drop down box on Location Description, click on “T – Temporary Fixed.”⁴

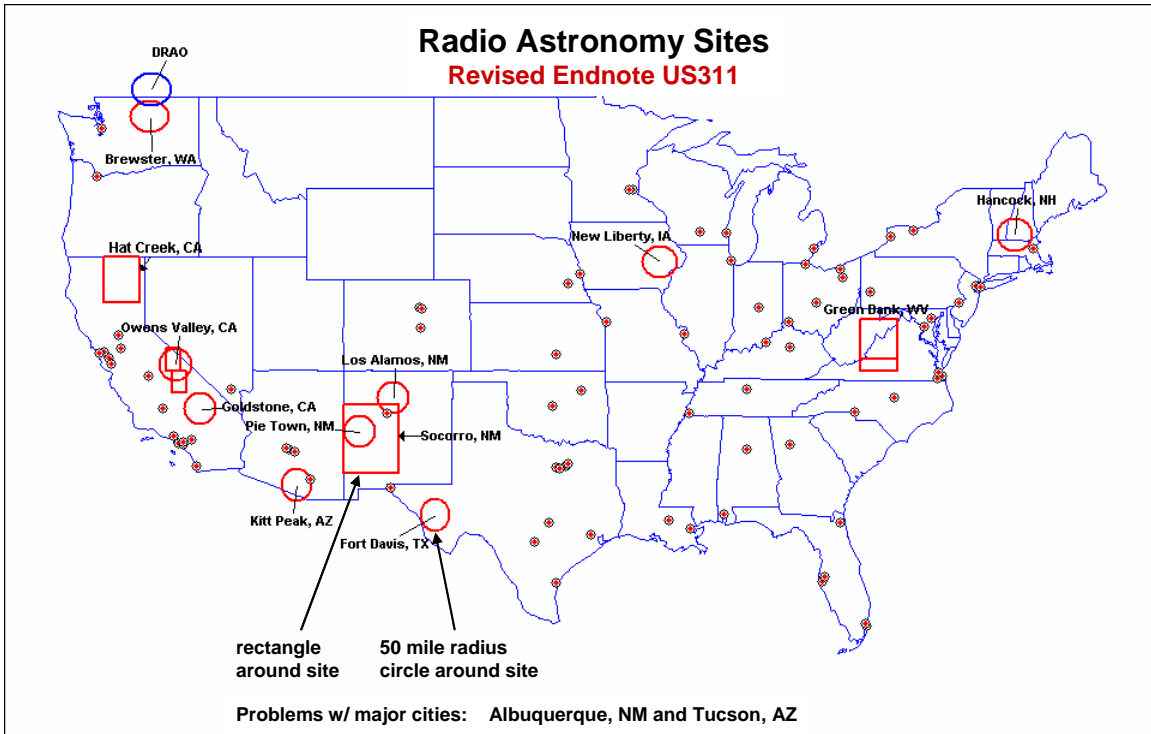
² Operation on-board aircraft requires a waiver. See text of 4.9 GHz Overview for details.

³ If you have requested a waiver, you will need to answer ‘yes’ to this question because the waiver will be attached to the application.

- Using the drop down box on Area of Operation Code, choose the area of operation that corresponds with your legal jurisdiction – Countywide, Statewide, or ‘Other’ (for Citywide operations), or kilometer radius of (kmra) a center point, or box rectangular”
 - Selecting the desired Area of Operation will activate the section of the form into which you must type information. If you choose:
 - “Other” indicate “within the legal jurisdiction of _(city)_,(state)”
 - “kmra around a set of coordinates,” enter the coordinates, city and state.
 - “County”, enter the county and state
 - “State”, enter the state
- The last two questions on the page are whether or not the sites would result in an Environmental Effect or are located within a Quiet Zone. Answer the environmental effect question using the drop down box. If the site is located in a Quiet Zone, type in the date the Quiet Zone entity was notified. If the site is not located in a Quiet Zone, the section can be left blank.
- Click “Save” to save the Temporary Fixed information
- Click “Add” to add the mobile information.
- Using the drop down box on Location Description, click on “Mobile.”
- Using the drop down box on Area of Operation Code, choose the area of operation as described above.
- Answer the Environmental Effect and Quiet Zone questions as described above.
- Click “Save.”
- Click on “Next Page.”
- This is the antenna page, no information is needed, unless you are filing for permanent fixed point-to-point operations. Click on “Next Page.”
- This is the frequency page. You do not need to enter anything in this section because the Universal Licensing System automatically fills in the frequency range for 4.9 GHz.
- Before you submit your application you can click on the “Check Errors” option. The ULS will review the application and any errors will be displayed in a dialogue box.
- At the bottom of the page, select ‘submit’ to file the application with the FCC.
- The FCC assigns your application a file number so that you can track it if necessary. You should receive a granted license within a short period of time. Some grant literally overnight.

⁴ Temporary Fixed operations are primary. If you propose to operate permanent fixed point-to-point stations, you must select that option from the drop down menu and each permanent fixed site must be listed separately on the application. You must provide coordinates, ground elevation, antenna height, HAAT, etc. for each permanent fixed site. You must click “Save” to save each permanent fixed site’s information and click “Add” until you have provided the site information for each permanent fixed site.

APPENDIX B



**APPENDIX C: GEOGRAPHIC AREAS WHERE DEPARTMENT OF DEFENSE
COOPERATIVE ENGAGEMENT CAPABILITY (CEC) WILL BE USED FOR
TRAINING IN ITS HIGH POWER, FULL BANDWIDTH MODE**

CEC TRAINING AREA 1

Training Area 1 supports Atlantic Coast Exercises, and extends inland from, seaward from, and along the low water mark of a portion of the Mid-Atlantic and South-Atlantic coastline, and includes separate areas in Maryland (MD) and Virginia (VA).

INLAND PORTION: The inland portion of Training Area 1 extends westward from the low water mark of the Atlantic Ocean, and includes all of the area contained within the boundaries of the following counties and within the other identified areas in the indicated state:

Delaware:	Sussex County
Maryland:	Wicomico, Somerset, and Worcester Counties
Virginia:	Accomack and Northampton Counties; all of the area east of the eastern most boundaries of Isle of Wight and Southampton Counties (includes the cities of Suffolk, Portsmouth, Chesapeake, Virginia Beach, Norfolk, and others)
North Carolina (NC):	Currituck, Camden, Pasquotank, Perquimans, Tyrell, Dare, Hyde, Craven, Pamlico, Jones, Carteret, Onslow, Pender, New Hanover, and Brunswick Counties

Exercises within the above boundaries of the inland portion of Training Area 1 will include aircraft operating at altitudes to 30 thousand feet (kft), mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere in the defined area. Permanent ground based terminals are now located at Wallops Island, VA; Eastville, VA; and Dam Neck Fleet Combat Training Center-Atlantic, VA. Other permanent ground based terminals will be added within the above defined area as required. Other specific sites within the above defined area include, but are not limited to: Norfolk Naval Base, VA; Norfolk Naval Air Station (NAS), VA; Little Creek Naval Amphibious Base, VA; Oceana NAS, VA; Marine Corps Bogue Field, NC; and Cherry Point Marine Corps Air Station (MCAS), NC.

Permanent ground based terminals not within the above defined area operate within the legal boundaries of the Naval Surface Warfare Center at Dahlgren, VA; and the Patuxent River Naval Air Warfare Center, MD. A permanent ground based terminal also operates within a 5 nm radius of Reedville, VA.

SEAWARD PORTION: The seaward portion of Training Area 1 is bounded on the north by the line that extends eastward from the low water mark of the Atlantic Ocean along 38.914055 north decimal degrees of latitude. The western boundary of the seaward portion of Training Area 1 begins at the intersection of the low water mark of the Atlantic

Ocean with 38.914055 north decimal degrees of latitude, extends generally southward and southwestward along the low water mark of the Atlantic Ocean to the intersection of the low water mark with 78.660000 west decimal degrees of longitude, and then continues southward along 78.660000 west decimal degrees of longitude. There is no eastern or southern boundary of the seaward portion of Training Area 1. Exercises in the seaward portion of Training Area 1 will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere within the defined area.

CEC TRAINING AREA 2

Training Area 2 supports Gulf Coast exercises. Training Area 2 extends inland from, seaward from, and along the low water mark of a portion of the Florida (FL), Alabama (AL), and Mississippi (MS) Gulf coastlines, and includes a separate area near Huntsville, AL and a separate area encompassing Pinellas County, FL.

INLAND PORTION: The inland portion of Training Area 2 extends northward from the low water mark of the Gulf of Mexico, and includes all of the areas contained within the boundaries of the following counties in the indicated state:

Florida: Bay, Washington, Holmes, Walton, Okaloosa, Santa Rosa, and Escambia
Alabama: Baldwin and Mobile
Mississippi: George, Pearl River, Stone, Jackson, Harrison, and Hancock

Exercises within the boundaries of the inland portion of Training Area 2 identified above will include aircraft operating at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere within the area defined above. Permanent ground based terminals will be added within the above defined area as required. Specific sites within the area identified above include, but are not limited to, Pensacola NAS, FL; Eglin Air Force Base (AFB), FL; and Tyndall AFB, FL.

Redstone Arsenal, located in Madison County, AL is included in Training Area 2. Mobile and ground based equipment will be located anywhere within the legal boundaries of Redstone Arsenal. Aircraft operating in the vicinity of Redstone Arsenal will maintain emissions at the lower defined power level and reduced bandwidth.

Pinellas County, FL is included in Training Area 2. Mobile and ground based equipment will be located anywhere within the legal boundaries of Pinellas County. Permanent ground based terminals are now located in the St. Petersburg, FL metropolitan area. Aircraft operating above Pinellas County, FL will maintain emissions at the lower defined power level and reduced bandwidth.

SEAWARD PORTION: The seaward portion of Training Area 2 is bounded on the east by the line that extends southward from the low water mark of the Gulf of Mexico along 85.400000 west decimal degrees of longitude. The northern boundary of the seaward portion of Training Area 2 begins at the intersection of the low water mark of the Gulf of

Mexico with 85.400000 west decimal degrees of longitude, extends generally westward along the low water mark of the Gulf of Mexico to the intersection of the low water mark with 89.350000 west decimal degrees of longitude. The seaward portion of Training Area 2 is bounded on the west by the line that extends due southeast from the intersection of low water mark of the Gulf of Mexico with 89.350000 west decimal degrees of longitude. There is no southern boundary of the seaward portion of Training Area 2. Exercises in the seaward portion of Training Area 2 will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere within the defined area.

CEC TRAINING AREA 3

Training Area 3 supports Pacific Coast Exercises, and extends inland from, seaward from, and along the low water mark of a portion of the California (CA) mid and southern Pacific coastline.

INLAND PORTION: The inland portion of Training Area 3 extends eastward from the low water mark of the Pacific Ocean, and includes all of the land areas contained within the boundaries of Ventura and Santa Barbara Counties in the state of California.

Exercises within the boundaries of the inland portion of Training Area 3 will include aircraft operating at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere within the area identified above. Permanent ground based terminals will be added within the area identified above as required. Specific sites within the identified area include, but are not limited to, Vandenberg AFB, CA; Point Magu NAS, CA; and Naval Surface Warfare Center at Port Hueneme, CA.

SEAWARD PORTION: The seaward portion of Training Area 3 is bounded on the north by the line that extends westward from the low water mark of the Pacific Ocean along 34.960000 north decimal degrees of latitude. The eastern boundary of the seaward portion of Training Area 3 begins at the intersection of the low water mark of the Pacific Ocean with 34.960000 north decimal degrees of latitude, extends generally southward and eastward along the low water mark of the Pacific Ocean to the intersection of the low water mark with 119.000000 west decimal degrees of longitude, then continues south along 119.000000 west decimal degrees of longitude. There is no southern or western boundary of the seaward portion of Training Area 3. Exercises in the seaward portion of Training Area 3 will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere within the defined area.

CEC TRAINING AREA 4

Training Area 4 supports Pacific Coast Exercises, and extends inland from, seaward from, and along the low water mark of a portion of the southern California Pacific coastline.

INLAND PORTION: The inland portion of Training Area 4 extends eastward from the low water mark of the Pacific Ocean, and includes all of the land areas contained within the boundaries of San Diego County in the state of California. Exercises within the boundaries of the inland portion of Training Area 4 will include aircraft operating at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere within the area identified above. Permanent ground based terminals will be added within the area defined above as required. Specific sites within the area defined above include, but are not limited to, Camp Pendleton Marine Corps Base, CA; Miramar NAS, CA; Coronado Naval Amphibious Base, CA; U.S. Naval Air Station North Island, CA; and at the Naval facilities located on the Point Loma, CA peninsula.

SEAWARD PORTION: The seaward portion of Training Area 4 is bounded on the north by the line that extends westward from the low water mark of the Pacific Ocean along 33.450000 north decimal degrees of latitude. The eastern boundary of the seaward portion of Training Area 4 begins at the intersection of the low water mark of the Pacific Ocean with 33.450000 north decimal degrees of latitude, extends generally southward and eastward along the low water mark of the Pacific Ocean to the intersection of the low water mark with 32.600000 north decimal degrees of latitude. The seaward portion of Training Area 4 is bounded on the south by the line that extends westward from the low water mark of the Pacific Ocean along 32.600000 north decimal degrees of latitude. There is no western boundary of the seaward portion of Training Area 4. Exercises in the seaward portion of Training Area 4 will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere within the defined area.

CEC TRAINING AREA 5

Training Area 5 includes all areas within the boundaries of the White Sands Missile Range, New Mexico and the Fort Bliss Military Reservation, Texas and New Mexico, to support the Joint Chiefs of Staff Roving Sands Exercise. The exercises will include aircraft flying at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. The assets can be positioned anywhere within the identified areas.

CEC TRAINING AREA 6

Training Area 6 includes the China Lake Naval Weapons Center, CA; Fort Irwin Military Reservation, CA; and Twentynine Palms Marine Corps Base, CA. The exercises will include aircraft flying at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. The assets can be positioned anywhere within the identified areas.

CEC TRAINING AREA 7

Training Area 7 supports Pacific training exercises. Training Area 7 includes all of the state of Hawaii and the Pacific Ocean waters surrounding the islands of Hawaii.

Exercises within the land boundaries of Training Area 7 will include aircraft operating at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere within the area. Permanent ground based terminals will be added as required. Specific sites within Training Area 7 include, but are not limited to, the Pacific Missile Range Facility on the Island of Kauai.

Exercises in the Pacific Ocean waters will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere. The waters of the Pacific Missile Range Facility are included.

CEC TRAINING AREA 8

Training Area 8 supports Atlantic Ocean and Caribbean Ocean training exercises. The area includes all of Puerto Rico; St. Thomas, Virgin Islands; and the ocean waters surrounding Puerto Rico and The Virgin Islands.

Exercises within the land boundaries of Training Area 8 include aircraft operating at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere within the area. A permanent ground based terminal is located on St. Thomas, Virgin Islands. Other permanent ground based terminals will be added as required. Specific sites within Area 8 include, but are not limited to, the Armed Forces Weapons Test Facility and the Navy Reservation, Vieques Island.

Exercises in the Atlantic Ocean and Caribbean Ocean waters will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere. The waters of the Armed Forces Weapons Test Facility are included.

CEC TRAINING AREA 9

Training Area 9 supports Atlantic Coast exercises. Training Area 9 extends inland from, seaward from, and along the low water mark of a portion of the South Carolina (SC) and Georgia (GA) Atlantic coastlines, and includes a separate area in the Jacksonville, FL metropolitan area.

INLAND PORTION: The inland portion of Training Area 9 extends westward from the low water mark of the Atlantic Ocean, and includes all of the areas contained within the boundaries of the following counties and facilities in the indicated state:

South Carolina: Beaufort and Jasper Counties

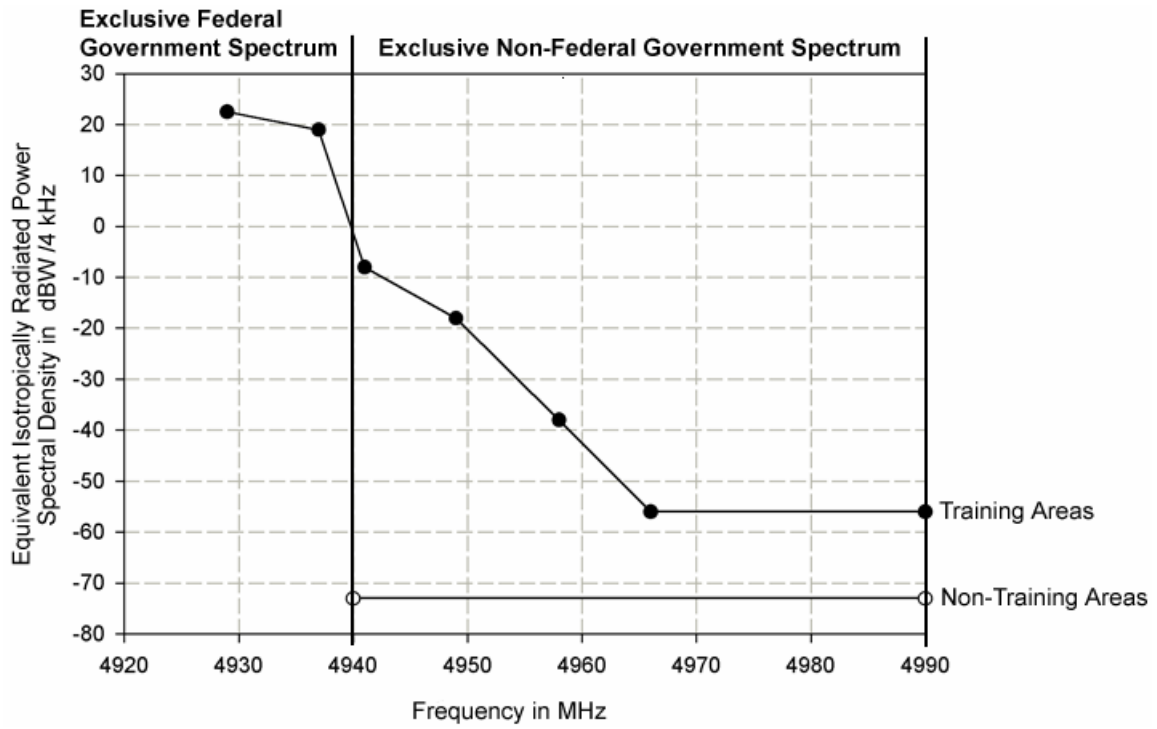
Georgia: Chatham, Bryan, Liberty, Long, and McIntosh Counties; Ft. Stewart
U.S. Army Facility

Exercises within the boundaries of the inland portion of Training Area 9 will include aircraft operating at altitudes to 30 kft, mobile ground based equipment, and permanent ground based equipment. Aircraft and mobile ground based equipment can be positioned anywhere within the area defined above. Permanent ground based terminals will be added within the above defined area as required. Specific sites within the above defined area include, but are not limited to, Beaufort MCAS, SC; Wright Army Air Field, GA; and Hunter Army Air Field, GA. All of the area within the legal boundaries of Ft. Stewart U.S. Army Facility, GA is included.

Training Area 9 also includes the Jacksonville, FL metropolitan area. Mobile and ground based equipment will be located anywhere within the legal boundaries of the Jacksonville NAS, FL. Mobile, ground based, and ship based equipment will be located anywhere within the legal boundaries of the Mayport Naval Station, FL. Aircraft operating in the vicinity of Jacksonville, FL will maintain emissions at the lower defined level.

SEAWARD PORTION: The seaward portion of Training Area 9 is bounded on the north by the line that extends eastward from the low water mark of the Atlantic Ocean along 32.480000 north decimal degrees of latitude. The western boundary of the seaward portion of Training Area 9 begins at the intersection of the low water mark of the Atlantic Ocean with 32.480000 north decimal degrees of latitude, extends generally southward and southwestward along the low water mark of the Atlantic Ocean to the intersection of the low water mark with 31.370000 north decimal degrees of latitude. The seaward portion of Training Area 9 is bounded on the south by the line that extends eastward from the low water mark of the Atlantic Ocean along 31.370000 north decimal degrees of latitude. There is no eastern boundary of the seaward portion of Training Area 9. Exercises in the seaward portion of Training Area 9 will include aircraft operating at altitudes to 30 kft and surface ships. These assets can be positioned anywhere within the defined area.

NAVY CEC EMISSIONS ACROSS THE 4940-4990 MHz BAND



APPENDIX D: 4.9 GHz Channel Planning

4.9 GHz Band Plan

The following channel center frequencies are permitted, per FCC rules (90.1213), to be aggregated to channel bandwidths of 5, 10, 15, or 20 MHz. The maximum bandwidth of a 4.9 GHz channel is 20 MHz.

Table C1

Center Frequency (MHz)	Channel Nos.	Channel Bandwidth
4940.5	1	1 MHz
4941.5	2	1 MHz
4942.5	3	1 MHz
4943.5	4	1 MHz
4944.5	5	1 MHz
4947.5	6	5 MHz
4952.5	7	5 MHz
4957.5	8	5 MHz
4962.5	9	5 MHz
4967.5	10	5 MHz
4972.5	11	5 MHz
4977.5	12	5 MHz
4982.5	13	5 MHz
4985.5	14	1 MHz
4986.5	15	1 MHz
4987.5	16	1 MHz
4988.5	17	1 MHz
4989.5	18	1 MHz

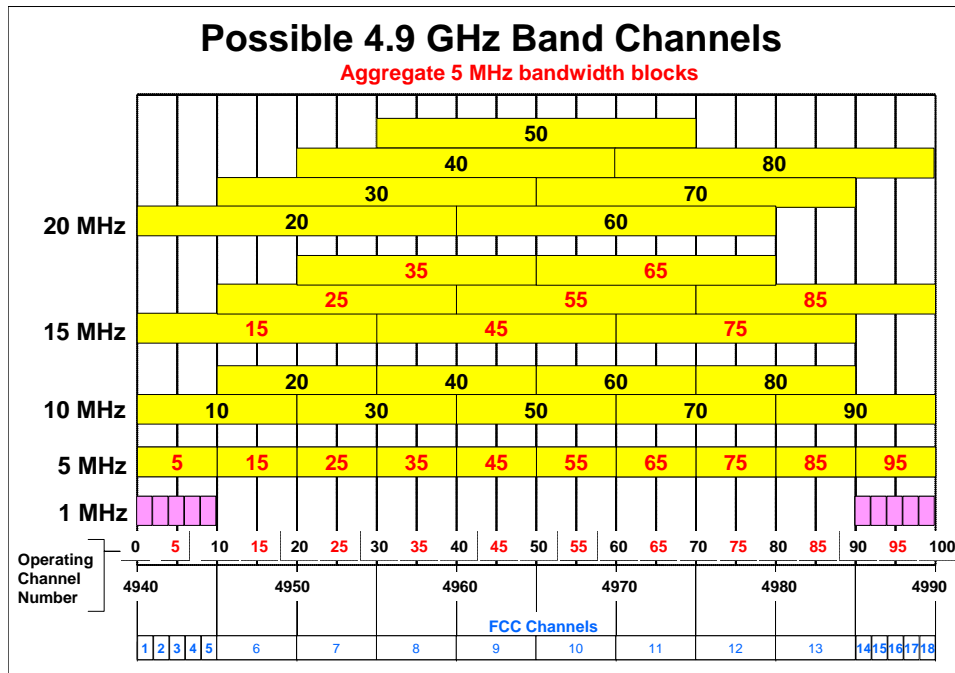
There are 18 defined channel blocks that can be aggregated, up to 20 MHz of bandwidth. If you only define channels that are aggregates of the FCC defined channel blocks, using 5 MHz as basic block size for larger channels, then center frequencies are every 2.5 MHz. This allows 10 possible 5 MHz bandwidth channels, 9 possible 10 MHz bandwidth channels, 8 possible 15 MHz bandwidth channels, and 7 possible 20 MHz bandwidth channels. There are also the original ten 1 MHz channels, that can also be aggregated.

The Table C2 below was submitted to TIA Working Group 8.8, which is considering 4.9 GHz Broadband requirements and standards. For reference, an “Operating Channel Number” was defined every 0.5 MHz relative to 4940.0 MHz for possible channel center frequencies. Operating Channel Number = $n \times 0.5 + 4940.0$ MHz. Basically, the Operating Channel Number (center frequency) and the operating bandwidth is needed to define a channel. Figure 1 below the table shows another way of visualizing the same information.

Table C2: Band Plan Proposed to TIA WG 8.8

Regulatory Domain	Band (GHz)	Operating Channel Numbers	Channel Center Frequencies (MHz)				
			1 MHz Channel Spacing	5 MHz Channel Spacing	10 MHz Channel Spacing	15 MHz Channel Spacing	20 MHz Channel Spacing
United States	4.94-4.99	1	4940.5				
		3	4941.5				
		5	4942.5	4942.5			
		7	4943.5				
		9	4944.5				
		10			4945.0		
		15		4947.5		4947.5	
		20			4950.0		4950.0
		25		4952.5		4952.5	
		30			4955.0		4955.0
		35		4957.5		4957.5	
		40			4960.0		4960.0
		45		4962.5		4962.5	
		50			4965.0		4965.0
		55		4967.5		4967.5	
		60			4970.0		4970.0
		65		4972.5		4972.5	
		70			4975.0		4975.0
		75		4977.5		4977.5	
		80			4980.0		4980.0
85		4982.5		4982.5			
90			4985.0				
91		4985.5					
93		4986.5					
95		4987.5	4987.5				
97		4988.5					
99		4989.5					

Figure 1: Possible Aggregated Channel Plan



Need for Planning and Coordination

This creates many possible overlapping channels. There could be a multitude of independent user groups. Channel usage will be uncoordinated between most devices (monitor before transmit).

Channel bandwidth requirements are dependent upon many local variables: the number of users/groups, geographic coverage requirements, data thru-put, reliability, operation on shared networks vs independent networks, technology, etc.

Some mobile devices will be worn on the body; operating at very low power levels and at very low channel usage. Fixed devices, like Access Points and secondary point-to-point/backhaul links, will operate at much higher power levels and at much higher channel occupancy rates.

There can be many combinations of channel bandwidths, center frequencies, power levels, and technologies, operating in fixed or mobile modes, placed in close proximity to each other. Channels can be aggregated and/or operate on different center frequencies, channels of different bandwidths, and/or on different center frequencies, can overlap.

Assuming you want to maximize available thru-put and minimize contention (potential interference) for channels among multiple independent users, some sort of band structure or channel assignment plan or geographic separation criteria should be considered for co-channel (or overlapping channel) re-use and adjacent channel separation, at least for fixed installations (access points, pt2pt links, back-haul). Coverage and re-use distances in this band are relatively short, measured in hundreds of meters or a few kilometers.

Planning could be as simple as assigning certain channels to uncoordinated itinerant operations (accept variable coverage and lower thru-put) and other channels to permanent assets like hot spots or wide-area networks (expect more reliable coverage and higher thru-put), where installation could be coordinated. Planning and coordination provide less contention and less co/adjacent channel interference, allowing more users, with more stable coverage, and higher reliability & thru-put than totally unorganized spectrum.

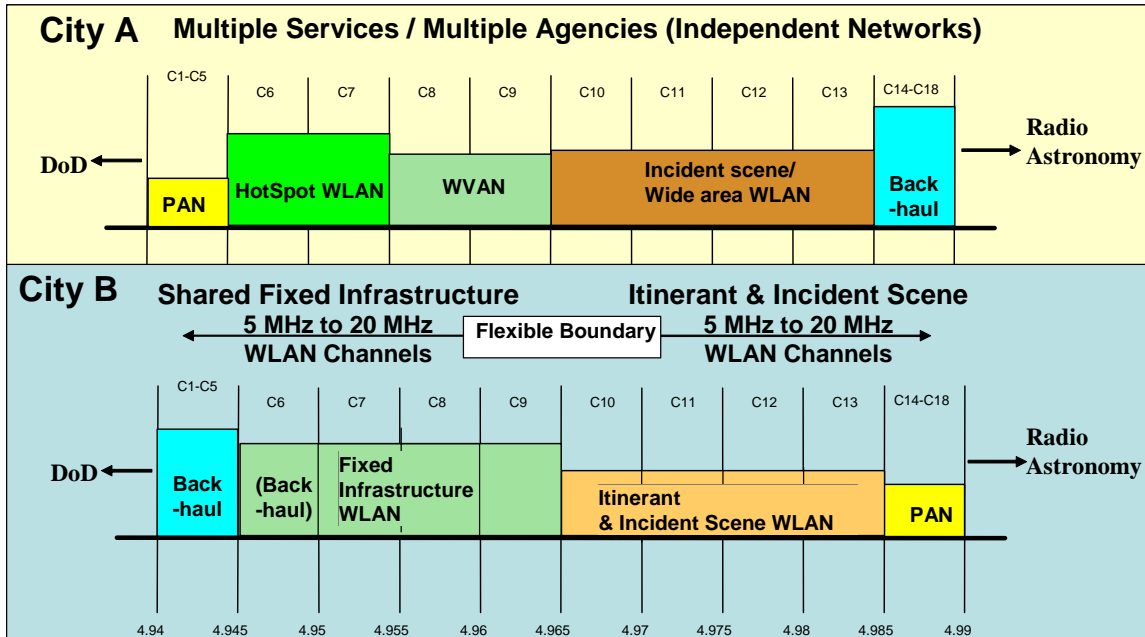
Some cities may decide to install a common, planned, multi-agency, wide-area network providing ubiquitous coverage and maximize available bandwidth. Other cities may decide to install (or allow individual agencies to install) a few hot spots and allow mobile (mesh) networking to provide wide-area access. In either case, there will also be a need to provide off-network, itinerant operations between devices operating at an incident scene. Figure 2 below shows two possible of the many possible channel arrangements.

With all these possible combinations, local users, either thru formal Regional Planning or voluntary local 'ad hoc' coordination, may need to decide how coordinate (or notify other users of) channel usage to minimize contention or potential co-channel, adjacent channel, or overlapping channel interference.

Figure 2: Example Channel Arrangements

Flexible Channel Usage

Adjacent channel users operating on multiple channel bandwidths, using multiple technologies, at various power levels



In a metropolitan area, there will be many agencies, most associated with the major political entities within the metro area. One possibility is to install a wide-area network over some, or all, of the metro area. Part of the 50 MHz of spectrum would be dedicated to the wide-area, shared network. The remainder of the 50 MHz would be shared spectrum, to be used locally for different applications, for itinerant/interoperability uses, or by users that are not part of the metro network. Figure 3 below shows an example.

The spectrum dedicated to the wide-area, shared network could be used to provide tailored coverage or ubiquitous coverage. The amount dedicated to the shared network may vary at different locations within the metro area, but should probably be a contiguous block. Network designers would have control over intra-network interference and contention: location of sites, power levels, antenna patterns, channel bandwidths, frequency re-use patterns for co-channels & adjacent channels & overlapping channels, etc. This shared network would provide interoperability capability for member agencies.

Figure 3: Example Metro Channel Plan

Possible 4.9 GHz Metro Channel Plan

